ANNUAL REPORT

OF THE

MINISTER OF MINES

FOR THE

YEAR ENDED 31ST DECEMBER

1928

BEING AN ACCOUNT OF

MINING OPERATIONS FOR GOLD, COAL, ETC.

IN THE

PROVINCE OF BRITISH COLUMBIA

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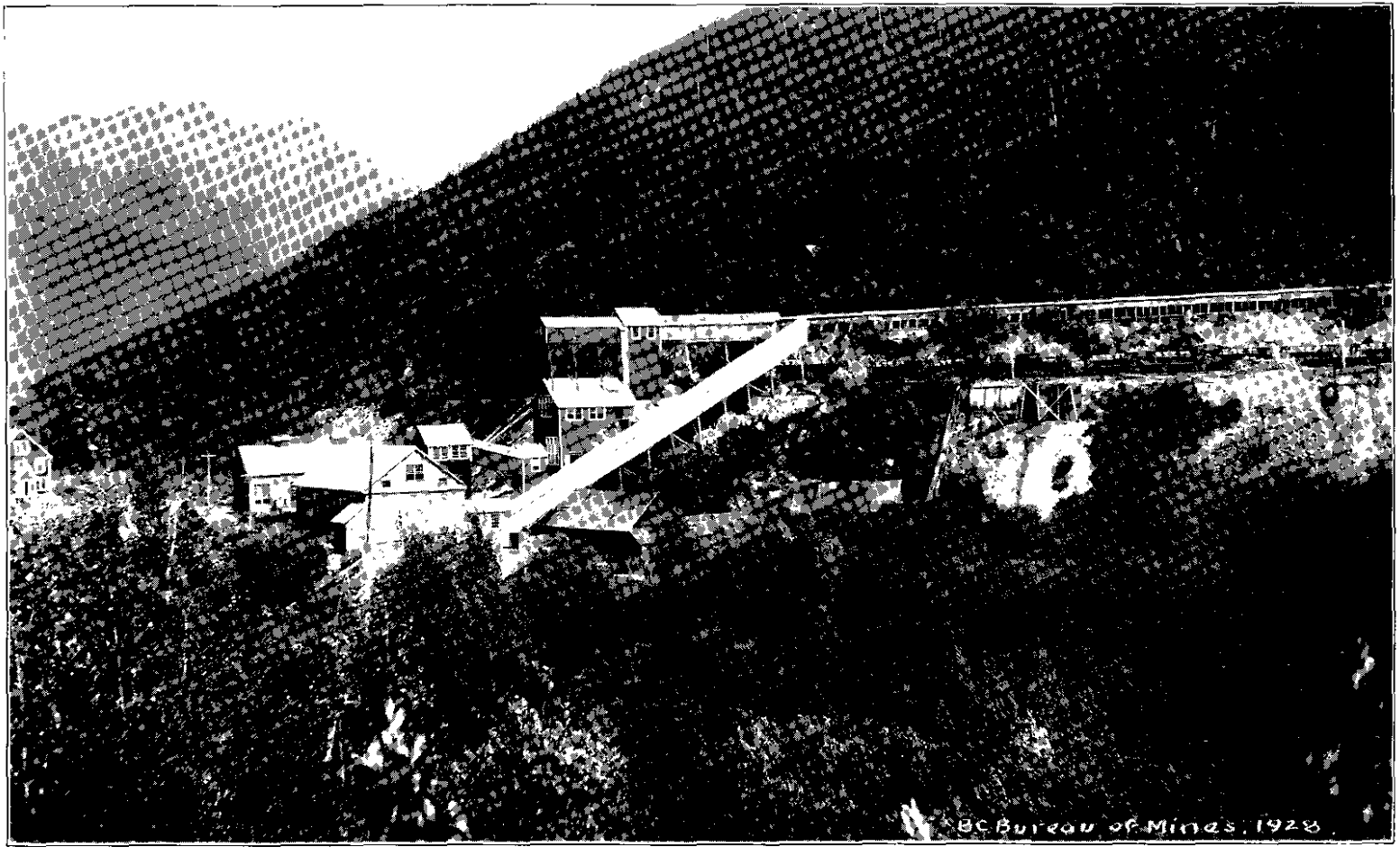

Lucky Jim Lead and Zinc Mining Co., Ltd., Slocan M.D.

To His Honour ROBERT RANDOLPH BRUCE,
Licutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mining Industry of the Province for the year 1928 is herewith respectfully submitted.

W. A. McKENZIE,
Minister of Mines.

Minister of Mines' Office,
February 6th, 1929.

To the Honourable W. A. McKenzie,

Minister of Mines.

SIR,—I have the honour to submit herewith my Annual Report on the Mining Industry of the Province for the year ended December 31st, 1928.

The statistical tables give the total mineral production of the Province to date and show by Districts and Divisions the output of the various metals and minerals for the year 1928, and comparative figures for previous years.

The reports of the Resident Mining Engineers give much information about the progress of mining, development, and prospecting throughout the Province. The reports of the Inspectors of Mines cover fully coal-mining in British Columbia.

I have the honour to be,

Sir,

Your obedient servant,

JOHN D. GALLOWAY,

Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,

February 6th, 1929.

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By John D. Galloway, Provincial Mineralogist.

GENERAL SUMMARY.

The steady progress which in recent years has characterized the mineral industry of British Columbia was again strikingly shown in the year 1928. Increased production, widespread development, and satisfactory profits all combined to make the year the most successful in the history of mining in the Province.

The gross value of the mineral production in 1928 was $65,372,583, as compared with $60,729,358 in 1927, an increase of $4,643,225, or 7.6 per cent. While the actual output of metals and minerals was the greatest on record, the gross value of the production was somewhat less than the figure for 1926, when an output valued at $67,188,842 was made. In 1926, however, metal prices on the average were much higher than in 1928, particularly for lead and zinc. The 1928 production valued at 1926 prices would be worth nearly $75,000,000, thus showing that a steady increase in the output of metals and minerals is being attained.

The tonnage of metalliferous ore mined and treated in the Province in 1928 amounted to 6,241,310 tons, which is a high record figure. It compares with 5,416,021 in 1927, an increase of 845,289 tons, or 15.2 per cent. The average gross value of the ore treated during the year was about $7.75.

All the larger mines of the Province maintained or increased the tonnage of ore treated and a number of properties recently equipped with concentrators made larger outputs. A further expansion of tonnage treated in 1929 is expected. Regardless of substantially lower prices for lead and zinc during 1928, there was in the aggregate no curtailment of production by the mines of the Province during 1928.

For the purpose of the statistical tables in this Report, the mineral production of British Columbia is divided into four classes—metal-mining, coal-mining, structural materials, and miscellaneous metals and minerals. Of these, the first class is by far the most important, with a production for 1928 valued at $48,425,033 (including placer gold). This is followed by coal, with an output valued at $12,633,510, and structural materials and miscellaneous metals and minerals totalling together $4,315,040.

As compared with 1927, the production figures show increased outputs of all metals except placer gold, a larger tonnage of coal, and increased valuations of structural materials and miscellaneous metals and minerals.

By value, the various products of the mineral industry produced in 1928 are ranked in the following order: Copper, lead, coal, zinc, silver, gold, structural materials, miscellaneous metals and minerals. The quantities of copper, lead, and zinc produced in 1928 were the highest in the history of mining in the Province.

Copper-mining recorded a prosperous year in 1928. The production for 1928 was 97,908,316 lb., valued at $14,265,242. This is a record output, but is a lower valuation than recorded in the three War years, 1916, 1917, and 1918, when the price of copper was nearly double that in 1928. The sharp advance in the price of copper metal towards the close of the year is reflected in the average yearly price, being 14.57 cents, as compared with 12.92 cents in 1927. During recent years the large copper-mines of the Province have been brought up to a high state of efficiency, with modern equipment resulting in lower costs. With an assured outlook for the price of copper metal to stay at 18 cents or higher for some time to come, the copper-mines of the Province will make very satisfactory profits. No expansion of production is expected in 1929 from the three main producers, but a full year's output at the rate shown in the last quarter of 1928 is expected, which would result in a production somewhat in excess of 100,000,000 lb.

The output of lead in 1928 was 305,140,792 lb., valued at $13,961,412. This is a high record in quantity, but owing to the low average price of lead for the year, 4.5754 cents a pound (London), the value was exceeded in 1925, 1926, and 1927. The increased lead production is partly due to an increase from the *Sullivan* and partly to increases from small shippers in Omineca and Slocan Divisions. A larger output of lead is expected in 1929.

The coal production for the year is valued at $12,633,510, as compared with $12,269,135 in 1927, an increase of $364,375, or 2.87 per cent. Coal-mining in the Province is subject to intensive competition in the marketing of the output from imported crude oil and hydro-electric

power, but since 1924 a steady though small yearly increase of output has been maintained. Improved conditions in the Crowsnest field and the amalgamation of the principal mines in the Vancouver Island field are important factors improving the coal-mining industry, which should result in its steady growth in the future. The Province has immense resources in coal and with the gradual perfection of more scientific methods of processing and using coal the yearly production may be expected to grow.

The *Sullivan* is also mainly responsible for the record output of zinc in 1928, amounting to 181,763,147 lb., valued at $9,984,613. All indications point to a steady increase for some years ahead in the zinc-output of the Province.

The silver production for 1928 was 10,627,167 oz., valued at $6,182,461. This output is slightly greater than in 1927 and slightly less than in 1926. The two largest contributors of silver are the *Sullivan* and *Premier*, the former maintaining its position as the largest silver producer in Canada. Approximately 80 per cent. of the silver production of the Province comes from mines in which the silver value is of less importance than the other metals, such as gold, copper, lead, and zinc, contained therein.

The production of gold (including placer and lode mines) in 1928 amounted to $4,031,305, an increase of $195,457 as compared with 1927. The virtual exhaustion of the Rossland gold-copper deposits in recent years has curtailed gold production, but during the last two years a number of gold properties have been under development and a larger gold-output may be expected in the future.

The production of placer gold continues to decline, the output for 1928 being valued at $143,208, as compared with $156,247 in 1927. There seems little doubt, however, that 1929 will show a greater output as several operations from which but little output has been made in recent years are in shape to make better returns.

The output of structural materials in 1928 is valued at $3,408,686, as compared with $2,867,380 in 1927, an increase of $541,306, or 18.8 per cent. This is a good indicator that building activity in the Province was greater in 1928 than the preceding year. Continued expansion of this branch of the mineral industry is expected as there is an abundance of raw material in the Province.

An encouraging feature during the last three years is the growth in annual value of the output of miscellaneous metals and minerals. The production in 1928 is valued at $905,354, as compared with $459,514 in 1927 and $332,583 in 1926. The most important item this year is cadmium, valued at $341,374, followed by pyrite and gypsum. It is interesting to note that the two most valuable items this year, cadmium and pyrite, are by-products which formerly went to waste. It is expected that as a result of research-work other metals will in future be recovered at the Trail plant of the Consolidated Mining and Smelting Company of Canada, Limited; these will include bismuth and antimony.

From the foregoing brief summary it can be readily seen that production in 1928 was satisfactory and it can be safely predicted that a larger output of metals and minerals will again be recorded for 1929.

METAL PRICES.

The important metals mined in British Columbia which are affected by fluctuations in market prices are silver, lead, zinc, and copper. During 1928 the average prices of silver and copper showed increases as compared with 1927, but these increases were more than offset by marked decreases in lead and zinc.

The following table shows comparative average yearly prices for the years 1926, 1927, and 1928:—

AVERAGE METAL-MARKET PRICES FOR 1926, 1927, AND 1928.

Year.	Silver (New York).	Copper (New York).	Lead.		Zinc.	
			London.	New York.	London.	St. Louis.
	Cents per Oz.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.
1926	* 62.107	* 13.795	* 6.7513	8.417	* 7.4096	7.337
1927	* 56.370	* 12.92	* 5.256	6.755	* 6.1946	6.242
1928	* 58.1760	* 14.570	* 4.5754	6.305	* 5.4932	6.027

* Prices used in compiling total metal valuations in 1926, 1927, and 1928 Annual Reports.

The above table shows that in 1928, as compared with 1927, there were increases in the average prices of silver and copper of 3.3 and 12.7 per cent. respectively, and for lead and zinc, decreases of 12.9 and 11.3 per cent.

The outlook for 1929 is that higher average metal prices will prevail than in 1928. Copper is in an excellent position and an 18-cent level or higher is anticipated for some time to come. Regardless of metal prices, production and development have forged ahead steadily in British Columbia mining in recent years and there is very reason to believe that this condition will continue in the future.

DEVELOPMENT.

During the last three years increased production of metals in British Columbia has been largely caused by greater outputs from the larger mines, including the *Sullivan, Premier, Britannia, Hidden Creek,* and *Copper Mountain.* Development of these properties has kept pace with production and in the aggregate this development has been successful in maintaining or increasing the ore reserves. A notable exception is the *Premier,* which apparently has only a limited life ahead of it.

Besides the steady development of the producing properties, much development was carried on in 1928 in various parts of the Province. In large part this consisted of reworking of old properties, some of which were former producers. It is quite noteworthy the number of old properties that have been taken up and operated in the last two years. Development of mineral properties has been carried on in many parts of the Province, but the most active areas were Portland Canal, Omineca, Slocan, and Nelson Mining Divisions.

The Consolidated Company has again been most active in optioning and trying out various properties. The Premier, Granby, and Howe Sound Companies also have taken up several properties. Numerous local companies have been formed to exploit properties, outside mining companies have also been active, and generally it has been an outstanding period in the history of the Province in the opening-up of our mineral resources.

Plenty of capital would now seem to be available for British Columbia mining. The large mining companies in the Province all have substantial surpluses which they are using to acquire and develop mineral properties. Many small companies have been formed in British Columbia, which in part get their capital locally and in part from various sources outside the Province. Large mining companies from many parts of the world have had scouting engineers looking for promising mineral properties in British Columbia during 1928.

During the last five years good progress has been made in trying out hundreds of prospects in the Province; many of these of course will never make mines, but a fair measure of success is being attained. The result is that prospectors, small mining syndicates, and small companies can feel assured that, once a promising prospect is shown up, abundance of capital is available to carry it forward to the production stage.

Full details of the development of properties are given in the reports of the Resident Engineers on their respective districts.

Owing to the considerably improved price of copper metal more interest was taken in the last half of 1928 in copper prospects than for several preceding years. Several companies were incorporated to develop copper properties, but it should be remembered that the bringing to production of even a medium-sized copper property generally takes several years.

It is quite apparent during the last three years that development of the mineral resources of the Province has steadily increased and it is also evident that this era of mining activity will continue. Provided the work is reasonably satisfactory as to results in the shape of production and profits, the whole mineral industry will progress. The potential ore-bodies of the Province are being tested with, in the aggregate, adequate capital and capable technical direction.

The history of mining in all countries shows that a small percentage of successful mining operations makes possible the exploration of many properties which fail to make mines. While mining is often highly speculative in individual cases, it is collectively a highly profitable business and the record of mining in British Columba amply corroborates this statement.

PROSPECTING.

Reports from the various districts would indicate that, on the whole, slightly more prospectors were in the field than in 1927. In some districts, however, very few men were in the field and it is quite evident that there is the need for many more. Without prospecting, mining

will eventually decline, but the known mineralized areas of British Columbia are so great that it is probable that sufficient prospectors will be forthcoming as needed in future years.

For years past British Columbia has had thousands of prospects lying dormant, but recently these have been carefully examined by scouting engineers. The best have been optioned and developed, so that before long more new prospects will be required. The activity in mining in the last two years is undoubtedly stimulating mining and in future years much prospecting will probably be carried on.

Besides the more or less unknown areas of the Province, largely in Northern British Columbia, many of the older mining camps will probably repay more intensive scientific prospecting than they have yet received.

Electrical prospecting, or the exploration of possible mineral-bearing ground by electrical methods, for the indication of ore-bodies is a new science in recent years. While called "prospecting," it is very specialized intensive prospecting of relatively small areas and is most frequently used in known mineralized areas to find extensions of ore-bodies, or contiguous ones.

It is to be looked on as an aid to the scientific and economic development of any area believed to be mineralized. Much of the information obtained is negative but nevertheless valuable. By its use certain areas may be eliminated and the expense of diamond-drilling or excavational development avoided. Its positive function is to indicate areas of electric conductivity which may be areas of sulphide mineralization. If the positive evidence is strong and confirmed by geologic or other evidence, then the exploration of the conductor by diamond-drilling or otherwise is warranted.

To many, electrical prospecting is believed to be a royal road to finding rich mineral-deposits, but such is not the case. It is only useful under certain conditions and is never infallible. It is simply useful in certain cases as an aid to development.

During the year electrical prospecting methods were tried on several British Columbia properties. The services of companies which have patented methods of electrical prospecting are engaged by the mining companies to do this work. So far no results of the work carried out this year have been announced, but if any marked success is attained the information will probably be made public eventually.

METALLURGICAL FEATURES OF THE YEAR.

Progress in the metallurgical treatment of ores in the Province during 1928 has kept pace with the mining activity. Construction of new plants, expansion of existing ones, and improvement in operating efficiency throughout has characterized the year.

Metallurgical art is an important branch of the mineral industry and the record in British Columbia in recent years is a tribute to the ability of the men engaged in this branch. The skill of the metallurgist now makes possible the treatment of almost any ore, no matter how complex, and also the mining of certain low-grade ores not formerly profitable. The improvements in metallurgy have done much to stimulate renewed development of dormant mineral properties.

Of the 6,241,310 tons of ore mined in 1928, less than 8 per cent. was treated by direct smelting of the crude ore, the remainder being first concentrated for the elimination of waste material.

In general, throughout the mills of the Province, greater efficiency was attained in the extraction of minerals, and in several instances notably high extractions are being obtained.

The Britannia Mining and Smelting Company again increased the capacity of its mill by installing more machinery and making changes; 5,000 tons a day is now being handled. The recovery of pyrite from the tailings was increased and an output of 69,113 tons was made, or nearly double the 1927 production.

Interesting work is being done at this mine in the recovery by precipitation of the copper content contained in the mine-waters. Full details of this work were given in a paper by Frank Ebbutt at the Western Annual Meeting of the Canadian Institute of Mining and Metallurgy at Vancouver, November, 1928.

The following quotation from the annual report of the Consolidated Mining and Smelting Company of Canada, Limited, shows the important construction and new plant installed and commenced during 1928 at the Trail plant and some of the company's mines:—

"The following construction was completed during the year: A plant for the recovery of refined cadmium; a plant to recover metallic bismuth; a boiler plant in connection with the zinc plant; a pipe-fitter's shop; a new research building; a 100,000-gallon fuel-oil storage-tank;

a 400,000-gallon acid-storage for the zinc plant; a 3,000-gallon-per-minute extension to the Columbia River pumping-station; a new rotary converter conversion-station for the trolley systems; a change-house, dining and wash rooms for the zinc-roaster plant; doubling up the acid-proof filter installation at the zinc plant; the completion of the extension of the zinc plant from 200 to 300 tons daily capacity; installation of the Dracco system for collecting flue-dust at the smelter; an electrical sub-station at the east side of the smelting plant; an extension to the lead-drossing plant; the completion of the coarse-crushing plants at the Trail concentrator and Moyie; a fire-proof warehouse at Kimberley; and several additions to the equipment in the various shops.

"Of the important construction under way, the contact sulphuric-acid plant is expected to commence operation in January; the enlargement of the *Sullivan* concentrator from 4,000 to 6,000 tons daily capacity, the enlargement of the zinc plant from 300 to 400 tons daily, the electric steel-foundry, and the further enlargement of the cadmium plant are all well under way."

The following further quotation from this report is of decided interest as indicating the important plans this company has for entering into the production of synthetic fertilizers:—

"Your Research Department is proving a valuable accessory. The staff is being increased and will continue to grow.

"Many problems have been solved, but many more remain.

"On the whole, last season's experiments with triple superphosphate on the Prairie were satisfactory. Further tests will be made during the coming summer.

"With the completion of the first unit of the contact sulphuric-acid plant, production on a commercial scale of acid phosphate can begin, and gradually expand as the market develops.

"A good deal of consideration has been given to the production of ammonia (NH_3), which, combined with sulphuric acid, makes ammonia sulphate, a well-known fertilizer, much used in the Orient and elsewhere. It can be combined, too, with phosphate rock and sulphuric acid, making a fertilizer carrying both nitrogen and phosphorus, for which there is a good market.

"It is likely, therefore, that in the near future your company will be a large producer of synthetic fertilizers. In addition to the commercial aspects, this should eliminate largely, if not entirely, any real damage from sulphur dioxide."

The construction of several new concentrating-mills throughout the Province was completed during the year and from most of these a full year's production is expected in 1929. Other new mills are planned for 1929 which will still further increase the tonnage of ore treated in the future.

PROFITS OF MINING COMPANIES.

The following table shows the dividends declared by companies engaged in the mineral industry in the Province during 1927 and 1928:—

Company.	1927.	1928.
The Consolidated Mining and Smelting Co. of Canada, Ltd.	$6,358,875	$6,366,594
Premier Gold Mining Co., Ltd.	1,601,250	1,300,000
Howe Sound Co.*	1,984,152	1,984,152
Duthie Mines, Ltd.	.....	50,000
Granby Consolidated Mining, Smelting, and Power Co., Ltd.	348,872	1,344,515
Bell	64,629	55,714
Whitewater Mines, Ltd.	10,000	.....
Crow's Nest Pass Coal Co., Ltd.	372,760	372,696
Clayburn Co.	32,000	32,000
Others	8,300	51,017
Totals	$10,800,838	$11,556,688

The amount of $11,556,688 shown above as distributed in 1928 by no means represents the total net profits earned during that year. In nearly all cases substantial sums are set aside

* The Howe Sound Company is the holding company for the *Britannia* mine in British Columbia and the *El Potosi* and *Calera* mines in Mexico. Dividends paid by this company are therefore derived from the profits on operation of all three mines, so that only part of the dividends paid, as shown, can be credited to the *Britannia* mine.

from profits to the credit of surplus and reserve accounts. Profits accruing to private companies and individual mining enterprises as a rule are not given publicity as dividends, as is the case with the large companies, so that no record of these profits, which in the aggregate are considerable, is available.

The following table shows strikingly the growth of dividends in recent years:—

Year.	Dividend.
1923	$2,809,295
1924	2,896,174
1925	6,319,808
1926	9,747,270
1927	10,800,838
1928	11,556,688

A dividend record of $11,556,688 from a gross production of $65,372,583, or 17.7 per cent., is an excellent one and shows that mining is a profitable industry.

It is desirable to again point out that reports by the Resident Engineers of the Department of Mines are available on nearly all the important mines and prospects of the Province. These reports are contained in the Annual Reports of the Minister of Mines and in special bulletins issued from time to time. All these reports are available to any one interested, free of charge, and the public is urged to make use of any official information issued by the Department of Mines on mines and prospects in the Province.

MINERAL PRODUCTION OF BRITISH COLUMBIA.

METHOD OF COMPUTING PRODUCTION.

The total mineral production of the Province consists of the outputs of metals, coal, structural materials, and miscellaneous minerals, valued at standard recognized prices.

In the Annual Report for 1925 some changes were made in the methods used in previous years in computing and valuing the products of the industry; but in order to facilitate comparisons with former years the same general style of tables was adhered to. The methods used in 1925 have been followed in subsequent Annual Reports.

The following notes explain the methods used:—

(1.) From the certified returns of lode mines of ore and concentrate shipments made during the full calendar year by the producers the net recovered metal contents have been determined by deducting from the "assay value content" necessary corrections for smelting and refining losses.

In making comparisons of production figures with previous years, it should be remembered that prior to 1925 in the Annual Reports the total metal production, with the exception of copper, was determined by taking the assay value content of all ores shipped; deductions for slag losses were made by taking varying percentages off the metal prices.

(2.) Gold-placer returns are received from the operators in dollars and the dollar value converted to ounces of placer gold at $17 an ounce, which is believed to represent the average value of placer gold throughout the Province.

(3.) The prices used in valuing the different metals are: For gold, the world standard price of $20.6718 an ounce; for silver, the average New York metal-market price for the year; for lead, the average London metal-market price for the year; for zinc, the average London metal-market price for the year; and for copper, the average New York metal-market price for the year. The silver and copper outputs of the Province are bought and sold on the basis of the New York metal-market prices of these metals and for this reason they are used. The bulk of the lead and zinc production of the Province is sold on the basis of the London prices of these metals and they are therefore used. The New York and Montreal lead- and zinc-market prices differ materially from the London prices of these metals and are not properly applicable to valuing the British Columbia production.

(4.) In 1926 a change was made in computing coal and coke statistics. The practice in former years has been to list coal and coke production (in part) as primary mineral production. Only the coke made in bee-hive ovens was so credited; that made in by-product ovens was not listed as coke, but the coal used in making this coke was credited as coal production. The result was that the coke-production figures were incomplete.

Starting with the 1926 Annual Report, the standard practice of the Bureau of Statistics, Ottawa, has been adopted. This consists of crediting all coal produced, including that used in making coke, as primary mineral production. Coke-making is considered a manufacturing industry. As it is, however, of interest to the mineral industry, a table included in the Report shows the total coke produced in the Province, together with by-products, and the values given by the producers. This valuation of coke is not, of course, included in the total gross value of mineral production of the Province.

(5.) Structural materials are valued at the prices given by the producers.

(6.) Miscellaneous minerals are valued at the market or the prices given by the producers.

STATISTICAL TABLES.

TABLE I.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1928.

Gold, placer	$78,318.003
Gold, lode	134,540,016
Silver	92,871,507
Copper	235,757,321
Lead	135,812,146
Zinc	69,493,305
Coal and coke	309,601,778
Structural materials	54,524,497
Miscellaneous minerals, etc.	3,291,838
Total	$1,114,210,411

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1928 (INCLUSIVE).

1852 to 1895 (inclusive)	$94,547,241	1913	$30,296,398
1896	7,507,956	1914	26,388,825
1897	10,455,268	1915	29,447,508
1898	10,906,861	1916	42,290,462
1899	12,393,131	1917	37,010,392
1900	16,344,751	1918	41,782,474
1901	20,086,780	1919	33,296,313
1902	17,486,550	1920	35,543,084
1903	17,495,954	1921	28,066,641
1904	18,977,359	1922	35,158,843
1905	22,461,325	1923	41,304,320
1906	24,980,546	1924	48,704,604
1907	25,882,560	1925	61,492,242
1908	23,851,277	1926	67,188,842
1909	24,443,025	1927	60,729,358
1910	26,377,066	1928	65,372,583
1911	23,499,072		
1912	32,440,800	Total	$1,114,210,411

Table III. gives a statement in detail of the quantities and value of the different mineral products for the years 1926, 1927, and 1928.

TABLE III.—QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1926, 1927, AND 1928.

Description.	1926.		1927.		1928.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer ....oz.	20,912	$355,503	9,191	$156,247	8,424	$143,208
Gold, lode ....oz.	201,427	4,163,859	178,001	3,679,601	188,087	3,888,097
Silver ....oz.	10,748,536	6,675,606	10,470,185	5,902,043	10,627,167	6,182,461
Copper ....lb.	89,339,768	12,324,421	89,202,871	11,525,011	97,908,316	14,265,242
Lead ....lb.	263,023,937	17,757,535	282,996,423	14,874,292	305,140,792	13,961,412
Zinc ....lb.	142,876,947	10,586,610	145,225,443	8,996,135	181,763,147	9,984,613
Coal ....tons, 2,240 lb.	2,330,036	11,650,180	2,453,827	12,269,135	2,526,702	12,633,510
Coke ....tons, 2,240 lb.	*	*	*	*	*	*
Structural materials and miscellaneous minerals	....	3,675,128	....	3,326,894	....	4,314,040
Totals	....	$67,188,842	....	$60,729,358	....	$65,372,583

* Coke not included in primary mineral production; coal used in making coke included in coal figures.

TABLE IV.—Output of Mineral Products by Districts and Divisions.

Names.	Divisions.			Districts.		
	1926.	1927.	1928.	1926.	1927.	1928.
North-western District (No. 1)				$11,069,032	$9,838,083	$9,684,465
Atlin, Stikine, and Liard	$234,936	$93,098	$64,197			
Nass River	5,853,804	4,943,253	5,307,358			
Portland Canal	4,678,739	4,753,782	4,255,393			
Skeena, Queen Charlotte, and Bella Coola	301,553	47,950	57,517			
North-eastern District (No. 2)				552,203	263,809	391,783
Cariboo and Quesnel	299,428	105,515	80,914			
Omineca and Peace River	252,775	158,294	310,869			
Central District (No 3)				831,975	658,927	697,101
Nicola and Vernon	273,979	224,209	254,056			
Yale, Ashcroft, and Kamloops	453,465	297,244	275,365			
Lillooet and Clinton	104,531	137,474	167,680			
Southern District (No 4)				3,972,608	4,002,908	4,866,414
Grand Forks, Greenwood, and Osoyoos	668,165	699,808	540,573			
Similkameen	3,304,443	3,303,100	4,325,841			
Eastern District (No 5)				36,704,484	31,762,546	33,416,442
Fort Steele	33,825,684	29,905,168	31,269,770			
Windermere and Golden	59,871	10,038	62,995			
Ainsworth	749,120	521,931	357,169			
Slocan and Slocan City	1,452,971	740,413	1,408,053			
Nelson and Arrow Lake	321,537	370,246	99,661			
Trail Creek	278,117	208,938	202,460			
Revelstoke, Trout Lake, and Lardeau	17,184	5,812	16,334			
Western District (No. 6)				14,058,540	14,203,085	16,316,378
Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria (Vancouver Island)	8,613,205	8,522,116	8,570,425			
Vancouver and New Westminster (Mainland)	5,445,335	5,680,969	7,745,953			
Totals			$65,372,583	$67,188,842	$60,729,358	$65,372,583

TABLE V.—Yield of Placer Gold to Date.

1858	$705,000	1876	$1,786,648	1894	$405,516	1912	$555,500
1859	1,615,070	1877	1,608,182	1895	481,683	1913	510,000
1860	2,228,543	1878	1,275,204	1896	544,026	1914	565,000
1861	2,666,118	1879	1,290,058	1897	513,520	1915	770,000
1862	2,656,903	1880	1,013,827	1898	643,346	1916	580,500
1863	3,913,563	1881	1,046,737	1899	1,344,900	1917	496,000
1864	3,735,850	1882	954,085	1900	1,278,724	1918	320,000
1865	3,491,205	1883	794,252	1901	970,100	1919	286,500
1866	2,662,106	1884	736,165	1902	1,073,140	1920	221,600
1867	2,480,868	1885	713,738	1903	1,060,420	1921	233,200
1868	3,372,972	1886	903,651	1904	1,115,300	1922	364,800
1869	1,774,978	1887	693,709	1905	969,300	1923	420,000
1870	1,336,956	1888	616,731	1906	948,400	1924	420,750
1871	1,799,440	1889	588,923	1907	828,000	1925	280,092
1872	1,610,972	1890	490,435	1908	647,000	1926	355,503
1873	1,305,749	1891	429,811	1909	477,000	1927	156,247
1874	1,844,618	1892	399,526	1910	540,000	1928	143,208
1875	2,474,004	1893	356,131	1911	426,000		
				Total			$78,318,003

TABLE VI.—PRODUCTION OF LODE MINES.

Year.	GOLD.		SILVER.		COPPER.		LEAD.		ZINC.		Total Value.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
		$		$		$		$		$	$
1887	.....	.....	17,690	17,331	.....	.....	204,800	9,216	.....	.....	26,547
1888	.....	.....	79,780	75,000	.....	.....	674,500	29,813	.....	.....	104,813
1889	.....	.....	53,192	47,873	.....	.....	165,100	6,498	.....	.....	54,371
1890	.....	.....	70,427	73,948	.....	.....	.....	.....	.....	.....	73,948
1891	.....	.....	4,500	4,000	.....	.....	.....	.....	.....	.....	4,000
1892	.....	.....	77,160	66,935	.....	.....	808,420	33,064	.....	.....	99,999
1893	1,170	23,404	227,000	195,000	.....	.....	2,135,023	78,996	.....	.....	297,400
1894	6,252	125,014	746,379	470,219	324,680	16,234	5,662,523	169,875	.....	.....	781,342
1895	39,264	785,271	1,496,522	977,229	952,840	47,642	16,475,464	532,255	.....	.....	2,342,397
1896	62,259	1,244,180	3,135,343	2,100,689	3,818,556	190,926	24,199,977	721,384	.....	.....	4,257,179
1897	106,141	2,122,820	5,472,971	3,272,836	5,325,180	266,258	38,841,135	1,390,517	.....	.....	7,052,431
1898	110,061	2,201,217	4,292,401	2,375,841	7,271,678	874,781	31,693,559	1,077,581	.....	.....	6,529,420
1899	138,315	2,857,573	2,939,413	1,663,708	7,722,591	1,351,453	21,862,436	878,870	.....	.....	6,751,604
1900	167,153	3,453,381	3,958,175	2,309,200	9,997,080	1,615,289	63,358,621	2,691,887	.....	.....	10,069,757
1901	210,384	4,348,603	5,151,333	2,884,745	27,603,746	4,446,963	51,582,906	2,002,733	.....	.....	13,683,044
1902	236,491	4,888,269	3,917,917	1,941,528	29,636,057	3,446,673	22,536,381	824,832	.....	.....	11,101,102
1903	232,831	4,812,616	2,996,204	1,521,472	34,359,921	4,547,535	18,089,283	689,744	.....	.....	11,571,367
1904	222,042	4,589,608	3,222,481	1,719,516	35,710,128	4,578,037	36,646,244	1,421,874	.....	.....	12,309,035
1905	238,660	4,932,102	3,439,417	1,971,818	37,692,251	5,876,222	56,580,703	2,399,022	.....	.....	15,180,164
1906	*224,027*	*4,630,639*	*2,990,262*	*1,897,320*	*42,990,488*	*8,288,565*	*52,408,217*	*2,667,578*	.....	.....	*17,484,102*
1907	196,179	4,055,020	2,745,448	1,703,825	40,832,720	8,166,544	47,738,703	2,291,458	.....	.....	16,216,847
1908	255,582	5,282,880	2,631,389	1,521,483	47,274,614	6,240,249	43,195,733	1,632,799	.....	.....	14,477,411
1909	238,224	4,924,090	2,532,742	1,239,270	45,597,245	5,918,522	44,396,346	1,709,259	8,500,000	400,000	14,191,141
1910	267,701	5,533,380	2,450,241	1,245,016	38,243,934	4,871,512	34,658,746	1,386,350	4,184,192	192,473	13,228,731
1911	228,617	4,725,513	1,892,364	958,293	36,927,656	4,571,644	26,872,397	1,069,521	2,634,544	129,092	11,454,063
1912	257,496	5,322,442	3,132,108	1,810,045	51,456,537	8,408,513	44,871,454	1,805,627	5,358,280	316,139	17,662,766
1913	272,254	5,627,490	3,465,856	1,968,606	46,460,805	7,091,489	55,364,677	2,175,832	6,758,768	324,421	17,190,838
1914	247,170	5,109,004	3,602,180	1,876,736	45,009,699	6,121,319	50,625,048	1,771,877	7,866,467	346,125	15,225,061
1915	250,021	5,167,934	3,366,506	1,588,991	56,918,405	9,835,500	46,503,590	1,939,200	12,982,440	1,460,524	19,992,149
1916	221,932	4,587,334	3,301,923	2,059,739	65,379,364	17,784,494	48,727,516	3,007,462	37,168,980	4,043,985	31,483,014
1917	114,523	2,367,190	2,929,216	2,265,749	59,007,565	16,038,256	37,307,465	2,951,020	41,848,513	3,166,259	26,788,474
1918	164,674	3,403,812	3,498,172	3,215,870	61,483,754	15,143,449	43,899,661	2,928,107	41,772,916	2,899,040	27,590,278
1919	152,426	3,150,645	3,403,119	3,592,673	42,459,339	7,939,896	29,475,968	1,526,855	56,737,651	3,540,429	19,750,498
1920	120,048	2,481,392	3,377,849	3,235,980	44,887,676	7,832,899	39,331,218	2,816,115	47,208,268	3,077,979	19,444,365
1921	135,663	2,804,154	2,673,389	1,591,201	39,036,993	4,879,624	41,402,288	1,693,354	49,419,372	1,952,065	12,920,398
1922	197,856	4,089,684	7,101,311	4,554,781	32,359,896	4,329,754	67,447,985	3,480,316	57,146,548	2,777,322	19,231,857
1923	179,245	3,704,994	6,032,986	3,718,129	57,720,290	8,323,266	96,663,152	6,321,770	58,343,462	3,278,903	25,347,062
1924	247,716	5,120,535	8,341,768	5,292,184	64,845,393	8,442,870	170,384,481	12,415,917	79,130,970	4,266,741	35,538,247
1925	209,719	4,335,269	7,654,844	5,286,818	72,306,432	10,153,269	237,899,199	18,670,329	98,257,099	7,754,450	46,200,135
1926	201,427	4,163,859	10,748,556	6,675,606	89,339,768	12,324,421	263,023,937	17,757,535	142,876,947	10,586,610	51,508,031
1927	178,001	3,679,601	10,470,185	5,902,043	89,202,871	11,525,011	282,996,423	14,874,292	145,225,443	8,996,135	44,977,082
1928	188,087	3,888,097	10,627,167	6,182,461	97,908,316	14,265,242	305,140,792	13,961,412	181,763,147	9,984,613	48,281,825
Totals	6,519,603	134,540,016	150,267,886	92,871,507	1,468,062,968	235,757,321	2,501,866,071	135,812,146	1,085,184,007	69,493,305	668,474,295

TABLE VII.—PRODUCTION IN DETAIL OF THE

DISTRICT AND DIVISIONS.	YEAR.	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
				$		$		$
North-western District (No. 1)	.....	.....	.....	.....	.....	.....	.....	.....
Atlin	1927	4,243	2,428	41,276	2,030	41,964	5,307	2,992
	1928	**400**	**3,174**	**53,958**	**193**	**3,990**	**133**	**78**
Stikine	1927	.....	.....	.....	.....	.....	.....	.....
	1928	.....	**29**	**493**	.....	.....	.....	.....
Liard	1927	.....	365	6,205	.....	.....	.....	.....
	1928	.....	**334**	**5,678**	.....	.....	.....	.....
Nass River	1927	1,375,878	.....	.....	4,960	102,532	298,152	168,068
	1928	**1,425,802**	.....	.....	**5,100**	**105,428**	**273,068**	**158,860**
Portland Canal	1927	285,171	.....	.....	122,242	2,526,962	3,302,244	1,861,475
	1928	**278,375**	.....	.....	**130,304**	**2,693,618**	**2,369,176**	**1,378,292**
Skeena	1927	38	105	1,785	56	1,158	12	7
	1928	**190**	**30**	**510**	**139**	**2,874**	**1,166**	**678**
Queen Charlotte	1927	.....	.....	.....	.....	.....	.....	.....
	1928	.....	.....	.....	.....	.....	.....	.....
Bella Coola	1927	.....	.....	.....	.....	.....	.....	.....
	1928	.....	.....	.....	.....	.....	.....	.....
North-eastern District (No. 2)	.....	.....	.....	.....	.....	.....	.....	.....
Cariboo	1927	5	3,125	53,125	.....	.....	36	20
	1928	.....	**2,287**	**38,879**	.....	.....	.....	.....
Quesnel	1927	.....	2,319	39,423	.....	.....	.....	.....
	1928	.....	**1,649**	**28,033**	.....	.....	.....	.....
Omineca	1927	3,900	236	4,012	165	3,411	173,072	97,561
	1928	**15,332**	**235**	**3,995**	**477**	**9,860**	**343,653**	**199,924**
Peace River	1927	.....	177	3,009	.....	.....	.....	.....
	1928	.....	**200**	**3,400**	.....	.....	.....	.....
Central District (No. 3)	.....	.....	.....	.....	.....	.....	.....	.....
Nicola	1927	.....	.....	.....	.....	.....	.....	.....
	1928	**73**	.....	.....	**1**	**21**	**1,595**	**928**
Vernon	1927	12	3	51	6	124	1,605	905
	1928	**36**	.....	.....	**2**	**41**	.....	.....
Yale	1927	.....	30	510	.....	.....	.....	.....
	1928	.....	**20**	**340**	.....	.....	.....	.....
Ashcroft	1927	1	.....	.....	1	21	.....	.....
	1928	.....	.....	.....	.....	.....	.....	.....
Kamloops	1927	15,576	5	85	326	6,739	55,070	47,954
	1928	**5,000**	**15**	**255**	**157**	**3,246**	**320**	**186**
Lillooet	1927	14,553	59	1,003	5,979	123,596	1,098	619
	1928	**14,360**	.....	.....	**7,730**	**159,793**	**1,400**	**814**
Clinton	1927	.....	133	2,261	.....	.....	.....	.....
	1928	.....	**186**	**3,162**	.....	.....	.....	.....
Southern District (No. 4)	.....	.....	.....	.....	.....	.....	.....	.....
Grand Forks	1927	59	.....	.....	1	21	491	277
	1928	**15**	.....	.....	.....	.....	**1,059**	**616**
Greenwood	1927	3,080	.....	.....	114	2,357	520,814	293,583
	1928	**2,711**	.....	.....	**134**	**2,770**	**386,957**	**225,116**
Osoyoos	1927	44,910	.....	.....	12,851	265,653	111	62
	1928	**45,437**	.....	.....	**11,843**	**244,816**	**3,148**	**1,831**
Similkameen	1927	757,675	59	1,003	4,031	83,328	137,971	77,774
	1928	**889,020**	**242**	**4,114**	**5,265**	**108,837**	**150,757**	**87,705**
Eastern District (No. 5)	.....	.....	.....	.....	.....	.....	.....	.....
Fort Steele	1927	1,453,916	126	2,142	939	19,411	5,123,925	2,888,357
	1928	**1,792,633**	**23**	**391**	**731**	**15,111**	**5,595,565**	**3,255,276**
Windermere	1927	110	.....	.....	.....	.....	2,583	1,456
	1928	**7,647**	.....	.....	**3**	**62**	**19,023**	**11,067**
Golden	1927	6	21	357	2	41	264	149
	1928	.....	.....	.....	.....	.....	.....	.....
Ainsworth	1927	40,432	.....	.....	123	2,542	120,908	68,156
	1928	**30,033**	.....	.....	**148**	**3,059**	**102,654**	**59,720**
Slocan	1927	25,052	.....	.....	176	3,638	402,065	226,644
	1928	**90,610**	.....	.....	**383**	**7,917**	**1,117,993**	**650,404**
Slocan City	1927	821	.....	.....	.....	.....	31,334	17,663
	1928	**623**	.....	.....	**41**	**848**	**13,906**	**8,090**
Nelson	1927	25,463	.....	.....	7,035	145,426	76,726	43,250
	1928	**14,985**	.....	.....	**2,712**	**56,062**	**43,357**	**25,223**
Arrow Lake	1927	.....	.....	.....	.....	.....	.....	.....
	1928	.....	.....	.....	.....	.....	.....	.....
Trail Creek	1927	15,450	.....	.....	6,625	136,951	16,868	9,508
	1928	**13,941**	.....	.....	**7,424**	**153,467**	**7,435**	**4,325**
Revelstoke	1927	30	.....	.....	.....	.....	2,025	1,142
	1928	**44**	.....	.....	**1**	**21**	**1,808**	**1,052**
Trout Lake	1927	2	.....	.....	.....	.....	274	154
	1928	**54**	.....	.....	**7**	**145**	**633**	**368**
Lardeau	1927	28	.....	.....	1	21	1,863	1,050
	1928	**11**	.....	.....	**15**	**310**	**5**	**3**
Western District (No. 6)	.....	.....	.....	.....	.....	.....	.....	.....
Nanaimo	1927	10	.....	.....	2	41	6	3
	1928	**47**	.....	.....	.....	.....	**128**	**74**
Alberni	1927	.....	.....	.....	.....	.....	.....	.....
	1928	.....	.....	.....	.....	.....	.....	.....
Clayoquot	1927	.....	.....	.....	.....	.....	.....	.....
	1928	.....	.....	.....	.....	.....	.....	.....
Quatsino	1927	.....	.....	.....	.....	.....	.....	.....
	1928	.....	.....	.....	.....	.....	.....	.....
Victoria	1927	.....	.....	.....	.....	.....	.....	.....
	1928	.....	.....	.....	.....	.....	.....	.....
New Westminster	1927	.....	.....	.....	.....	.....	.....	.....
	1928	.....	.....	.....	.....	.....	.....	.....
Vancouver	1927	1,349,591	.....	.....	10,336	213,664	165,361	93,214
	1928	**1,613,931**	.....	.....	**15,277**	**315,803**	**192,228**	**111,831**
Totals	1927	5,416,023	9,191	156,247	178,001	3,679,601	10,470,185	5,902,043
	1928	**6,241,310**	**8,424**	**143,208**	**188,087**	**3,888,097**	**10,627,167**	**6,182,461**

METALLIFEROUS MINES FOR 1927 AND 1928.

COPPER.		LEAD.		ZINC.		TOTALS FOR DIVISIONS.		TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1927.	1928.	1928.
	$		$		$	$	$	$
								9,635,111
		12,582	661			86,893		
							58,026	
							493	
						6,205		
							5,678	
36,150,380	4,670,629	445	24			4,941,253		
34,605,833	**5,042,070**	**21,911**	**1,002**				**5,307,358**	
550,060	71,068	3,663,414	192,549	1,609,923	99,728	4,751,782		
317,493	**46,259**	**2,933,599**	**134,224**				**4,252,393**	
						2,950		
48,012	**6,995**	**2,309**	**106**				**11,163**	
								367,145
		295	15			53,160		
							38,879	
						39,423		
							28,033	
1,344	174	398,888	20,966	268,562	16,636	142,760		
52	**8**	**868,695**	**39,746**	**788,253**	**43,300**		**296,833**	
						3,009		
							3,400	
								198,903
		4,131	**189**	**3,770**	**207**		**1,345**	
		2,574	135	1,976	122	1,337		
614	**89**	**1,583**	**72**				**202**	
						510		
							340	
						21		
268,368	34,673	68,787	3,616	147,087	9,112	102,179		
202,882	**29,560**						**33,247**	
						125,218		
							160,607	
						2,261		
							3,162	
								3,801,005
907	117	24,500	1,288	4,502	279	1,982		
		5,206	**238**				**854**	
		265,996	13,981	68,059	4,216	314,137		
5,000	**729**	**175,898**	**8,048**	**6,366**	**350**		**237,013**	
						265,715		
528	**77**	**1,645**	**76**				**246,800**	
17,725,294	2,290,108	7,163	376	6,567	407	2,452,996		
21,384,228	**3,115,682**						**3,316,338**	
								27,971,027
128	17	270,703,660	14,228,184	132,287,862	8,194,704	25,332,815		
83	**12**	**292,757,130**	**13,394,810**	**167,842,300**	**9,219,913**		**25,885,513**	
		51,981	2,732	18,478	1,145	5,333		
200	**29**	**369,982**	**16,928**	**557,593**	**30,630**		**58,716**	
		3,298	173	463	29	749		
		3,251,280	170,887	4,225,392	261,746	503,331		
		1,350,894	**61,809**	**3,662,363**	**201,181**		**325,769**	
		2,906,697	152,776	4,937,784	305,876	688,934		
		5,440,581	**248,928**	**8,735,009**	**479,831**		**1,387,080**	
		259,072	13,617	293,801	18,199	49,479		
		48,392	**2,214**	**142,370**	**7,821**		**18,973**	
1,347	174	1,325,338	69,660	1,342,188	83,143	341,653		
190	**28**	**160,974**	**7,365**	**2,967**	**163**		**88,841**	
466,604	60,285					206,744		
292,850	**42,668**						**200,460**	
		41,155	2,163	4,167	258	3,563		
		44,208	**2,023**				**3,086**	
		646	34	945	59	247		
		11,703	**536**	**22,156**	**1,217**		**2,266**	
		8,652	455	7,687	476	2,002		
							313	
								6,451,842
604	78					122		
4,348	**633**						**707**	
34,037,835	4,397,688					4,704,566		
41,046,003	**5,980,403**	**941,951**	**43,098**				**6,451,135**	
89,202,871	11,525,011	282,996,423	14,874,292	145,225,443	8,996,135	45,133,329		
97,908,316	**14,265,242**	**305,140,792**	**13,961,412**	**181,763,147**	**9,984,613**		**48,425,033**	**48,425,033**

TABLE VIII.—Coal Production per Year to Date.*

Year.	Tons (2,240 lb.)	Value.	Year.	Tons (2,240 lb.)	Value.
1836–1885	3,029,011	$9,468,557	1908	1,677,849	$5,872,472
1886	326,636	979,908	1909	2,006,476	7,022,666
1887	413,360	1,240,080	1910	2,800,046	9,800,161
1888	489,301	1,467,903	1911	2,193,062	7,675,717
1889	579,830	1,739,490	1912	2,628,804	9,200,814
1890	678,140	2,034,420	1913	2,137,483	7,481,190
1891	1,029,097	3,087,291	1914	1,810,967	6,338,385
1892	826,335	2,479,005	1915	1,611,129	5,638,952
1893	978,294	2,934,882	1916	2,084,093	7,294,325
1894	1,012,953	3,038,859	1917	2,149,975	7,524,913
1895	939,654	2,818,962	1918	2,302,245	11,511,225
1896	896,222	2,688,666	1919	2,267,541	11,337,705
1897	882,854	2,648,562	1920	2,595,125	12,975,625
1898	1,135,865	3,407,595	1921	2,483,995	12,419,975
1899	1,306,324	3,918,972	1922	2,511,843	12,559,215
1900	1,439,595	4,318,785	1923	2,453,223	12,266,115
1901	1,460.331	4,380,993	1924	1,939,526	9,697,630
1902	1,397,394	4,192,182	1925	2,328,522	11,642,610
1903	1,168,194	3,504,582	1926	2,330,036	11,650,180
1904	1,253,628	3,760,884	1927	2,453,827	12,269,135
1905	1,384,312	4,152,936	1928	2,526,702	12,633,510
1906	1,517,303	4,551,909			
1907	1,800,067	6,300,235	Totals	73,237,169	$283,928,178

* For all years to 1925 (inclusive) figures are net coal production and do not include coal made into coke; subsequent figures are entire coal production, including coal made into coke.

TABLE IX.—Coke Production from Bee-hive Ovens in British Columbia from 1895 to 1925.

Year.	Tons (2,240 lb.)	Value.	Year.	Tons (2,240 lb.)	Value.
1895–97	19,396	$96,980	1913	286,045	$1,716,270
1898 (estimated)	35,000	175,000	1914	234,577	1,407,462
1899	34,251	171,255	1915	245,871	1,475,226
1900	85,149	425,745	1916	267,725	1,606,350
1901	127,081	635,405	1917	159,905	959,430
1902	128,015	640,075	1918	188,967	1,322,769
1903	165,543	827,715	1919	91,138	637,966
1904	238,428	1,192,140	1920	67,792	474,544
1905	271,785	1,358,925	1921	59,434	416,038
1906	199,227	996,135	1922	45,835	320,845
1907	222,913	1,337,478	1923	58,919	412,433
1908	247,399	1,484,394	1924	30,615	214,305
1909	258,703	1,552,218	1925	75,185	526,295
1910	218,029	1,308,174			
1911	66,005	396,030			
1912	264,333	1,585,998	Totals	4,393,255	$25,673,600

TABLE X.—Coke and By-products Production of British Columbia, 1928.

	Quantity.	Value.
Coal used in making coke, long tons	187,685	$940,668
Coke made in bee-hive ovens, long tons	61,370	$429,590
Coke made in by-product ovens, long tons	28,680	263,781
Coke made in gas plants, long tons	37,242	187,882
Total coke made, long tons	127,292	$881,253
Gas produced		1,313,407
Tar produced		45,313
Other by-products		14,036
Total production value of coke industry		$2,254,009

TABLE XI.—Production in Detail of Structural Materials, 1928.

District and Division.	Cement.	Lime and Limestone.	Building-stone.	Riprap and Crushed Rock.	Sand and Gravel.	Pottery and Tile.	Clay.	Firebrick.	Face and Front Brick.	Red Brick.	Totals for Divisions.	Totals for Districts.
	$	$	$	$	$	$	$	$	$	$	$	$
North-western District (No. 1)												42,354
Atlin, Liard, and Stikine												
Nass River												
Portland Canal				2,000	1,000						3,000	
Skeena and Queen Charlotte				7,000	2,790						9,790	
Bella Coola		36,152			412						36,564	
North-eastern District (No. 2)												10,661
Cariboo and Quesnel					6,681		1,400	1,120			9,201	
Omineca and Peace River					1,000					460	1,460	
Central District (No. 3)												44,254
Nicola and Vernon			3,200		22,256					3,823	29,279	
Yale, Ashcroft, and Kamloops				1,000	13,975						14,975	
Lillooet and Clinton												
Southern District (No. 4)												19,951
Grand Forks and Greenwood					1,752					11,000	15,752	
Osoyoos		4,199									4,199	
Similkameen												
Eastern District (No. 5)												68,416
Fort Steele				1,280	7,028						8,308	
Windermere and Golden					3,229						3,229	
Ainsworth			31,400								31,400	
Slocan and Slocan City				1,000	1,000						2,000	
Nelson			5,401	2,606	2,813						10,820	
Trail Creek				1,000	1,000						2,000	
Revelstoke					10,659						10,659	
Western District (No. 6)												3,216,050
Nanaimo		439,636	20,509		2,450					44,848	507,443	
Victoria and Quatsino	1,495,204	43,873		1,000	78,492	12,018				76,205	1,669,426	
Vancouver			11,950	86,470	237,318						373,104	
New Westminster				98,890	19,267	264,573	13,404	206,291	59,286	4,366	666,077	
Totals	1,495,204	523,860	72,460	202,246	413,122	276,591	14,804	207,411	59,286	143,702	3,408,686	3,408,686

TABLE XII.—Miscellaneous Metals and Minerals: Production by Mineral Survey Districts, 1928.

District.	Arsenic.	Bentonite.	Cadmium.	Cobalt.	Diatomite.	Gypsum.	Iron.	Lime and Quartz for Flux.	Palladium.	Platinum.	Pyrite.	Sodium Carbonate.	District Totals.
	$	$	$	$	$	$	$	$	$	$	$	$	$
No. 1													
No. 2	340			420	4,801					76			5,637
No. 3						227,123						3,591	230,714
No. 4	14,564	100						21,391		2,743			38,798
No. 5			341,374			2,960	1,050		22,270	1,730			369,384
No. 6							765	5,184			254,872		260,821
Totals	14,904	100	341,374	420	4,801	230,083	1,815	26,575	22,270	4,549	254,872	3,591	905,354

TABLE XIII.

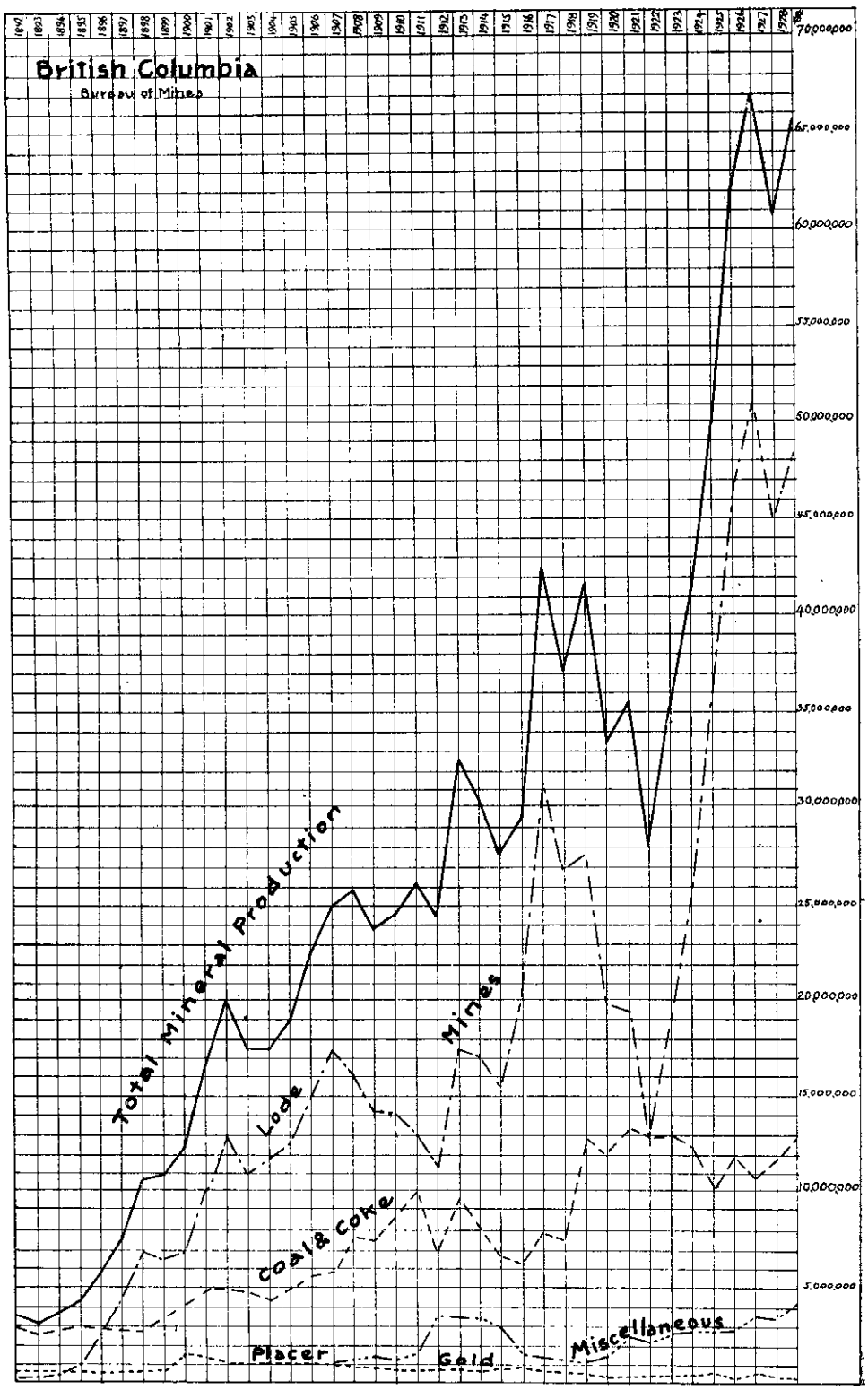

British Columbia
Bureau of Mines
Total Mineral Production
Lode Mines
Coal & Coke
Placer Gold
Miscellaneous
70,000,000
65,000,000
60,000,000
55,000,000
50,000,000
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000

TABLE XIV.

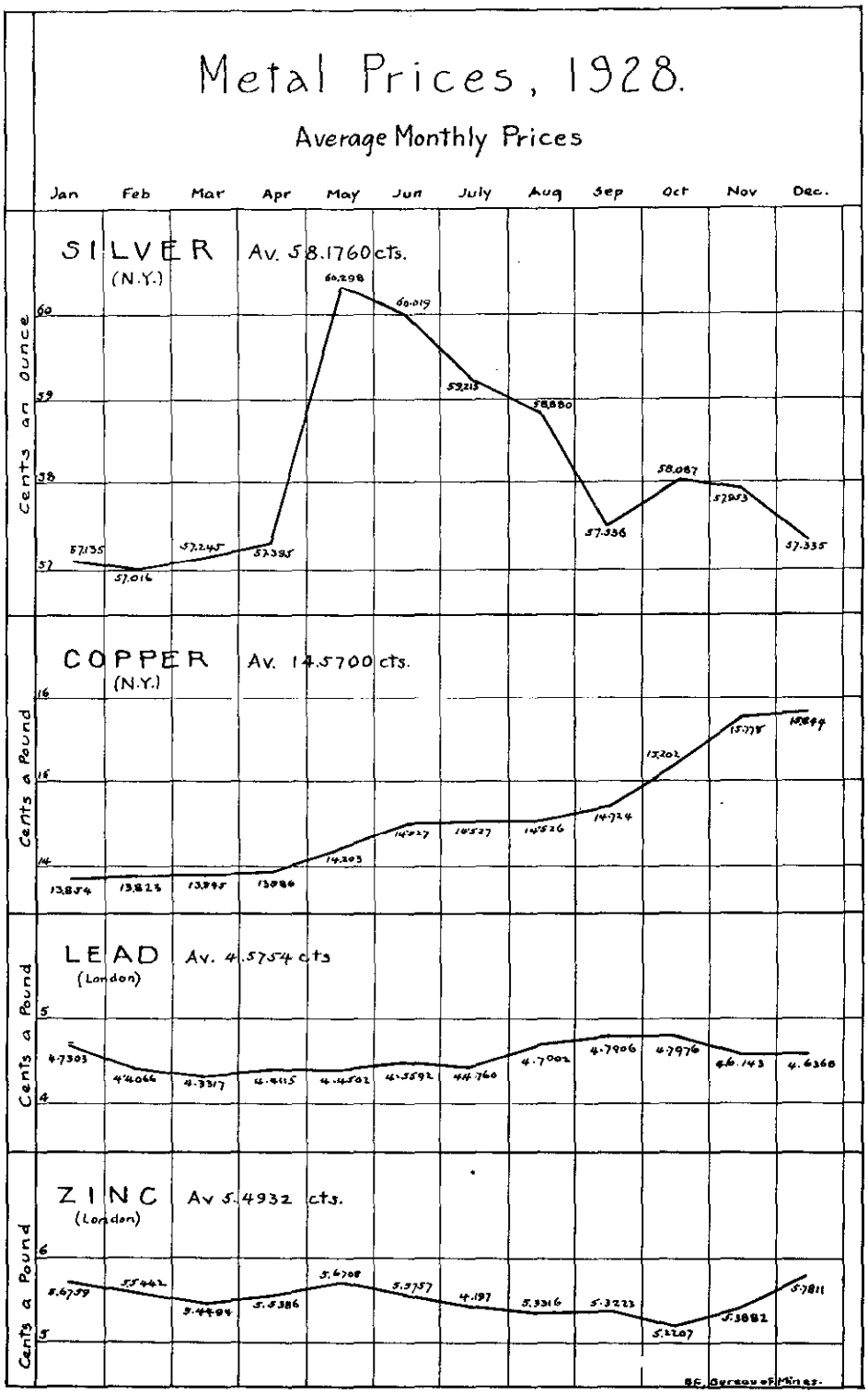

Metal Prices, 1928.
Average Monthly Prices
Jan Feb Mar Apr May Jun July Aug Sep Oct Nov Dec.
SILVER (N.Y.) Av. 58.1760 cts.
Cents an ounce.
60 59 58 57
57.135 57.016 57.245 57.385 60.298 60.019 59.213 58.880 57.336 58.087 57.953 57.335
COPPER (N.Y.) Av. 14.5700 cts.
Cents a Pound
16 14
13.854 13.824 13.895 13.986 14.303 14.527 14.527 14.526 14.724 15.202 15.778 15.844
LEAD (London) Av. 4.57574 cts
Cents a Pound
5 4
4.7303 4.4066 4.3517 4.4115 4.4502 4.5592 4.4760 4.7002 4.7906 4.7976 4.6143 4.6360
ZINC (London) Av 5.4932 cts.
Cents a Pound
6 5
5.6759 5.5442 5.4494 5.5386 5.6708 5.5757 5.197 5.3316 5.3223 5.2207 5.3882 5.7811
BC Bureau of Mines.

TABLE XV.

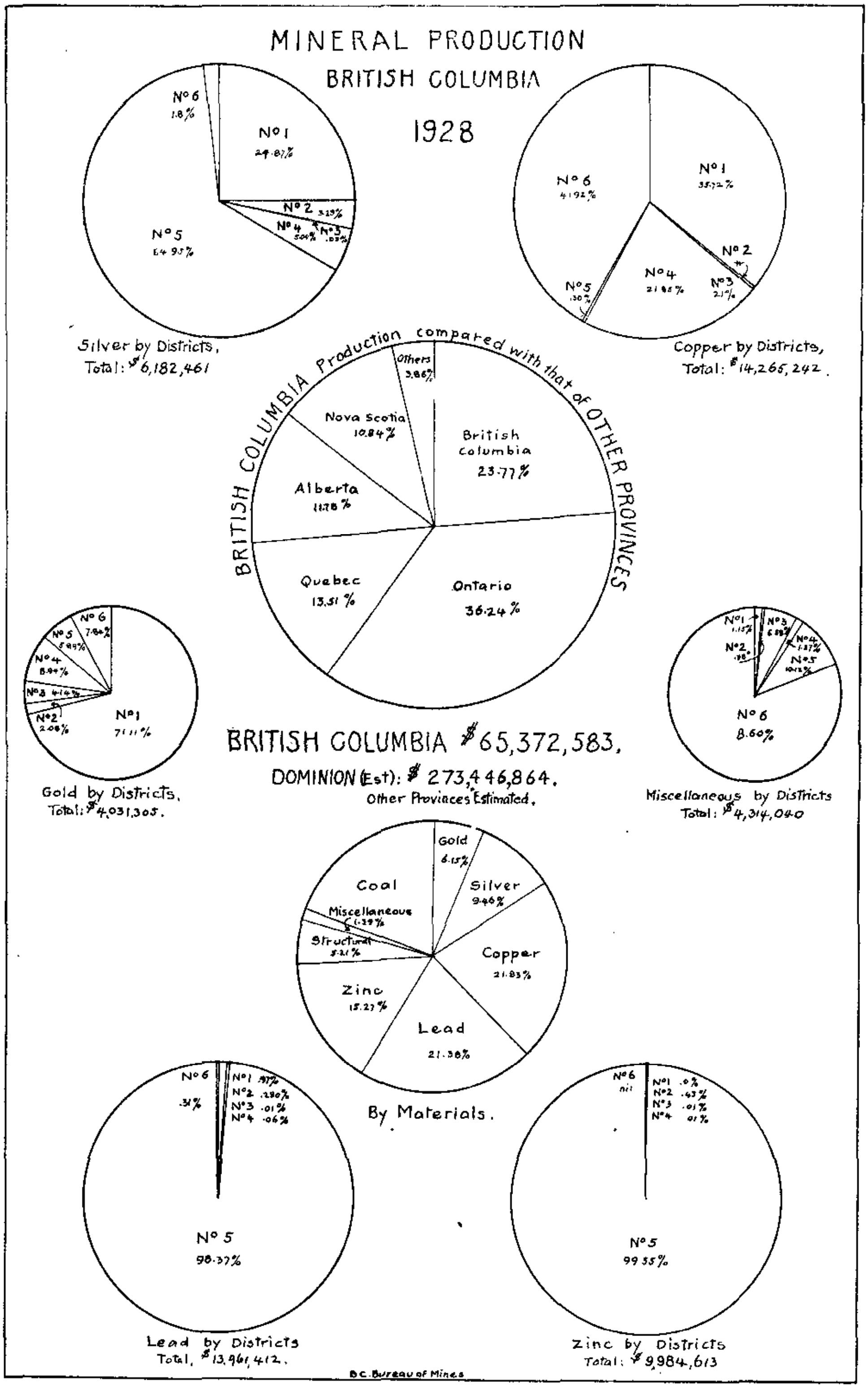

MINERAL PRODUCTION
BRITISH COLUMBIA
1928
Nº 6
1.8%
Nº 1
24.87%
Nº 2
Nº 4
Nº 3
Nº 5
64.95%
Silver by Districts,
Total: $6,182,461
Nº 1
35.72%
Nº 6
41.92%
Nº 2
Nº 3
Nº 4
21.65%
Nº 5
Copper by Districts,
Total: $14,265,242.
BRITISH COLUMBIA Production compared with that of OTHER PROVINCES
Others
3.86%
Nova Scotia
10.84%
British
Columbia
23.77%
Alberta
11.78%
Quebec
13.51%
Ontario
36.24%
Nº 6
7.84%
Nº 5
Nº 4
Nº 3
Nº 2
Nº 1
Gold by Districts,
Total: $4,031,305.
BRITISH COLUMBIA $65,372,583.
DOMINION (Est): $273,446,864.
Other Provinces Estimated.
Nº 1
Nº 2
Nº 3
Nº 4
Nº 5
Nº 6
8.60%
Miscellaneous by Districts
Total: $4,314,040
Gold
6.15%
Silver
9.46%
Coal
Miscellaneous
Structural
Copper
21.83%
Zinc
15.27%
Lead
21.38%
By Materials.
Nº 6
.31%
Nº 1
Nº 2
Nº 3 .01%
Nº 4 .06%
Nº 5
98.37%
Lead by Districts
Total, $13,961,412.
Nº 6
nil
Nº 1
Nº 2
Nº 3
Nº 4
Nº 5
99.55%
Zinc by Districts
Total: $9,984,613
B.C. Bureau of Mines

TABLE XVI.—MEN EMPLOYED IN THE MINERAL INDUSTRY OF BRITISH COLUMBIA, 1928.

District.	Placer-mining.	Lode-mining.			In Concentrators.	In Smelters.	Coal-mining.			Structural Materials.		Miscellaneous Minerals.	Total.
		Under.	Above.	Total.			Under.	Above.	Total.	Quarries.	Plants.		
No. 1	134	535	467	1,002	88	540	.....	.....	.....	.....	.....	.....	1,764
No. 2	136	127	251	378	10	.....	6	2	8	4	1	6	543
No. 3	15	93	177	270	7	.....	87	33	120	8	3	84	507
No. 4	43	386	286	672	140	.....	313	179	492	6	.....	4	1,357
No. 5	22	985	833	1,818	460	2,208	1,153	468	1,621	19	1	20	6,169
No. 6	5	581	455	1,036	206	.....	2,255	838	3,093	375	363	6	5,084
Totals	355	2,707	2,469	5,176	911	2,748	3,814	1,520	5,334	412	368	120	15,424

TABLE XVII.—TONNAGE, NUMBER OF MINES, AND NET VALUE OF LODE MINERALS.

District.	Tonnage.	No. of Shipping Mines, 1928.	No. of Mines shipping over 100 Tons.	Net Value of Lode Minerals produced.
No. 1	1,704,767	9	7	$7,024,507
No. 2	15,332	7	2	247,276
No. 3	19,469	5	2	186,388
No. 4	937,183	18	6	3,041,394
No. 5	1,950,581	68	31	13,497,779
No. 6	1,613,978	3	1	5,072,731
Totals	6,241,310	110	49	$29,070,075

SUMMARY OF STATISTICAL TABLES.

In compiling the Statistical Tables for the 1928 Annual Report the same general arrangement has been followed as in previous years, and the order of the tables is the same as in the 1927 Annual Report.

Referring to the preceding Statistical Tables showing the mineral production of the Province, the following is a summary of their contents:—

Table I. shows the total gross value of each mineral product mined in the Province up to the end of 1928, aggregating $1,114,210,411. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of $309,601,778; followed next in importance by copper at $235,757,321, and next in order is lead at $135,812,146, with lode gold in fourth place at $134,540,016.

Table II. shows the value of the total production of the mines of the Province from 1852 to 1895 (included in one total) and for each year from 1896 to 1928. The value of the total mineral production of the Province up to the end of 1928 was $1,114,210,411.

Table III. gives the quantities in the customary units of measure and the values of the various metals or minerals which go to make up the total of the mineral production of the Province for 1928, and also, for the purpose of comparison, similar data for the two preceding years.

Table IV. shows the proportions of the total mineral productions made in each of the various districts into which the Province is divided.

It will be noted that again this year the Eastern District has the honour of first place on the list, followed, in order of importance, by the Western, North-western, Southern, Central, and North-eastern Districts. The Western and Eastern Districts owe a considerable proportion of their output to the coal-mines situated within their limits, whereas in the other districts the production is chiefly from metal-mining.

The Western District also derives a fair proportion of its production from structural materials, due to the larger cities therein; this year this amounted to $3,216,050, as shown in Table XI.

Table V. shows the statistical record of the placer mines of the Province from 1858 to 1928, and shows a total production of $78,318,003. The value of the output for 1928 was $143,208, a decrease, as compared with the previous year, of $13,039.

Table VI. relates entirely to the lode mines of the Province, and shows the quantities and values of the various metals produced each year since the beginning, in 1887, of such mining in the Province. The gross value of the product of these mines to date is $668,474,295; this figure includes the zinc production of 1909 and all subsequent years.

Table VII. gives the details of production of metalliferous mines of the Province for the years 1927 and 1928 and the divisions and districts in which such productions were made, showing the tonnage of ore mined in each district, with its metallic contents and the market value of the contained metals recovered in treatment.

The total tonnage of ore mined in the Province during the year 1928 was 6,241,310 tons, having a gross value of $48,281,825, and, with the placer gold, a total value of $48,425,033.

Table VIII. contains the statistics of production of the coal-mines of the Province. The total amount of coal produced to the end of 1928 was 73,237,169 tons (2,240 lb.), worth $283,928,178. Of this, 2,526,702 tons was produced in 1928, valued at $12,633,510. In these figures of coal production up to and including 1925 the coal used in making coke is not included, as such coal is accounted for in the figures of output of coke, but the 1926, 1927, and 1928 figures include coal made into coke.

More detailed statistics as to the coal production of the Province are given in the reports of the Inspection Branch.

Table IX. shows the production of coke from bee-hive ovens in the Province up to the end of 1925.

Table X., commenced in 1926, shows complete statistics of the coke industry of the Province. Commencing with 1926, coke is not considered a primary mineral production as the coal used in making coke is included and valued in the coal production total. The statistics of the coke industry for the current year are, however, given in this table, as they are believed to be of interest to the mineral industry.

Table XI. shows in detail the production of structural materials. The production in 1928 was valued at $3,408,686, as compared with $2,867,380 in 1927. Rock used as flux by smelters does not appear in this table, but will be found in Table XII., "Miscellaneous Metals and Minerals."

Table XII. shows the production of "Miscellaneous Metals and Minerals" by districts. This branch of the industry is steadily expanding. In 1928 the production value was $905,354, as compared with $459,514 in 1927, or an increase of 97 per cent.

Table XIII. presents in graphic form the facts shown in figures in the tables, and demonstrates to the eye the rapid growth of mining in the Province, and also the fluctuations to which it has been subject.

The curve of lode production shows on the average a steady growth, but some marked interruptions have occurred; it is satisfactory that a substantial increase in production has occurred in the last six years. The total mineral production also shows a progressive increase, with, however, some large fluctuations.

Table XIV. shows graphically the metal prices for 1928.

Table XV. shows graphically the Dominion mineral production (preliminary estimates for all Provinces except British Columbia) in 1928 by Provinces, and the outputs by minerals and districts of the British Columbia production.

Table XVI. shows the total number of men employed in the mineral industry of the Province. The figures are probably incomplete with regard to a number of very small operators and leasers working intermittently, but the totals for the different branches indicate very closely the actual men employed.

Table XVII. shows the tonnages of ore and number of shipping mines for each district. A column in this table shows the net value of lode minerals produced by districts. 1926 was the first year that statistics were collected from which to compile such figures. The net value is

the amount given by the mine-owner as being the money value received for his ore; it is the gross value less deductions for transportation, smelting, refining, and marketing charges on the contained metals.

The total net value of $29,070,075 is believed to be approximately correct, although the statistics obtained were not as complete as desired. In many instances small operators and leasers did not give a return of net value, and in all these cases the value was estimated.

REVIEW BY METALS AND MINERALS.

GOLD.

Placer Gold. The production of placer gold was $143,208, as compared with $156,247 in 1927. The principal placer camps of the Province are in the Atlin and Cariboo Districts. In the former, production was greater than in 1927. In Dease Lake area prospecting and development was actively carried on and the Clearwater river, tributary to Stikine river, received considerable attention. On Squaw creek, on the United States-Yukon boundary, north of Rainy Hollow, a small rush took place, when many placer claims were staked; $7,000 of gold production was accounted for.

At Manson creek, at Pete Toy bar on the Finlay, prospecting resulted in several hundred ounces of gold.

In Clinton Mining Division, on Watson Bar creek, a very good clean-up was recorded, the largest in the history of the creek.

The usual developments on Tulameen and Similkameen rivers was carried on and production was won from the vicinity of Coalmont.

Little work was carried on in the Fort Steele Mining Division, this being confined to operations by W. A. Drayton on Wildhorse creek and those of individuals on Moyie and Palmer Bar creeks. No production was made from the Vancouver Island area.

Owing to the larger operators in Atlin and Similkameen and Quesnel Divisions confining attention to development it is expected that there will be an increase in production in 1929.

Gold from Lode-mining. The value of lode gold produced in 1928 was $3,888,097, as compared with $3,679,601 in 1927, an increase of $208,496, or about 5.2 per cent. Of the total, Portland Canal Division produced $2,693,618, or 69 per cent. A considerable part of the gold production comes as a by-product of copper and silver mining and is subject to yearly variations according to the grade of ore treated.

As compared with 1927, the *Premier* production showed an increase of over 8,000 oz. and the *Britannia* nearly 5,000 oz. In both instances the higher output was due to larger tonnages of ore treated. The only important decrease was from the *Engineer* at Atlin, where milling operations were only carried on for a short time.

Several important gold-mining developments are now being carried on which give promise that a larger gold production will materialize within the next two years. These include the *Lorne* in the Bridge River section, the *Yankee Girl* near Ymir, and the *Engineer* in Atlin. At this latter mine steady development was proceeded with in 1928 with satisfactory results. A number of other partially developed gold properties and prospects are being steadily developed.

The following table shows the gold production by Mining Divisions for the years 1927 and 1928:—

Mining Divisions.	1927. Oz.	1928. Oz.
Portland Canal	122,242	130,304
Osoyoos	12,851	11,843
Trail Creek	6,625	7,424
Nass River	4,960	5,100
Vancouver	10,336	15,277
Lillooet	5,979	7,730
Atlin	2,030	193
Nelson	7,035	2,712
Similkameen	4,031	5,265
All others	1,912	2,239
Totals	178,001	188,087

Silver.

The quantity of silver produced in 1928 was 10,627,167 oz., worth $6,182,461, an increase from the production in 1927 in quantity of 156,982 oz., or 1.5 per cent., and in value of $280,418. The Fort Steele and Portland Canal Divisions together produced 7,964,741 oz., or 75 per cent. of the total output.

Increases in production were made in Fort Steele, Slocan, Omineca, Vancouver, and Similkameen Divisions. The biggest decrease was in Portland Canal Division, amounting to nearly 1,000,000 oz.; this was caused by a smaller output from the *Premier*. Much of the silver production of the Province is secured from the mining of gold, copper, lead, and zinc ores, and as the output of these ores increases, the silver production will continue to grow.

It is encouraging to see that the silver-output of the Slocan Division for 1928 was nearly double that of 1927. The full effect of mine-development and mill-construction in recent years in the Slocan is not yet apparent in production figures and undoubtedly the silver-output will be still greater in 1929.

The market price of silver was fairly steady throughout the year, the average for the year being 58.176 cents an ounce, as compared with 56.37 cents for 1927, an increase of 3.3 per cent.

All indications point to a considerable increase in silver-output in 1929.

The following table shows the silver production by Mining Divisions for the years 1927 and 1928:—

Mining Divisions.	1927. Oz.	1928. Oz.
Fort Steele	5,123,925	5,595,565
Portland Canal	3,302,244	2,369,176
Slocan	402,065	1,117,993
Greenwood	520,814	386,957
Nass River	298,152	273,068
Omineca	173,072	343,653
Vancouver	165,361	192,228
Trail Creek	16,868	7,435
Ainsworth	120,908	102,654
Similkameen	137,971	150,757
Kamloops	85,070	320
Nelson	76,726	43,357
All others	47,009	44,004
Totals	10,470,185	10,627,167

Copper.

The amount of copper produced in 1928 was 97,908,316 lb., valued at $14,265,242. This represents, as compared with 1927, an increase of 8,705,445 lb., or 9.76 per cent., and an increase in value of $2,740,231. This is the greatest production of copper ever recorded in the Province.

The three important copper-mines of the Province—*Britannia*, *Hidden Creek*, and *Copper Mountain*—produced about 99 per cent. of the total output. All three treated longer tonnages than in any preceding year. The *Britannia* is now producing at the rate of 5,000 tons a day and has taken first place as the leading copper-producer of the Province.

The price of copper metal gradually rose throughout 1928, the average for December being 15.844 cents a pound, as compared with 13.854 cents in January. The average for the year was 14.570 cents, or 1.65 cents higher than in 1927. The outlook is that copper metal price will be at a permanently higher level than during recent years. With an increased price for copper, the demand for copper prospects in British Columbia has been stimulated and much development is planned for 1929.

It is not expected that there will be any large increase in copper-output in 1929, but development plans now under way should cause a higher production within two or three years.

The following table shows the production of copper by Mining Divisions for the years 1927 and 1928:—

Mining Divisions.	1927. Lb.	1928. Lb.
Nass River	36,150,380	34,605,833
Vancouver	34,037,835	41,046,003
Similkameen	17,725,294	21,384,228
Trail Creek	466,604	292,850
Portland Canal	550,060	317,493
Skeena	.....	48,012
All others	273,298	213,897
Totals	89,202,871	97,908,316

LEAD.

The amount of lead produced in 1928 was 305,140,792 lb., valued at $13,961,412. This represents, as compared with the previous year, an increase in quantity of 22,158,369 lb., or 7.8 per cent., but, owing to a lower average market price for the metal, a decrease in value of $912,880. This is another high record output for lead-mining in the Province.

This enormous production of lead comes largely from the *Sullivan* mine of the Consolidated Mining and Smelting Company of Canada. This mine has regularly increased its lead production every year since 1919 and is now mining and milling at the rate of 4,000 tons a day.

A further addition to the concentrator was started in 1928, which will be completed in the early part of 1929; the capacity will then be 6,000 tons a day. This will not, however, mean a 50 per cent. increase in metal-output as it is planned to treat a larger tonnage of somewhat lower-grade ore. Some increase in the metal-output will probably occur from the larger tonnage handled. The mine is well equipped to produce 6,000 tons a day and a long life is indicated from the known ore reserves.

The lead-output of the Slocan Division was nearly double that of 1927 and a further increase is expected in 1929. Ainsworth Division showed a marked decline owing to the closing-down of the *Bluebell*.

The average London market price of lead in 1928 was 4.5754 cents a pound, as compared with 5.256 cents in 1927, a decrease of 12.9 per cent.

The following tables shows the production of lead, according to Mining Divisions, for the years 1927 and 1928:—

Mining Divisions.	1927. Lb.	1928. Lb.
Fort Steele	270,703,660	292,757,130
Slocan	2,906,697	5,440,581
Ainsworth	3,251,280	1,350,894
Windermere	51,981	369,982
Portland Canal	3,663,414	2,933,599
Nelson	1,325,338	160,974
Greenwood	265,996	175,898
Omineca	398,888	868,695
All others	429,169	1,083,039
Totals	282,996,423	305,140,792

The Fort Steele Division continues to head the list, with 95.8 per cent. of the total output of the Province for the year.

ZINC.

The production of zinc in 1928 was 181,763,147 lb., valued at $9,984,613. Compared with the 1927 output, this is an increase in quantity of 36,537,704 lb., or 25 per cent., and an increase in value of $988,478. This is the greatest quantity of zinc produced in any year in the Province. The increased output was due to a larger production from the *Sullivan* and increases from mines in the Slocan Division. Similarly as with lead, the mainstay of the Provinical zinc production is the *Sullivan*. A larger output of this metal is expected in 1929, through increases at the *Sullivan* and various mines in the Slocan and Ainsworth Divisions.

The average London price of zinc for the year was 5.4932 cents a pound, as compared with 6.1946 cents in 1927, a decline of 11.3 per cent. A slightly better price is anticipated in 1929.

The following table shows the production of zinc by Mining Divisions for the years 1927 and 1928:—

Mining Divisions.	1927. Lb.	1928. Lb.
Fort Steele	132,287,862	167,842,300
Slocan	4,937,784	8,735,009
Ainsworth	4,225,392	3,662,363
Portland Canal	1,609,923	.....
Nelson	1,342,188	2,967
Omineca	268,562	788,253
Windermere	18,478	557,593
All others	535,254	174,662
Totals	145,225,443	181,763,147

Coal.

The production of coal in 1928 was 2,526,702 long tons, which shows an increase, as compared with 1927, of 72,875 tons.

Summarizing the Provincial production of coal, the following table shows the output:—

	1925.	1926.	1927.	1928.
Vancouver Island mines ..... tons, 2,240 lb.	1,412,757	1,293,175	1,331,325	1,277,533
Nicola-Princeton mines ..... ,,	175,474	187,153	213,292	245,978
Crowsnest mines ..... ,,	854,480	848,448	907,519	1,001,523
Northern District ..... ,,	1,581	1,260	1,691	1,668
Total quantity of coal mined ..... ,,	2,444,292	2,330,036	2,453,827	2,526,702

The greater part of the Provincial coal production is still being mined by three companies—the Crow's Nest Pass Coal Company, of East Kootenay; the Canadian Collieries (Dunsmuir), Limited; and the Western Fuel Corporation, of Vancouver island, which mined, collectively, 75 per cent. of the output.

Of the other collieries: In the Coast District, on Vancouver island, the Granby Company, from its colliery near Cassidy, produced 186,799 tons; the East Wellington Coal Company, 5,357 tons; the Diamond Jubilee mine, 750 tons; the Fiddick mine, 1,805 tons; the Consumers' Coal Company, Limited, 138 tons: the Little Ash mine, 1,532 tons; and the Richardson mine, 72 tons. In the Nicola Valley section of the district the Middlesboro Colliery Company mined 44,646 tons; the Coalmont Colliery, 164,816 tons; the Tulameen Valley Coal Company, Limited, produced 17,886 tons; the Lynden Coal Mines, Limited, produced 18,398 tons; the Normandale Colliery, 162 tons; and the Pleasant Valley Coal Company, 70 tons.

In the Northern District the Telkwa Collieries, Limited, shipped 1,668 tons. This property, for convenience, is included in the Coast District figures.

In the East Kootenay District, in addition to the Crow's Nest Pass Coal Company, which produced 822,280 tons, the Corbin Coals, Limited, produced 179,243 tons.

The collieries of the Coast District, including the Nicola-Princeton and Telkwa fields, are to be credited for 1928 with about 60 per cent. of the total coal-output.

The output of the collieries of the Province for 1928 was, as already stated, 2,526,702 tons, which includes 29,623 tons of coal taken from stock.

Of this amount, there was sold for consumption in Canada, 1,780,237 tons; sold for consumption in the United States, 332,445 tons; sold in other countries, *nil;* making the total coal sales for the year 2,112,682 tons of 2,240 lb.

In addition to the coal sold, there was used by the Crow's Nest Pass Coal Company in the manufacture of coke, 92,607 tons; used under companies' boilers, etc., 188,111 tons; while 162,925 tons was lost in washing and screening.

The following table indicates the markets in which the coal-output of the Province was sold:—

Coal.	Coast District.	Crowsnest Pass District.	Total for Province.
Sold for consumption in Canada.....tons, 2,240 lb.	1,192,689	587,548	1,780,237
Sold for export to United States..... ,,	92,422	240,023	332,445
Sold for export to other countries..... ,,	.....	.....	.....
Total coal sales..... ,,	1,285,111	827,571	2,112,682

Collieries of Coast District.

The collieries of the Coast District, which includes those on Vancouver island and in the Nicola-Princeton fields and one small colliery in the Northern District, mined 1,525,179 tons of coal in 1928, in addition to which 27,735 tons was taken from stock, making 1,552,914 tons distributed from these collieries in 1928. This amout was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada	1,192,689	
Sold as coal in United States	92,422	
Sold as coal in other countries	.....	
Total sold as coal		1,285,111
Used under companies' boilers, etc.		127,661
Lost in washing, etc.		140,142
		1,552,914
Less coal taken from stock		27,735
Gross output		1,525,179

The total coal sales of the Coast collieries for 1928 show, as compared with the sales of the previous year, an increase of 43,844 tons, equivalent to about 3.4 per cent.

The coal sold in Canada by the collieries of the Coast District in 1928 shows an increase of 56,991 tons, or about 5 per cent. more than the preceding year; the amount exported to the United States was 13,147 tons less than the preceding year, a decrease of about 14 per cent.

On Vancouver island nine companies produced coal in 1928—the Canadian Collieries (Dunsmuir), Limited; the Western Fuel Corporation of Canada, Limited; the Granby Consolidated Mining, Smelting, and Power Company; the East Wellington Coal Company, the Diamond Jubilee mine, the Fiddick mine; the Consumers' Coal Company; the Little Ash mine; and the Richardson mine. The combined output of the Island collieries was 1,277,533 tons.

In the Nicola and Princeton coalfields of the Coast District the Middlesboro Colliery Company produced 44,646 tons; the Coalmont Collieries, 164,816 tons; the Tulameen Valley Coal Company, Limited, 17,886 tons; the Lynden Coal Mines, Limited, 18,398 tons; the Normandale Colliery, 162 tons; and the Pleasant Valley Coal Company, 70 tons. The total output of this portion of the sub-district was 245,978 tons.

The Telkwa Collieries produced 1,668 tons.

East Kootenay Coalfield.

There were only two companies operating in this district in 1928—the Crow's Nest Pass Coal Company, operating two separate collieries, which together mined 822,280 tons; and the Corbin Coals, Limited, which mined 179,243 tons; making an output for the district for 1928 of 1,001,523 tons of coal.

The amount of coal actually distributed was 955,077 tons, which includes 1,888 tons taken from stock, making the total production 953,189 tons.

The following table shows the distribution made of the coal of this district:—

	Tons.	Tons.
Sold as coal in Canada	587,548	
Sold as coal in United States	240,023	
Total sold as coal		827,571
Used by Crow's Nest Pass Coal Co. in making coke		92,607
Used by the companies under boilers, etc.		12,116
Lost in washing		22,783
		955,077
Less coal taken from stock		1,888
Gross output		953,189

STRUCTURAL MATERIALS.

The output of structural materials in 1928 was valued at $3,408,686, an increase of $541,306, or 18.8 per cent., as compared with 1927.

Building construction in Vancouver, where the bulk of the structural materials is marketed, continues active, and, in general, production in this branch of the industry varies with the demand very closely. It will, therefore, continue to increase with the growth of population. The raw materials are to be found in many parts of the Province ready for use when required.

Approximately 94 per cent. of the total production of structural materials comes from the Coast District and the larger part of this is marketed in the Coast cities.

Building-stone.—The production of building-stone in 1928 was valued at $72,460. The chief item was marble from Ainsworth Mining Division. High-grade pulp-stones are obtained in Nanaimo Mining Division.

Lime and Limestone.—The value of the production in 1928 was $523,860, as compared with $466,551 in 1927.

Crushed Rock.—The value of the production in 1928 was greater than in 1927, amounting to $202,246.

Sand and Gravel.—The demand for these materials varies considerably and in 1928 the production value of $413,122 is the highest attained for any year.

Cement.—This shows an increase in 1928, being $1,495,204, as compared with $1,182,552 in 1927.

Firebrick.—This is made chiefly by the Clayburn Company. A small amount was made from clay obtained from Quesnel Mining Division. The total output was valued at $207,411.

Red Brick.—The value of the production in 1928 was $143,702.

MISCELLANEOUS MINERALS.

The production of miscellaneous minerals in 1928 was valued at $905,354, an increase, as compared with 1927, of $445,840, or 97 per cent. Increased outputs of gypsum, pyrite, platinum, and iron were made as compared with 1927. The production of pyrite was more than doubled.

Cadmium, cobalt, diatomite, and palladium were new products for 1928.

Attention is now being directed to the possibility of utilizing certain non-metallic minerals in connection with various manufacturing industries.

Platinum.—Platinum occurs in irregular and variable amounts in the placer deposits of the Tulameen and Quesnel rivers. Small amounts of crude platinum were recovered in placer operations on the Tulameen and Finlay rivers. Some platinum and the palladium production were recovered as by-products of refining at the Trail plant.

Arsenic.—From the arsenical-iron gold concentrates of the *Nickel Plate* $14,564 worth was recovered at the Tacoma smelter.

Cadmium.—This was produced at the Trail smelter, the output being valued at $341,374. This metal occurs in small quantities in the zinc concentrates from the *Sullivan* and other mines.

Bog-iron.—A small production was shipped to Vancouver from Alta lake for use as a cleaning material and not as iron ore. Iron oxide in the form of ochre was shipped from Windermere Mining Division.

Gypsum.—Gypsum produced in 1928 was valued at $230,083, an increase of $28,931 over that of 1927.

DEPARTMENT OF MINES.

VICTORIA, B.C.

HON. W. A. MCKENZIE - - - - - - *Minister of Mines.*
ROBERT DUNN - - - - - - - - - *Deputy Minister.*
JOHN D. GALLOWAY - - - - - - *Provincial Mineralogist.*
D. E. WHITTAKER - - - - - *Provincial Analyst and Assayer.*
JAMES DICKSON - - - - - - - *Chief Inspector of Mines.*

J. W. JEMSON, *District Inspector*, Nanaimo.
T. R. JACKSON, *District Inspector*, Nanaimo.
ROBERT STRACHAN, *District Inspector*, Fernie.
JOHN MACDONALD, *District Inspector*, Fernie.
JOHN G. BIGGS, *District Inspector*, Merritt.
THOS. J. SHENTON, *Dist. Inspector*, Prince Rupert.
H. H. JOHNSTONE, *Inspector*, Nelson.
JAS. STRANG, *Inspector and Examiner*, Victoria.
H. E. MIARD, *Inspector and Examiner*, Fernie.

Resident Mining Engineers.

H. T. JAMES, No. 1 District, Prince Rupert.
DOUGLAS LAY, No. 2 District, Hazelton.
H. G. Nicholls, No. 3 District, Kamloops.
P. B. FREELAND, No. 4 District, Grand Forks.
A. G. LANGLEY, No. 5 District, Revelstoke.
GEO. A. CLOTHIER, No. 6 District, Nanaimo.

DEPARTMENT OF MINES.

Mining in British Columbia is administered for the Government by the Department of Mines through the Deputy Minister of Mines and under the direction of the Honourable the Minister of Mines. The Department has charge of all Government offices in connection with the mining industry and, except as may be otherwise provided by Statute, the administration of the laws with respect to all kinds of mining.

Under the "Mineral Act" the Province is divided into forty-two Mining Divisions. Over each of these Divisions there is a Mining Recorder and over groups of Divisions of varying sizes there are Gold Commissioners. Of Mining Recorders, inclusive of Sub-Mining Recorders, there are 121, and of Gold Commissioners, 25. These figures give an insight into the extensive provision which has been made to assure prospectors and mining men generally that, wherever they may find themselves within British Columbia's 370,000 square miles of territory, they at all times will be within reasonable reach of a Mining Recorder, or a Deputy Mining Recorder, or a Gold Commissioner ready to extend to them all the privileges to which they are entitled, as free miners, under the "Mineral," "Placer," or other Mining Acts.

A sketch of the respective duties of the above-enumerated officers may be of interest. The Gold Commissioner in many cases also is Government Agent and in the latter capacity may represent every department of public service. Under the mining laws he has all the powers of a Mining Recorder and sometimes discharges the duties of both offices. One of his responsible duties is the issuing of certificates of improvement in respect of mineral claims for which Crown grants are sought; another is the consideration and the granting or otherwise of placer-mining leases; and in addition he has quasi-judicial authority in regard to questions which arise from time to time under both the "Mineral Act" and the "Placer-mining Act." A Gold Commissioner may have one or more Mining Divisions under his supervision.

As to Mining Recorders and Sub-Mining Recorders, the Acts clearly explain their duties. They are the officials first looked for on the discovery and location of placer-ground or mineral claims. They must see that all records are properly made and that the order of priority is carefully observed in respect of the same. They issue Free Miners' Certificates and must see that a proper return of the same is made to the Department.

It is this comprehensive system of administration which, broadly speaking, constitutes the Department of Mines, headquarters of which, under the Honourable the Minister of Mines, are in Victoria. From the head office the activities of the officers in the different parts of the Province

are directed and co-ordinated. Care must be given the application of the mining laws to divergent problems in order that, while justice is accorded in all cases, in none are the vital principles underlying the Statute departed from. This is one of the most important of the duties of the Department functioning under the direct supervision of the Minister.

There also is the duty of administering the "Mines Development Act," 1916, under the terms of which the sum of $1,175,000 was expended in the construction and the maintenance of mine roads, trails, and bridges from May 31st, 1916 to date. As a result, mines, found upon inspection by Government Mining Engineers to merit assistance, have benefited by the building of 384 miles of road and 1,220 miles of trail and the maintenance of 2,032 miles of road and 6,507 miles of trail. This means that a grand total of 10,143 miles of roads and trails have been opened and kept open in order that the development of mining might be facilitated. This, then, is another phase of the work of the Department, which maintains its touch with the field through six Resident Mining Engineers appointed under the "Mineral Survey and Development Act."

All who are interested in mining in British Columbia should make themselves acquainted with the "Mineral Survey and Development Act." It is interesting not only because of the appointment of Resident Mining Engineers over six Mineral Survey Districts, who are required to apply themselves constantly to the making of a survey of the mineral resources of their respective districts, to prepare a report each year dealing with their activities and observations, and to extend every possible assistance to mining men and prospectors. There are other features; perhaps the most important, in view of recent increased public financial support of mining enterprises, being contained in sections 15 and 16 of the Act. Briefly these sections make it necessary for a mining company to forward a copy of its prospectus to the Resident Mining Engineer of the district in which its mining property is situated. The Engineer's duty is to compare statements contained in the prospectus with the conditions as he knows them to exist on the ground. If he finds misstatements or discrepancies calculated to mislead an investor, the Minister is notified. He makes further investigation. The company may be communicated with and asked to withdraw the statements complained of; or, if the case is one that seems to demand more extreme measures, the Minister may authorize the public advertisement of the facts through the Provincial Gazette and the public press.

The foregoing will serve to convey a general idea of the activities of the administrative headquarters of the Department in Victoria and those branch offices situated in the large centres of population as well as in the most remote parts of the Province over which jurisdiction is exercised.

If you want information as to the mining laws of the Province, apply to the Department. If you are contemplating investment in the stock of a British Columbia mining company, do not fail to get the last Annual Report of the Minister of Mines. References to practically every mine or mining prospect in British Columbia are contained in these Annual Reports. If no such references were made last year, the desired information may have been given in the Annual Report of some previous year. It is possible that the slight trouble of asking for a search will be well rewarded. The Department is prepared to render this service on application.

Communications from anywhere in Canada, the United States, or South America, seeking either copies of Annual Reports or mining maps, or any other information concerning mining in the Province, will have immediate attention if directed to:—

HON. W. A. McKENZIE,
Minister of Mines,
Victoria, B.C.,
Canada.

Applications for information, as above set out, from Great Britain, or any other European country, will receive prompt attention by being referred to the Agent-General for British Columbia, British Columbia House, 1 and 3 Regent Street, London, S.W. 1, England.

INSPECTION BRANCH.

The Inspection Branch of the Department of Mines consists of a Chief Inspector, seven District Inspectors, two examiners, who are also Acting-Inspectors, and four Instructors in Mine-rescue Work.

The Inspectors have jurisdiction over both coal and metalliferous mines within the boundaries of their respective districts. Every part of all operating coal-mines are inspected at least once every month, and metalliferous mines as often as time will permit, generally once in every sixty days, to see that general conditions are good for the safety and health of the workmen employed, and that the Coal and Metalliferous Mines Regulation Acts are complied with.

The Mine-rescue Stations are under the jurisdiction of the Inspection Branch. Four are maintained at the principal mining centres for the purpose of supplementing, in case of need, the colliery installations of mine-rescue apparatus, and also for the purpose of training the holders of certificates in the use of mine-rescue apparatus. In cases of emergency these stations are available for the use of any trained corps of mine rescuers, duly qualified medical practitioners, or corps trained in the work of first aid to the injured, subject to the order of an Inspector. All certificated officials who are physically fit, and not less than 3 per cent., or such number as the Chief Inspector may deem sufficient, of the workmen at each colliery must be trained in the use of mine-rescue apparatus.

The examining boards for granting certificates of competency to coal-mine officials and coal-miners are under the jurisdiction of the Inspection Branch. The Chief Inspector and the two examiners form the board for coal-mine officials for the whole of the Province, and the two examiners and the District Inspector form the board for granting certificates to coal-miners within their respective districts.

A District Inspector may grant a provisional certificate to a coal-miner between examinations for a period not exceeding sixty days.

Blasting certificates of competency to miners at metalliferous mines are granted by the Inspector of Mines.

A section of the Annual Report of the Minister of Mines contains the reports of the officials of the Inspection Branch.

GOLD COMMISSIONERS AND MINING RECORDERS.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Atlin	Atlin	C. L. Monroe	C. L. Monroe	J. G. Garrett.
Sub-office	Telegraph Creek			H. W. Dodd.
Sub-office	Haines (U.S.)		(Com. for taking Affidavits)	Risdon M. Odell.
Sub-office	Juneau (U.S.)		Ditto	Harold E. Brown.
Stikine	Telegraph Creek	H. W. Dodd	H. W. Dodd	
Sub-office	Boundary			W. R. Overend.
Liard	Telegraph Creek	H. W. Dodd	H. W. Dodd	
Sub-office	Porter			Chas. H. Smith.
Sub-office	McDame Creek			Mike Larsen.
Sub-office	Fort St. John			F. W. Beatton.
Skeena	Prince Rupert	N. A. Watt	N. A. Watt	
Sub-office	Kitimat			C. M. Carlson.
Sub-office	Copper City			L. G. Skinner.
Sub-office	Terrace			O. T. Sundal.
Sub-office	Rosswood			Mrs. C. Warner.
Sub-office	Stewart (Portland Canal)			J. P. Scarlett.
Nass River	Anyox	N. A. Watt	R. M. McGusty	
Sub-office	Aiyansh			A. F. Priestly.
Sub-office	Alice Arm			Mrs. L. Cummings.
Portland Canal	Stewart	N. A. Watt (at Prince Rupert)	J. P. Scarlett	
Bella Coola	Prince Rupert	N. A. Watt	N. A. Watt	
Sub-office	Bella Coola			Brynild Brynildsen.
Sub-office	Bella Bella			
Sub-office	Ocean Falls			Geo. H. Hill.
Queen Charlotte	Queen Charlotte	N. A. Watt	Dr. G. A. C. Roberts	Mrs. G. A. C. Roberts.
Sub-office	Jedway			Isaac Thompson.
Sub-office	Masset			J. C. S. Dunn, M.D.
Sub-office	Lockeport			W. J. Simpson.
Omineca	Smithers	Stephen H. Hoskins	Jas. E. Kilby	
Sub-office	Fort Grahame			F. W. Rogers.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Omineca—*Continued.*				
Sub-office	Finlay Forks			Ole Johnson.
Sub-office	Fort St. James			Alex. C. Murray.
Sub-office	Manson Creek			W. B. Steele.
Sub-office	Telkwa			T. J. Thorp.
Sub-office	Prince George			Geo. Milburn.
Sub-office	Hudson Hope			J. L. Ruxton (Acting).
Sub-office	Fort St. John			F. W. Beatton.
Sub-office	Copper City			L. G. Skinner.
Sub-office	Terrace			O. T. Sundal.
Sub-office	Fort Fraser			J. D. Moore.
Sub-office	Pacific			T. H. McCubbin.
Sub-office	Hazelton			W. J. Sanders.
Sub-office	Burns Lake			S. Godwin.
Sub-office	Usk			Jas. L. Bethurem.
Sub-office	Tatla Landing			E. G. McCorkell.
Peace River	Fort St. John	S. H. Hoskins (at Smithers)	F. W. Beatton	
Sub-office	Prince George			G. Milburn.
Sub-office	Finlay Forks			Ole Johnson.
Sub-office	Hudson Hope			J. L. Ruxton (Acting).
Sub-office	Pouce Coupe			Fred. Fraser.
Cariboo	Barkerville	L. J. Price	L. J. Price	Mrs. L. J. Price.
Sub-office	Quesnel			E. C. Lunn.
Sub-office	Prince George			Geo. Milburn.
Sub-office	McBride			H. McGlinchy.
Quesnel	Williams Lake	L. C. Maclure	L. C. Maclure	
Sub-office	Quesnel			E. C. Lunn.
Sub-office	Likely			A. B. Campbell.
Sub-office	Barkerville			L. J. Price.
Clinton	Clinton	R. J. A. Dorrell	R. J. A. Dorrell	
Sub-office	Williams Lake			L. C. Maclure.
Sub-office	S. Fork, Bridge River			W. Haylmore.
Sub-office	Taseko Lake, via Lillooet			Herbert Hunter.
Lillooet	Lillooet	E. F. Little	E. F. Little	R. W. Melton.
Sub-office	S. Fork, Bridge River			W. Haylmore.
Kamloops	Kamloops	E. Fisher	E. Fisher	R. F. Ure.
Sub-office	Chu Chua			George Fennell.
Sub-office	Vavenby			H. Finley.
Ashcroft	Ashcroft	E. Fisher (at Kam.)	W. C. Adams	F. H. C. Wilson.
Sub-office	Lytton			W. Greenwood.
Nicola	Merritt	E. Fisher (at Kam.)	R. G. Cowper	
Yale	Yale	E. Fisher (at Kam.)		
Sub-office	Hope		C. R. Macdonell	
Similkameen	Princeton	L. A. Dodd	L. A. Dodd	
Sub-office	Hedley			R. E. Baxter.
Vernon	Vernon	R. Ross Napier	R. Ross Napier	
Greenwood	Greenwood	S. B. Hamilton	S. B. Hamilton	
Sub-office	Vernon			
Sub-office	Rock Creek			Owen Wheeler.
Sub-office	Beaverdell			D. R. McElmon.
Grand Forks	Grand Forks	Chas. Mudge	Chas. Mudge	
Osoyoos	Penticton	W. R. Dewdney	W. R. Dewdney	
Sub-office	Keremeos			L. H. Patten.
Sub-office	Hedley			R. E. Baxter.
Sub-office	Oliver			Edward B. Rossiter.
Golden	Golden	G. E. Sanborn	G. E. Sanborn	H. C. Moore.
Windermere	Wilmer	G. E. Sanborn (at Golden)	E. M. Sandilands	
Fort Steele	Cranbrook	N. A. Wallinger	J. E. Kennedy	
Sub-office	Fernie			E. T. Cope.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Ainsworth	Kaslo	Ronald Hewat	A. McQueen	A. W. Anderson.
Sub-office	Howser			J. F. Thompson.
Sub-office	Trout Lake			Roy V. Jacobson.
Sub-office	Poplar			Arthur G. Johnston.
Slocan	New Denver	Ronald Hewat (at Kaslo)	Angus McInnes	
Sub-office	Sandon			W. J. Parham.
Slocan City	Slocan	Ronald Hewat	T. McNeish	
Trout Lake	Trout Lake	Ronald Hewat	Roy V. Jacobson	
Nelson	Nelson	J. Cartmel	J. Cartmel	
Sub-office	Creston			H. W. McLaren.
Sub-office	Ymir			Wm. Clark.
Sub-office	Salmo			M. C. Donaldson.
Arrow Lake	Nakusp	J. Cartmel (at Nelson)	Walter Scott	
Sub-office	Vernon			R. Ross Napier.
Revelstoke	Revelstoke	Wynfield Maxwell	C. J. Aman	
Lardeau	Beaton	Wynfield Maxwell (at Revelstoke)	H. J. Gunterman	Mrs. H. J. Gunderman.
Trail Creek	Rossland	W. H. Reid	W. H. Reid	
Nanaimo	Nanaimo	W. H. Boothroyd	W. H. Boothroyd	
Sub-office	Ladysmith			J. A. Knight.
Sub-office	Alert Bay			Ernest H. Robinson.
Sub-office	Vananda			Leonard Raper.
Sub-office	Granite Bay			Henry Twidle.
Alberni	Alberni	A. G. Freeze	A. G. Freeze	
Clayoquot	Clayoquot	A. G. Freeze (at Alberni)	W. T. Dawley	
Quatsino	Quatsino	A. G. Freeze (at Alberni)	Ed. Evensen	
Victoria	Victoria	R. J. Steenson	R. J. Steenson	
New Westminster	New Westminster	F. C. Campbell	A. B. Gray	
Sub-office	Harrison Lake			L. A. Agassiz.
Sub-office	Chilliwack			Chas. J. Whittaker.
Vancouver	Vancouver	John Mahony	A. P. Grant	

OFFICE STATISTICS FOR MINING DIVISIONS.

NORTH-WESTERN DISTRICT (No. 1).

ATLIN MINING DIVISION.

REPORT BY C. L. MONROE, GOLD COMMISSIONER, ATLIN.

I have the honour to submit the office statistics of the Atlin Mining Division for the year ended December 31st, 1928.

Free miners' certificates (individual)	369
Free miners' certificates (company)	5
Free miners' certificates (special)	1
Placer records	18
Mineral records	24
Placer rerecords	84
Placer lease applications	15
Placer leases granted	5
Certificates of work (leases)	123
Certificates of work (mineral)	143
Leaves of absence	11
Conveyances, etc. (pages)	40
Filings	9
Certificates of improvements	4

Revenue.

Free miners' certificates	$2,103.50
Mining receipts	7,225.65
Total	$9,329.15

STIKINE AND LIARD MINING DIVISIONS.

REPORT BY H. W. DODD, GOLD COMMISSIONER, TELEGRAPH CREEK.

I have the honour to submit the office statistics of the Stikine and Liard Mining Divisions for the year ended December 31st, 1928.

Free miners' certificates (individual)	188
Free miners' certificates (company)	2
Placer claims recorded	1
Placer claims rerecorded	15
Mineral claims recorded	2
Placer leases issued	19
Dredging leases issued	3
Certificates of work (placer)	51
Certificates of work (mineral)	31
Bills of sales and assignments	29
Agreements	24
Filings	6

Revenue.

Free miners' certificates	$1,030.25
Mining receipts	9,133.15
Total	$10,163.40

SKEENA AND BELLA COOLA MINING DIVISIONS.

REPORT BY NORMAN A. WATT, GOLD COMMISSIONER, PRINCE RUPERT.

I have the honour to submit the office statistics of the Skeena and Bella Coola Mining Divisions for the year ended December 31st, 1928.

Free miners' certificates issued	340
Free miners' certificates (substitute)	2
Free miners' certificates (special)	2
Mining receipts issued	171
Mineral claims recorded	182
Placer claims recorded	7
Certificates of work issued (mining)	138
Certificates of work issued (placer)	1
Filings	42
Placer leases issued	14
Mining leases issued (section 180, "Taxation Act")	18

Revenue.

Free miners' certificates	$1,635.00
Mining receipts	2,108.50
Total	$3,743.50

NASS RIVER MINING DIVISION.

REPORT BY R. M. MCGUSTY, MINING RECORDER, ANYOX.

I have the honour to submit the office statistics of the Nass River Mining Division for the year ended December 31st, 1928.

Free miners' certificates (individual)	179
Free miners' certificates (company)	5
Free miners' certificates (special)	1
Records of mineral claims	160
Certificates of work (mineral)	410
Certificates of improvements	2
Conveyances, etc.	103
Filings	30

Revenue.

Free miners' certificates	$1,305.25
Mining receipts	2,301.70
Total	$3,606.95

PORTLAND CANAL MINING DIVISION.

REPORT BY J. P. SCARLETT, MINING RECORDER, STEWART.

I have the honour to submit the office statistics of the Portland Canal Mining Division for the year ended December 31st, 1928.

Free miners' certificates (individual)	524
Free miners' certificates (company)	21
Free miners' certificates (special)	3
Mineral claims recorded	1,418
Certificates of work issued	1,395
Bills of sale, etc., recorded	404
Certificates of improvements recorded	109
Abandonments	21
Filings	127

Revenue.

Free miners' certificates	$4,495.50
Mining receipts	12,508.80
Total	$17,004.30

QUEEN CHARLOTTE MINING DIVISION.

REPORT BY JOHN L. BARGE, MINING RECORDER, QUEEN CHARLOTTE.

I have the honour to submit the office statistics of the Queen Charlotte Mining Division for the year ended December 31st, 1928.

Free miners' certificates issued	36
Mineral records (locations) (quartz)	9
Mineral records (locations) (placer)	1
Certificates of work issued (quartz)	23
Certificates of work issued (placer)	6
Records, bills of sale, powers of attorney, etc.	5
Filings	2

Revenue.

Mining receipts	$292.50
Free miners' certificates	109.25
Total	$401.75

NORTH-EASTERN DISTRICT (No. 2).

CARIBOO MINING DIVISION.

REPORT BY L. J. PRICE, GOLD COMMISSIONER, BARKERVILLE.

I have the honour to submit the office statistics of the Cariboo Mining Division for the year ended December 31st, 1928.

Free miners' certificates (individual)	453
Free miners' certificates (company)	7
Free miners' certificates (special)	3
Mineral claims recorded	113
Certificates of work recorded (mineral)	101
Permission to relocate	3
Certificates of improvements issued	4
Placer claims recorded	1
Placer claims rerecorded	18
Placer-mining leases issued	39
Certificates of work issued (leases)	87
Placer leases in force	141
Powers of attorney recorded	23
Conveyances and agreements recorded (mineral)	28
Conveyances and agreements recorded (placer)	26
Filings	34

Revenue.

Free miners' certificates	$2,466.50
Mining receipts, general	9,163.02
Total	$11,629.52

QUESNEL MINING DIVISION.

REPORT BY L. C. MACLURE, GOLD COMMISSIONER, WILLIAMS LAKE.

I have the honour to submit the office statistics for the Quesnel Mining Division for the year ended December 31st, 1928.

Free miners' certificates issued (individual)	403
Free miners' certificates issued (special)	1
Mineral claims recorded	46
Placer claims recorded	1
Relocations recorded	7
Applications for placer leases	110
Placer-mining leases issued	88
Placer-mining leases in force	259
Certificates of work (mineral)	42
Certificates of work (placer)	223
Conveyances, agreements, etc., recorded	126

Revenue.

Free miners' certificates	$1,498.50
Mining receipts, general	10,505.71
Total	$12,004.21

OMINECA MINING DIVISION.

REPORT BY S. H. HOSKINS, GOLD COMMISSIONER, SMITHERS.

I have the honour to submit the office statistics of the Omineca Mining Division for the year ended December 31st, 1928.

Free miners' certificates (ordinary)	838
Free miners' certificates (company)	10
Free miners' certificates (special)	6
Mineral claims recorded	1,584
Certificates of work recorded (mineral)	1,276
Certificates of work recorded (placer)	36
Placer claims recorded and rerecorded	3
Bills of sale, mining agreements, and options	397
Powers of attorney	37
Mining documents filed	135
Application for placer-mining leases (Omineca)	39
Placer-mining leases issued	17

Revenue.

Free miners' certificates	$4,899.25
Mining receipts	11,700.85
Total	$16,600.10

CENTRAL DISTRICT (No. 3).

LILLOOET MINING DIVISION.

REPORT BY E. F. LITTLE, GOLD COMMISSIONER, LILLOOET.

I have the honour to submit the office statistics of the Lillooet Lillooet Mining Division for the year ended December 31st, 1928.

Free miners' certificates (individual)	276
Free miners' certificates (company)	3

Mineral claims recorded	410
Certificates of work recorded (mineral)	203
Certificates of work recorded (placer)	48
Placer-mining leases issued	7
Notices to group	34
Powers of attorney recorded	12
Bills of sale, mining agreements, etc., recorded	94
Mineral claims in existence	608
Placer leases in existence	65

Revenue.

Free miners' certificates	$1,514.50
Mining receipts	5,018.05
Total	$6,532.55

CLINTON MINING DIVISION.

REPORT BY R. A. DORRELL, GOLD COMMISSIONER, CLINTON.

I have the honour to submit the office statistics of the Clinton Mining Division for the year ended December 31st, 1928.

Free miners' certificates	57
Mineral claims recorded	155
Certificates of work (mineral)	85
Certificates of work (placer)	10
Placer claims rerecorded	3
Leases issued	21
"Mineral Act," bills of sale, etc.	51
"Placer Act," assignments, etc.	32
Notices to group	17
Filings	4
Certificates of improvements	1

Revenue.

Free miners' certificates	$354.00
Mining receipts, general	2,877.55
Total	$3,231.55

NICOLA MINING DIVISION.

REPORT BY R. G. COWPER, MINING RECORDER, MERRITT.

I have the honour to submit the office statistics of the Nicola Mining Division for the year ended December 31st, 1928.

Free miners' certificates	109
Mineral claims recorded	165
Certificates of work (mineral)	77
Bills of sale (mineral)	62
Agreements recorded	5
Placer leases issued	1
Notices to group	6

Revenue.

Free miners' certificates	$537.50
Mining receipts, general	905.15
Total	$1,442.65

VERNON MINING DIVISION.

REPORT BY R. ROSS NAPIER, GOLD COMMISSIONER, VERNON.

I have the honour to submit the office statistics of the Vernon Mining Division for the year ended December 31st, 1928.

Free miners' certificates issued (individual)	209
Certificates of work issued (mineral)	69
Certificates of work issued (placer)	22
Free miners' certificates issued (special)	1
Mineral claims recorded	131
Placer-mining leases in force	20
Applications (placer-mining leases)	1
Conveyances and agreements recorded	49
Powers of attorney recorded	6
Certificates of improvements	2

Revenue.

Free miners' certificates	$943.00
Mining receipts, general	1,871.15
Total	$2,814.15

YALE MINING DIVISION.

REPORT BY D. A. HAZELTON, MINING RECORDER, HOPE.

I have the honour to submit the office statistics of the Yale Mining Division for the year ended December 31st, 1928.

Free miners' certificates (ordinary)	285
Free miners' certificates (company)	2
Free miners' certificates (special)	3
Mineral claims recorded	691
Placer claims recorded	1
Certificates of work (mineral)	230
Certificates of work (placer)	23
Placer leases in existence	26
Bills of sale recorded (mineral)	93
Agreements recorded (mineral)	21
Powers of attorney recorded (mineral)	11
Powers of attorney recorded (placer)	4
Filings	24

Revenue.

Free miners' certificates	$1,460.25
Mining receipts	3,727.75
Total	$5,188.00

ASHCROFT MINING DIVISION.

REPORT BY W. C. ADAM, MINING RECORDER, ASHCROFT.

I have the honour to submit the office statistics of the Ashcroft Mining Division for the year ended December 31st, 1928.

"Mineral Act"—

Claims recorded	77
Certificates of work recorded	55
Free miners' certificates issued	100
Bills of sale recorded	4

"Mineral Act"—*Continued.*	
Powers of attorney filed	2
Certificates of improvements filed	2
"Placer Act"—	
Claims recorded	3
Placer leases granted	7
Certificates of work	3
Transfers recorded	2
Bills of sale recorded	1
Powers of attorney	13

Revenue.

Free miners' certificates	$465.00
Mining receipts	853.00
Total	$1,318.00

KAMLOOPS MINING DIVISION.

REPORT BY E. FISHER, GOLD COMMISSIONER, KAMLOOPS.

I have the honour to submit the office statistics of the Kamloops Mining Division for the year ended December 31st, 1928.

Free miners' certificates	462
Mineral claims recorded	260
Mineral claims (partnership)	35
Placer leases issued	9
Certificates of work (mineral)	397
Certificates of work (placer)	26
Bills of sales, etc.	91
Filings	51

Revenue.

Mining receipts	$3,773.90
Free miners' certificates	2,800.25
Total	$6,574.15

SOUTHERN DISTRICT (No. 4).

GREENWOOD MINING DIVISION.

REPORT BY S. B. HAMILTON, GOLD COMMISSIONER, GREENWOOD.

I have the honour to submit the office statistics of the Greenwood Mining Division for the year ended December 31st, 1928.

Free miners' certificates	164
Locations (quartz)	98
Locations (placer)	2
Certificates of work (quartz)	119
Bills of sale, agreements, etc.	26
Leases of reverted Crown-granted mineral claims	114
Certificates of improvements	1
Notices to group mineral claims, etc.	15

Revenue.

Free miners' certificates	$749.50
Mining receipts, general	3,704.05
Total	$4,453.55

GRAND FORKS MINING DIVISION.

REPORT BY CHAS. MUDGE, MINING RECORDER, GRAND FORKS.

I have the honour to submit the office statistics of the Grand Forks Mining Division for the year ended December 31st, 1928.

Free miners' certificates	86
Records of locations (mining)	62
Certificates of work (mining)	65
Certificates of work (placer)	1
Placer-mine rentals	1
Bills of sale	13
Filings, etc.	7
Leases of reverted mineral claims	65

Revenue.

Total revenue	$2,424.15

OSOYOOS MINING DIVISION.

REPORT BY W. R. DEWDNEY, GOLD COMMISSIONER, PENTICTON.

I have the honour to submit the office statistics of the Osoyoos Mining Division for the year ended December 31st, 1928.

Special free miners' certificates	1
Free miners' certificates (ordinary)	138
Locations (quartz)	42
Certificates of work	61
Conveyances	8
Certificates of improvements	2
Filings	12
Leases of reverted mineral claims	41

Revenue.

Mining receipts	$305.50
Free miners' certificates	745.60
Leases of reverted mineral claims	1,025.00
Total	$2,076.10

SIMILKAMEEN MINING DIVISION.

REPORT BY L. A. DODD, GOLD COMMISSIONER, PRINCETON.

I have the honour to submit the office statistics of the Similkameen Mining Division for the year ended December 31st, 1928.

Free miners' certificates	395
Mineral claims recorded	259
Certificates of work (mineral)	373
Certificates of work (leases)	99
Conveyances, etc.	185
Powers of attorney	44
Filings	33
Placer leases issued	102
Placer leases in force	199
Mineral claims Crown-granted	2

Revenue.

Free miners' certificates	$2,383.00
Mining receipts, general	10,360.85
Total	$12,743.85

EASTERN DISTRICT (No. 5).

GOLDEN MINING DIVISION.

REPORT BY G. E. SANBORN, GOLD COMMISSIONER, GOLDEN.

I have the honour to submit the office statistics of the Golden Mining Division for the year ended December 31st, 1928.

Free miners' certificates (ordinary)	157
Free miners' certificates (special)	2
Mineral claims recorded	100
Certificates of work (mineral)	68
Certificates of work (placer)	3
Bills of sale, agreements, etc.	43
Leases of reverted Crown-granted claims	10

Revenue.

Free miners' certificates	$702.25
Mining receipts	1,074.50
Total	$2,406.75

WINDERMERE MINING DIVISION.

REPORT BY E. M. SANDILANDS, MINING RECORDER, WILMER.

I have the honour to submit the office statistics of the Windermere Mining Division for the year ended December 31st, 1928.

Free miners' certificates issued (ordinary)	81
Free miners' certificates issued (special)	4
Claims recorded (quartz)	57
Certificates of work (quartz)	105
Bills of sale, bonds, powers of attorney, agreements, etc.	10

Revenue.

Free miners' certificates	$655.25
Mining receipts	1,413.50
Total	$2,068.75

FORT STEELE MINING DIVISION.

REPORT BY P. H. MCCURRACH, GOLD COMMISSIONER, CRANBROOK.

I have the honour to submit the office statistics of the Fort Steele Mining Division for the year ended December 31st, 1928.

Free miners' certificates	322
Locations recorded (quartz)	287
Certificates of work (quartz)	572
Placer claims recorded	3
Placer leases issued	12
Certificates of work (placer)	10
Bills of sale, agreements	148
Filings	36
Leases of Crown-granted mineral claims	13
Certificates of improvements issued	176

Revenue.

Free miners' certificates	$1,772.75
Mining receipts, general	5,419.50
Total	$7,192.25

REVELSTOKE MINING DIVISION.

REPORT BY CHARLES J. AMAN, MINING RECORDER, REVELSTOKE.

I have the honour to submit the office statistics of the Revelstoke Mining Division for the year ended December 31st, 1928.

Free miners' certificates	118
Free miners' certificates (company)	5
Locations recorded	73
Certificates of work issued	148
Leases of Crown-granted mineral claims	10
Placer claims recorded	3
Placer leases	9
Groupings recorded	7
Bills of sale, agreements, and powers of attorney	32

Revenue.

Mining receipts, general	$2,898.90
Free miners' certificates	1,036.00
Crown-grants to reverted claims	175.28
Total	$4,110.18

LARDEAU MINING DIVISION.

REPORT BY E. ROBERTS, MINING RECORDER, BEATON.

I have the honour to submit the office statistics of the Lardeau Mining Division for the year ended December 31st, 1928.

Free miners' certificates issued	62
Free miners' certificates issued (company)	3
Locations recorded	37
Certificates of work	145
Bills of sale	10
Grouping notices	13
Search of records	2
Powers of attorney	1
Time elapsed	1
Elapse of free miners' certificates	1

Revenue.

Free miners' certificates	$301.00
Free miners' certificates (company)	250.00
Locations recorded	92.50
Certificate of work	362.50
Bills of sale	25.00
Grouping notices	3.25
Search of records	.50
Powers of attorney	2.50
Time elapsed	10.00
Elapse of free miners' certificates	5.00
Total	$1,052.25

AINSWORTH MINING DIVISION.

REPORT BY RONALD HEWAT, GOLD COMMISSIONER, KASLO.

I have the honour to submit the office statistics of the Ainsworth Mining Division for the year ended December 31st, 1928.

Free miners' certificates	234
Mineral claims recorded	244
Certificates of work recorded	315
Bills of sale, agreements, etc.	104
Dredging leases issued	2
Leases of reverted Crown-granted mineral claims issued	77

Revenue.

Free miners' certificates	$1,992.25
Mining receipts	2,380.20
Total	$4,372.45

SLOCAN MINING DIVISION.

REPORT BY ANGUS MCINNES, MINING RECORDER, NEW DENVER.

I have the honour to submit the office statistics of the Slocan Mining Division for the year ended December 31st, 1928.

Free miners' certificates issued	133
Mineral claims recorded	71
Certificates of work	125

Revenue.

Free miners' certificates issued	$932.00
Mineral claims recorded	488.75
Certificates of work	312.50
Total	$1,733.25

SLOCAN CITY MINING DIVISION.

REPORT BY THOS. MCNEISH, MINING RECORDER, SLOCAN.

I have the honour to submit the office statistics of the Slocan City Mining Division for the year ended December 31st, 1928.

Free miners' certificates issued	53
Locations recorded	38
Certificates of work issued	81
Bills of sale	8
Notices to group	11

Revenue.

Free miners' certificates	$258.50
Mining receipts, general	527.05
Total	$785.55

TROUT LAKE MINING DIVISION.

REPORT BY R. V. JACOBSON, MINING RECORDER, TROUT LAKE.

I have the honour to submit the office statistics of the Trout Lake Mining Division for the year ended December 31st, 1928.

Free miners' certificates	49
Mineral claims recorded	92

Certificates of work	156
Conveyances and agreements	12
Notices to group	26

Revenue.

Free miners' certificates	$239.50
Mining receipts	1,360.25
Total	$1,599.75

NELSON MINING DIVISION.

REPORT BY J. CARTMEL, GOLD COMMISSIONER, NELSON.

I have the honour to submit the office statistics of the Nelson Mining Division for the year ended December 31st, 1928.

Free miners' certificates (individual)	636
Free miners' certificates (company)	18
Free miners' certificates (special)	2
Claims recorded (mineral)	536
Claims recorded (placer)	1
Claims rerecorded (placer)	1
Leases issued (placer)	3
Certificates of work issued	493
Bills of sale, agreements, etc.	328
Grouping notices filed	40
Certificates of improvements issued	9
Leases of forfeited Crown-granted mineral claims	126

Revenue.

Free miners' certificates	$4,301.50
Mining receipts, general	3,880.00
Mining receipts, covering lease fees on forfeited Crown-granted mineral claims	3,150.00
Total	$11,331.50

ARROW LAKE MINING DIVISION.

REPORT BY WALTER SCOTT, MINING RECORDER, NAKUSP.

I have the honour to submit the office statistics of the Arrow Lake Mining Division for the year ended December 31st, 1928.

Free miners' certificates issued	47
Certificates of work recorded	32
Mineral claims recorded	43

Revenue.

Office collections	$1,361.90

TRAIL CREEK MINING DIVISION.

REPORT BY W. H. REID, GOLD COMMISSIONER, ROSSLAND.

I have the honour to submit the office statistics of the Trail Creek Mining Division for the year ended December 31st, 1928.

Free miners' certificates (individual)	141
Free miners' certificates (company)	5

Locations recorded	22
Certificates of work issued	54
Bills of sale recorded	7
Notices to group filed	6
Leases under section 180, "Taxation Act"	6

Revenue.

Free miners' certificates	$1,093.75
Mining receipts, general	359.00
Total	$1,452.75

WESTERN DISTRICT (No. 6).

ALBERNI MINING DIVISION.

REPORT BY A. G. FREEZE, GOLD COMMISSIONER, ALBERNI.

I have the honour to submit the office statistics of the Alberni Mining Division for the year ended December 31st, 1928.

Mineral claims recorded	85
Certificates of work recorded	16
Free miners' certificates issued	74
Leases of Crown-granted claims	37
Placer leases issued	5
Bills of sale	12
Powers of attorney filed	4

Revenue.

Free miners' certificates	$292.25
Mining receipts, general	1,415.05
Total	$1,707.30

CLAYOQUOT MINING DIVISION.

REPORT BY S. J. GRANT, ACTING MINING RECORDER, CLAYOQUOT.

I have the honour to submit the office statistics of the Clayoquot Mining Division for the year ended December 31st, 1928.

Mineral claims recorded	51
Certificates of work issued	24
Bills of sale recorded	11
Powers of attorney recorded	1
Option recorded	1
Free miners' certificates issued	20
Mining receipts issued	33

Revenue.

Free miners' certificates	$63.00
Mining receipts	245.65
Total	$308.65

QUATSINO MINING DIVISION.

REPORT BY ED. EVENSON, MINING RECORDER, QUATSINO.

I have the honour to submit the office statistics of the Quatsino Mining Division for the year ended December 31st, 1928.

Mineral claims recorded	170
Certificates of work	89
Bills of sale	55
Notices of group on file	12
Powers of attorney	2
Agreements	2
Partnership agreements	1
Option	1
Abandonment of mineral claims	4
Free miners' certificates	48

Revenue.

Total revenue collected	$1,072.50

NANAIMO MINING DIVISION.

REPORT BY W. H. BOOTHROYD, GOLD COMMISSIONER, NANAIMO.

I have the honour to submit the office statistics of the Nanaimo Mining Division for the year ended December 31st, 1928.

Free miners' certificates	301
Mineral claims recorded	370
Certificates of work	229
Bills of sale recorded	131

Revenue.

Free miners' certificates	$1,230.00
Mining receipts, general	3,066.30
Total	$4,296.30

VICTORIA MINING DIVISION.

REPORT BY R. J. STEENSON, GOLD COMMISSIONER, VICTORIA.

I have the honour to submit the office statistics of the Victoria Mining Division for the year ended December 31st, 1928.

Free miners' certificates issued (individual)	428
Free miners' certificates issued (company)	25
Free miners' certificates issued (special)	2
Mineral claims recorded	41
Certificates of work recorded	23
Placer claims recorded	4
Placer leases issued	15
Certificates of work (placer leases)	1
Certificates of improvements	1
Leases of reverted Crown-granted mineral claims	4
Grouping notices filed	1
Bills of sale recorded	3
Powers of attorney recorded	7
Lay-overs of placer claims	2

No. 3 Mine.

Harry Hopkins, John Davis, and Robert Barrass, Firebosses.

This mine is situated on the same level and 1,000 feet north of the top terminal of the overhead tramway, which constitutes the mine-yard, and has been developed by a well-timbered 8- by 12-foot adit-level, generally known as the "Wilson tunnel." The pillars have been drawn back to within close proximity to the entrance of No. 2 slope, which is about 1,600 feet from the entrance to the mine. This slope is separated from the old No. 2 mine above by a 100-foot barrier-pillar and operates the same seam of coal. All work at present is to the dip of the Main level and near the face of the No. 2 slope.

This mine was sealed off during the early part of the year 1925 owing to a mine fire and was allowed to fill with water. It was opened again during the latter part of the same year and during the last two years the principal work done has been the dewatering of the mine to the dip, cleaning out and retimbering the No. 2 slope and counter, the erection of heavy beam stoppings on each side of the slopes as the water receded for the purpose of sealing off the old disused portions of the mine, and preventing any spontaneous heating. This slope had been cleaned out and retimbered a distance of 1,600 feet to the old No. 6 level, which was the lowest working-level in this section of the mine, and at present work consists of drawing back these pillars and recovering all the coal possible.

This is a friable seam of coal about 12 feet in height. Since the lower section of the mine was dewatered it has been found a very hard matter to maintain roads owing to a general crush which is at all times taking place. This requires a large staff of timbermen to keep the roads in repair, and as a result this mine is being drawn back with as little delay as possible. Owing to the old disused roads and the gobs being loaded with this high volatile coal, this mine is at all times subject to spontaneous heating and requires very careful and diligent supervision by the mine officials.

The coal is mined by hand and, owing to the friable nature, little blasting is required. It is loaded into the mine-cars at the face of the levels and the dips by means of chutes from the headings, brought to the landings situated near the Main slope by horse-haulage, and hauled out of the slope by a compressed-air hoist to a landing situated on the Main adit-level; thence to the surface in large trips by an electric trolley-motor.

Ventilation is produced by a 5-foot "booster" fan situated near the entrance to the counter-level and belt-driven by a 30-horse-power induction-motor. During my last visit ventilation measured showed 9,800 cubic feet of air a minute passing into this mine for the use of eighteen men. The air was well conducted around the working-faces, while the brattice and stoppings were found in good order.

The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The roads were well timbered and in fairly good condition. This mine has been free from explosive gas during the year, but owing to the fluctuation of the atmosphere pressure from time to time there is a possibility of the gases from the gobs expanding into the working-places. To guard against this source of danger the miners working in the open skips are not only provided with an electric head-light, but a flame safety-lamp which is hung on a post near the face with full directions as to the use of same. The roads of this mine are naturally damp and as a result are free from dangerous coal-dust.

No. 4 Mine.

James Webster, Overman; Frank Bond, William Ross, George Walker, Thomas Vincent, Robert Murray, James Sim, James McWhirter, and John Ovington, Firebosses.

This is the largest and the most important operation of the Coalmont Collieries. This mine is situated 5,400 feet north of the entrance to the No. 3 mine and is connected to the mine-yard by a light railway built around the side of the mountain, upon which an electric trolley-motor system of haulage has been employed. This mine is entered by a 7- by 10-foot rock tunnel 1,600 feet in length, driven into the side of the mountain and cuts the No. 6 level of the mine. This has been developed by two 18° slopes 1,500 feet in length below the No. 6 level to the No. 17 East level on the right side and the No. 15 West level on the left side of the slopes. These are

BUREAU OF MINES.

REPORT BY JOHN D. GALLOWAY, PROVINCIAL MINERALOGIST.

The permanent staff of the Bureau of Mines consists of John D. Galloway, Provincial Mineralogist; D. E. Whittaker, Provincial Analyst and Provincial Assayer; J. B. Adams, Laboratory Assistant; H. T. Nation, general office assistant; and H. Pearson, clerk.

The Bureau of Mines is a branch of the Department of Mines, which collects, compiles, and supplies to the public much technical information regarding mining and mineral properties in the Province. At the close of each year the Annual Report of the Minister of Mines is prepared by the staff of the Bureau under the supervision of the Provincial Mineralogist. This Annual Report contains detailed statistics of mineral production compiled by the Bureau, reports by each of the six Resident Mining Engineers on their respective districts, and the reports of the Inspection Branch. The reports of the Resident Engineers have also been printed as separate bulletins for the years 1924 to 1928, inclusive. Special bulletins descriptive of mining are issued at intervals.

The Bureau has a well-equipped Assay and Analytical Laboratory. Mineral and rock samples are examined qualitatively without charge. This is done for the purpose of encouraging the search for new mineral-bearing areas and to assist prospectors and others by enabling them to have determined, free of cost, the nature and probable value of any rock they may find.

The Bureau also has an excellent and comprehensive collection of British Columbia ores and mineral samples on exhibit for the public in its Mineral Museum.

With greater activity in mining the work of the Bureau has increased considerably during recent years. The routine work of the office consists of supplying to the public much information regarding mining in the Province, directing prospectors to promising areas, supplying statistical information, interdepartmental reports, etc.

During the field season of 1928 the Provincial Mineralogist made a number of special examinations involving field-trips in the southern interior and northern sections of the Province.

By arrangement with the Dominion Bureau of Statistics the British Columbia Bureau of Mines collects all Provincial mineral statistics required by both Bureaus. By this arrangement the mine-owner is only required to fill out one form in duplicate instead of making two separate returns as heretofore. An agreement has also been reached whereby the same average metal prices are used by both Bureaus in valuing the outputs of metals.

At the present time the practice of the Dominion Bureau is to use refinery and smelter production to arrive at the yearly output of metals; the British Columbia Bureau uses mine production figures. This of course causes a difference in the yearly quantities of metals produced as reported by the two Bureaus, but the variation is only slight. The method in use by the British Columbia Bureau of Mines has been followed for many years and was adopted in order to compile the mineral production for the Province by Mining Divisions and Districts. These detailed statistics of mineral production are shown in the Annual Reports of the Minister of Mines in comprehensive sets of tables. It is believed that the statistics as given, based on mine production, are informative and useful to those engaged in the mineral industry of the Province. No change in the present general system of statistics is therefore contemplated.

By the co-operation so far effected it is expected that the mineral statistics of the Province, as reported by the two Bureaus, will not differ in any marked degree. The work of collecting, compiling, and presenting mineral statistics is somewhat complex, in which many arbitrary rulings or methods must be used.

The attention of prospectors and miners is drawn to the following definition of mineral contained in section 2 of the British Columbia "Mineral Act":—

> "'Mineral' means all valuable deposits of gold, silver, platinum, iridium, or any of the platinum group of metals, mercury, lead, copper, iron, tin, zinc, nickel, aluminium, antimony, arsenic, barium, bismuth, boron, bromine, cadmium, chromium, cobalt, iodine, magnesium, manganese, molybdenum, phosphorus, plumbago, potassium, sodium, strontium, sulphur, tungsten, fluorine, vanadium, radium, uranium, lithium, thorium, titanium (or any combination of the aforementioned elements with themselves or with any other elements), asbestos, emery, mica, and mineral pigments;

but limestone, marble, clay, or any building-stone shall not be considered as mineral within the meaning of this Act."

Limestone, marble, clay, and building-stone are acquired under the British Columbia "Land Act."

It should be noted that in 1925, for purposes of administration, the mineral tricalcium phosphate was taken out of the "Mineral Act." Under the "Phosphate-mining Act, 1925," deposits of tricalcium phosphate may be acquired by the location of phosphate claims one square mile in area.

Geological Information.

By an arrangement made at the time the Province of British Columbia entered Confederation, all geological investigations and mapping in the Province were to be carried on by the Geological Survey of Canada; this agreement has been fully adhered to by the Dominion Government and has proved of great benefit to the mining industry of the Province. Each year a number of geological parties are kept in the field and in the aggregate a vast amount of information is available to the prospector and the mining engineer in the many excellent reports and maps covering British Columbia which have been issued by the Geological Survey of Canada.

For some years a branch office of the Geological Survey has been maintained in Vancouver, where copies of maps and reports on British Columbia can be obtained. The officer in charge of the British Columbia office is Dr. Victor Dolmage and the address is 512 Winch Building, Vancouver, B.C.

ASSAY OFFICE.

Report by D. E. Whittaker, Provincial Assayer.

During the year 1928 there were made by the staff in the Government Assay Office 5,382 assays or quantitative determinations and 319 analyses: of these the majority were for the Bureau of Mines or for the other departments, for which no fees were received.

The fees collected by the office were as follows:—

Fees for analyses	$228.50
Fees for assaying	311.90
Fees for assayers' examinations	105.00
Total cash receipts	$645.40

Determinations and examinations made for other Government departments for which no fees were collected:—

Attorney-General's Department	$935.00
Agricultural Department	892.00
Board of Health	565.00
Treasury Department	4.50
Forest Branch	925.00
Other departments	120.00
	$3,441.50
Value of work done outside of Mines Department work	$4,086.90

The value of gold melted during the year 1928 was $205 in 3 lots, as compared with $715 in 9 lots in 1927.

Free Determinations.

In addition to the above quantitative work, about 2,100 qualitative determinations, or tests, were made in connection with the identification and classification of rocks or minerals sent to the Bureau for a report; for these no fees were charged, as it is the established custom of the Bureau to examine and test qualitatively, without charge, samples of minerals sent in from any part of the Province, and to give a report on the same. This has been done for the purpose of encouraging the search for new or rare minerals and ores, and to assist prospectors and others in the discovery of new mining districts, by enabling them to have determined, free of cost, the nature and probable value of any rock they may find. In making these free determinations, the Bureau asks that the locality from which the sample was obtained be given by the sender.

EXAMINATION FOR ASSAYERS.

REPORT BY D. E. WHITTAKER, SECRETARY OF BOARD OF EXAMINERS.

I have the honour, as Secretary, to submit the Annual Report for the year 1928 of the Board of Examiners for Certificates of Competency and Licence to Practise Assaying in British Columbia, as established under the "Bureau of Mines Act," R.S.B.C. 1924.

A meeting of the Board of Examiners was held on May 18th, October 29th, and November 21st, 1928. One candidate applied for examination on May 18th and passed the examination on that date. Two candidates applied for examination on October 29th and both passed the examination on that date. Two candidates applied for exemption under section 2, subsection (2), of the Act, one each on May 18th and November 21st respectively. The Board recommended that certificates be issued to the above-mentioned five candidates.

In accordance with the recommendation of the Board, certificates have been duly issued by the Honourable the Minister of Mines to the five successful candidates.

LIST OF ASSAYERS HOLDING PROVINCIAL CERTIFICATES OF EFFICIENCY UNDER THE "BUREAU OF MINES ACT," R.S.B.C. 1924.

(Only the holders of such certificates may practise assaying in British Columbia.)

Under section 2, subsection (1).

Adams, J. B.	Victoria.
Archer, E. G.	Anyox.
Armstrong, N.	Vancouver.
Ayres, D. A.	
Austin, John W.	Vancouver.
Backus, Geo. S.	Britannia Beach.
Baker, C. S. H.	
Bajus, N. J.	Vancouver.
Barke, A. C.	
Beilby, E. B.	Vancouver.
Bernard, Pierre	Monte Christo, Wash.
Bishop, Walter	
Boulding, J. D.	Vancouver.
Broughton, F. W.	Vancouver.
Buchanan, James	Trail.
Buehman, A. S.	Trail.
Campbell, Colin	New Denver.
Carmichael, Norman	New York.
Church, George B.	
Clarke, E. R.	Vancouver.
Cobeldick, W. M.	Scotland.
Collison, H.	Cobham, England.
Comrie, George H.	Vancouver.
Cotton, G. W.	Trail.
Craufurd, A. J. F.	Rossland.
Crerar, George	
Crompton, S. V.	Vancouver.
Crossley, C. E.	Nelson.
Cruickshank, G.	
Davidson, J. R.	Sacramento.
Day, Athelstan	Duncan.
Dedolph, Ed.	
Dockrill, Walter R.	Chemainus.
Dunn, G. W.	Rossland.
Edwards, A. H.	Trail.
Farquhar, J. B.	Vancouver.
Fingland, John J.	Kaslo.
Gardner, C. S.	Victoria.
Grimwood, G.H.	Rosebery.
Grosvenor, F. E.	Vancouver.
Hamilton, Wm. J.	Anyox.
Hannay, W. H.	Trail.
Harsant, R. C. C.	
Hart, P. E.	
Hawkins, Francis	Lake Hill.
Hawes, F. B.	Vancouver.
Hodgson, A. R.	Anyox.
Hurter, C. S.	Prince Rupert.
Irwin, George E.	Vancouver.
John, D.	Haileybury, Ont.
Kiddie, Geo. R.	California.
King, R.	
Kitto, Geoffrey B.	Victoria.
Lang, T. F.	Vancouver.
Langley, A. G.	Revelstoke.
Laucks, I. F.	Seattle.
Lee, Fred E.	Trail.
Lee, Geo. M.	
Ley, Richard H.	Victoria.
Levy, Frank	
Lindsay, W. W.	Kimberley.
Locke, V. F.	Vancouver.
Longworth, F. J.	Boyds, Wash.
Manning, S. M.	Trail.
Martin, S. J.	
Marsh, Richard	Spokane, Wash.
Marshall, H. Jukes	Vancouver.
Marshall, William S.	Ladysmith.
Meale, Eric A.	East Helena, Mont.
Merrifield, T. T.	Trail.
Miles, Arthur D.	
Milne, A. S.	Vancouver.
Mitchell, Charles T.	Copper Cliff, Ont.
McCormick, Alan F.	Ruth, Nevada.
MacDonald, Alec C.	Vancouver.
MacDonald, J. S.	Vancouver.
McIntosh, J. H.	Bamberton.
McLellan, R. D.	Vancouver.
Morgan, Richard	Trail.
Nicholls, Frank	Norway.
Okell, S. E.	Vancouver.
Parker, Robt. H.	
Parsenow, W. L.	
Perkins, Walter G.	
Pickard, T. D.	Vancouver.
Pirrie, Noble W.	Victoria.
Poole, H. W.	Vancouver.
Prior, C. E.	Hedley.
Puder, H. F. H.	Vancouver.
Raht, K.	Trail.
Richmond, Leigh	Duncan.
Robertson, T. R.	Vancouver.
Rodgers, Ch. B.	
Rogers, G. J.	Knutsford.

Under section 2, subsection (1)—Continued.

Rombauer, A. B.	Butte, Mont.
Schroeder, Curt A.	
Segsworth, Walter	Toronto, Ont.
Shepherd, G. H.	North Vancouver.
Sharpe, Bert N.	
Sharples, H.	Vancouver.
Shore, J. T.	Vancouver.
Sim, Chas. John	Monte Carlo.
Sloan, Wm.	Vancouver.
Snyder, Blanchard M.	
Steven, Wm. Gordon	
Stimmel, B. A.	Trail.
Stockly, Galt	Princeton.
Sundberg, Gustave	Mexico City.
Tally, Robert E.	Spokane, Wash.
Taylor, E. S.	Vancouver.
Taylor, H. L.	Vancouver.
Teed, A. J.	Vancouver.
Thirkell, V. R.	Vancouver.
Thomas, Percival W.	Vancouver.
Tretheway, John H.	
Turner, H. A.	Vancouver.
Vance, John F. C. B.	Vancouver.
Van Agnew, Frank	Siberia.
Vaughan-Williams, V. L.	California.
Wales, Roland T.	
Watson, Wm. J.	Ladysmith.
Watson, Thomas	Vancouver.
Welsh, J. Cuthbert	Butte, Mont.
Wells, Ben T.	
West, Geo. G.	Vancouver.
Wenerstrom, L. H.	Anyox.
Whittaker, Delbert E.	Victoria.
Widdowson, E. Walter	Nelson.
Willemar, Douglas R.	Masset.
Williams, W. A.	Vancouver.
Williams, Eliot H.	
Williams, J. R.	Vancouver.
Wilson, Thomas S.	Windermere.
Wimberley, S. H.	Nevada, U.S.A.
Youngs, T. N.	Victoria.

Under section 2, subsection (2).

Archer, Allan	
Blaylock, Selwyn G.	Trail.
Bissett, D. G.	Trail.
Bolton, George E.	Silverton.
Brennan, Charles Victor	Britannia Beach.
Browne, R. J.	Rossland.
Browne, P. J.	Nelson.
Bryant, Cecil M.	Victoria.
Bryden, James	Trail.
Burwash, N. A.	
Cavers, Thomas W.	
Clothier, George A.	Nanaimo.
Cole, Arthur A.	Cobalt, Ont.
Cole, G. E.	Rossland.
Cole, L. Heber	Ottawa, Ont.
Collins, H. E.	Stewart.
Conway, E. J.	Vancouver.
Coo, Cecil William	Toronto, Ont.
Coulthard, R. W.	
Cowans, Frederick	
Dawson, V. E.	Trail.
Dempster, R. C.	Rossland.
Dempster, A. S.	Rossland.
Dixon, Howard A.	Toronto, Ont.
Eardley-Wilmot, V. L.	Ottawa.
Fotheringham, D. F.	Trail.
Galbraith, M. T.	
Gilman, Ellis P.	Vancouver.
Gray, Stanley	
Green, J. T. Raoul	Blairmore, Alta.
Guess, George A.	Toronto, Ont.
Harding, Wilson M.	
Heal, John H.	
Hearn, Roy D.	Trail.
Hilliary, G. M.	Idaho, U.S.A.
Howells, J. O.	Calgary, Alta.
Johnston, William Steele	Lachine, Que.
Kaye, Alexander	Vancouver.
Kendall, George	Vancouver.
Kidd, G. L.	Edmonton, Alta.
Kilburn, Geo. H.	Victoria.
Lathe, Frank E.	Montreal.
Lay, Douglas	Hazelton.
Lewis, Francis B.	South Africa.
Mellish, Albert Henry	Premier.
Merrit, Charles P.	
Millen, J.	Trail.
Murphy, C. J.	St. Catharines, Ont.
Musgrave, W. N.	England.
McArthur, Reginald E.	
McBean, K. D.	Trail.
McDiarmid, S. S.	
McGinnis, Wm. C.	Queen Charlotte Ilds.
McKay, Robt. B.	Vancouver.
McLellan, John	Skidegate.
McMurtry, Gordon O.	
McNab, J. A.	Thompson, Nevada.
McPhee, W. B.	
McVicar, John	Edmonton, Alta.
Maclennan, F. W.	
Moran, P. J.	Vancouver.
Newton, W. E.	Sandon.
Nicolle, C. C.	Nelson.
Norrie, James P.	Kirkland Lake, Ont.
Oliver, Chas. E.	Vancouver.
Oughtred, S. W.	Ainsworth.
Outhett, Christopher	Kamloops.
Owen, Francis J.	Trail.
Pellew-Harvey, Wm.	London, England.
Pemberton, W. P. D.	Victoria.
Reid, J. A.	Cobalt, Ont.
Ritchie, A. B.	Nelson.
Roaf, J. R.	
Roscoe, Harold M.	Anyox.
Rose, J. H.	Thompson, Nevada.
Rutherford, R. C.	Trail.
Sampson, E. H. S.	Riondel.
Scott, John Mitchell	Stewart.
Scott, Oswald Norman	
Shannon, S.	
Sharpe, G. P.	Midland, Ont.
Shorey, P. M.	Trail.
Sloan, David	Three Forks.
Stevens, F. G.	Mexico.
Stewart, A. G.	Vancouver.
Stroud, J. E. C.	Anyox.
Sullivan, Michael H.	Kellogg, Idaho.
Sutherland, T. Fraser	
Sutherland, Wm.	Glasgow, Scotland.
Swinney, Leslie A. E.	
Thompson, W. K.	Trail.
Thomson, H. Nellis	Anaconda, Mont.
Watson, A. A.	
Watson, Henry	

Under section 2, subsection (2)—Continued.

Weir, William.....Anyox.
White, E. Grove.....Stewart.
Willis, F. S.....Trail.
Winslow, R. H.....Vancouver.
Wilson, Ridgeway R.....Victoria.
Workman, Ch. W.....
Wright, Richard.....Rossland.
Wynne, Llewellyn C.....
Yuill, H. H.....

Under section 2, subsection (3).

Carmichael, Herbert.....Victoria.
Galloway, J. D.....Victoria.
(Provincial Mineralogist.)
Harris, Henry.....Tasmania.
Hedley, Robt. R.....Vancouver.
Kiddie, Thos.....California.
Marshall, Dr. T. R.....London, England.
McKillop, Alexander.....Vancouver.
Robertson, Wm. Fleet.....Victoria.
(Provincial Mineralogist.)
(Retired Feb., 1925.)

PREVIOUSLY ISSUED UNDER THE "BUREAU OF MINES ACT, 1897," SECTION 12.

Thompson, James B.....Vancouver.

REPORTS OF RESIDENT MINING ENGINEERS.

"MINERAL SURVEY AND DEVELOPMENT ACT."

During the session of 1917 the Hon. the Minister of Mines brought in the "Mineral Survey and Development Act," which was passed on May 19th, 1917, and under the provisions of which the Province was divided into six Mineral Districts, to each of which there was appointed a Resident Mining Engineer with headquarters at a centrally located point in such district.

In the district to which he is appointed the Resident Engineer is expected to devote his whole time to the performance of the duties of his office, and to carry on continuously a mineral survey of his district, keeping records of the same and of the mining and mineral developments taking place, and at the same time to assist prospectors and others with such advice as may be necessary and may come within the scope of a mining engineer's work.

Aside from special reports which may be called for by the Minister, the Resident Mining Engineers are expected annually to make a comprehensive report covering all matters relating to mining, mine development, and prospecting that have occurred within the year in their respective districts.

These annual reports of the Resident Mining Engineers follow, and form the basis of the information given in respect to the mineral industry and its development within the Province.

During the session of 1929 the "Mineral Survey and Development Act" was completely redrafted by the Hon. the Minister of Mines; one of the changes made was the doing away with the defining of the Mineral Survey Districts and headquarters, which can now be changed as necessary by regulation.

The section dealing with the duties of the Resident Engineers remains as before, and is as follows:—

"11. Each Resident Engineer shall, so far as practicable, throughout his mineral survey district assist miners and prospectors in the manner following, that is to say:—

"(*a.*) By giving information as to mineral indications and as to ground open for location as mineral claims or placer claims as a result of knowledge gained during the carrying-out of the mineral survey of his district:

"(*b.*) By examining samples and applying such tests as may be possible on the ground or in his office and advising as to the nature of any mineral and as to the best available methods of analysis, sampling, assay, and test:

"(*c.*) By forwarding samples to the Minister of Mines for further examination and tests whenever in his opinion such course is necessary or expedient:

"(*d.*) By reporting to the Minister of Mines the location and approximate cost of such roads, trails, and bridges as in his opinion are reasonably necessary in order to render possible the development of any mineral resources; and

"(*e.*) Generally, by giving such advice, information, and directions as may be of assistance to miners and prospectors within his district."

Provisions for the Protection of Investors.

The sections dealing with the protection of investors now read as follows:—

"15. Where it appears to the Minister of Mines:—

"(*a.*) That a sale of shares in any mining company or in any mining property is being advertised or solicited upon statements, either of fact or opinion, which are not in accord with the actual facts and conditions as shown by the report of a Resident Engineer or of any official of the Department of Mines or by information on file in the Department; or

"(*b.*) That any statements of the nature referred to in clause (*a*) are being published or circulated with the intention of influencing or which may influence such a sale of shares;

and if the Minister considers it advisable in the interest of any person or of the public, he may give or cause to be given such notices, either personal or public, by telegraphic dispatch, letter, bulletin, advertisement, or otherwise as he considers necessary to prevent injury to investors; and it shall not be necessary in any notice so given to refer to this section or to state any fact

or reason as preliminary to or leading up to the giving of the notice; and every notice so given shall be deemed to be given pursuant to this section, and shall be absolutely privileged.

"16. (1.) Where a corporation, other than a private company under the 'Companies Act,' acquires an interest in, or title to, or engages in work on any mining property situate in a mineral survey district, it shall forthwith notify the Resident Engineer of that district and the Provincial Mineralogist, and file with them full particulars thereof, and shall also file with them, as soon as it is issued, a copy of every prospectus or statement in lieu of prospectus which is required by the 'Companies Act' to be filed with the Registrar of Companies.

"(2.) Where a corporation, other than a private company under the 'Companies Act,' issues, publishes, or distributes, or causes to be issued, published, or distributed, any pamphlet, bulletin, circular, advertisement, or publication relating to any mining property situate in the Province in which the corporation has any interest or on which the corporation is engaged in work, the corporation shall forthwith file a copy of the pamphlet, bulletin, circular, advertisement, or publication in the office of the Resident Engineer of the mineral survey district in which the mining property is situate, and shall also forthwith file three copies of the same in the office of the Department of Mines at Victoria.

"(3.) If a corporation makes a default in complying with any requirement of this section, it shall be liable, on summary conviction, to a fine not exceeding twenty-five dollars for every day during which the default continues, and every director and every manager of the corporation who knowingly and wilfully authorizes or permits the default shall be liable to the like penalty."

NOTE.—All corporations to which these sections apply are specially requested to comply with the provisions of the Act.

NORTH-WESTERN MINERAL SURVEY DISTRICT (No. 1).

By H. T. James, Resident Engineer.

INTRODUCTION.

The North-western Mineral Survey District includes all the Pacific drainage area of the Province between the north end of Vancouver island and the Yukon—excepting the Skeena River valley east of Terrace—and all the Arctic drainage area of the Province north of the Peace river and its tributaries.

Mineral-zones.

The dominant geological feature of the district, and the one which is responsible for the distribution of the mineral-deposits, is the Coast Range batholith, that huge mass of plutonic rock which underlies the whole western part of the district as a belt from 40 to 125 miles wide. Within the main area of the batholith are a number of inclusions, or roof-pendants, some of which are very large and very important from a mining standpoint. The Granby Company's *Hidden Creek* mine at Anyox is in an inclusion which crosses the peninsula between Portland canal and Observatory inlet. In the same inclusion, a few miles down the bay from Anyox, is the *Bonanza*, and on the opposite side of the peninsula is the *Outsider*. In the next large inclusion north, extending from the mouth of the Georgia river at Portland canal, south-easterly nearly to Hastings arm, is situated the property of the Georgia River Gold Mines and other less developed prospects. Another inclusion south of Prince Rupert contains the Ecstall River pyrite-deposit; and in an inclusion near the head of Howe sound are the ore-deposits of the Britannia Mining and Smelting Company. It is evident that the inclusions are important economically and yet very little is known about them. With very few exceptions they have been mapped, geologically, only along the shore-line, and no attempt has been made to determine their real extent. Prospecting likewise has been along the inlets only, and then in a very desultory manner. Searching for a mine by rowing along the beach is like prospecting along a railway-grade—an easy but not very profitable occupation. With two of the largest copper-mines of the Province, *Britannia* and *Hidden Creek*, in roof-pendants, other roof-pendants should attract the attention of individual prospectors and exploration companies more than they have done. It is possible that some of the inclusions farther south in No. 6 District have been prospected fairly well, but the only one which has been at all well prospected in No. 1 District is the one in which the *Hidden Creek* mine is situated. Since this prospecting resulted in the discovery of the *Bonanza* and *Outsider* and numerous prospects, as well as the *Hidden Creek* deposits, it is evident that the whole inclusion is well mineralized.

There is no reason to believe that this particular inclusion was more favoured by mineralizing solutions than others. Structural conditions may have caused a development of larger ore-deposits, but, from our present knowledge, other inclusions should be mineralized just as extensively as either the Anyox or Britannia inclusions, and therefore the other inclusions must be regarded by Governments and by mining companies as potential copper-producing areas. The indicated areal extent of the inclusions is small as compared to the total area of the batholith, but it is to be expected that the known area of the inclusions will be increased as the country is explored and mapped.

Along the western side of the Coast Range batholith is a zone of Palæozoic and Mesozoic volcanic and sedimentary rocks, penetrated by numerous stocks and smaller batholiths of the same general age as the main Coast Range intrusives. Within this zone are numerous contact-metamorphic copper-deposits, several free-milling gold-deposits, and one or two lead-zinc deposits. Most of this western contact-zone north of Vancouver island is either within the territory of Alaska or beneath the sea. The only parts of the zone within No. 1 District are the Queen Charlotte islands and a section on the mainland north-west of Skagway, known generally as the Rainy Hollow section.

The northern half of the Queen Charlotte islands is covered with Tertiary deposits and is of but little interest from a lode-mining standpoint, but the southern half is underlain by limestones, shales, and volcanics cut by granitic plugs, and should be an area favourable for the occurrence of ore-deposits. Low-grade copper-deposits have been found at a number of points and a few small gold-quartz veins have been found, but nothing of commercial importance has been developed. The *Ikeda* mine did produce a small amount of copper during the war, but has not

been able to operate on normal copper prices. Very few attempts have been made to test out the Queen Charlotte Island copper prospects, and as a result prospectors avoid the district.

The Rainy Hollow section of the western contact-zone is 40 miles from tide-water through United States territory, but a good motor-road has been constructed from Haines to the British Columbia boundary. Known deposits in this section consist of contact-metamorphic copper-silver deposits, lead-zinc deposits, and free-milling gold-deposits. The principal showings of the latter type are to be explored by the Bradley interests next season (1929). If the property proves to be commercial it is to be expected that several other properties in the same district will be explored and other discoveries will be made.

Along the eastern border of the main batholith is a zone similar in many respects to the western contact-zone. A series of Palæozoic and Lower Mesozoic stratified rocks are intruded by numerous stocks of the same general age as the main intrusives. Available maps show the eastern contact to be more smooth and regular than the western contact and the number of outlying stocks to be less numerous, but it is doubtful if this is actually the case. The difference in detail of mapping may account for much of the apparent difference in the regularity of the two contacts. Until F. A. Kerr started his investigations of the Stikine River area for the Geological Survey of Canada, the eastern contact of the batholith had been mapped at but three isolated points between Stewart and the Yukon boundary, a distace of 350 miles. Dr. Kerr's work will give much valuable information of more than 100 miles of this but little-known section of the eastern contact-zone.

The general district immediately east of the Coast Range batholith has long been regarded as a favourable one for prospecting and much has been said about its possibilities, but, in spite of this, very few mines have been developed in this zone. In the 400-mile section north of the Skeena river, which is the main part of the zone within No. 1 District, there have been but three shipping-mines of any consequence—the *Dolly Varden* at Alice arm, the *Premier* at Portland canal, and the *Engineer* at Atlin. The lack of shipping-mines does not mean that the zone has been overrated and is of little importance, but rather that the zone has not been prospected and that many of the known good prospects have not been developed. Very few prospectors have ever looked for a lode deposit between Portland canal and Atlin, and the only part of the 400-mile section north of the Skeena that has been at all well prospected is the Portland Canal section, representing approximately 25 miles of the zone. A section of similar length at the head of Alice arm has been prospected fairly well, but not thoroughly (*see* introduction to Alice Arm section), and prospecting for lode properties in the Atlin district has not been at all intense. In the Portland Canal section is situated the *Premier* mine and many other properties now being developed or explored by strong companies. Among these are the B.C. Silver, the Sebakwe, the *Big Missouri*—one of the Consolidated holdings; the *Silverado*, *Porter-Idaho*, *Prosperity*—three properties with high-grade silver-lead showings being developed by the Premier Company; also the *Mountain Boy*, *Black Hill*, and other promising properties that are to be developed more extensively next season.

At Alice arm is the *Doly Varden*, now inactive but a property well worth investigation. Across from it is the *Toric*, one of the best low-grade silver prospects in Northern British Columbia; adjoining the *Toric* is the *Tiger*, recently acquired by the Utility Mines (Number One), Limited; and within a mile of tide-water is the *Esperanza* group, a small high-grade silver property. Many other good prospects could be mentioned, but these are fairly well known and are sufficient to show what has been found in two short sections of the eastern contact-zone.

Important mining camps have been established at the heads of Portland canal and Alice arm rather than at other points along the zone, only because these are the only two arms of the sea which penetrate the Coast Range mountain to the eastern contact-zone, and not because these are the only two sections of the zone that have been mineralized extensively. There is every reason to believe that as other sections of the zone are made accessible and are prospected, valuable mineral-deposits will be found in them.

The problem of opening up these other new sections is now being considered by the Department of Mines. It is obviously desirable to open the most accessible sections first, other things being equal. Such a long section of the eastern contact-zone is directly tributary to the Stikine river and its tributaries, that this section would seem to be deserving of special attention. Geological reports and maps to be published by the Geological Survey will be of great use to prospectors and will do much to focus attention on the district. The Department of Mines is considering

the advisability of following up the Geological Survey work with examination of parts of the district by its own engineers with the object of laying out and building trunk trails where they will be of the most service.

The Stikine River section is but one of several sections of the northern part of the eastern contact-zone which is reasonably accessible, but it is one of the largest, having from two to three times as great a length as the Portland Canal and Alice Arm sections together. The next valley north of the Stikine offering easy access to the eastern contact-zone is the valley of the Taku river. Small gas-boats may be taken up the Taku river several miles past the actual contact, so no difficulty is to be experienced in reaching the main mineral-zone, even under present conditions. One very excellent prospect has been located in this section and is to be given a thorough testing out next season. A replacement vein of complex ore up to 30 feet wide has been cut by a tunnel at a depth of over 100 feet, but no appreciable length has yet been proved on the vein. Values are in gold, silver, copper, and zinc, and the grade is exceptionally good. (See *Tulsequah Chief* group, this report.) The Taku section is recommended to prospectors because it is accessible, is known to be mineralized, and now that one property in the section is to be developed the prospectors will have no difficulty in disposing of their discoveries.

Between the Stikine and the Portland Canal sections is the Unuk River section. Many prospectors are anxious to get into this area, for it is immediately north of the Portland Canal area, but the difficulties of getting into the district are so great under present conditions that few have attempted it. Just at present it seems that the mineralized area is a bit too far from tide-water to encourage the belief that it would develop very quickly into a producing district. That is hardly sufficient reason, however, for not giving prospectors every opportunity of discovering what is in the country, as transportation can be provided if the discoveries warrant it.

South of Portland canal and north of Alice arm is a small section of the eastern contact-zone that should have been opened up and prospected long ago, for it is between two of the best-known mining camps on the zone and is within a very few miles of tide-water. I refer to the section at the head of Hastings arm. This section is mentioned again in the introductory remarks on the Nass River Mining Division.

Between Alice arm and the south end of Kitsumgallum lake it seems that most of the rocks immediately east of the batholith are argillites, and since experience has shown that areas of argillite are not as favourable for prospecting as areas of greenstone, this section is not recommended as highly as the others. The district is, however, very accessible, particularly south of the Nass, and it has been prospected but little. Most of the prospecting has been done on the east side of Kitsumgallum lake, and not on the west side towards the main batholith. The main batholith is in contact with greenstones along the Canadian National Railway, but it is not known how far north the greenstones extend along the contact. They are cut off on the south side of the river by a big lobe of the batholith, which swings back north along the east side of the Kitsumgallum valley for several miles. The greenstones north of the railway, between the batholith and Kitsumgallum valley, are worth prospecting. A few mineralized zones have been located within this zone right along the railway-grade, and it is understood that some prospecting has been done at a little distance from the railway, but I have not been able to find a prospector who has been in the country and could give me first-hand information of the general type and extent of mineralization found.

Most of the eastern contact-zone south of the Skeena river is in other districts and will not be mentioned here.

East of the Coast Range mountains and its mineral-zones is the Interior plateau of British Columbia and the Yukon, from which practically all of our placer-gold production has been derived. While this district may continue to produce important quantities of placer gold, it is possibly more significant to the future development of the country that within and on the margin of this plateau are a number of batholiths. These would be regarded as large batholiths if they were not dwarfed by their proximity to the Coast Range batholith. Our information about them is very scanty indeed. A few around Atlin have been mapped,* a portion of one near Dease lake has been mapped,† and sections of another have been mapped in the Finlay River area.‡ Others have been indicated on upper Stikine river and east of Teslin lake. The Teslin lake, Dease lake,

* Gwillim, J. C.: Atlin Mining District. G.S.C. Annual Report, 1899, Vol. 12, Part B.
† Kerr, F. A.: Dease Lake Area. G.S.C. Summary Report, 1925, Part A.
‡ Geological Survey of Canada, Map 207A, Finlay River area.

eastern upper Stikine, and Finlay areas, including Ingenika and Omineca, are all on one north-west zone and may possibly be parts of one or two larger batholiths, but this, however, is by no means established. All we know is that a series of batholiths outcrop along a zone from 100 to 150 miles east of the Coast Range batholith, for a distance of nearly 400 miles in British Columbia, and continue far into the Yukon.

Knowing that the principal mineral-zones of the north-western part of the continent are associated with batholiths, or small stocks, there is every reason to believe that numerous mineral-deposits will be found along the line of these interior batholiths. The placers of the Interior plateau are undoubtedly derived from the mineral-deposits associated with these batholiths. Under present conditions this whole interior zone is out of the question as a possible lode-mining section, as all parts of the zone are scores of miles from transportation, but these conditions may be changed very quickly by railway developments now being considered north of the Canadian National Railway.

New Developments.

Although the whole district has responded to the general revival of interest in mining, most of the activity has centred around the established camps on Portland inlet and its various arms, such as Alice arm, Observatory inlet, and Portland canal. Only three major operations are being conducted south of Portland inlet. These are the operations of the Detroit Western Syndicate at Khutze inlet, of the Los Angeles-Vancouver Mines, Limited, at the old *Drum Lummon*, and J. B. Woodworth at the *Trixie* property, Porcher island. A considerable amount of money has been spent on the surface plant of the Khutze Inlet property and a little ore was shipped during the year, but no ore reserves of any kind have been developed. The Los Angeles-Vancouver Mines, Limited, is undertaking the driving of a 1,500-foot crosscut to give an additional depth of 250 feet on the old *Drum Lummon* vein, from which a small amount of ore has been shipped in the past by other companies. Development-work on the *Trixie* property, Porcher island, is showing up some gold ore, but the actual quantity developed by the end of the year is not known.

The territory tributary to Portland inlet has always been the most active part of No. 1 District and this year has proved no exception. On the east side of the inlet, at the head of Alice arm, the general mining situation looks brighter than it has done for a number of years. This is due, very largely, to the fact that the *Toric* mine has started production and is to be developed by one of the larger mining companies. While the *Toric* ore-body contains some high-grade ore, it is distinctly a low-grade milling proposition and is attractive chiefly because it offers a possibility of a fair tonnage. The vein is more than 50 feet wide on the one and only level opened up and has been developed for a length of about 300 feet.

Adjoining the *Toric* is the *Tiger*, on which a smaller silver-bearing quartz vein is explored by the Utility Mines (Number One), Limited. The Esperanza Company, working on its property within a mile of tide-water, has a showing of a foot of ore carrying ruby silver in No. 1 tunnel and is working on other levels with a reasonable expectation of finding other ore-shoots. The McGrath Mountain zinc-deposits are being explored at 500 feet depth by the Kitsault-Eagle Silver Mines, Limited, but the work has not progressed far enough to give definite results.

Immediately west of Alice arm is the Observatory Inlet section, in which the *Hidden Creek* is situated. The tonnage output from this property has been increased again this year, and the Granby Company, which owns the mine, is opening up a near-by property, the *Bonanza*. The company's option on the *Outsider* was relinquished during the year.

The western arm of Portland inlet is Portland canal, near the head of which is situated the Portland Canal mining section. From 10 to 20 miles from the head of the canal is the Georgia River valley, recently opened up by a pack-horse trail as far as the property of the Georgia River Gold Mines, about 8 miles from the mouth of the river. The active development of this property has encouraged a number of prospectors to go into the valley, with the result that some encouraging showings have been found. The most important and the only producing property at the head of the canal is the *Premier* mine of the Premier Gold Mining Company. Aside from maintaining a steady production from the *Premier* mine, the company has spent a very considerable amount of money in pushing development on the *Porter-Idaho* and *Prosperity* properties in the Marmot River section, and on the *Silverado*, just across the ridge from the first two. The results of the work on the Marmot properties have not been announced and the crosscut on the *Silverado* has not yet reached the veins. The B.C. Silver and Sebakwe Com-

panies have been exploring the north-easterly extension of the *Premier* ore-zone from shafts, and it is known that the Sebakwe at least is opening up a lens of milling-ore.

North-west of the *Premier* a considerable amount of underground work and some diamond-drilling have been done by the Woodbine Gold Mining Company, Limited, but up to the end of the year no commercial ore had been found. The Consolidated Mining and Smelting Company has improved the showings on the *Big Missouri*, situated farther north in the same valley, but much further development will be required before the future outlook is definitely indicated. At the present rate it will take another two seasons to explore the surface. The Silver Tip Mining and Development Company's showings, a short distance north of the *Big Missouri*, have been improved during the season.

The most important event in the Bear River valley was the discovery of high-grade silver values in a new vein on the *Mountain Boy* property, now owned by the Pat Daly Mining Company, financed from Montreal. From present indications it would seem that quite a number of properties would be working in the Bear valley next season, for the *Mountain Boy*, *Silverado*, and *Black Hill*, all seem to have some possibilities as silver or silver-lead-zinc properties, while the *George* and one or two others in the upper part of the valley have copper-showings of more or less merit and all have ample funds for development.

Aside from the *Prosperity* and *Porter-Idaho*, which are being developed by the Premier Company, considerable work has been done in the Marmot valley by the Marmot River Gold and the Marmot Metals Companies. The possibilities of the Marmot Metals Company have been greatly increased by its having obtained an interest in four other properties in the Portland Canal Division. No definite results have been obtained by the Marmot Gold.

Much of the territory north of Portland inlet is devoted to placer-mining, but it is expected that as the section is made more accessible many good lode properties will be discovered. The most important lode development in this northern section during the year was on the *Telsequah Chief* group, situated on the Taku River section. This group has been known for years and has had some work done on it by one of the larger mining companies, but apparently not in the right place. A crosscut driven this year from the old tunnel cut 25 feet of excellent gold-silver-copper-zinc ore at a depth of more than 100 feet below the outcrop. Just at present this looks like the most important discovery made in No. 1 District this year, but the amount of work done to date is too limited to give any real indication of the possibilities of the property. The *Engineer* at Atlin was reopened for the summer, and it is understood that some fairly good ore was found, but no authentic information has been obtained about the possible quantity and grade of the material or about the future plans of the company. The Atlin Silver-Lead Company's property, in the same section, has been developing slowly and apparently with sufficiently encouraging results to justify further expenditure. On the opposite side of the Coast range from Atlin, in the Rainy Hollow section, surface prospecting was continued on the *Stampede* group and a few short drill-holes were put down on the *Maid of Erin* property.

The placer production from the two placer sections of No. 1 District, Atlin and Cassiar, is not great, but the chances for an increase in production seem to be fairly good. Three companies in Atlin are developing their ground with reasonable expectations of finding "pay." These are the Compagnie-Francaise Des Mines d'or du Canada on Otter creek, the Consolidated Mining and Smelting Company on Boulder creek, and the Discovery Mining and Power Company on Pine creek. In addition to these, other creeks seem to offer possibilities. In the Cassiar section drilling by the Barrington Transportation Company resulted in the finding of some good values in dredging ground on the Clearwater river. It is expected that another season will find some fair production from Mosquito creek, a tributary to Thibert, and from Gold Pan creek on the Little Eagle river. McDame creek also offers possibilities of production.

Geological Survey Work.

The Geological Survey is continuing its investigation of the eastern contact of the Coast Range batholith. F. A. Kerr has completed his fourth year's investigation of the Stikine River area, one of the longest sections of the eastern contact-zone to be mapped by the Survey. The publication of his maps and findings will be extremely useful to prospectors and will do much to assist in the development of this important area. George Hanson commenced a detailed investigation of the whole Alice Arm section, a section which promises to become an important one in the near future.

Bibliography.

A fairly complete list of articles on No. 1 District is given in the 1927 Annual Report. To these might be added the following: Silver-lead-zinc veins at Atlin, B.C., by H. E. McKinstry; *Engineering and Mining Journal*, Vol. 125, No. 12; Mineral Association at the George Gold Copper Mine, Stewart, B.C., by W. V. Smitheringale, Economic Geology, Vol. 23, No. 2; Salmon River Area in Southern Alaska, by A. F. Buddington, *Engineering and Mining Journal*, March 26th, 1927.

Production.

The following table gives the production from lode mines within No. 1 District for the year 1928:—

Name.	Ore.	Gold.	Silver.	Copper.	Lead.
Atlin Mining Division—	Tons.	Oz.	Oz.	Lb.	Lb.
Engineer	400	193	133	.....	.....
Portland Canal Mining Division—					
Outsider	2,564	10	718	109,854	.....
Premier	275,811	130,294	2,368,458	207,632	2,933,599
Nass River Mining Division—					
Hidden Creek	1,411,150	4,075	246,930	34,605,833	.....
Goiskeish	13,111	1,022	6,170	.....	.....
Toric	1,540	.....	19,968	.....	21,911
Bonanza	1	3	.....	.....	.....
Skeena Mining Division—					
Black Wolf	25	37	113	.....	2,309
Western Copper	165	102	1,053	48,012	.....
Totals	1,704,767	135,736	2,643,543	34,971,338	2,957,819

The placer production for the district during 1928 amounted to $60,639, which is an increase of $11,373 over last year's production.

Review by Mining Divisions.

The following is a detailed review of mining activities in the various Mining Divisions and sections, as follows:—

Queen Charlotte Mining Division—Graham Island section; Moresby Island section.
Bella Coola Mining Division.
Skeena Mining Division—Coast section; Canadian National Railway section; Kitsumgallum Lake section; Lakelse section.
Nass River Mining Division—Observatory Inlet section; Hastings Arm section; Alice Arm (Proper) section; Illiance River section; Kitsault River section.
Portland Canal Mining Division—Portland Canal (Proper) section; Georgia River section; Marmot River section; Bear River section; Salmon River section.
Stikine and Liard Mining Divisions.
Atlin Mining Division—Rainy Hollow section; Atlin Lake section; Taku River section.

QUEEN CHARLOTTE MINING DIVISION.

Graham Island Section.

All of Graham island, with the exception of a small section at the south end, is relatively flat country, covered with Tertiary deposits, and therefore offers no possibilities for lode-mining. For a number of years past, however, some interest has been taken in gold-bearing black sands found along the north-east coast of the island, and a few attempts have been made to mine the sands, but without success. Nothing was being done on the deposits at the time of my examination, but, according to John L. Barge, Mining Recorder at Queen Charlotte, the Graham Island Mining Company, holding five leases covering an area of 7,500 by 1,000 feet of beach on the north-east coast of the island, has sunk fifty-six test-pits and sent several tons of sand to Tonopah and New York for testing purposes. If these tests are satisfactory it is expected that further testing will be carried out on the ground.

A little prospecting has been done for lode properties on the south end of the island, and one group, the *Northwester*, was staked during the year.

Northwester.

This group of claims, consisting of the *Northwester Nos. 1, 2,* and *3,* is situated about a mile north of the head of Vancouver harbour, one of the most southerly inlets on the west coast of Graham island. It was staked in the spring of 1928 by George McRae and Archie Dewall, of Queen Charlotte. The showings are at an elevation of about 2,000 feet above sea-level and are reached by a foot-trail which leaves the beach at the north-west corner of Vancouver harbour.

The rocks on either side of the harbour, from the entrance to the head, are granitic rocks, with the exception of a narrow strip of greenstones near the entrance, on the north side. The granitic rocks outcrop along the trail for something less than a mile, to an elevation of about 1,000 feet, and then give place to a series of recrystallized limestones containing bands of andesitic material. It would seem that the andesitic bodies are intrusive in the limestones, either as dykes or sills, for the contacts between the andesites and limestones are marked by a zone of contact-metamorphic silicates at all points examined. Fairly large bunches of magnetite and smaller bunches and disseminations of copper and iron sulphides are found at intervals along these zones, indicating that the andesitic rocks are responsible for the introduction of economic minerals as well as for the alteration of the limestone.

The owners of the *Northwester* group have prospected the contacts of two dykes or sill-like bodies of andesite. The lower one outcrops along the trail between 1,600 and 1,800 feet elevation, and the upper one from a little over 1,800 feet elevation to about 2,000 feet elevation. A few hundred feet north of the trail the distance between the two bodies of andesite is much greater than it is along the trail. The general trend of the contact is north-south parallel to the hillside and the dip is steep to the west into the hill.

The first mineral-showing to be found along the trail is in a narrow creek-bed at about 1,800 feet elevation. It consists of a bunch of chalcopyrite in a narrow band of limestone between andesitic walls. Extending northerly for several hundred feet is a 10- to 20-foot band of garnetite, apparently the metamorphosed equivalent of the limestone. A few small cuts have been made along this zone, but nothing more than occasional specks of copper carbonate and sulphide have been found.

A broader band of limestone outcrops farther up the hill and a little north of the showing at 1,800 feet elevation. At one point the talus from a cliff in this limestone contains a considerable number of blocks of good copper ore, consisting of chalcopyrite, with variable amounts of pyrrhotite, pyrite, and occasionally sphalerite. On reaching a point of vantage it is found that the float comes from an irregularly shaped body of sulphides within the limestone. This is inaccessible at present. The area of sulphides exposed is small and the body is probably not commercial, but judging from the float the grade seems to be fairly good and should encourage further prospecting in the area.

A lime-silicate zone may be traced from this showing for several hundred feet north to a rock point overlooking Rennell sound. From this point of rock several iron-stained patches may be seen higher up along the same hillside. The claims were located only a short time before the examination and the owners had not had an opportunity of prospecting the ground thoroughly.

The showings found to date are encouraging and justify a careful prospecting of the whole section between Rennell sound and Vancouver harbour.

Moresby Island Section.

A number of properties have been staked in the past on Moresby island, but during recent years engineers and prospectors have shown very little interest in the island. Most of the showings are of low-grade copper mineralization, frequently associated with magnetite, but a few small gold properties have also been found. Owing to general inactivity in the section during the last two years I have examined but one property on the island. The following paragraph is from G. A. Clothier's report in the 1925 Annual Report:—

"There are several groups and claims that I think would bear investigation: The *Blue Mule* on the west coast of Moresby island, which carries encouraging values in free gold; the *Swede* at Lockeport, an immense body of low-grade copper ore, in which small platinum values have been obtained; the *Copper Queen* at Jedway, on which considerable work was done years ago, and on which a large body of low-grade copper ore has since been discovered and prospected to

some extent by stripping and open-cutting; the *Hope* at the head of Huston inlet, where assessment-work has exposed a 6-foot vein of 3.5-per-cent. copper ore; the *Ikeda Mines* on Ikeda bay, from which a large tonnage of high-grade ore was shipped during several years and on which are a number of showings of low-grade ore which might develop into a milling tonnage; the *Thunder* at Collison bay, owned by Ike Thompson, of Jedway, which shows a wide vein of magnetite carrying a fair copper content; the *Meal Ticket*, adjoining the *Thunder*, which has a large vein of quartz exposed along the surface, well mineralized with pyrrhotite and chalcopyrite; the *Copper Island* showings, belonging to A. Heino, of Lockeport."

Swede.

This group is one of the old and well-known groups on the Queen Charlotte islands, having been staked by its present owners, Larsen, Pearson & Rogers, in 1907. In 1927 it was reported that the group had been abandoned, but apparently it was abandoned only that a smaller group might be located over the principal showings. At present four claims only—the *Dana*, *Gladstone*, *Stanton*, and *Lincoln*—are included in the group. These cross a small peninsula from Klunkwoi bay to Salmon creek, just opposite Lockeport, one of the ports of call of the Canadian National steamships.

The rocks on the peninsula consist chiefly of a series of basic igneous rocks, with a very small amount of well-banded material, which may be tufaceous. At many points the igneous rock has a distinctly amygdaloidal structure, suggesting that the series contains a number of lava-flows, as well as tuff-beds, but the relative amount of the various rock types is not known. At one point near the north end of the peninsula some of the bedded material strikes about east-west (mag.) and dips to the south at about 50°.

Copper sulphide has been found at a number of widely separated points on the property. The rock containing the greater amount of sulphides has an amygdaloidal structure and the sulphides occur chiefly as a filling of the amygdules, or, more rarely, as small veinlets cutting the rock. Chalcopyrite is the principal sulphide, but small amounts of bornite and pyrite are also to be found, and epidote is invariably present as an associated mineral, occurring in the same manner as the sulphide and in approximately proportionate amounts.

On the Salmon Creek side of the peninsula, at an elevation of about 150 feet, is an open-cut some 50 feet in length in an amygdaloidal rock slightly mineralized with chalcopyrite. It is said that the bottom of the cut is more highly mineralized than the top, but the cut had not been cleaned out for years and the lower part could not be seen. Three diamond-drill holes were put down at this point by the Granby Consolidated Company in 1918. Another hole had been drilled from a cut some little distance farther towards the point in similar rock.

The greatest amount of work has been done on the side of the peninsula facing Klunkwoi bay, where a series of workings extend from 100 feet to over 700 feet elevation. At about 100 feet elevation there is considerable open-cut work and two tunnels, aggregating well over 250 feet of underground work. At 500 feet elevation is a 55-foot tunnel driven below an open-cut, and at about 720 feet elevation are other open-cuts. The ground is mineralized with variable but small amounts of chalcopyrite at all points, but, as far as I know, the best showings are to be found at the two lowermost tunnels.

The southerly of these two tunnels is probably 200 feet long and has a lateral working driven to the right at about 30 feet from the portal. During the past winter the owners have turned the main tunnel to the right and advanced it about 15 feet, leaving a shoulder on the left-hand side of the working. This shoulder, which is about 4 feet wide, is well mineralized and the mineralization continues to the face of the tunnel, but only on the left-hand side and from the floor to about 4 feet up the wall. A chip sample from the 15-foot zone exposed along the side of the tunnel assayed: Gold, trace; silver, trace; copper, 1 per cent. The mineralization appears to be in an amygdaloidal rock and grades very rapidly into a rock relatively free from amygdules and sulphides. I am informed by Alex. Rogers, one of the owners, that the tunnel crosscut another 15- or 20-foot zone very similar to the one which I sampled, but this zone was not noticed as it is in an old section of the tunnel where the walls are covered with much dust.

The second tunnel is parallel to the one just mentioned and about 100 feet north of it. A short drill-hole was driven from the face of this tunnel by the Granby Consolidated Company in 1918, but the results of the drilling are not known, as the drill-core was lost overboard while being shipped to the company's plant at Anyox.

It is possible that a large tonnage of material, assaying something like the value reported above, could be developed on the *Swede* group, but more work would have to be done both

underground and on the surface before the structure and probable size of the more heavily mineralized zone could be determined. For further description, with assays, *see* Annual Reports for 1907, 1909, 1913, and 1918.

Cumshewa Gold Mines.

The property of the Cumshewa Gold Mines is the old *Homestake* property, situated on the north shore of Cumshewa inlet. Between 1907, the date of its location, and 1913 considerable development was done on a series of gold veins and some sorted ore was shipped to the smelter, but the property has been idle since 1913. It was examined in 1928 by the General Exploration Company, of Vancouver. A Government engineer's report on the property is to be found in the 1913 and 1923 Annual Reports, under the name *Homestake* group.

BELLA COOLA MINING DIVISION.

The Bella Coola Mining Division is the most southerly Division in No. 1 Mineral Survey District. It embraces an area of about 125 miles square on the Pacific slope of the Coast range, drained by the Bella Coola and Dean rivers, flowing into the heads of Burke and Dean channels respectively.

The eastern contact of the batholith enters the Bella Coola Division at its extreme north-eastern corner, near the west end of Eutsuk lake, and follows an irregular south-easterly course to Kappan (or Charlotte) lake, at the head of Bella Coola river. The contact has been mapped* from Kappan lake to a short distance above Firvale, on the Bella Coola river, but its exact position is not known between here and Eutsuk lake. The part of the contact which has been mapped follows along the north side of the Bella Coola river, at a distance of 2 to 10 miles from it. Unfortunately much of the area immediately along the contact is covered with glacial drift or Tertiary lavas and is not a favourable area for prospecting. Apparently the most favourable area in the whole Bella Coola valley is along the north side of the river, between Burnt Bridge creek and Precipice camp, in a belt of greenstone from 4 to 8 miles wide, although it is quite probable that mineral-deposits will be found in other parts of the valley.

From our present information it seems that the eastern contact of the batholith must cross Dean river about 20 miles from its mouth. If this is the case, the Dean River valley should be opened to prospectors, for a mineralized section, only 20 miles from tide-water through a large river-valley, is very favourably situated—more so than many which are now being developed.

The large inclusion within the batholith at the head of Dean channel also offers distinct possibilities as a potential copper-producing area, for the *Britannia* and *Hidden Creek* deposits occur in similar inclusions.

Numas.

This group of eight claims—*Numas Nos. 1* to *8*—is situated on east side of Dean channel, about midway between Kimsquit and Labouchere channel, and is owned by B. T. Jacobson, T. Olson, and A. J. Enjvich, of Bella Coola. One of the Union Steamship Company's boats calls regularly at Bella Coola, where gas-boats may be hired for making the run up to the claims. A good cabin has been built just above the beach near the showings.

The workings consist of a large open-cut, a 20-foot tunnel just above high-water mark, and two or three smaller cuts at elevations of 300 and 400 feet above sea-level. The lowest cut is 25 to 30 feet wide and exposes a belt of green schist, which is apparently a sheared phase of the surrounding batholith rocks. It contains some fairly good-looking chalcopyrite and lenses of quartz, but, so far, no particular continuity of the sulphides has been demonstrated. Since, however, the full width of the shear-zone has not been exposed, it is possible that more continuous lenses may be found. A few tons of copper ore has been taken from the upper side of a smooth wall at the bottom of the cut and piled on the dump. This wall was thought to be the foot-wall of the vein, but it is more probably a fault-plane offsetting the shear-zone. The wall strikes N. 70° E. (mag.) and dips at a small angle to the south, while the shear-zone appears to strike about S. 70° E. and dips quite steeply to the south. A 20-foot tunnel has been driven along the shear-zone and a crosscut is now being driven to the right from the face of the tunnel to pick up the hanging-wall of the zone.

The cuts at 300 feet elevation are approximately on the strike of the shear-zone exposed in the lower workings and are in a sheared phase of moderately basic batholithic rocks. The shear-zone contains a few narrow basic dykes, as well as quartz-lenses sparsely mineralized with

* Dolmage, V.: Tatla-Bella Coola Area. Geol. Survey Can., Summary Report, 1925, Part A.

pyrite and chalcopyrite and a very small amount of molybdenite. Two quartz veins are exposed in similar material at about 400 feet elevation, but the amount of sulphides in these upper cuts is quite small. As the shear-zone (or zones) is followed up the hill the strike swings to the east, varying from S. 70° E. at the beach to S. 30° E. (mag.) at 400 feet elevation.

It would seem advisable to determine the full width of the shear-zone at the beach and to follow this easterly with intermediate cuts, or with a tunnel, if fair mineralization is found.

SKEENA MINING DIVISION.

The Skeena Mining Division is a rectangular strip of the British Columbia coast, extending from the entrance to Portland inlet, just north of Port Simpson, to Milbanke sound, including all the Coast islands, except the Queen Charlotte group, and the Mainland as far east as the crest of the Coast range. For the purpose of these reports it is divided into four sections: The Coast section; Canadian National Railway section; Kitsumgallum Lake section, embracing the Kitsumgallum valley from the railway at Terrace to Lava lake in the divide between the Nass and the Skeena rivers; and finally the Lakelse Valley section, which takes in the extension of the Kitsumgallum Valley depression, lying on the south side of the railway.

Considerably more work has been done in the Coast section during the past year than for some time previously. Several prospectors have been out prospecting, or doing more work on their old discoveries, and serious attempts are being made to develop three properties along the Coast—namely, the Detroit Western property, the *Drum Lummon*, and the *Trixie* on Porcher island.

The Canadian National Railway section has been quite inactive this year. The area of greenstone between Shames and Terrace, on the north side of the area, should be prospected more carefully than it has been.

Nothing new of importance has been developed in the Kitsumgallum Lake section. Most of the prospectors are working on the east side of the valley, but it would seem that the best possibilities are on the west side, near the Coast Range batholith, particularly in greenstone areas.

The Lakelse section contains big contact-zones, mineralized with copper chiefly, and is probably worth investigating, particularly if the railway to Kitimat should materialize.

Coast Section.

Moult Property. This property is situated on a salt-water lake, known as Hidden lake, on the west side of James island. The property's camp-site is immediately south of the string of narrows which leads into the lake from the north and may be reached in a small gas-boat at high slack tide. Larger boats may be taken to within half a mile of the northern end of the narrows.

The property was optioned to the Granby Company in 1928, but the option was relinquished after a certain amount of surface work had been done. At about 400 feet from the camp-site a deep cut was made across a mineralized band of limestone, which appeared on the surface to be about 20 feet wide. It was found, however, that this width of limestone was merely the top of an anticlinal fold in a band of limestone no more than 3 or 4 feet thick. Other cuts along the same zone failed to find more than highly metamorphosed rocks.

Since no one was on the property at the time of examination, it is possible that some of the showings were not identified.

Detroit Western Mining Corporation. This corporation is a private company whose stock is held by a small group of Detroit and Eastern American individuals. It was formed for the purpose of taking over certain mining properties in British Columbia, among them being the *Western Copper* property of fifty-four claims, situated at the head of Khutze inlet. One of the Union Steamship boats has been calling regularly at Khutze inlet since the early part of 1928 and other Coast boats call regularly at Butedale, about 15 miles distant.

The main camp is about 4½ miles from the beach, and a second camp, near the showings, is about a mile farther along and approximately 2,000 feet higher in elevation. Between the beach and the main camp, which has accommodation for about 100 men, is a narrow-gauge railway, on which heavier steel was laid during 1928. From the main camp to a point which had been

designated the "main tunnel-site," 1,500 feet above the camp, a substantial tram was built during the winter of 1927–28, and a lighter tram has been constructed from the tunnel-site to an upper camp near the showings, about 2,000 feet above the main camp.

The principal showing is a long and fairly flat vein which outcrops on either side of a very steep-walled canyon. It is a narrow shear-zone in granitic rock—in places more properly called a sheeted zone—filled with quartz and variable amounts of the sheared or fractured country-rock, and containing in places lenses of copper and iron sulphides. It strikes in a general north-east, south-west direction and dips at approximately 30° to the south-east. Minor variations are to be found in both strike and dip. Prior to this last summer most of the work had been done on the section of the vein east of the canyon, but owing to the difficulty of crossing the canyon and of finding a suitable place for driving exploratory tunnels the scene of activity was shifted to the west side of the canyon. Here a camp has been built with accommodation for about thirty men. During the summer about 100 tons of ore has been mined from the surface and a considerable amount of exploratory work has been done underground. Since the showings on the east side of the canyon are described in some detail in the Annual Report for 1926, commencing on page 68, under the heading "Western Copper," it will be necessary to mention only the new workings in this section. Approximately 10 tons of ore was taken from the vein at the point where it crosses the canyon, and although this spot is referred to in the report mentioned above as the best showing east of the canyon, very little ore is to be found in the bottom of the cut now. A crosscut tunnel, driven to the vein a short distance east of the canyon, cut the vein at about 150 feet from the portal. Short drifts were driven along the vein this year both ways from the crosscut, but nothing more than occasional short and very narrow streaks of sulphides were found. Although these are said to assay quite high in gold, they are of no commercial significance whatever.

The westerly section of the vein extends from the canyon to the elevation of the upper camp, a distance of some 700 or 800 feet. It varies in width from an inch of quartz to 4 or 5 feet of quartz and country-rock, with more or less sulphides. One of the largest lenses, measuring possibly 5 by 75 feet, outcrops in an inaccessible place down near the head of the canyon. Most sections of the vein are narrower than this, running generally from 6 inches to 2 feet in width. At the camp elevation the vein is cut off by a flat fault which dips westerly into the hill. From beneath this fault approximately 125 tons of ore has been mined from the surface, along a 15- or 20-foot section of the vein. The vein as exposed in the face of the cut is less than 1 foot wide, but it is well mineralized with chalcopyrite and is said to assay fairly well in gold.

A tunnel was started to the foot-wall of the vein and about 12 feet below the fault. When in a few feet the tunnel was swung over to the vein, but within this distance the vein had pinched to an inch or two of quartz and sulphide, and rapidly narrowed to a mere slip, before being cut off completely by the fault outcropping on the surface. Crosscutting and further searching underground has failed to locate the continuation of the vein. At the time of examination, about the middle of October, a crosscut was being driven into the hanging-wall and an inclined winze was to be sunk from the end of the working to explore lower sections of the vein.

Approximately 75 feet north of the tunnel, towards the camp, a nice little bunch of copper ore is exposed in a cut and short tunnel. Its relation to the main vein and other showing is not clear. Still farther around the hill, straight above the camp, are two small intersecting veins, or, rather, intersecting mineralized joint-planes. They both strike about north-east, but one dips 80° south-east and the other 15° south-east. The flat vein can be traced about 25 feet from the steep vein. A drift on the latter run out of ore, which is about 1 foot wide on the surface, within a few feet of the portal.

Extending south-westerly from these veins, around the shoulder of the hill and for several hundred feet along the hillside, are a series of open-cuts and short tunnels in what is supposed to be the continuation of the main vein. The best showing in this section is to be found in a little tunnel several hundred feet from the camp. The vein exposed varies from ½ to 5 inches in width and consists of quartz and a little chalcopyrite. At other points there is nothing but a joint-plane in the granite or an inch or two of barren quartz.

Sacramento.

In March, 1928, fifteen claims were staked near the head of Minette bay by C. H. Edmond, who is said to be connected with the Sacramento Exploration Company, Limited, apparently a private company. Minette bay is a small

shallow bay at the head of Kitimat arm. Large boats may be taken as far as Kitimat village, but it is inadvisable to attempt to take more than rowboats, or gas-boats of very shallow draught, beyond the village, as Kitimat arm between the village and the mouth of Kitimat river is very shallow and full of snags. The showings on the property are situated about a mile from the head of the bay and may be reached by a foot-trail which leaves a cabin at the north-west corner of the bay.

The showings consist of nothing more than a 7- or 8-foot fine-grained light-coloured quartz-porphyry dyke, which is exposed for a short distance in a creek-bed. A short veinlet of quartz is found in the dyke at one point, but there is nothing to suggest that any of it would carry values of any kind. The surrounding rock is the granitic material of the Coast Range batholith.

Golden Crown.

This group of five claims—*Golden Crown Nos. 1* to *5*—was staked in the early spring of 1928 for the Cal-Brit Exploration Company. Since then it seems that the Cal-Brit Exploration Company has gone into liquidation, and J. A. Anderson, acting as agent for all parties, has given a bill of sale of the *Golden Crown* group to the Big Slide Mining and Development Company, Limited. This latter company was incorporated in 1928 with a capitalization of $2,000,000, divided into 8,000,000 shares. It owns mining properties in other sections of the Province and an oil lease in Turner valley, Alberta.

The claims are situated about 4½ miles east of Kitimat village, on a branch of the creek which flows into Kitimat arm immediately north of the village. It was not possible to visit the showings, as no one was on the property and a guide could not be secured. It was learned, however, that the property is a very old one, having been staked prior to 1900 by Steele & Dunn and held by them until after 1909. I am informed by the Deputy Mining Recorder at Kitimat that the property was abandoned only after a considerable amount of exploratory work had been done and had failed to develop any appreciable amount of commercial ore. Judging from reports in earlier Annual Reports, the surface showings must have been fairly good, and it is possible the property would be worth an engineer's examination. The Annual Report for 1901, page 992, contains the following statement: "It is situated about 4½ miles from Kitimat arm, nearly behind the Indian village, and is approached by a good wagon-road which has been constructed by Messrs. Steele and Dunn, assisted by a Government grant. The ledge itself, which is about 20 feet wide, appears on the wall of a canyon on Wa-hugh creek. The gangue is of quartz, with values in copper, gold, and silver. The owners have driven some 20 feet on the vein, and in addition have constructed cabins, a blacksmith-shop, etc., and stripped 100 feet of the ledge."

On page 74 of the 1907 Annual Report is the following: "A tunnel 155 feet long has been driven, with crosscuts, 17 and 24 feet; also surface work and open-cuts on the *Golden Crown* claims."

The property was relocated in the spring of 1928, when there was several feet of snow on the ground. Since it was located the property has not been worked or examined by the owners.

Kildala.

Two groups of claims, the *Kildala* and *Bolton No. 2*, were staked in the spring of 1928 at the mouth of the Kildala river, flowing into the head of Kildala arm. The discovery of mineral in this section caused quite a bit of local excitement and a number of claims were staked as a result. The *Kildala* and *Bolton No. 2* groups were the only ones examined, however, as the others had been staked on "ground" rather than on "showings." These two groups are owned by John Bolton and partners, of Kitimat village.

The claims cover a point which juts into the north side of the Kildala river-flats and extend back up the hill for about a mile. The rocks forming this point and ridge are a series of highly metamorphosed greenstones and tuffs, with a certain amount of limestone. It is probable that some of the hornblendic rocks, resembling basic igneous rocks very closely, are metamorphosed limestones. The whole series is an inclusion of unknown dimensions in the Coast Range batholith, and as such is a very favourable place to search for possible copper-deposits. Sulphides were found first, right on the point within a foot or two of the Kildala river-flats, in a narrow band of recrystallized limestone and other metamorphosed rock. Most of the sulphides had been taken out and piled alongside the shallow trench. Another showing, in a creek at 400 feet elevation, on the *Bolton No. 2* group, consists of small bunches of pyrite and a little chalcopyrite, scattered irregularly through a series of bedded rocks. The owners claim to have had assays of

more than 1.7 per cent. tin from this locality, but samples selected by the owner and tested in Victoria failed to show any signs of tin.

Although nothing of commercial importance has been found to date, the greenstones and limestones of the area are well worth prospecting.

Los Angeles-Vancouver Mines, Ltd. (Drum Lummon).

This company was incorporated in the fall of 1927 to take over and operate the *Drum Lummon* property, formerly held by the Paisley Point Mines, Limited. The new company has a capitalization of 1,000,000 shares of the par value of $1 each. Since the showings and workings of the *Drum Lummon* property have been described in previous Annual Reports and in the Summary Report of the Geological Survey for 1921, Part A, it is not necessary to describe the property here. It is sufficient to say that the old workings consisted of one level, having approximately 900 feet of crosscuts and drifts, with about 100 feet of raise and 50 feet of winze. Two or three short stopes have been driven from the main drift, which is about 400 feet long, and a short drift driven from the bottom of the 50-foot winze. Although much of the vein remains to be explored on the level of the main workings, the company has started to drive a 1,500-foot crosscut to tap the vein at an additional depth of 250 feet, because, it is said, snow-slides make it unsafe to continue working from the present tunnel.

Trixie.

The *Trixie* group, or Patterson's property, is situated about a mile inland from Welcome harbour, a small and none-too-secure anchorage on the north end of Porcher island, approximately 20 miles south of Prince Rupert. During the past several years small shipments of sorted ore have been made to the smelters, either by the locator or by some operator working under lease and bond. The Belmont-Surf Inlet Mines, Limited, did considerable work on the property in 1917, but apparently did not think the results were sufficiently encouraging to warrant it exercising its option. Since then other ore-shoots have been found and shipments made, but the property was not developed seriously again till 1927, when it was optioned to J. B. Woodworth and associates. Since these people are still working the property, it is to be assumed that the results have been reasonably satisfactory.

The ore occurs as short ore-shoots in a series of quartz-pyrite veins within granitic rocks of the Coast Range batholith. These veins are decidedly lenticular and somewhat irregular in their strikes, following courses of N. 50° N. 80° E. Aside from quartz and a variable quantity of altered wall-rock, pyrite is the only conspicuous vein material, and it is the valuable constituent, for it carries an appreciable and fairly uniform amount of gold. Solid sulphides run from $100 to $200 a ton in gold, whereas the clean quartz is invariably barren.

The property has not been examined since early spring (1928), so the results of the year's work are not known. It is understood that J. B. Woodworth and associates have taken options on other adjoining groups.

A new camp and office buildings were put up in the early part of the year, and a compressor-house was also built near the workings, housing a 250-cubic-foot compressor, belt-connected to a 52-horse-power full Diesel-Rusten engine.

I.X.L.

This group of five claims—*I.X.L.*, *I.X.L. Fraction*, *Klim*, *Starlight*, and *H.E.B. Fraction*—is situated on Porcher island, immediately west of the *Trixie* group, and is owned by Captain Dennison, of Prince Rupert, and D. L. Wright, of Toronto. The showings consist of a number of quartz-pyrite veins in quartz diorite, very similar to the veins on the adjoining *Trixie* group, except that they are narrower and contain a smaller amount of sulphides. The veins strike approximately east-west (mag.) and dip at a steep angle to the south. Widths vary from a mere stringer to 4 feet.

Up to May, 1928, the main tunnel had been advanced to a depth of about 65 feet, exposing a quartz vein carrying a small amount of pyrite. About half-way along the drift the vein is 3 to 4 feet wide, but at the portal it is only a few inches wide, and at the face there is nothing but a fracture and one or two quartz stringers making into the walls. A small amount of pyrite is disseminated through the altered quartz diorite at the face of the tunnel, but a grab sample from this assayed only traces in gold and silver.

Morning Star.

This group is situated on the west side of Tuck inlet, about 6 miles north of Prince Rupert, and is owned by S. K. Larson, of Prince Rupert. Tuck inlet is the northerly continuation of Prince Rupert harbour. The owner of the group has found two or three veins in the series of highly metamorphosed rocks which outcrop in the general vicinity of Prince Rupert. One vein outcrops along the beach, a couple of hundred

feet down the inlet from the small cabin on the property, and another vein outcrops about 500 feet from the beach and a little north of the cabin. The one on the beach strikes about N. 30° E. (mag.) and dips steeply to the south. It is about 2 feet wide in the cut nearest the beach and consists of watery-appearing quartz. About 75 feet inland it is from 4 to 5 feet wide and, aside from quartz and silicified country-rock, contains a little pyrrhotite and a very small amount of chalcopyrite. A 4-foot sample from this cut assayed 40 cents in gold and 2.2 oz. of silver to the ton.

The second vein is some 500 feet back from the cabin and is reached by a foot-trail leaving the beach at the cabin. As far as I know, the only workings on the vein are an open-cut and shallow shaft, filled with water, at the end of the trail. These workings expose a vein from 2 to 2½ feet wide, striking south-west (mag.) and dipping 43° south-east. It consists of quartz and massive bunches of pyrrhotite and in places a little chalcopyrite is to be found. A 2-foot sample assayed *nil*, *nil*, *nil*, in gold, silver, and copper. Another lens is exposed on the wall of the creek about 60 feet from the cut. It is only about 1 foot wide and strikes N. 20° W. These are probably short lenses in the highly metamorphosed and schistose rocks and are of little importance.

Kitsumgallum Lake Section.

Martin. The *Martin* group is a small group of claims on the north side of the Little Beaver river, about 6 miles west of Kitsumgallum lake. It is reached by a fair trail which leaves Kitsumgallum from a point near the north end, and runs up the Little Beaver river for approximately 6 miles, to an elevation of 1,500 feet above sea-level, and then climbs to the showings by a series of switchbacks at an elevation of about 2,800 feet above sea-level, or 2,300 feet above the lake. The group is owned by William Treston, of Terrace.

The showing is a narrow vein in a shear-zone within a small stock of medium-grained granodiorite. The main eastern contact of the Coast Range batholith is several miles west. The vein is traceable for a distance of about 300 feet and has been opened up more or less continuously for about 100 feet. It is quite narrow and consists of quartz with pyrrhotite, arsenopyrite, galena, sphalerite, and a little chalcopyrite, and carries values in gold and silver. It strikes north-east (mag.) and dips 65° north-west into the hill.

A 1-foot sample across the vein at a point directly above the one and only tunnel assayed: Gold, 0.10 oz. to the ton; silver, 0.4 oz. to the ton. This sample consists of quartz with about 15 per cent. pyrrhotite. A 4-inch sample from a point 30 feet easterly along the vein, and consisting of about equal parts of quartz and arsenopyrite, assayed: Gold, 0.24 oz. to the ton; silver, 0.2 oz. to the ton. A third sample over a width of 1 foot from a point 50 feet farther along the vein, where it consisted of quartz with a little arsenopyrite and galena, assayed: Gold, 0.24 oz. to the ton; silver, 4 oz. to the ton; lead, 4 per cent.

A tunnel was driven to the vein in 1926 when the property was optioned to D. W. Davis. It is approximately 75 feet below the outcrop, and although a vein was struck at 125 feet from the portal, it was entirely barren and the tunnel was continued another 50 feet on the chance that the real vein might be farther in the hill. It is said that a small vein, similar to the surface section of the main vein, was cut at the portal of the tunnel, but it was covered up at the time of the examination.

Mayou. This group, owned by William Treston and partner, of Terrace, is situated on the north side of the Little Beaver river, about 8 or 9 miles west of Kitsumgallum lake. A trail has been blazed from the *Martin* showings to the *Mayou*, but it is very indistinct in places and should not be followed without a guide.

A series of small lenticular veins outcrop along the bluffs, which are just to the west of the narrow saddle between the Beaver and Little Beaver rivers. The veins strike north-west (mag.) and dip north-east at 30°. Some of the veins are nearly barren quartz up to 3 feet wide; others contain a small amount of galena, but in none of them does the vein-filling continue for any distance, although the fracture-zone may be a couple of hundred feet long. A 10-inch sample from one of the veins, showing a very small amount of galena, assayed: Gold, 0.12 oz. to the ton; silver, 8.8 oz. to the ton.

A second group of veins outcrop on the south shoulder of the smooth slope immediately beyond the bluffs just mentioned. One vein up to 3 feet wide has been traced by a series of open-cuts for a distance of about 200 feet. It consists of quartz with a little galena. A 22-inch

sample from the principal cut assayed: Gold, 0.04 oz. to the ton; silver, 6.5 oz. to the ton. A picked sample showing an appreciable amount of galena assayed: Gold, 0.20 oz. to the ton; silver, 4.5 oz. to the ton; lead, 12.5 per cent. About 50 feet below this vein is a parallel vein showing 4 inches of galena and 5 inches of quartz. It may be traced for about 50 feet, and it is said that numerous other showings may be found farther west along the ridge.

Although none of the showings examined appears to have commercial possibilities, the surrounding country is well worth prospecting, particularly farther west nearer the main Coast Range batholith.

Black Bear. This group, consisting of the *Black Bear* and *Cub* claims, is situated on Maroon mountain, about 4½ miles due east from the head of Kitsumgallum lake. The trail to this property and others on Maroon mountain leaves the Kitsumgallum Lake trail just behind Olander's ranch, about a mile from the head of the lake. The trail is in good condition, although steep in places. Most of the work which has been done on the property within the last few years has been done by Chiro Mining Company, Hopper-Davis Syndicate, and D.W. Mines, Limited, but the property is now owned by the original locator, Mat Allard, of Terrace. A map showing the location of the property is to be found in the Annual Report for 1925.

The workings consist of three tunnels, two shallow shafts, and numerous open-cuts, which trace the vein for several hundred feet along the surface. Two of the tunnels are crosscuts, driven to the vein from points just above the camp. Immediately above the upper crosscut and on the south side of a small aplite dyke the vein is a good 3 feet wide and is well mineralized with pyrite, sphalerite, galena, and some chalcopyrite. A sample taken from the north face of the working, about 15 feet below this outcrop, assayed: Gold, 1.26 oz. to the ton; silver, 3.5 oz. to the ton; lead, 6 per cent.; zinc, 4 per cent. North of the dyke the vein is of similar character, but no more than 1 foot wide, and apparently maintains this width for a couple of hundred feet north to a shallow shaft filled with water. For the next few hundred feet north to a tunnel on the vein the width varies from a mere stringer to 3 or 4 feet of quartz. Parts of it are well leached and evidently contained an appreciable amount of sulphides. The tunnel at the end of this section of the vein has been driven from the side of a small gulch and follows a vein, from 1 to 4 inches wide, for about 25 feet. North of the gulch and west of the strike of the vein are small trenches exposing about a foot of vein-matter at one or two points. Although the vein cannot be seen at most points along these cuts, the vein is apparently well mineralized, for piles of iron oxide and leached vein material may be seen at several places.

The third tunnel is a 143-foot crosscut driven to the vein from a point just back of the camp. From this tunnel drifts have been driven north and south for distances of about 40 and 25 feet respectively. The width of the vein in the face of the north drift is 14 inches and in the face of the south drift 4 inches. At intervening points it varies from a stringer to a maximum of 18 inches. A sample from the face of the north drift assayed: Gold, 0.80 oz. to the ton; silver, 1.2 oz. to the ton; lead, 0.4 per cent.; zinc, 50 per cent.

If anything more is to be done on the property, it would be advisable to clean out and sample the open-cuts and to continue the drift from the lower level to the south side of the aplite dyke, where the best width and values were found on the surface. The vein is in fairly flat-lying argillites and strikes N. 20° E. (mag.), dipping 60° to 65° to the west.

Hawk. This mineral claim, owned by William Treston and partners, of Terrace, adjoins the *Black Bear* group on the west. A quartz vein containing very little sulphide is exposed along the bare ridge for approximately 100 feet. It follows very closely the contact between an aplite dyke and argillite. Nothing of commercial importance is indicated in the section of the vein exposed, but owing to proximity to the *Black Bear* showings it would be advisable to search for the southerly continuation of that vein.

Hall Fraction. This is a fractional claim between the *Hawk* to the north and the *Black Wolf* group to the south, owned by Hall & Nash, of Terrace. The claim is supposed to contain the continuation of the *Black Bear* vein, but I doubt very much if this is the case. Just near the top of a bare ridge of conglomerate is a 2- to 3-foot barren quartz vein exposed for a distance of about 20 feet. The conglomerate northerly along the strike of the vein is oxidized a bit, suggesting that the vein may continue a little distance in this direction, but there is no indication of it continuing farther south.

South of this exposure, along the bluffs behind the *Black Wolf* camp, is a narrow flat vein in argillites, consisting of quartz with a small amount of pyrite. Good gold values are said to have been obtained along the surface, but the vein is so small and flat that it could not be worked profitably unless the values were exceptionally good.

Black Wolf Mining Co.

This company was organized in the State of Washington in 1923 with a capitalization of $100,000, divided into 100,000 shares of the par value of $1 each. The company has acquired the *Black Wolf* group of five claims—*Black Wolf Nos. 1* to *5*—situated on Maroon mountain at an elevation of from 4,500 to 5,500 feet above sea-level and about 4½ miles due east of the head of Kitsumgallum lake. The property is on the main Maroon Mountain trail, which leaves Kitsumgallum Lake trail about a mile from the head of the lake.

Late in 1928 a shipment of 25 tons of ore was taken from a tunnel which had been driven along a vein outcropping in conglomerate near the top of a series of bluffs south-east of the camp-site. This ore was taken from a narrow vein similar in character to the *Black Bear* vein and which was thought by the owners to be a continuation of that vein. After having examined the surface showings this summer it became evident that the two veins are not the same. The *Black Wolf* tunnel was driven on a steep section of a vein which is otherwise fairly flat. This steep section is very local and it is also wider and more heavily mineralized than the other sections. Owing to these conditions it is doubtful if the vein is commercial. Another wider vein outcropping along a small creek crossing the trail between *Black Bear* and *Black Wolf* camps should be investigated by the owners.

Marmot.

This group of two claims—*Marmot* and *Sunlight*—owned by A. Egan and partners, of Rosswood, is situated at about 3,900 feet elevation on the south side of Goat mountain, on the opposite side of Hall creek from the *Black Bear* group. It is reached by a trail up Hall creek or by a branch trail from Douglas creek.

The principal workings are on a bedded vein in argillites immediately east of a deep gulch cutting into Goat mountain. The vein strikes N. 74° E. (mag.) and dips north into the hill at 35° to 40°. It varies in width from 1 inch to 12 feet and consists of quartz with small amounts of galena, sphalerite, pyrite, and chalcopyrite. A tunnel has been driven easterly along the vein from the gulch, where the vein has pinched down to a clay-seam. The first 40 feet of the tunnel is along the strike of the vein and the remaining 60 feet was driven in a N. 08° E. direction, in an attempt to pick up the hanging-wall. So far, however, there seems to be no definite hanging-wall, for the wall-rock contains a number of barren quartz-streaks to the face of the tunnel. Nothing but barren quartz has been found underground, but it is probable that better material would have been found if the tunnel had been continued on its original course a short distance farther, for the vein contains sulphides in the vicinity of a shallow shaft a little farther along the vein.

West from the tunnel, across the gulch, and in the same horizon as the main vein, is a narrow vein, undoubtedly the continuation of the main vein. On the hillside west of the next gulch a vein up to 3 feet wide outcrops at intervals for a few hundred feet. Nothing has been done on this vein.

One of the owners obtained fair values in gold from some slightly oxidized material on the shoulder of Goat mountain. I took two samples in the same locality, one from a large slightly sheared granodiorite dyke and one from the adjoining argillites. The first contained neither silver nor gold and the second contained a trace of gold and 0.2 oz. of silver to the ton.

Hunter.

This group is situated about 17 miles north of the head of Kitsumgallum lake and about half a mile east of Cedar river. The first half of the route to the property is over a wagon-road which runs from Rosswood, at the head of the lake, to Cedar River crossing, and the last half is over a trail which swings north from the road about half a mile south of the crossing. Horses can be taken over the trail, but it has not been graded. The cabin and showings are at an elevation of 1,400 feet, or a little less than 1,000 feet above Kitsumgallum lake. The group consists of seven claims—*Blue Grouse, Creek, Hunter, Hunter No. 2, Hemlock, Aurora*, and *Bear Hill*—and it is owned by Oscar Olander, A. Egan, and the Broden Bros., of Rosswood.

The principal showing is on the south side of Egan creek, directly across the creek from the cabin, where the vein outcrops more or less continuously for a distance of about 300 feet along the bank of the creek. As a matter of fact, part of it is in the creek, and all the hanging-wall,

and some of the vein has been worn away by the creek, making it difficult to determine the actual width of the vein. It seems not to exceed 5 feet, although quartz stringers penetrate the foot-wall sandstone for several feet from the main vein. The vein strikes N. 80° W. (mag.), dips north under the creek at about 40°, and is composed of quartz and calcite, cementing fragments of sandstone. It is mineralized with small amounts of galena, chalcopyrite, and sphalerite. A vertical shaft has been sunk about 24 feet in the foot-wall of the vein, near the east end. It was full of water and could not be examined.

A 2-foot sample taken from a cut just west of the shaft, and in one of the most heavily mineralized sections of the vein, assayed: Gold, trace; silver, 2.2 oz. to the ton; copper, 0.5 per cent.; lead, 1 per cent.; zinc, 0.5 per cent. Judging from the appearance of the dumps, material of this same general tenor extends for 50 or 60 feet east.

At some distance east of the main vein, open-cuts have been made in other veins, but at no point is there more than a very small amount of sulphide.

Scenic and Log Cabin.

These two groups of claims cover the divide between Maroon creek, flowing west into Kitsumgallum lake, and Fiddler creek, flowing east into the Skeena river near Dorreen. The present route to the properties is from Terrace to Kitsumgallum lake by road, then along the Kitsumgallum Lake trail to Maroon creek, and up Maroon creek about 10 miles to a small cabin on the *Log Cabin* group. If the property were developed seriously, a trail, but little longer than the Maroon Creek trail, could be built up Fiddler creek from the Canadian National Railway. The present trail from the end of the road to Maroon creek is in good condition, but before horses could be taken over the Maroon Creek trail proper some grading would have to be done at points along the first 8 or 9 miles, and the last mile or so, from the valley-floor to the showings, would need to be reconstructed. The claims are owned by J. Garland, of Terrace.

A short distance east of the cabin, and at approximately the same elevation—4,000 feet—are a few cuts in silicified material, and also an 80-foot tunnel driven through fine-grained and highly silicified rocks and fresher-appearing grey porphyries. The fine siliceous material is regarded as the ledge. It contains one strong lens of pyrite and numerous small veinlets carrying pyrite, iron carbonate, and an occasional grain of chalcopyrite or sphalerite. A sample from the siliceous material on the dump assayed: Gold, trace; silver, 0.6 oz. to the ton. Straight up the hill from the tunnel, at about 4,300 feet elevation, are two more open-cuts. The lower one is really a pit in greenstone mineralized with small amounts of chalcopyrite, while the upper is an open-cut, 40 or 50 feet long, in a silicified rock containing small amounts of pyrite. Other cuts have been made from here on up to the divide, but they contain nothing more important than these already described.

The rocks from the divide down to Maroon creek are a series of greenstones, presumably volcanic, and from the divide over into the Fiddler Creek slope they are chiefly argillites, overlying the greenstones. Occasional bands of greenstones are found in the sediments, either as dykes or sills or possibly as interbedded volcanics.

A number of cuts and workings are found in various mineralized zones on the *Scenic* group, which occupies the Fiddler Creek side of the divide. One of the first workings reached from the divide is a 25-foot tunnel under iron-stained sediments. The face of the tunnel is a strong wall or slip, below which the slates are fractured and mineralized with a little pyrite and an occasional speck of galena. A sample along the west wall, from 0 to 6 feet from the face, contained no values in gold, silver, or lead.

A little farther along the hill is another short tunnel and open-cut in a fairly flat-lying 8-foot band of greenstones within the argillites. The greenstone is seamed with quartz and iron-carbonate stringers and contains small amounts of pyrite, chalcopyrite, sphalerite, and galena. A chip sample from the zone assayed only 1 oz. of silver to the ton and traces of gold and copper. Other cuts are found farther along at about the same elevation.

The most important showing on the whole property is a mineralized and silicified zone in argillites at about 4,700 or 4,800 feet elevation. This is on the same hillside as the other showings of the *Scenic* group, but a few hundred feet above them and a little farther down Fiddler creek. It has been prospected by an open-cut and a short crosscut tunnel. Both of these are on the north edge of a big snowslide, and the tunnel was still covered by the snow at the time of examination, July 31st. The mineralized zone at the cut is 8 to 10 feet wide and consists of a silicified zone containing stringers of pyrite and small amounts of chalcopyrite. A 5-foot sample

from the centre of the vein, including a few inches of heavy sulphide, assayed: Gold, 0.54 oz. to the ton; silver, 4 oz. to the ton; copper, 0.5 per cent. These values are decidedly encouraging and warrant further prospecting of this zone.

Lakelse Section.

A and B. This group of two claims—*A* and *B*—is a relocation of the best showings on the old *Beaver* group, originally known as the *Lucky Seven* group. It is owned by Verner Roy, of Terrace. The trail leaves the Lakelse wagon-road a little beyond the 7-Mile post and leads to a small cabin at about 3,550 feet elevation, or about 2,600 feet above the road. A branch trail to a lower group of showings takes off from the main trail to the right at about 2,750 feet elevation.

For convenience in description, the showings and workings may be divided into two groups—an upper group, or the old *Beaver* showings, and a lower group. The upper showings consist of a flat quartz vein in diorite, about 150 feet above the cabin, and a second narrow vein which outcrops in the bed of the small creek which flows by the cabin. The first of these is said to have produced $3,900 and $700 in gold from two small pockets which had been uncovered in a big open-cut. Nothing can be seen in the cut now, as many tons of material have carried into it from the hanging-wall. A tunnel below the cut is also caved, but a more recent tunnel driven from the creek-bed is open and may be examined. It is about 15 feet long and exposes about 1 foot of quartz in the face. The vein is quite flat in the tunnel, but dips at a small angle on the surface. A sample from the face of the tunnel assayed traces in gold and silver.

The vein outcropping in the creek flowing by the cabin has been prospected by tunnels at 3,250 and 3,150 feet elevation and may be followed for some little distance above and below the tunnels. This vein, or rather series of lenses, consists of quartz, galena, and grey copper in a north-easterly-striking shear-zone, but the lenses are narrow and the sulphide content low. Silver values are said to be quite good in places.

The lower group of showings are in the next creek-bed south, between 2,750 and 2,900 feet elevation. They are found most easily by following the branch trail referred to in the first paragraph. On the surface at the end of the trail are a number of old surface cuts, now filled in, and two tunnels. The upper and older tunnel is about 70 feet long and crosses the shear-zone a short distance from the portal. About 25 feet lower is a second tunnel, about 45 feet long, driven about two years ago, when the property was under option to O. P. Brown. A drift from the face of the tunnel follows a very narrow vein for a short distance. Open-cuts along the strike of the vein farther up the creek to an elevation of 2,900 feet expose a quartz vein from 3 to 6 feet wide, sparsely mineralized with pyrite and containing an occasional bunch of galena. Above 2,900 feet elevation the overburden is too thick to permit surface-trenching. A sample over 38 inches at 2,850 feet elevation assayed: Gold, $4.40 to the ton; silver, 2 oz. to the ton. The vein is in quartz diorite and strikes N. 30° E. (mag.), dipping at a moderate angle to the south-east.

The values obtained from the sample would warrant further work being done on this vein, as the sample was from an average section of the vein and gave values of about $5.50 in gold and silver.

Star. This mineral claim is owned by Verner Roy, of Terrace, and was formerly known as the *Golden Nib* claim. It is situated on the lower slopes of Thornhill mountain, about 7 miles from Terrace. The lower terminal of a short "jig-back" tram is a few hundred feet north of the Terrace–Lakelse road and the upper terminal is at the showings, about 350 feet above the road. This was put up two years ago when the property was being worked under bond by O. P. Brown. In 1926 30 tons of ore was shipped to the smelter as from the *Golden Nib* and since then the property has been idle.

The showing consists of a short lens of gold ore in what appears to be a greenstone inclusion within a diorite phase of the Coast Range batholith. A lower tunnel, about 100 feet long, picked up stringers of quartz within about 20 feet from the portal. These widened and were joined by other stringers, until at the face there is about 12 feet of quartz. A 25-foot crosscut driven to the left at 5 feet from the face is in quartz and diorite for the first 5 feet and in barren diorite for the remaining distance. A 5-foot sample from the face of the drift assayed but a trace in gold and silver.

About 25 feet vertically and 100 feet horizontally above this tunnel is another tunnel with a small open stope above it. It would seem that the vein consisted of a number of quartz and sul-

phide lenses in a sheared greenstone. Pyrite seems to have been the principal sulphide, although chalcopyrite is conspicuous in some lenses. Thirty tons of ore shipped from this working in 1926 gave net returns of: Gold, 1.6 oz. to the ton; silver, 1.4 oz. to the ton; copper, 1.1 per cent.

Quartz can be found in the creek for 75 to 100 feet beyond the end of the upper tunnel. The lower tunnel was not driven far enough to reach the ore-shoot.

NASS RIVER MINING DIVISION.

The Nass River Mining Division though relatively small is an important Division, embracing all of Portland inlet, with its various arms, and the lower part of the Nass River valley. The upper part of the Nass River valley is more accessible from the head of Portland canal than from any other point on the Coast and is therefore included in the Portland Canal Division. Recognized mining sections in the Nass River Division are five in number—the Observatory Inlet, Hastings Arm, Alice Arm (Proper), Kitsault River, and Illiance River sections.

The Observatory Inlet section is really the most important in the entire North-western Mineral Survey District from the standpoint of the present mineral production, for within its boundaries is situated the *Hidden Creek* mine of the Granby Consolidated Mining, Smelting, and Power Company, Limited, one of the largest copper-mines of the Province.

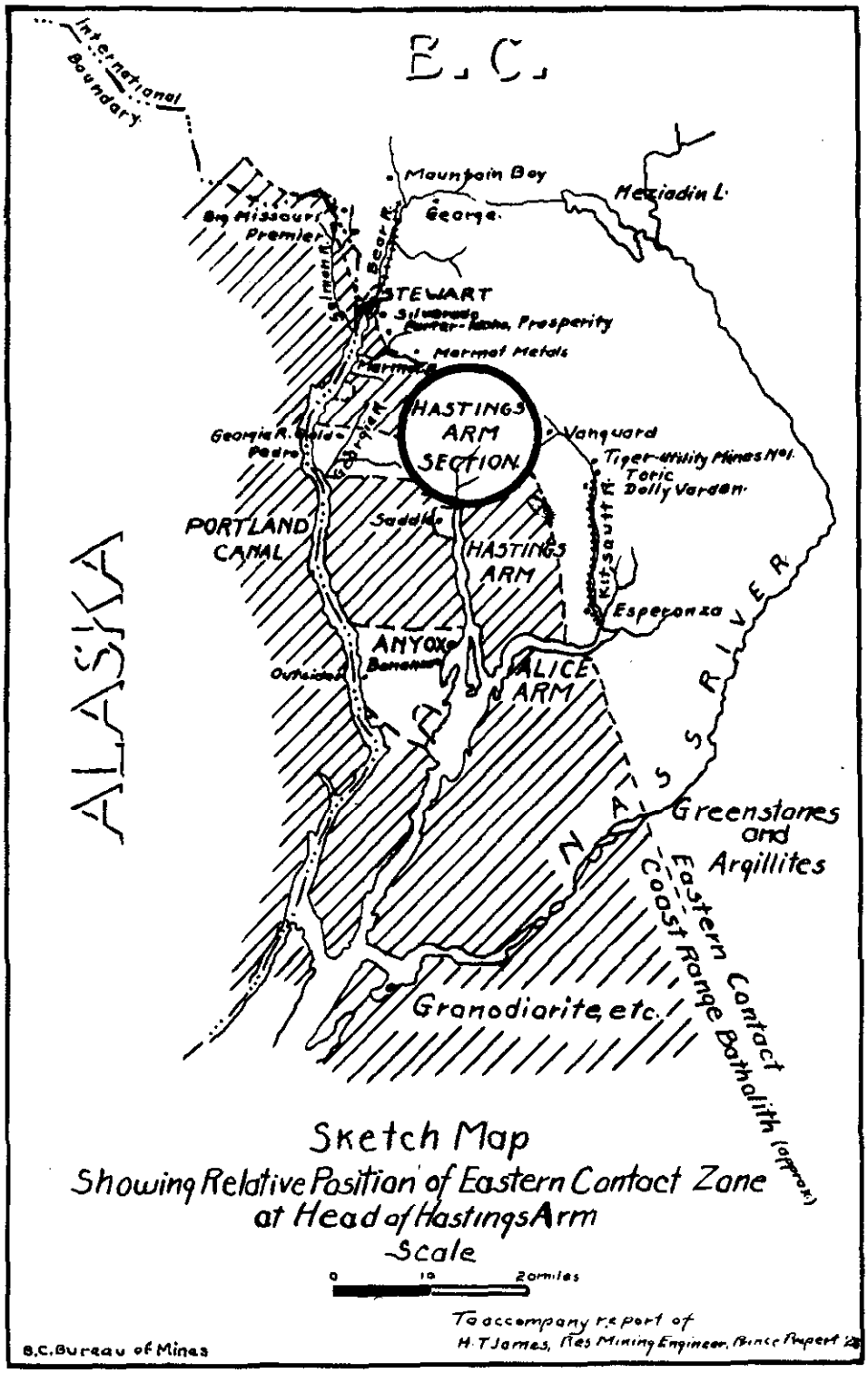
Besides treating its own ore at the Anyox smelter, the company takes a certain amount of custom ore, and in this way is a distinct asset to the small producers in the northern sections of the Coast, particularly to those who have copper or gold ores to ship.

The Hastings Arm section is that part of the Division which is tributary to Hastings arm, a long narrow arm of Portland inlet, which parallels Portland canal and penetrates the Coast range to within about 5 miles of the eastern contact of the Coast Range batholith. After this eastern-contact area has been made more accessible by better trunk trails it may become an important mining section. As it now stands it is a very attractive section for prospecting, for it lies between the Portland Canal and Alice Arm sections, both of which are known to contain important mineral-deposits. It is only about 15 miles in a direct line from the head of the Marmot river, flowing into Portland canal, to the head of the Kitsault, flowing into Alice arm. On the Marmot are situated such properties as the *Porter-Idaho* and *Prosperity*, two very promising prospects, and in the upper part of the Kitsault River section are a number of prospects with very good showings, such as the *Dolly Varden*, *Toric*, *Tiger*, *Wolf*, *Vanguard*, *Lucky Strike*, and others. With good showings at both ends of a 15-mile strip of the eastern contact of the Coast Range batholith, the middle section should be a favourable one for prospecting. It is a section which should receive the attention of those interested in the development of the mining industry of the Province.

The accompanying sketch-map shows clearly the positions of the eastern contact-zone at the head of Hastings arm relative to the Portland Canal and Alice Arm mineral districts, and should emphasize the importance of developing this section.

The only property being explored in this section at the present time is the *Saddle* at the head of Hastings arm. This property is situated, however, in a small inclusion and not in the eastern contact mineral-zone.

The Kitsault River section of the Alice Arm district is developing very slowly, but there is reason to believe that it eventually will be an important silver-producing district. Hopes are pinned on the *Toric*, for if it should develop into a producer of importance much work will undoubtedly be done on other silver properties in the same section. Although the *Toric* has been milling a small amount of ore, the property is not yet ready for real production, as the vein has been developed for only 300 feet along the strike. This gives a fairly good indicated tonnage, as the vein is wide, but the values are low grade, necessitating a moderately large scale of production for profitable operation. The present 50-ton mill can be regarded as a pilot mill only. The Utility Mines (Number One), Limited, is developing the *Tiger* group, adjoining the *Toric*, and considerable work has been done on the *North Star*, *Last Chance*, *Vanguard*, and *Homeguard*. The last-named property is being developed by the Dalhousie Mining Company. Esperanza Mines, Limited, has been finding some silver ore similar to the material that has kept the *Esperanza* on the shipping-list for years. The only important work being done in the Alice Arm district, other than in the Kitsault valley, is on the *Sunrise* group, McGrath mountain, where the Kitsault-Eagle Silver Mines, Limited, is driving a 1,000-foot tunnel to the *Sunrise* vein.


B. C.
International Boundary
Mountain Boy
George
Meziadin L.
Big Missouri Premier
Bear R.
STEWART
Silbonite
Porter-Idaho
Prosperity
Marmot Metals
Marmot
HASTINGS ARM SECTION
Vanguard
Tiger-Utility Mines No1
Toric
Dolly Varden
Georgia R. Gold Pedro
Salmon R.
Saddle
PORTLAND CANAL
HASTINGS ARM
Kitsault R.
Esperanza
ANYOX
Bonanza
Outpost
ALICE ARM
ALASKA
NASS RIVER
Greenstones and Argillites
Eastern Contact
Coast Range Batholith (approx)
Granodiorite, etc.
Sketch Map
Showing Relative Position of Eastern Contact Zone at Head of Hastings Arm
Scale
0 10 20 miles
To accompany report of
H. T. James, Res Mining Engineer, Prince Rupert
B.C. Bureau of Mines

OBSERVATORY INLET SECTION.

Granby C.M.S. & P. Co., Ltd.

The 1928 production from the company's *Hidden Creek* mine was 1,411,150 tons, or about 40,000 tons more than last year's production. The mill treated 1,219,700 tons of this ore, producing 88,150 tons of concentrates, of which 82,190 tons were smelted at Anyox and the remainder at Tacoma. The Granby mill has been "stepped up" again. Originally built to handle 1,000 tons a day, additional machinery has been added from time to time, until 3,800 tons could be treated in one day, and in a very short time the 4,000-ton mark will be reached. A "scavenging plant" recently added to the mill brings the recovery up to 92 per cent.

The 1928 metal production amounted to 4,075 oz. of gold, 246,930 oz. of silver, and 34,605,833 lb. of copper.

The *Outsider* mine produced only 2,564 tons of ore, for the mine was closed down and the option relinquished early in the year.

The *Golskeish* mine produced 13,111 tons of silica, containing over 1,000 oz. of gold and 6,000 oz. of silver. This property has also been closed down, and its place as a producer of silica will be taken by the *Quartz Point* mine.

It is expected that the *Bonanza* property, about 3 miles from Anyox and owned by the Granby Company, will be shipping between 200 and 250 tons of copper ore a day by early spring. During the past year camps, power plant, crushers, and tram-line have been built or installed and the mine itself is being opened up rapidly.

The 1928 output from the coke plant is as follows:—

Coke (tons)	28,680
Gas (thousands of cubic feet)	230,107
Tar (imperial gallons)	246,579
Ammonia (pounds)	200,555
Solvent naphtha (imperial gallons)	659
Naphthaline (pounds)	58,253

Hanna.

This property consists of fourteen claims adjoining the Granby Company's *Hidden Creek* mine at Anyox. (*See* 1927 Annual Report.) The Granby Company has taken an option on the property and has had certain parts of it tested by the Radiore Electrical Prospecting Company. It is understood that some drilling is to be done on the ground next year.

HASTINGS ARM SECTION.

Silver Crest Mines, Ltd. (Saddle).

The *Saddle* group, situated at the head of Hastings arm, on the west side, is being developed by the Silver Crest Mines, Limited, a company which was organized in 1919 with a capitalization of $500,000, divided into 2,000,000 shares. The company also owns a group of claims in the Salmon River section, north of the *Big Missouri* and adjoining the property of the Silver Tip Mining and Development Company, but nothing was done on the Salmon River property during 1928.

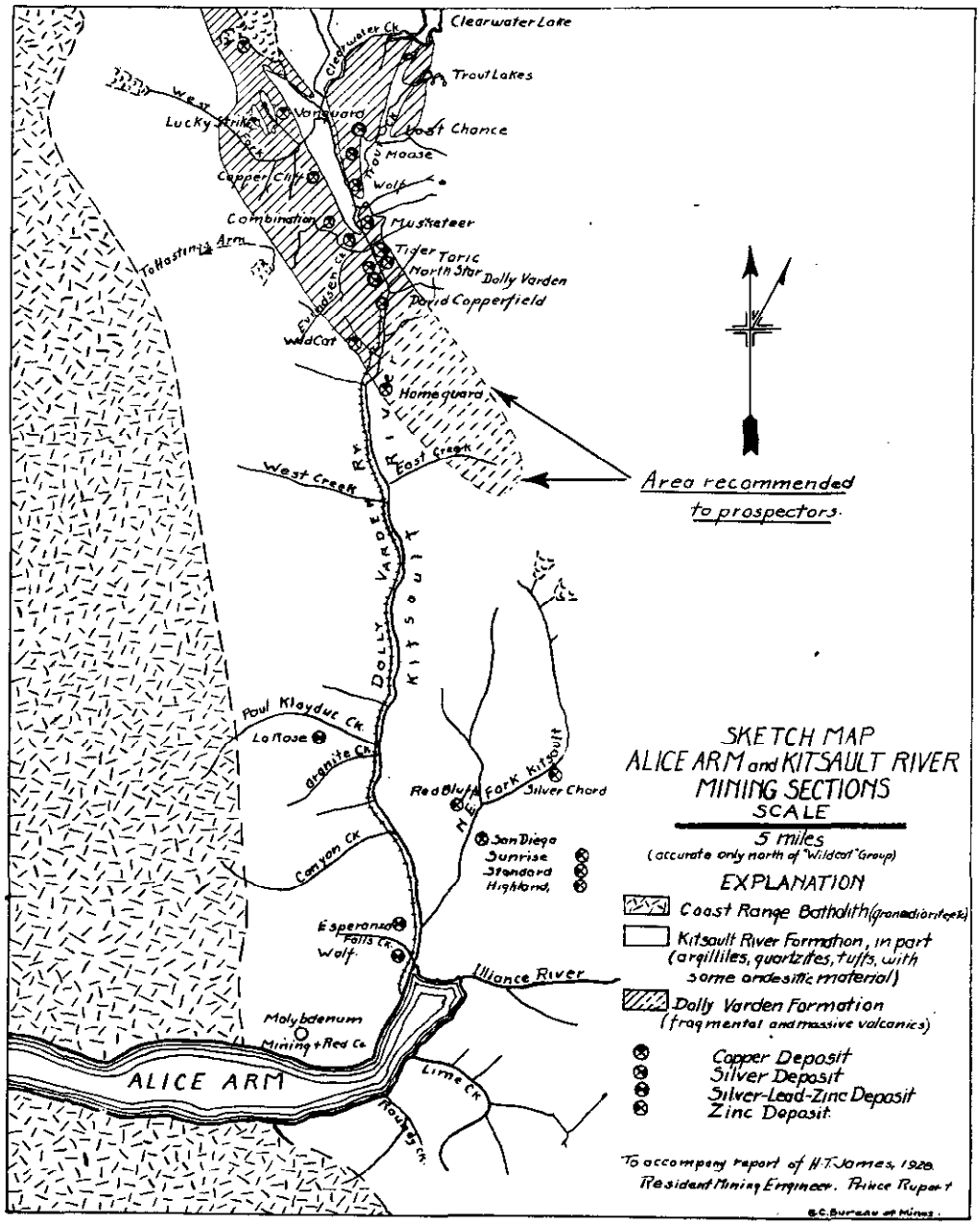
The showings of the *Saddle* group are situated at an elevation of 4,000 feet on the bald shoulder of a mountain overlooking Hastings arm and the valley of the Sutton river. They consist of a main vein and several branch veins, which had been prospected by open-cuts and three shafts to a maximum depth of 46 feet. These workings, described in more detail in 1927 Annual Report, have proved the existence of lenses of silver-lead-zinc ore up to 18 inches wide. In 1928 a drift has been started on a parallel vein which outcrops several hundred feet south of the original showings. Up to the time of examination, near the end of September, the drift had been driven about 90 feet, exposing, for the first 35 feet, about a foot of well-mineralized material along the foot-wall of the vein. On the surface, a short distance beyond the face of the tunnel, is a showing of ore, judging from the appearance of the dump. The cut itself was filled with snow. The course of the vein from here north for a considerable distance is marked by a snow-filled draw.

An aerial tram is being built from the portal of the tunnel to the beach, where a wharf and terminal bunkers have been constructed. Early snowfalls prevented the completion of the tram in 1928. It is to be a two-section "jig-back" tram, with intermediate bunkers at 2,700

feet elevation. The slope from the intermediate point to the beach is 45°. When the tram is completed a more rapid development of the property is to be expected.

ALICE ARM (PROPER) SECTION.

Nothing of importance has been done in this section this year. It is understood that the Keystone Mining Company has been keeping up its payments on the *Sunset* group on Roundy



creek, but no work was done on the property. I have been informed that a company is being incorporated to develop a group of claims on the north side of Alice arm near the property of the Molybdenum Mining Company, but the showings were not examined and no further information has been obtained.

Kitsault River Section.

The rectangular strip of country, some 25 miles long and 10 miles wide, through which the Kitsault river flows is one of the most interesting in the district and is one which has a possibility of becoming one of the most important. On the western side of the area, as shown in the accompanying sketch-map, is the Coast Range batholith. The remainder of the area, with the exception of a small irregular zone crossing the upper part of the Kitsault river in a north-westerly direction, is underlain by the Kitsault River formation, consisting of argillites, sandstones, quartzites, and other bedded rocks. The small irregular zone referred to is underlain by fragmental and massive volcanic rocks of the Dolly Varden formation, outcropping along the crest of an anticlinal structure.

In the south part of the Kitsault valley, between the granitic rocks and the river, are a series of small high-grade silver-lead-zinc properties, best represented by the *Wolf*, *Esperanza*, and the *La Rose*. On each of these properties are lenses of high-grade silver ore, consisting of quartz with galena, sphalerite, pyrite, tetrahedrite, and some arsenopyrite, together with ruby and native silver. Across the valley, between the Illiance river and the North-east fork of the Kitsault, are a number of zinc properties, such as the *Sunrise*, *Standard*, *Highland*, and others. It is characteristic of these showings that sphalerite is the only sulphide present in any appreciable amount and zinc the only valuable constituent. In places some galena is associated with the sphalerite, but more frequently it is absent and the precious-metal content is negligible. Between these two distinct zones are some low-grade copper-showings, represented by the *San Diego* and the *Red Bluff* groups.

At the upper end of the Kitsault valley, within the area of massive and fragmental volcanics of the Dolly Varden formation, are two more distinct mineral-zones. One of these is a copper-zone, extending from the *Vanguard* group at the north to the *Homeguard* group at the south, and paralleling it is a string of silver properties extending from the *Last Chance* to the *David Copperfield*, including such well-known properties as the *Dolly Varden*, *Toric*, and *Tiger*. Although it is extremely interesting to find two parallel mineral-zones, each characterized by its own peculiar type of deposit, it is not this fact that I wish to stress at the present time. It is sufficient to note that a number of good prospects have been located in the area of fragmental and massive volcanic rocks north of the point where these rocks are cut by the Kitsault river. It is to be noted particularly that the majority of the prospects have been found either in that section of the valley north of the canyon (at the *Toric*) where prospecting is relatively easy, or west of the river, on the same side as the railway and the old trails. Only a few prospects have been found in the extension of the volcanic rocks south-east of the river, although there is no reason to believe that this section of the volcanics should not contain as many prospects per unit area as the northerly section. A number of old-timers from the Alice Arm district have been questioned about this south-easterly extension of the volcanics, and each one has admitted that he either has neglected the area entirely or has given it very little attention. It is admitted at the same time that good float has been brough out of the section.

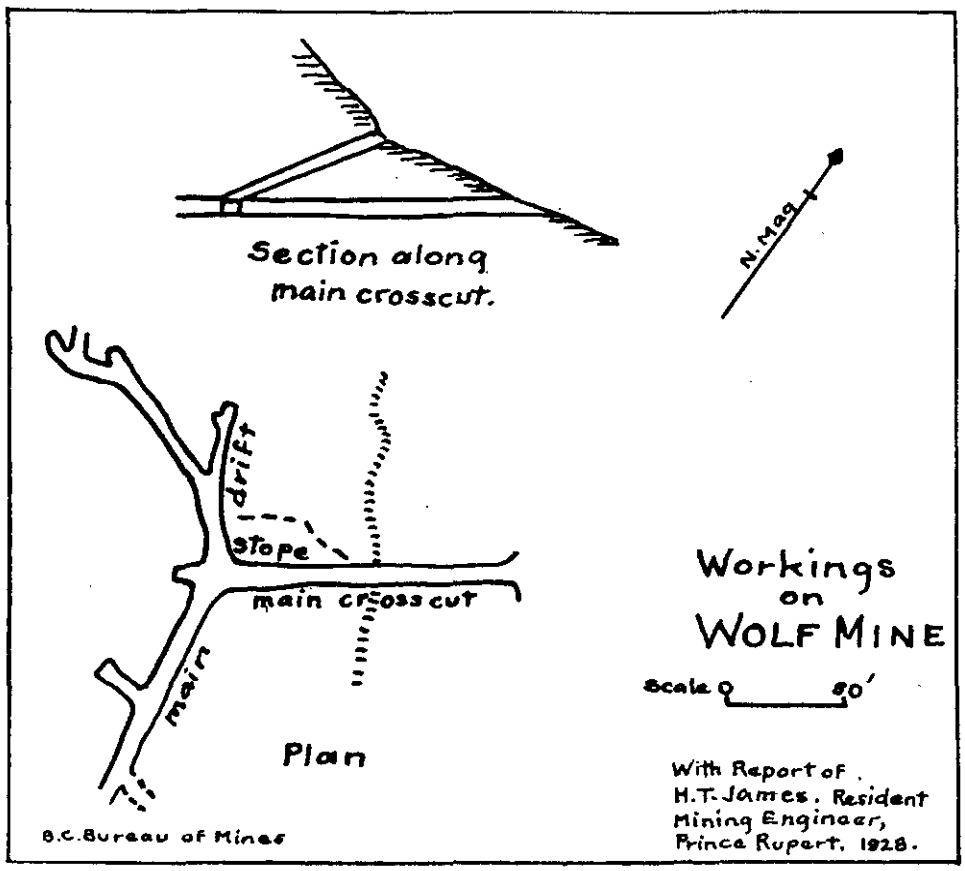
The reason that the area of volcanics east of the railway has not been prospected is that the other section is more accessible. It is also partly due to the fact that the Alice Arm camp in general ceased to be "popular" before the whole area had been investigated by the prospectors. Now that some properties in the upper Kitsault valley are being developed satisfactorily, the area of fragmental and massive volcanics south and east of the river should be prospected very thoroughly. The area is so small and well defined that mining companies could send their own parties into the area to advantage.

Wolf. This mineral claim is situated on the west side of the Dolly Varden Railway, within a few minutes' walk from the centre of Alice Arm village. It was staked years ago by John Stark, one of the old-timers of the district, and is being worked now by J. Fiva and associates, of Alice Arm, under lease and bond.

Two years ago the lessees sacked and shipped a small amount of high-grade silver ore from the outcrop of a small quartz vein outcropping in a series of sandy argillites about 300 or 400 feet west of the Dolly Varden Railway and a short distance south of Falls creek. The vein strikes from N. 10° W. to No. 48° W. (mag.) and dips westerly at a flat angle as indicated in the accompanying plan and section. It varies in width from about 2 to 15 inches and is mineralized with galena, sphalerite, pyrite, ruby and native silver. Some of the high-grade ore

occurs as narrow lenses of heavy sulphide, and at other points it consists of quartz with native silver plating the joint-cracks. Ruby silver is more plentiful where the vein has been broken by a slight movement parallel to the vein.

The extent of the underground work is shown in the plan and section of the *Wolf* workings. The work of 1928 consisted of driving the main drift south for some distance, with a short raise at the end of the working, and of driving the north-westerly workings from the north section of the main drift. In the extremity of this working is a second quartz vein, quite wide, but barren where cut by the tunnel. The main south drift encountered some very fine ore showing considerable native silver.

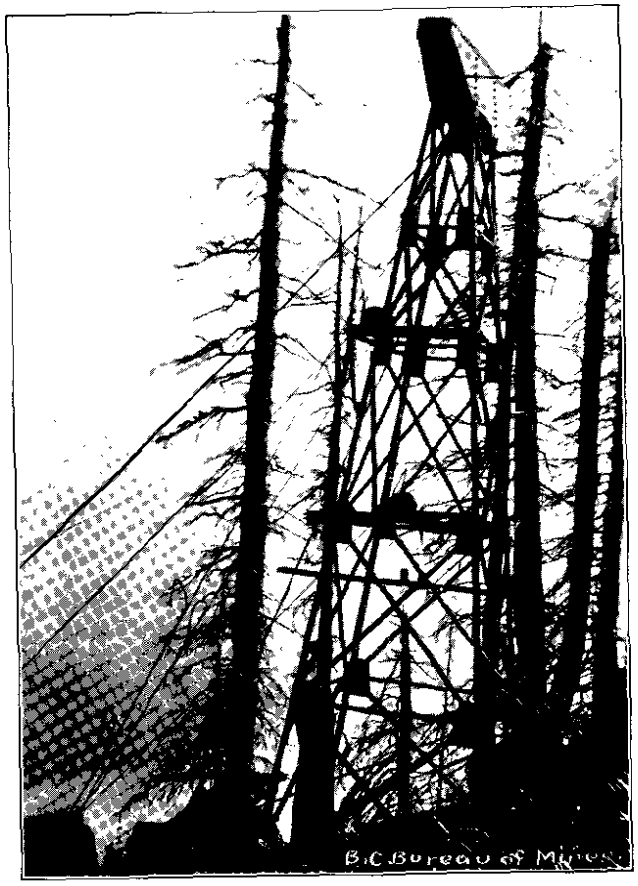


Esperanza Mines, Ltd. (N.P.L.).

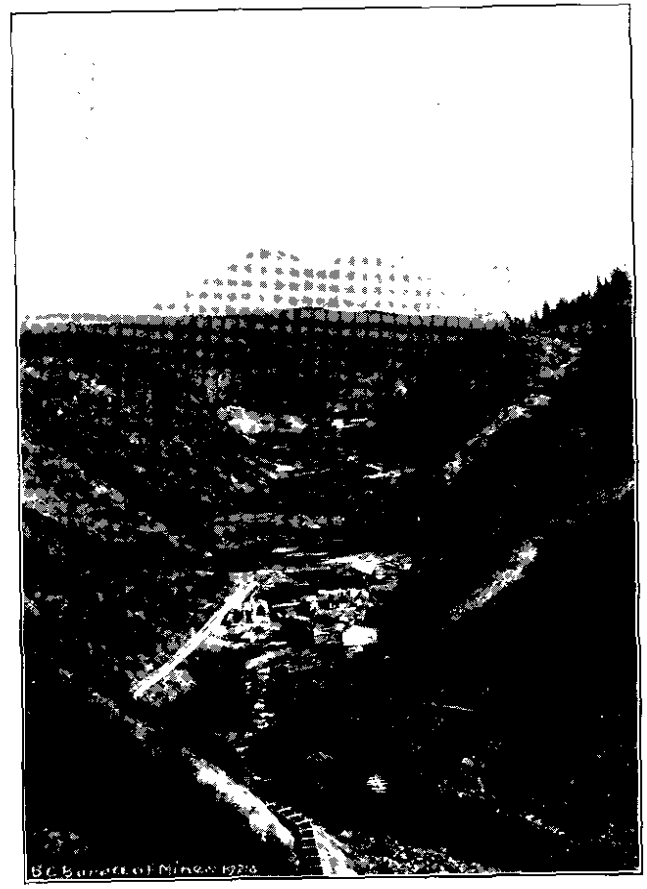
This is a specially limited company organized on November 19th, 1927, with a capitalization of $500,000, divided into 500,000 shares of the par value of $1 each. The company is purchasing the Esperanza group of three claims—*Aldebaran*, *Black Bear*, and *I'll Chance It*—situated on the north side of the Dolly Varden Railway, about a mile from the village of Alice Arm.

The Esperanza is a small high-grade silver property which has been worked intermittently for a number of years by locators, lessees, and small companies. Since 1916 the records show 950 tons of ore having been shipped from the property, giving a net recovery of 127 oz. of gold and about 82,000 oz. of silver. Some copper (as grey copper), lead, and zinc are also contained in the ore, but the base-metal content is not given in the smelter returns in all instances. This ore has been mined when found, with the result that the mine had no developed ore reserves, at least not of shipping grade, at the time of examination.

All the high-grade ore-shoots have been mined from the floors of the tunnels, as well as from the backs, and the stopes more or less filled with waste. The company is now endeavouring to block out shipping-ore by developing both the upper and lower sections of the main vein and by

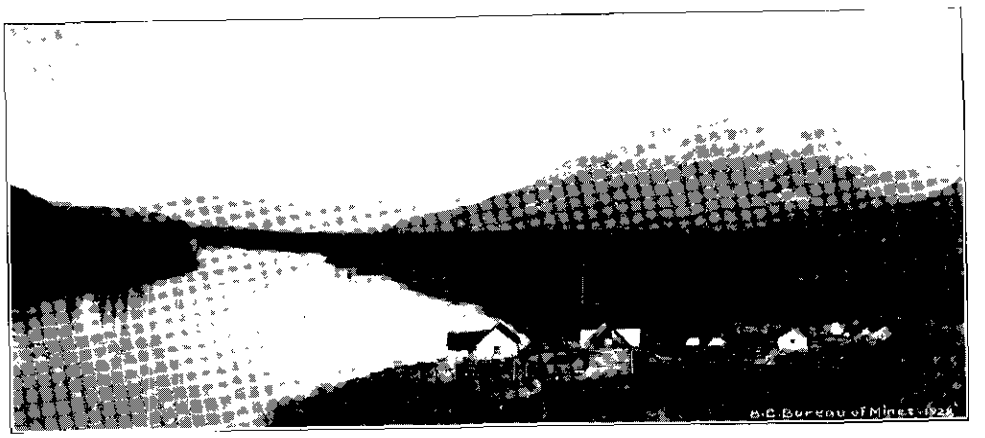


Saddle Mine Tram, Nass River M.D.

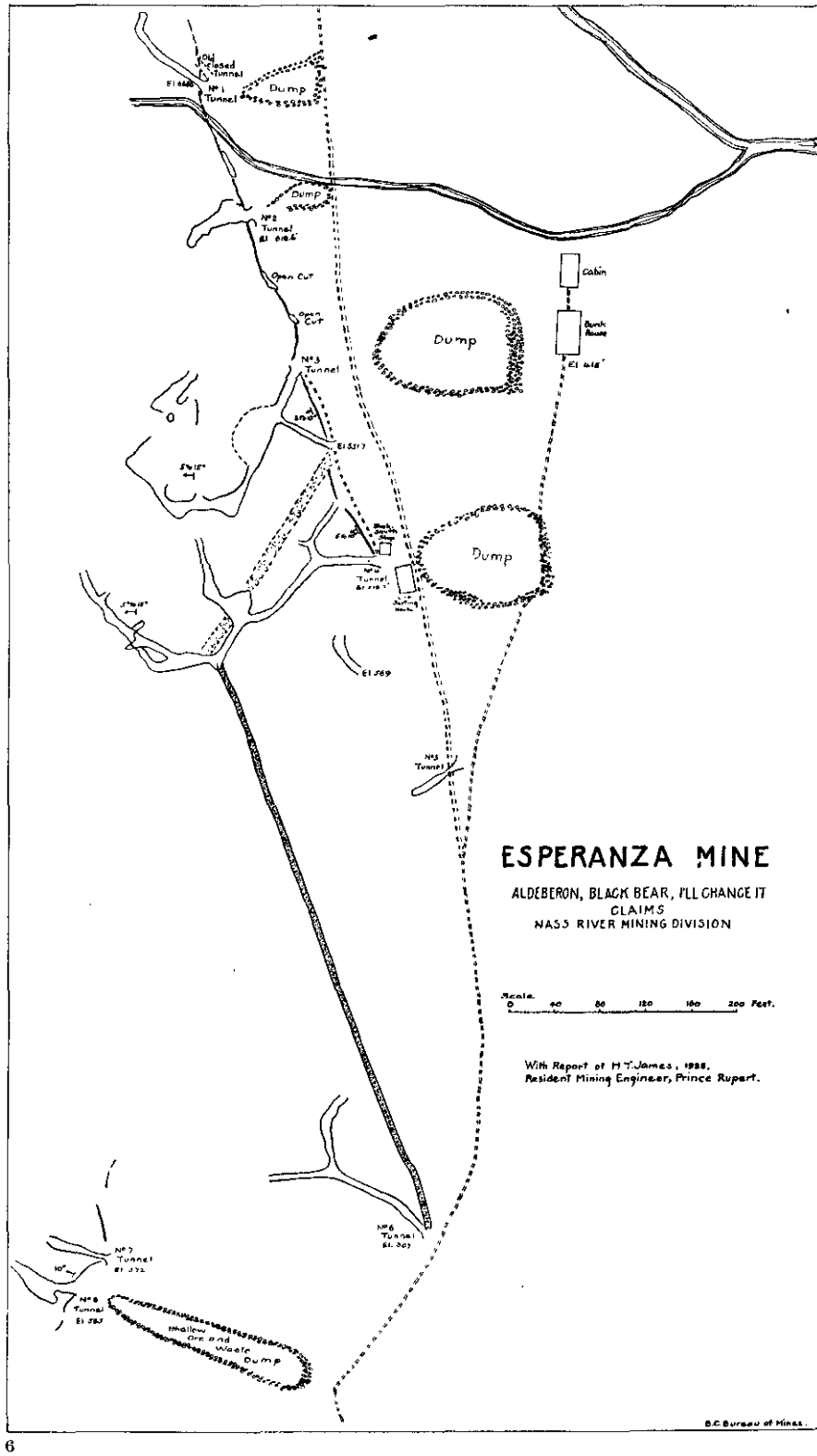


Mosquito Creek, Liard M.D.

Looking North from Mount Johnstone, Portland Canal M.D.



McDame Post, Hudson's Bay Co., Liard M.D.


Old Closed Tunnel
No 1 Tunnel
Dump
Dump
No 2 Tunnel
Open Cut
Open Cut
Cabin
Bunk House
El. 418'
Dump
No 3 Tunnel
El. 537'
Dump
No 4 Tunnel
El. 569
No 5 Tunnel
ESPERANZA MINE
ALDEBERON, BLACK BEAR, I'LL CHANGE IT CLAIMS
NASS RIVER MINING DIVISION
Scale.
0 40 80 120 160 200 Feet.
With Report of H. T. James, 1938.
Resident Mining Engineer, Prince Rupert.
No 7 Tunnel
El. 372
No 8 Tunnel
El. 383
shallow ore and waste Dump
No 6 Tunnel
El. 307
B.C. Bureau of Mines.

exploring a second vein from which high-grade ore has been mined. The result of the work has been distinctly encouraging.

The main vein is a flat quartz vein, from 1 inch to 3 or 4 feet in thickness, occurring in a series of argillites and sandstones. The general strike is north-easterly, but wide variations in both strike and dip are common. These variations make it difficult to follow the vein with underground workings, and the difficulty is further increased by the fact that the vein terminates abruptly at its west end and fails to outcrop below No. 3 tunnel. It is also paralleled and intersected by other veins, frequently barren, and by slips, and is cut by a series of nearly vertical dykes.

The best ore in the main vein occurs where the vein is crenulated into a series of "rolls" which plunge a little east of south at a flat angle. The "rolls" are developed where the vein is generally transverse to the bedding, but follows along the bedding-planes for a few feet before resuming its normal course. The ore consists of quartz, with ruby and native silver as the principal silver-bearing minerals. The common sulphides present are pyrite, arsenopyrite, galena, sphalerite, and grey copper. Samples of arsenopyrite found along the hanging-wall of a wide quartz vein in No. 7 tunnel assayed 12 oz. in gold to the ton. The amount of this material is apparently quite limited, for it occurs only as a narrow discontinuous streak, as far as can be told from present developments.

The upper part of the main vein is a bedded vein, from 1 inch to 3 feet thick, striking north-westerly and dipping south-westerly at 10° to 26°. It is being developed by No. 1 tunnel at an elevation of 667 feet. Within the first 35 feet of the tunnel the vein is 2 to 3 feet wide and consists of quartz with some scheelite. For the remaining distance to the face it is a narrow stringer of practically barren quartz, but just at the face ruby silver is beginning to make its appearance in the vein. This tunnel has since been continued some distance and the vein has widened to 12 inches of quartz with ruby silver and some galena and sphalerite.

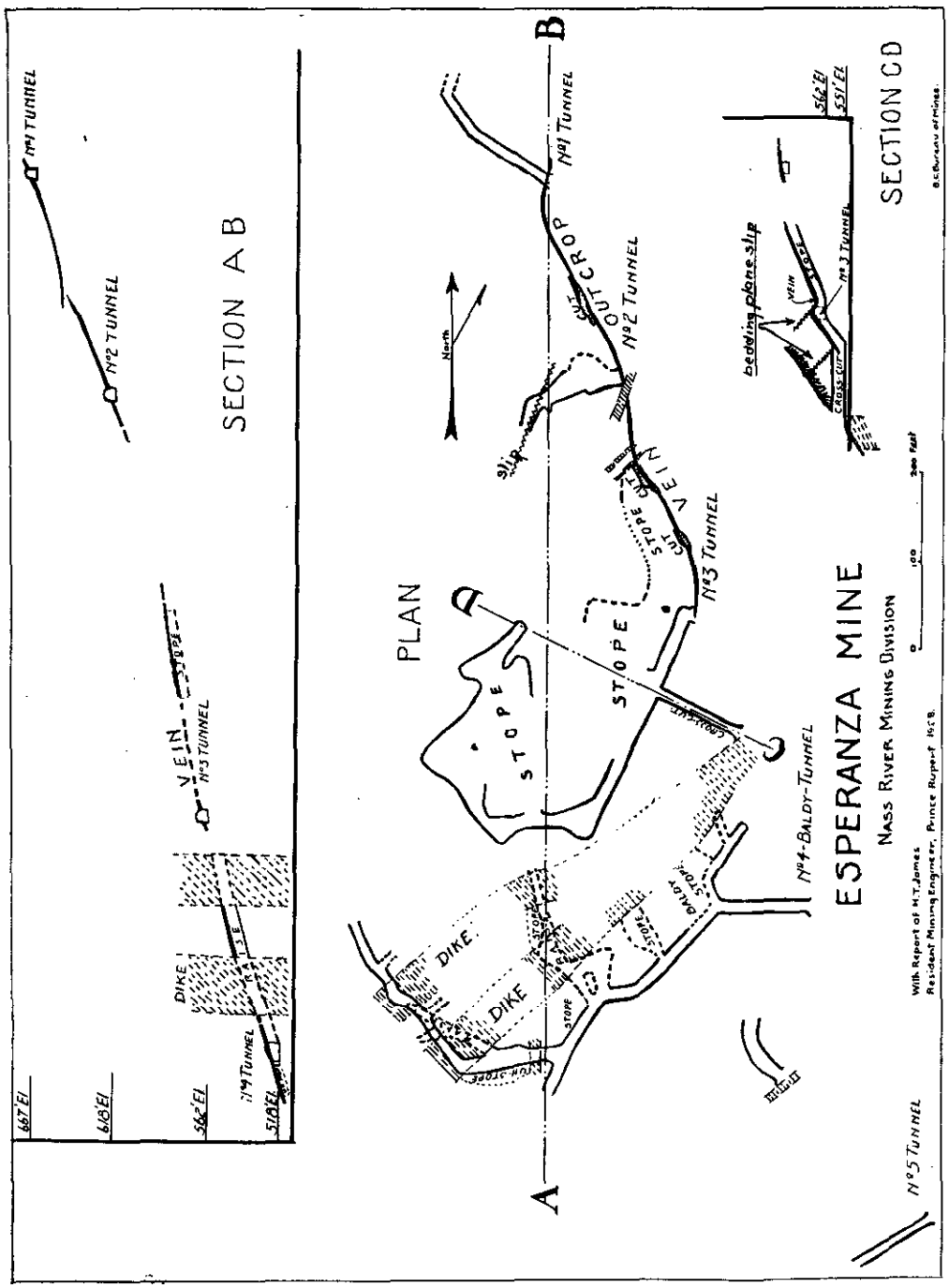
The bedded section of the vein pinches out in the cut 60 feet south of No. 1 tunnel, but its place is taken by the lower section of the main vein, which follows a shear-zone cutting the bedding at an angle. In places it is nearly parallel to the bedding, but at other points it crosses the bedding at about 90°. No. 2 tunnel follows the vein for about 40 feet to a point where it appears to end rather abruptly against one of the "rolls." The westerly side of the "roll" is a slip, striking N. 10° W. (mag.) and dipping 60° east. In this slip, near the floor of the tunnel, can be found some sulphides, so I think the drift should be continued along the structure, particularly since the slip parallels parts of the vein which carried the best ore in Nos. 3 and 4 tunnels, and also because the best ore on these lower levels is associated with "rolls" in the vein. A small amount of ore has been taken from No. 2 tunnel near the portal.

For a distance of 100 feet south of No. 3 tunnel is the series of "rolls," with which the best high-grade ore on the property was associated. These plunge S. 15° E. (mag.) at angles of 12° to 16°, crossing the dip of the vein at an appreciable angle. No. 3 tunnel follows the vein for 140 feet to a small slip, and although the slip does not appear to have altered the course of the vein, the tunnel was turned sharply to the right and picked up another vein within a few feet. This was followed and stoped up in a very flat dip for some distance, as indicated on the accompanying plan.

The vein does not outcrop south of No. 3 tunnel, but ends abruptly as shown in section C-D. The first 45 feet of No. 4 tunnel is therefore a crosscut. At about 45 feet the crosscut found the vein and drifts were run north-east and south-west for short distances on some of the best ore found in the mine. Other smaller bunches of ore were found farther along the drift and in the raise crossing section-line A-B. A vertical raise through the vein at the face of the short drift just east of the first dyke picked up 6 feet of clean quartz. It stands vertically and terminates just a few feet above the main vein on the Esperanza group. Values in the vertical vein are negligible at this point.

No. 5 tunnel is a long crosscut being driven to search for the downward continuation of the main ore-shoot.

No. 6 tunnel is 37 feet vertically below No. 5 tunnel and 400 feet south of it. The tunnel was driven a few years ago by the Granby Company to prospect a quartz vein exposed in a cut 15 feet above the tunnel. Nothing was found in the tunnel, for the vein bottomed abruptly just below the cut, in the trough of a flatly pitching synclinal fold in the sediments.



Nos. 7 and 8 tunnels are two tunnels at about 585 feet elevation and approximately 300 feet west of No. 6 tunnel. Two veins are exposed in the upper tunnel. One of these is a fairly strong and continuous vein striking No. 62° W. (mag.) and dipping into the hill south-west at 35°, and the other is a short stringer striking N. 65° E. and dipping north at 32°. It is said that the lessees on No. 8 tunnel had taken out $7,000 worth of ore from the second vein within 15 feet of its intersection with the main vein. No. 7 tunnel had been started to pick up this

same intersection, but had not been driven far enough. The ore appeared to have been such high-grade material that the company decided to continue the tunnel. The first round broke into quartz, striking apparently across the tunnel, so the tunnel was continued on its original course and had crosscut over 40 feet of quartz, sparsely mineralized with arsenopyrite. A sample from a very narrow streak of arsenopyrite on the hanging-wall side of the quartz assayed 12 oz. in gold to the ton. It is expected that a drift will be run to the left along this streak to pick up the ore-shoot which was the original objective of the tunnel.

Records of the Esperanza group show that the property has produced quite a little good silver ore, and it seems reasonable to expect that with systematic development more ore of similar grade will be found.

Alice Arm-La Rose Mining Co., Ltd. (N.P.L.).

This company was incorporated in 1920 to acquire and work the La Rose group of claims, situated on the south side of Paul Klayduc creek at an elevation of 2,250 feet. The capitalization of the company is $100,000, divided into 100,000 shares of the par value of $1 each. The trail to the camp leaves the railway at the north side of Granite creek, about 6 miles from Alice Arm. The upper section of the trail is very steep, but the lower section is a wide trail on a good grade and in excellent condition.

The original discovery is a quartz vein outcropping on the north side of a small depression at 2,250 feet elevation. The vein strikes N. 20° W. (mag.), dips at a steep angle to the east, and is up to 2½ feet wide. It is not exposed for more than 40 or 50 feet, but within this short distance it contains some very good high-grade silver ore. In 1919 a tunnel was driven southerly along the vein for a reported length of 125 feet. The first 30 or 40 feet of this is said to have been in good ore, but the tunnel was partly filled at the portal and could not be examined. Later, a short shaft was sunk from the surface and a small amount of high-grade ore mined by enlarging the shaft.

In 1922 a 420-foot crosscut was driven to the vein at a depth of about 150 feet below the outcrop. This encountered the vein at about 350 feet. It was found to have flattened at this elevation to a dip of 45°, so the drift was continued to and beyond the projected position of the vein. A short drift north and a 135-foot drift south failed to find anything of importance, although the drifts were under the vertical projection of the ore-shoot.

A raise driven to connect with the old shaft began to pick up good values at about 20 feet above the level and the vein straightened at about this point to its usual dip. A sub-level was run north and south at the bottom of the ore-shoot and found good ore in the north drift. This working is some 25 or 30 feet long and has not yet reached the end of the ore-shoot. A small amount of ore has been mined from below the sub-level. Since the ore is south of the shaft on the surface and north of the shaft on the sub-level, it would seem that the ore-shoot plunges to the north. Having this in mind, it was suggested that the north drift on the main level be continued a short distance. The results of this work have not been learned.

The ore is said to be high-grade shipping-ore, but a careful sampling of the workings has not been made. A 2-foot sample from the enlarged section of the shaft at about 18 feet from the surface on the south side assayed 0.06 oz. in gold and 244 oz. in silver to the ton, and a 16-inch sample from the north side of the shaft, about 35 feet from the surface, assayed 0.04 oz. in gold and 20 oz. in silver to the ton. These samples merely represent values from points where the vein could be sampled easily and are not intended to give any indication of average values.

A wide shear-zone was cut by the main crosscut before it reached the main vein. This shear-zone finds expression on the surface as a long draw paralleling the hillside, striking a little more north-south than the main vein. Several hundred feet south of the surface workings, near the boundary between the *Speculator No. 2* and La Rose groups, a 30-foot shaft in this depression found ore similar in appearance to the La Rose high-grade ore. The finding of ore at this point, merely by sinking in the depression, has encouraged the belief that other ore-shoots might be found along the depression, or rather in the shear-zone which is responsible for it. Consequently, an attempt was made to surface-trench the zone on the La Rose ground at no great distance south of the upper workings. The cuts, however, which are as much as 15 feet deep, failed to reach bed-rock except on the "rim" of the depression, and it was found inadvisable to deepen the cuts because of the difficulty of handling the water. This zone is, apparently, worth prospecting, but because of the depth of overburden it may be cheaper to drift on it from under-

ground. Trenching in higher ground, nearer the *Speculator No. 2* line, might be done more easily, but the ground was not examined with this in view. Three men were employed at the time of examination.

Homeguard. This group of claims, owned by William McFarlane and partners, of Alice Arm, is situated on the east side of the Kitsault river, opposite the 14-Mile post on Dolly Varden Railway. The property was not examined this year. The following extracts from the 1922 and 1924 Annual Reports give a good indication of the possible value of the property. The 1922 report contains the following paragraphs under "*Central* group," which is the old name of the property:—

"The first showing is at an elevation of 1,000 feet, or 350 feet above the railway on the opposite side of the river. Here an open-cut along the hillside crosses a vein 20 feet wide, filled with a breccia of greenstone country-rock cemented with calcite. The calcite is heavily mineralized with pyrite and chalcopyrite. Across 12 feet 6 inches of the face of the exposure assayed as follows: 4 feet 6 inches in width, $2.40 in gold and 6 oz. in silver to the ton and 3.9 per cent. copper; 8 feet in width, 60 cents in gold and 2.4 oz. in silver to the ton and 3.5 per cent. copper. I judge the 12 feet 6 inches of ore will concentrate from 5 to 8 into 1. Other similar showings are found up the hill.

"The property was bonded by the Granby Consolidated Mining, Smelting, and Power Company, Limited, and diamond-drilling done. It was found that in each case the showings consisted of isolated boulders, or masses of the vein broken away and embedded in the slide-rock. A tunnel was then started by the owners at an elevation of 1,275 feet and has been driven over 150 feet. The first 20 feet went through coarse slide-rock of the country-rock, encountering no more boulders of ore; the balance of the tunnel is in solid andesitic country-rock, but the vein has not been found."

Under "*Homeguard* group" in the 1924 Annual Report is the following paragraph: "This year the owner, William McFarlane, discovered what appears to be the vein in place on the crest of the first bench, at an elevation of about 1,600 feet. . . . The recent discovery mentioned above is supposedly the vein, and it has many of the earmarks, though it is not so wide, nor is the mineralization as heavy, nor the values as high. However, it is something to work from, and the vein may be stripped and followed down the hill to a convenient point from which to start a drift-tunnel."

Late in 1928 the property was optioned to the Dalhousie Mining Company and preparations have been made for working on the property throughout the winter.

Dolly Varden. The property of the Dolly Varden Mines Company, Limited, consisting of the *Dolly Varden* group of eight claims and the *Wolf* group of four claims, was optioned early in the spring of 1928, along with other silver properties in the upper Kitsault valley, by Spencer and associates, but nothing was done on the properties. The *Dolly Varden* ore occurrence and workings are described in the Canadian Geological Survey Summary Report for 1921, Part A, and in previous Annual Reports, particularly in the 1916, 1917, and 1922 Reports.

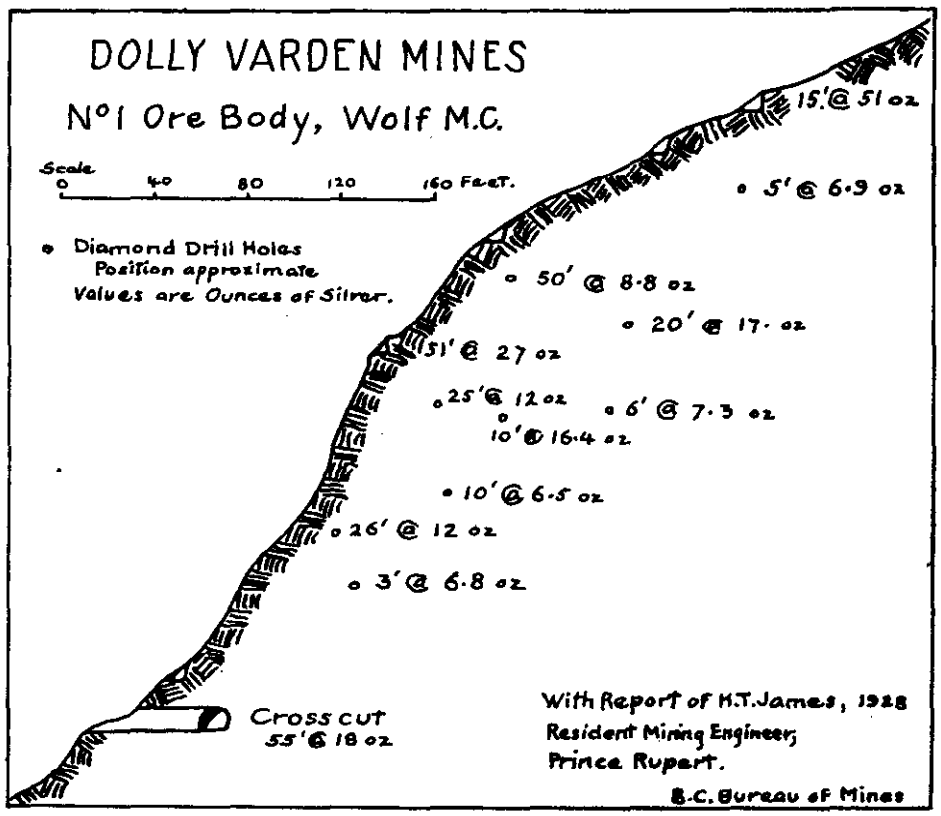
During the three years of its production—1919 to 1921—36,620 tons of ore was mined, yielding 1,301,238 oz. of silver. This was all shipping-ore from the upper 250 feet of a 300-foot section of the main vein. The remaining 1,200 feet of the main vein has not been developed underground and has been explored by only a few drill-holes. Another vein farther up the hill has been cut by a few drill-holes, but has not been prospected by underground workings. Between 25,000 and 40,000 tons of ore is either developed or partially developed in the old workings. Some of this is high-grade shipping-ore.

It is believed that the greater part of the values in the ore mined were secondary, and therefore it is expected that the values would decrease with depth. Work on the No. 5 level seemed to indicate that the primary values would be too low grade to be commercial, but now that the *Toric*, just across the canyon, is developing a vein which apparently contains primary ore of commercial grade, it seems reasonable to suppose that certain sections of the *Dolly* veins might be commercial below the zone of secondary enrichment.

Two large quartz veins on the *Wolf* group, a part of the Dolly holdings, were drilled by the company. Most of the holes found non-commercial material, but one ore-shoot was indicated on the main vein. This was opened by a shallow tunnel. The values obtained in this working are

shown in the accompanying sketch. The *Wolf* veins are up to 50 feet wide and have been traced for many hundred feet.

The Dolly Varden holdings—that is, the *Dolly Varden* and *Wolf* groups—are worth a very careful investigation in my opinion. When they are examined they should be examined in the light of recent developments on near-by properties—the *Toric* and *Tiger*.



North Star. This is a fractional claim immediately north of the *Dolly Varden* group and straight across the canyon from the *Toric*. It is owned by Gus Pearson and partners, of Alice Arm. The cabin and showings are a few hundred feet beyond the Dolly Varden mine camp and are reached by the mine-trail, which leaves the railway half a mile or so south of the upper railway terminal.

In the uppermost open-cut, just below the cabin, is a sparsely mineralized quartz vein up to 20 feet wide. A little lower down is a big cut and a short tunnel, exposing a similar width of vein, sections of which are said to run quite high in silver over a width of 6 to 7 feet. A drift some 200 feet long has been driven along the vein at a depth of 62 feet below this cut. At 150 feet from the portal a short raise was driven and a winze sunk on the ore. The winze must have been filled in with waste, for last fall the owners sunk another winze alongside the old one, and in doing so broke through a basic dyke paralleling the vein and found ore on the other side of it. A crosscut to the right near the face of the tunnel might pick up this ore.

A new tunnel is being driven about 80 feet below the old main tunnel. It was in 225 feet at the time of examination and had failed to find anything more than an occasional bunch of galena. The vein is very difficult to follow, because it is crossed by a number of slips and is cut by several dykes running about parallel with it. A short crosscut was to be started near the face of the tunnel to prospect for the ore found in the winze below the upper tunnel. The results of the work have not been learned. The property is worth examining, particularly along with the *Dolly Varden*.

Toric Mines Co., Ltd. (N.P.L.).

This company was formerly known as the Consolidated Homestake Mining and Development Company, Limited, and was incorporated with a capitalization of $500,000, divided into 100,000 shares. In 1927 its name was changed to the Toric Mines Company, Limited, and the capitalization increased to $625,000. Since then the capitalization has been increased to $1,000,000, divided into 200,000 shares of the par value of $5 each. The company is developing the *Toric* group—*Toric*, *Anglo*, *Moose*, and *Lamb*—situated about a mile beyond the terminus of the Dolly Varden Railway on the east side of the Kitsault river.

Two veins had been found on the surface. An upper vein contained but very poor values where opened along the surface, but a lower vein up to 20 feet wide contained sufficient values in a number of open-cuts to warrant underground exploration. On the strength of these showings the Toric Company started a crosscut at the level of the trail, and within 200 feet picked up a quartz-barite vein, which later proved to be between 50 and 70 feet wide. The whole vein seems to be commercial, according to the company's assay plan, and certain sections of it contain high-grade values. These are apparently secondary and localized along fault-zones. The vein has been developed on one level for a length of 300 feet and raises are being driven to ascertain the values and character of the vein above the level. The section of the vein opened up during 1928 contains more galena than the section near the portal, and it is said that the silver values have increased with the lead content. Although the lead content has increased appreciably in the new workings, the new ore assays only about 2½ per cent. lead; other sections of the vein containing but a very small percentage of sulphides.

The vein which is being developed underground is so much wider than the one which the crosscut was expected to strike that some doubt has been expressed about the possibilities of the vein holding its width in depth or for more than a very short distance above the level. The new mine superintendent, E. Hayes, has had the underground workings tied in with the surface by survey, and it is understood that the vein being developed underground is to the foot-wall of the lower of the two veins exposed on the surface. If this should be verified by underground work the possibilities of the *Toric* mine will be increased very greatly, for it will mean that in addition to the lower surface vein, which has a maximum width of 20 feet, they have a new vein entirely, 50 feet wide, with the original vein yet to be explored. To date, however, but one vein has been developed underground.

The mill constructed in 1927 was changed to a straight flotation-mill, as amalgamation and table-concentration proved to be quite unsuited to the ore. It has been running two shifts a day (sixteen hours), treating the ore which is broken from crosscuts, drifts, or raises during the remaining eight hours of the day. This amounts to about 30 tons. The power unit installed in 1927 at the terminus of the Dolly Varden Railway is not large enough to run the mill and compressor at the same time, but it is understood that a new power unit has been purchased and is to be installed near the mill.

The engineer of the Britannia Mining and Smelting Company examined and sampled the *Toric* in December, 1928, but at the time of writing it is not known whether or not the Britannia Company is to become interested in the development of the property. Production from the *Toric* mine during 1928 amounted to 1,540 tons.

Utility Mines (Number One), Ltd.

This company is developing the *Tiger* group, situated in the Kitsault valley immediately north of the *Toric*, and also has an option on the *Kitsol* group, which adjoins the *Tiger*, *Toric*, and *Dolly Varden* groups. The company was incorporated in 1928 under the "Companies Act" of the Dominion of Canada, with an authorized capitalization of 5,000,000 shares of no par value. The *Tiger* showings consist of four or five faulted sections of a quartz vein, from 4 to 14 feet wide, outcropping for a distance of about 300 feet along a steep side-hill about 800 feet above the main Kitsault trail. The fault-blocks vary in length from 10 to 240 feet and these strike from N. 05° to N. 40° W. (mag.). The dip seems to be about vertical. The vein occurs in greenstones of the Dolly Varden formation and consists of quartz pyrite and small amounts of galena, sphalerite, ruby silver, native silver, and another silver mineral which has not been identified.

Several short diamond-drill holes were drilled along the vein a few years ago by some Eastern people, but, although the values were decidedly encouraging, the property was not developed or prospected by underground workings at that time. Since then quite a little underground work has been done by the locator, Ed. Pickett, and by the Utility Company after it undertook the development of the property in 1928.

Prior to 1928 one of the fault-blocks had been crosscut at a depth of a little over 100 feet from the surface. From this crosscut a short working had been driven to the right in the country-rock along one wall of the vein to a point where one of the drill-holes had found good values. A short crosscut from the end of this drift did not go through the vein, but verified the existence of silver minerals at this point.

Since the property has been taken over by the Utility Company crosscuts have been driven to the vein at depths of 240 and about 400 feet below the outcrop. These are known as the No. 2 and No. 3 tunnel respectively, No. 1 tunnel being the old working at a little over 100 feet below the outcrop. No. 2 tunnel was driven to but not quite through the vein. Apparently satisfied with having found the vein at this depth, although the values are low, No. 3 tunnel was started immediately and is reported to have cut very good ore. This tunnel had not reached the vein at the time of my examination.

At the time of examination preparations were being made to build camps and to install a power plant. The company evidently intends to make a thorough job of prospecting the property and the chances of developing a moderate tonnage of milling-ore seem to be fairly good.

Vanguard. This group of four claims, owned by M. Peterson and partners, of Alice Arm, is situated on the west side of the Kitsault river, about 5 miles beyond the end of the Dolly Varden Railway. A good cabin and the principal workings are at an elevation of about 2,800 feet above sea-level. Considerable work was done on the property in 1927, when the property was bonded to the Spencer interests.

Two zones of copper mineralization have been found and prospected to a certain extent. One of these is exposed in a large open-cut and tunnel a few hundred feet north of the camp and at about the same elevation. A crosscut a little over 100 feet long was driven under the north end of the cut, finding several feet of mineralized ground near the portal. This year the owners have drifted along one wall of the zone in a S. 20° E. (mag.) direction for about 20 feet. This zone seems to be fairly wide and deserves further attention.

The zone which has been most attractive so far is an east-west (mag.) vein outcropping about 400 feet north of the one just described and from 150 to 200 feet above it. One mineralized showing, apparently on the strike of this vein, is less than 50 feet above the tunnel first mentioned and less than 300 feet north of it. One or two of the upper cuts contain some excellent copper ore, but the length of the high-grade material is quite limited. The owners drove a crosscut 50 feet or so below one of the best showings and found ore only after drifting to the right a short distance. The face of this drift, which is about 30 feet long, is in good copper ore. In 1927 a crosscut over 200 feet long was driven to the vein, and drifts were run along the vein for about 75 feet west and 14 or 20 feet east. A short diagonal crosscut was also driven to the vein from the east side of the tunnel, a short distance back from the face. These lateral workings are all in mineralized ground, and in places along the west drift from 2 to 3 feet of massive copper and iron sulphides have been found. A crosscut to the north, from about the centre of the west drift, shows that small amounts of chalcopyrite penetrate the walls for a distance of 10 or 12 feet.

A 5-foot sample along the east wall of the crosscut and a part of the back of the drift assayed: Gold, trace; silver, 4.2 oz. to the ton; copper, 3 per cent. A 6-foot sample from the face of the west drift assayed: Gold, trace; silver, 1.6 oz. to the ton; copper, 1 per cent.

It is possible that a systematic exploration of these two known zones would result in the discovery of higher-grade ore-shoots and other veins might possibly be found. If other properties in the Kitsault valley develop into producing mines and transportation is improved, this property will be well worth investigation. This property and the *Vanguard Extension* should be examined together.

Vanguard Extension. This group adjoins the *Vanguard* on the south and is owned by Morris Peterson, of Alice Arm. The *Vanguard* camp has been used for prospecting the *Extension* ground. A foot-trail to the main showing leaves the *Vanguard* trail at about 2,400 feet elevation. The showings and tunnel are a very short distance south of this and at about 2,450 feet elevation.

The showing is merely a bluff of iron-stained and silicified greenstone. A 25-foot tunnel driven into the zone has a fairly good-looking face of copper ore, but the tunnel had not demonstrated any width to the zone and it was not sampled. Further work will be necessary before the width, values, or attitude of the copper mineralization can be determined. This extra work is warranted by the present showings.

The *Vanguard* and *Vanguard Extension* taken together offer some possibilities as copper prospects, chiefly because they are in a zone of copper mineralization and three or more copper veins have been found on them. Further careful prospecting might well uncover other veins.

Illiance River Section.

Kitsault-Eagle Silver Mines, Ltd.

This company was incorporated in April, 1926, with a capitalization of $500,000, divided into 500,000 shares. Last year the company was developing three properties in the Alice Arm camp—the *Silver Chord*, *LeRoy*, and *Eagle*—and in the spring of 1928 took an option on the *Sunrise* group, McGrath mountain. During 1928 a crosscut was continued to the vein on the *Eagle*, but the values were so low that nothing further was done. The *LeRoy* did not receive a great deal of attention, but a tunnel crew was kept busy throughout the year on the *Silver Chord*. Unfortunately the results have not been very encouraging. The *Sunrise* group is situated along the summit of McGrath mountain, immediately south of the *Silver Chord*, at an elevation of about 4,000 feet. The claims are exceptionally well situated for mining, since the foot of McGrath mountain is only about a mile from the head of Alice arm, across the deltas of the Illiance and Kitsault rivers.

The *Sunrise* showings consist of three or more veins in argillites, varying from 2 to 12 or 14 feet in width. Two of the veins, having a general north-south strike, have been traced by a series of cuts for a distance of several hundred feet along the surface. A third vein, at an angle to the others, has been traced for 300 feet. These veins are mineralized with quartz, sphalerite, and a small amount of pyrite. An average of a number of samples from the surface is said to run about 14 per cent. zinc, with essentially no lead or precious-metal values. The veins are described in more detail in the 1926 and 1927 Annual Reports.

Shortly after taking over the *Sunrise* property the company started a crosscut which is expected to reach the main vein at 1,000 feet from the portal. Good progress is being made on the drive, but the objective will not be reached till the spring of 1929, as the work is being done by hand. The results of this deeper exploration of the McGrath Mountain zinc-deposits will be awaited with much interest, for if the Kitsault-Eagle Company is successful in developing commercial ore on the *Sunrise* group many other claims on the mountain will become attractive prospects.

PORTLAND CANAL MINING DIVISION.

The Portland Canal Mining Division is that portion of the Province which is directly tributary to Portland canal. This includes not only the watershed of Portland canal, but also the upper part of the Nass River valley, for this section is readily accessible from the head of the canal via the Bear River-Nass divide and Meziadin lake, or the Salmon River divide towards Bowser lake. The Bear River pass is the one which will be used by the Canadian North-Eastern Railway if the railway is built from Stewart into the Groundhog and Peace River areas. The Unuk River area is also included in the Division, although it is not particularly accessible from the canal. Just at present it is an inactive section and falls more readily into the Portland Canal than any other Division.

More properties are being developed or explored in the Portland Canal Mining Division than in any other Division in No. 1 District, and from a production standpoint it is the second most important Division in the district. The *Premier* is the only important producer now that the *Outsider* has been closed down, but from present indications it would seem as though one or more of several properties might eventually become shipping-mines. Mineralized zones have been explored extensively on the B.C. Silver and Sebakwe Companies' properties, and a number of promising prospects are either being developed or are about to be developed by strong companies. Chief among these is the group of three being explored by the Premier Company—namely, the *Silverado*, *Prosperity*, and *Porter-Idaho;* while other properties with interesting possibilities are the *Big Missouri*, Georgia River Gold Mines, *Mountain Boy*, *George Copper*, and *Black Hill*.

The most sensational strike in the Division during the season was the discovery of high-grade silver ore on the *Mountain Boy* group, American creek. The development of this property by the Pat Daly Mining Company will be followed with more than the usual amount of interest, for not only is it new to the public, but it is one of the more promising properties in Bear River section and is in a part of the Bear valley that has received very little attention. While the

Mountain Boy group may be new to the public, it is one of the oldest locations in the Portland Canal Division.

The construction of the railway as far as the Bear River-Nass divide will greatly facilitate the development of all properties in the Bear River valley, and undoubtedly will induce a number of prospectors to explore the mountain east of the divide. As a matter of fact, a number of prospectors have already located in this section in anticipation of the railway's construction. Other prospectors are going into the Nass valley by way of the Salmon River divide and Tide lake. Several groups of claims have been located in the vicinity of Tide lake, and a block of fifty-seven claims was located in the upper part of the Nass valley by representatives of the Consolidated Mining and Smelting Company of Canada.

Georgia River Section.

Pedro Georgia River Syndicate.

This syndicate was formed about July, 1928, to develop a block of sixteen claims lying on the east side of Georgia river between 4½ and 5 miles from Portland canal. The syndicate consists of 1,500 units, which are offered to the public at $10 per unit. The upper camp is on the east side of Georgia river, immediately below the point where the main trail crosses the river the second time. A new camp has been built on the same side of the river, but about a mile lower down. Supplies are taken across the river on a cable, as the cabin is on the opposite side of the river from the main trail.

Crossing a small creek-bed just north of the upper cabin is a very narrow north-westerly striking vein in greenstone, along which a tunnel has been driven for about 150 feet. A little galena was found along the drift, but nothing of commercial importance is indicated.

A second showing is situated a little north of the lower cabin and 400 or 500 feet above it in elevation. At this point, approximately 50 feet of underground work has been done on a lens of quartz from 20 to 25 feet long and up to 4 feet wide. The lens strikes about north-west, south-east, and dips to the south-west. It is paralleled on the foot-wall side, at a distance of 2 or 3 feet, by a strong shear-zone or fault. On the west side of this shear and just a few feet from the tunnel is a quartz vein striking apparently east-west, or nearly straight up and down the hill. The lower end of the vein bends southerly into the shear-zone, suggesting that the vein has been faulted along this zone. Apparently nothing has been done to prospect this vein, but is worth a few open-cuts at least, for some quartz veins in the Georgia River section carry good gold values.

The most important showing from present indications is quite near the lower cabin, at an elevation of about 1,050 feet. A 40-foot cut has exposed a wide zone of mineralized greenstone. The mineralization is quite strong over a width of 10 feet in the north end of the cut. A sample from a 5-foot section of this 10 feet assayed: Gold, trace; silver, 1 oz. to the ton; copper, 1.3 per cent. The remaining 5 feet should contain similar values. Although this material may not be of commercial grade, it contains sufficient values to justify considerably more work being done along the strike of the zone.

Georgia River Gold Mines, Ltd. (N.P.L.).

This company was incorporated in April, 1925, with a capitalization originally of $1,000,000, but the present authorized capital is $3,000,000, divided into 3,000,000 shares of the par value of $1 each. According to the original prospectus, a part of the company's present holdings were purchased from the Georgia River Mining Company, Limited (N.P.L.), for 150,000 shares and the remaining holdings were purchased for additional shares.

Operations on the property have been at a standstill for a number of years, apparently because of a lack of funds, but the recent revival of interest in mining has made it possible to finance the enterprise. The company seems to have considerable cash on hand and has started a programme of development which should determine the real merits of the property. Most of the 1928 summer season was taken up with trail and camp construction, delaying the beginning of actual underground work till late in the fall. With assistance from the Department of Mines, the first 4 miles of trail were reconstructed where necessary and 4 miles of new trail were built to the property. As soon as this was finished lumber was rushed in for camp-construction and supplies taken in for the winter's operations.

Although the property was visited in the fall, the workings and showings were not examined in detail, partly because underground work had not yet commenced, but chiefly because very

little has been done since the property was described by G. A. Clothier in the 1922 Annual Report. This description is given below for the convenience of those who may not have the 1922 Report:—

"The main working is a drivage of over 400 feet, known as the 'Bullion tunnel,' following a quartz vein from 4 to 12 inches wide, contained in an argillite country-rock. In this work the vein was encountered at 55 feet from the portal, and the ore was drifted on for a distance of 135 feet, varying from 4 to 12 inches in width of pyritized quartz, carrying gold values, and in places showing free gold. The ore-shoot was further proven by a raise of 35 feet through to the surface, in which some very high-grade gold ore was found. A little farther along a winze has been sunk 45 feet. The winze was started on about 10 inches of good ore, which was followed down for 22 feet, the quartz dipping out of the winze to the west at this point. A small stringer coming in from the east side was then followed down to 35 feet, where the winze was turned west, picked up the main quartz vein, which was about 24 inches wide here, and a further 7 feet was sunk on it. The vein at the bottom of the winze is a little over 2 feet wide, about half quartz and the balance pyrrhotite, the heavier sulphide assaying 2.28 oz. in gold and 3.7 oz. in silver to the ton. A grab sample of the dump, representing a more or less sorted ore from the workings on the vein, assayed $47 in gold to the ton.

"A crosscut at the face of the tunnel was driven west, toward the big vein, a distance of 35 feet. Neither the cut nor the last 200 feet in the tunnel show any values. To the west of the tunnel a big vein of quartz has been exposed on the surface by open-cuts. It outcrops at intervals for a distance of from 1,200 to 1,500 feet and varies in width from 10 to 20 feet. Its strike is N. 50° W. (mag.) and the small vein about N. 30° W. They should have intersected in the Bullion tunnel, but it was not apparent. However, a little crosscutting should pick up the big vein, on which a depth of 300 feet could be obtained with a little drifting.

"There are a number of small rich veins, more or less paralleling each other, on the property, which would prove valuable 'sweeteners' if a tonnage of milling-grade ore could be developed in the big vein. I think this property and vicinity worth some investigation."

North Country Mining Co., Ltd. This company was organized by a group of Dakota business-men to develop a large group of claims located along the ridge east of the divide between Bulldog creek and Georgia river. In 1927 the company's holdings consisted of fourteen claims and two fractions—*Gloria Nos. 1* to *8*, *Julia Nos. 1* to *4*, *Peggy Nos. 1* and *2*, and *Glory Fraction Nos. 1* and *2*—but since then the *Glory Extension* group seems to have been added to their holdings. This last group of eight claims—*Glory Extension Nos. 1* to *8*—belonged to A. Linke, of Hyder, who is in charge of the North Country Mining Company's operations, but it seems that he has turned them over the North Country Mining Company to strengthen their position.

Routes into the upper section of the Georgia River valley are not at all good at present, but they are being improved. The route most commonly used is a very poor foot-trail which leaves Burnt point, on Portland canal, and crosses the 3,300-foot ridge between the canal and Georgia river. A new trail is being constructed up Bulldog creek and into the upper end of the valley, and a horse-trail has been built from Portland canal up the Georgia river about 8 miles to the Georgia River Gold property.

In spite of the fact that all supplies have been packed on men's backs at a cost of 15 cents a pound, more than 1,200 feet of underground work has been done on the company's ground. Most of this work has been done on the claims at the north end of the valley, where mineralized showings had been found in the batholithic rocks. (*See* 1927 Annual Report.) On finding neither commercial ore nor encouraging prospects in the northern group of claims, attention has been directed to prospecting the southern or *Glory Extension* group. The principal showings on this group are on the east side of the valley, opposite the upper end of the more southerly of the two larger lakes in the valley. Unlike the northern showings, most of these are in a series of highly metamorphosed sediments, tuffs, and greenstones, apparently an inclusion in the batholith. In a large open-cut on the trail, about 150 feet above the valley-floor, just where the trail turns uphill to the camp-site, is a narrow quartz vein, from 6 inches to a foot in width, striking a little west of north (ast.) and dipping steeply to the east into the hill. A 1-foot sample across the vein on the south side of the cut assayed: Gold, 2.6 oz. to the ton; silver, 2.5 oz. to the ton. Although the vein is small, the values are well worth following. Linke's assays from the same

vein have been somewhat similar and he claims that samples of the wall-rock give very good gold returns.

Other cuts on other showings are found between elevations of 2,800 and 3,500 feet in the canyon of the creek which flows into the upper end of the south lake. At some of these points the rock contains a slight dissemination of iron, zinc, or copper sulphides, and occasionally some galena is found, but never in commercial quantities. The uppermost working in the canyon is a 20-foot tunnel driven northerly along a north-south fracture-zone, mineralized with galena, sphalerite, and pyrite. In places, over a width of a few inches, one may find solid sulphides, but in general the vein is poorly mineralized. A 2-foot sample from the face assayed: Gold, 0.04 oz. to the ton; silver, 1.6 oz. to the ton; lead, 2.8 per cent.; zinc, 5 per cent.

A number of cuts have been made in a series of metamorphosed argillites exposed in the next two creeks south, but nothing of commercial significance has been indicated.

A strong quartz vein is said to outcrop still farther south, but nothing had been done on it and the vein was not examined. It is understood that some work was done later on this vein and that very encouraging gold values were found. This quartz vein and the smaller one first described deserve further attention and give the North Country Mining Company's ground a certain prospective value.

M.J.

This group, owned by James Lydden, of Stewart, is situated on the north side of the Georgia River valley, about 3½ miles from the mouth of the river. The group consists of the following six claims: *J.L. Nos. 1* and *2*, *M.J. Nos. 1* and *2*, and *Little Pat Nos. 1* and *2*. Owing to a misunderstanding as to the location of the property it was not examined, but since so much interest is being taken in the Georgia River section the following description is reproduced from the 1926 Annual Report:—

"The showings are quartz veins occurring in a quartz diorite or granodiorite formation. The quartz is mineralized with pyrrhotite and chalcopyrite. A sample of the heavy sulphides assayed only a trace in gold and 0.6 oz. in silver to the ton, but 12 per cent. copper. There are apparently two or more veins.

"The lower exposures are at 2,100 feet on the *L.J. No. 1* claim, where a couple of open-cuts have been put in about 100 feet apart and the vein stripped between, showing its strike to be N. 60° W. and dip about 75° north-east. The lower of these cuts shows 18 inches of nearly solid chalcopyrite.

"The upper showings are on the *M.J. No. 1* at 2,350 feet, here showing a foot or more well mineralized with chalcopyrite, standing perpendicularly along a ridge of granodiorite containing epidote, striking N. 30° W. Little work has been done, but the mineralization crops for about 100 feet. These showings are in themselves worth opening up and indicate a worthy area for close prospecting."

Marmot River Section.

Marmot Consolidated Mines, Ltd. (N.P.L.).

This company was incorporated on June 16th, 1927, with a capitalization of $5,000,000, divided into 5,000,000 shares of the par value of $1 each. It seems from the "statement in lieu of prospectus" that provision has been made for two series of shares, a series "A" and a series "B," but no other detail is given. A block of forty-one claims, covering the west end of the ridge between the North and South forks of the Marmot river, and a smaller strip of ground on the north side of the main stream below the forks, constitute the company's holdings. These were purchased from the International Metals Exploration Company, 327 Colman Building, Seattle, Wash., for 3,000,000 shares, including both "A" and "B" series, of the Marmot Consolidated Company's stock.

According to information received by the Department of Mines from T. S. Waltermeyer, secretary of the International Metals Company, his company purchased the claims from S. K. Green shortly after the Sterling Silver Lead Mines, Limited, had lost some of them by failing to carry out the terms of their options, and had sold the remainder—the *Wire Gold* group—to S. K. Green in consideration of his paying certain creditors' accounts. This statement is made at the request of T. S. Waltermeyer to correct the following statement, appearing in the Annual Report for 1926, page 87: "I understand that the company (Sterling Silver Lead Mines, Limited) and holdings have been taken over by the International Metals Exploration Company, a Seattle organization with offices at 622 Hoge Building, Seattle."

So very little work has been done recently on the properties of the Marmot Consolidated Company that they have not been examined by the Resident Engineer for several years. The following report is based on previous examinations of groups which now form a part of the consolidation:—

The *Patricia* group is situated on the north side of the South fork of the Marmot river, about half-way between the forks and the tip of the glacier. Crossing the lower part of the claims is the main eastern contact of the Coast Range batholith. A small vein in this, known as the "Patricia" vein, outcrops at the top of a talus-slope at about 1,500 feet elevation. A tunnel has been driven along the vein N. 15° W. (mag.) for a distance of a little over 100 feet. For the first 30 feet the vein carries from 4 to 6 inches of sphalerite, galena, and pyrite, but for the remaining distance to the face it is barren.

Above the main contact of the batholith and just above the "break" of the hill is a band of sheared argillites within a thick series of greenstones. This band of argillite strikes N. 70° W. (mag.), dips 70° northerly, and may be traced for several claim-lengths along the hillside at an elevation of approximately 4,000 feet. Trenches at points along this zone have uncovered quartz veins carrying some values in silver. At one point along a dioritic dyke on the *Iron Mask* two or three narrow stringers have been found crossing the argillites at a sharp angle. These contain high-grade silver values, but they are so narrow and short that they offer no commercial possibilities. High-grade silver values are said to have been found farther west along the same zone, but these have not been examined.

The *Dwyre* group covers ground north and west of the *Patricia*. Most of the work on this group has been done on a series of rusty croppings of volcanic rocks on the north side of the mountain above timber-line, although some showings are said to have been found in the band of argillites mentioned above. Nothing but very low values have been found in the mineralized zones within the volcanics, but in view of the discoveries on the *Glacier Girl* all the rusty outcrops of volcanics are worth careful investigation.

The *Crawford* is situated on the main North Fork trail, possibly a mile east of "Green Point." The showings consist of silicified and mineralized zones in the volcanics. Very little work has been done and nothing of commercial importance has been found so far.

The *Wire Gold* group consists of a string of four claims situated north of the Marmot river and west of the forks. The claims are entirely within the granitic area and have no mineral-showings to my knowledge.

Although nothing of commercial importance seems to have been found to date on the property of the Marmot Consolidated, the ground is certainly worth very careful prospecting.

Marmot Metals Mining Co., Ltd.

This company was incorporated in 1925 with a capitalization of $1,500,000, divided into 3,000,000 shares of the par value of 50 cents each. The company's property consists of the *Montana* group of five claims and the adjoining *Horseshoe*, all of which are situated on the north side of the South fork of the Marmot river, about 5 miles from tide-water. The old route to the property was via the South Fork trail to a point on the glacier, and thence by foot-trail to the camp-site at about 3,300 feet elevation. The present route is via the North Fork trail and over the summit of the ridge, a route which is longer, but one over which horses may be taken all the way to the camp.

The showings on the Marmot Metals ground have been described in more or less detail in the 1925 and 1927 Annual Reports and they need not be described again, particularly since nothing new of importance has been found. Work in 1928 consisted of prospecting for new veins or mineral-zones, as previous work had demonstrated the lack of commercial possibilities in the known veins.

Although the showings on the original Marmot Metals ground have not been improved during the past year, the position of the Marmot Metals Company has been strengthened very greatly by virtue of its having secured options on either the control or an interest in four other properties in the Portland Canal district. An option has been secured on the entire assets of the Glacier Girl Mining Company, Limited, for a small percentage of the total share capital of the Marmot Metals Company. An option has also been secured on a little over fourteen twenty-fifths of the Melvin Syndicate, owning a group of claims adjoining the *Porter-Idaho* and *Prosperity* in the North fork, Marmot section. The company has also taken an option on 500,000 shares of the Bitter Creek Mines, Limited, owning the *L.L. & H.* group on the South fork of Bitter creek, and this company, in turn, has an option on two-thirds of the stock of the

Black Hill Mining Company, Limited, owning a group of claims on the South fork of Glacier creek, which seems to have some promise of developing into a silver-lead-zinc mine.

Glacier Girl Mining Co

The Glacier Girl Mining Company, capitalized at $150,000, divided into 300,000 shares, was organized in 1928 to develop the *Glacier Girl* group, situated on the east end of the ridge between the north and south glaciers of the Marmot river. The group, consisting of eight claims—*Glacier Boy Nos. 1* and *2*, *Glacier Girl Nos. 1* and *2*, *Glacier Girl Extension Nos. 1* and *2*, and *Evolution Nos. 1* and *2*—was staked by George Bacon and partners in 1927, and in 1928 the entire assets of the Glacier Girl Company were optioned to Marmot Metals.

The route to the camp-site is by way of the North Fork Marmot trail to the crest of the ridge between the North and South forks, and then straight east towards the ice-field which is the source of most of the streams on the east side of Bear river. The actual distance to tide-water at the mouth of the Marmot river cannot be over 5 or 6 miles, but it takes a full day to make the return trip, as the camp is at about 6,700 feet elevation and the showings at about 7,000 feet.

The main showing is a big iron-stained bluff of silicified material, outcropping between the main ice-fields and a small tributary glacier. A part of the zone is covered by the smaller glacier, but it seems to be a few hundred feet long and up to 150 feet wide. The whole zone is mineralized to a slight extent with pyrrhotite, but the economic possibilities are limited to narrower fracture-zones along which the pyrrhotite has been concentrated. These narrower zones are up to 5 feet wide and, aside from pyrrhotite, contain a small amount of copper and good silver values. The association of silver with pyrrhotite is rather unusual, but a number of samples seem to check the values. A sample over a width of 4 feet from cut A assayed: Gold, 0.10 oz. to the ton; silver, 22.40 oz. to the ton; copper, 0.4 per cent.; and a sample over a width of 5 feet from cut B assayed: Gold, 0.4 oz. to the ton; silver, 20 oz. to the ton; copper, 0.2 per cent.

These samples are from two separate zones exposed in a long cut being made across the iron-stained bluff. The whole width of the zone has not been open-cut, so other fracture-zones may yet be found. The values reported are certainly encouraging and justify further exploration.

Marmot Engineer Syndicate.

A syndicate of this name has been formed to develop the *Engineer* group of five claims—*Engineer*, *Engineer No. 1*, *Engineer Fraction Nos. 1*, *2*, and *3*—situated on the south side of the South fork of the Marmot glacier, about 5 miles from the mouth of the river. The showings consist of a few lead-zinc veins and one quartz-copper vein in argillites, immediately east of the main eastern contact of the Coast Range batholith. The property was not examined in 1928. Descriptions of the showings may be found in the 1921 and 1927 Annual Reports. It is understood that about 150 feet of tunnel has been driven towards the quartz-copper vein.

Marmot River Gold Mines, Ltd. (N.P.L.).

This company was incorporated on February 10th, 1928, with an authorized capitalization of $1,000,000, divided into 4,000,000 ordinary shares of the par value of 25 cents each. It owns the *Harner* and the *High Grade* groups of claims, situated on the east side of McGee pass, near the head of the South fork of the Marmot river. These two groups are described as one property in the 1926 and 1927 Annual Reports under the caption *Ficklin-Harner* and *High Grade* respectively.

Prior to this year the three main veins had been found and prospected by surface cuts and by one shallow working. These proved to be strong and persistent and contained distinctly encouraging gold values at one or two places along the surface. Although it was realized that these gold values were partly secondary and would undoubtedly diminish with depth, they seemed sufficiently good to justify a certain amount of underground exploration.

Since taking over the property in 1928 the company has driven No. 2 tunnel a distance of 80 feet to No. 2 vein, and drifted on this vein for a distance of 320 feet, apparently without striking anything of importance. In addition, Nos. 1 and 3 tunnels are being driven to Nos. 1 and 3 veins respectively. On November 15th the tunnels were in 370 feet and 198 feet respectively, but neither had reached its objective.

Porter-Idaho Mining Co., Ltd.

The Porter-Idaho Company was incorporated in January, 1925, with a capitalization of $2,000,000, divided into 4,000,000 shares of the par value of 50 cents each. For a description of the showings *see* 1927 and earlier reports. Early in 1928 the Premier Gold Mining Company assumed management of the

Porter-Idaho for a specific number of years and agreed to spend $500,000 on the property for the 1,651,406 shares remaining in the treasury.

As soon as conditions permitted, work was started on an aerial tram, to reach from tide-water at the mouth of the Marmot river to a suitable point on the *Porter-Idaho* ground. The tram is being built in two sections. The first section, from the beach to the angle-tower at the junction of the North and South forks, is about 2 miles long and on a gentle grade. At the angle-tower the line swings nearly 90° and leads straight to the mine across exceedingly rugged and difficult country for 3 miles. One span across the North Fork glacier is 4,100 feet long and another is 2,300 feet long. In places the line will be 1,000 feet above ground. Some towers in this section are 80 feet high. One has to see the North fork of the Marmot to appreciate the difficulties that have been met with and overcome by the engineering staff of the Premier Gold Mining Company. It is expected that the tram will be completed by about the middle of next season.

It is of interest to note that the standing cable used in the lower 2-mile section is 1¼ inches on the loaded side and 1 inch on the light side, and in the upper 3-mile section 1⅜- and 1⅛-inch cable is used.

The company has been drifting both ways on the vein from the lower level and has connected with one of the upper levels by a raise for ventilation. The results of the drifting have not been announced by the company.

Prosperity. This group adjoins the *Porter-Idaho* and both are being developed by the Premier Gold Mining Company. Arrangements have been made to ship *Prosperity* ore over the *Porter-Idaho* tram on a cost-plus basis when the tram is completed. In the meantime the Premier Company is drifting both north and south on three veins cut by the No. 3 crosscut tunnel which was started on *Porter-Idaho* ground last year. The veins are all continuations of *Porter-Idaho* veins, which are shear-zones in acidic volcanics, containing on the surface small lenses of high-grade silver-lead ore. The results of the underground development have not been announced by the Premier Company.

Shortly after the discovery of high-grade ore on the *Prosperity* a 52-per-cent. interest was optioned by the Premier Company for $125,000, with $20,000 cash. Within the year payments were completed on the 52-per-cent. interest and an option was taken on an additional 24-per-cent. interest, giving the Premier 76 per cent. of the property. It is understood that the Prosperity Mine Syndicate, Limited (N.P.L.), has been formed recently to purchase the 24 per cent. remaining with the original owners. According to an agreement between the Premier Gold Mining Company and the original owners, all the money spent in exploration, development, and equipment of the property is to be repaid to the Premier Company out of smelter returns before the minority interests receive any share of the operating profits. After the advances have been amortized all outlays from then on will be charged regularly as operating expenses, and the net profits from the operation will be divided currently in the proportion of the respective ownerships.

Melvin Syndicate. This syndicate, with 25,000 units at $5 each, was formed in September, 1928, to assume ownership of the *Melvin* group of five claims—*Melvin* and *Melvin Fractions 1* to *4*—situated on the North fork of the Marmot river, immediately east of the *Porter-Idaho* and *Prosperity*. A little over 14,000 units of the syndicate have been optioned to the Marmot Metals Company. The units are to be taken up by the company as money is advanced for development.

At the time of making the agreement nothing at all had been found on the claims, they having been staked only because of the high-grade discoveries on adjoining properties, but before the season was over two narrow veins had been found. One of these is a very small fracture occurring on the *Porter-Idaho-Melvin* boundary-line. Its extension on the *Melvin* side is covered with talus and cannot be prospected except by tunnel. Values of 125 oz. of silver have been obtained, but the sample width is only about an inch.

The second vein is a stronger shear-zone up to a foot wide and carries at one point about 6 inches of sulphide. A 4-inch sample from this short lens assayed nearly 700 oz. of silver to the ton, but the quantity of this grade of material is very limited. The fissure has been traced for about 30 feet to slide-rock too deep for surface-trenching. A tunnel was started late in the fall, but was driven only a short distance before work was closed down for the winter. The showings were not found early enough to permit preparations being made for winter operations.

Experience on the *Porter-Idaho* and *Prosperity* has shown that veins, similar to the second one found on the *Melvin*, carry lenses of high-grade silver ore. The *Melvin* vein is therefore worthy of further exploration.

Stimulator.

This group of five claims—*Stimulator Nos. 1* to *4* and *Gold Pan*—is situated in the granitic rocks on the south side of the South fork of the Marmot river, about 3 miles from tide-water. It is owned by C. W. McGee, of Stewart. The property has not been examined. It is said to contain a narrow shear-zone mineralized with pyrite and carrying high-grade gold values. It is known that samples brought in from the surface at the time of discovery assayed very high in gold. The vein is said to have been traced for several hundred feet and is up to 3 feet wide in places.

BEAR RIVER SECTION.

Red Hill Mining Co., Ltd. (N.P.L.).

This company was incorporated on February 20th, 1928, with an authorized capital of $1,000,000, divided into 5,000,000 shares of the par value of 20 cents each. The registered office of the company is 208 Yorkshire Building, Vancouver. According to the prospectus, the company proposes to acquire six mineral claims—*Red Hill Nos. 1* to *6*—situated within 3 miles of the town of Stewart. The vendor is J. Haathi, of Stewart.

Nothing was being done on the property when the Stewart district was visited and consequently the property was not examined.

Coast Silver Mines, Ltd.

This company has obtained a very comprehensive charter under the laws of the Dominion of Canada. The capitalization of the company is 4,000,000 shares of no par value. The company has acquired, for a share consideration, the *Silver Hill* group of six claims—*Silver Hill Nos. 1* to 6—situated on the east side of the Portland canal, about 2½ miles south of Stewart. The group adjoins the *Silver Bell* group on the south and is west of the *Aberdeen* group. It lies on the west side of the Silverado ridge, between about 1,500 feet elevation and the summit of the ridge.

The lower part of the claim is underlain by the granitic rocks of the Coast Range batholith and the upper part by the greenstones into which the batholith is intrusive. At an elevation of about 4,000 feet in a steep-walled canyon is a fairly wide quartz vein striking north-west and dipping steeply to the south-east. A short tunnel driven into this ledge shows a small amount of copper and iron sulphides, but the copper content is quite low and the vein has but little commercial value. About 400 feet below the tunnel is a second short tunnel in slightly mineralized ground. At 4,400 feet elevation, in a small canyon north of the one just mentioned, is a small and nearly vertical east-west vein. It is only a few inches wide, but is said to carry good gold and silver values.

Judging from descriptions of the position of the Silver Slipper Company's property and descriptions of the showings on the *Silver Slipper*, the Coast Silver Mining Company must control essentially the same ground as did the Silver Slipper Company.

Silver Bell Mining Co., Ltd.

The Silver Bell Company was incorporated, under the laws of British Columbia, in 1922 with a capitalization of $2,000,000, divided into 2,000,000 shares of the par value of $1 each. The registered office is at 404 National Bank of Commerce Building, Seattle, Wash. The company owns sixteen claims immediately south of the *Silverado*, about 1½ miles south-east of Stewart.

The property is referred to briefly in the 1925 Annual Report, page 80. It is said that a good showing was found near the summit of the ridge late in the fall. Lack of time prevented an examination of this showing.

Silverado Consolidated Mines, Ltd.

This company's holdings consist of nineteen Crown-granted claims, situated at the head of Portland canal, on the east side, overlooking the town of Stewart. These claims were formerly owned by the Silverado Mines, Limited, a company incorporated in 1924 with a capitalization of $500,000, divided into 500,000 shares. Control of the *Silverado* mining property was secured in the early part of 1928 by the Premier Gold Mining Company when that company took an option on 55 per cent. of the Silverado Consolidated Mines, Limited, a new company organized to assume ownership of the Silverado Mines, Limited. This new company has an authorized capitalization of $1,000,000, divided into 1,000,000 shares of the par value of $1 each.

The important *Silverado* showings consist of a series of shear-zones containing lenses of high-grade silver-lead-zinc ore, similar in many respects to the *Porter-Idaho* and *Prosperity*

showings, a mile or two west on the opposite side of the ridge. These showings are described in detail in last year's report and need not be redescribed here, as little or no change has been made in the showings since the report was written.

Owing to the fact that the veins outcrop below a hanging glacier, where snowslides are frequent, they can be developed only from a crosscut tunnel driven from timbered areas on either side of the snowslide section. Such a crosscut is now being driven from the south. By the end of the year it was in 550 feet and had 250 to 300 feet to go before reaching the first vein.

Red Reef Mining Co., Ltd. This company was incorporated in March, 1928, with a capitalization of $1,000,000, divided into 5,000,000 shares of the par value of 20 cents each. The company's holdings consist of four claims below the *Silverado* group, extending from tide-water at the mouth of the Bear river to about 1,800 feet above sea-level. The camp is just north of the *Silverado* trail at 900 feet elevation.

The main eastern contact of the Coast Range batholith crosses the lower part of the group. A very short distance above the contact, in Silverado canyon, at about 900 feet elevation, is a broad but poorly defined mineral-zone in highly altered greenstones. Aside from the altered country-rock, it contains pyrite, pyrrhotite, chalcopyrite, with quartz, garnet, and other silicates. Although it is said that fair gold and copper values have been obtained from individual samples, the zone will not average commercial ore at any point opened to date. The zone runs nearly due east-west, or up and down the hill. It was being open-cut along a flat quartz-pyrrhotite cross-vein at 1,150 feet elevation, and iron-stained bluffs at about 1,400 feet elevation seemed to be about on the strike of the zone. At about 950 feet elevation the zone was cut by a 200-foot diamond-drill hole driven northerly at minus 20° from a point about 10 feet south of the zone.

At 1,400 feet elevation, in Silverado Creek channel, is a narrow north-westerly-striking lens of pyrite, galena, and sphalerite. The lens is apparently short, but it is said to carry good values in gold.

About 300 feet higher, in the same channel, are two more narrow north-west veins exposed in a 15-foot crosscut. The northerly one crosses the creek and can be traced to the easterly boundary of the group at 1,800 feet elevation. Good values have been found in this vein, and although the veins are very narrow the values they contain justify further exploration.

Other showings and workings are in the timber near the *Silverado* trail, a few hundred feet south of Silverado creek. At the end of one of the switchbacks on the trail, at 1,300 feet elevation, is a cut in a flat quartz vein mineralized with sphalerite. This is said to have been traced to the flat cross-vein at 1,150 feet elevation, mentioned in the second paragraph. At 950 feet elevation, just off the trail, is a large open-cut in highly altered and pyritized rock. Four holes were drilled from this cut, as follows: North for 708 feet, east for 738 feet, south about 180 feet, and south-east for 140 feet. The holes were not drilled to explore any particular mineral-zone, but were drilled merely for general prospecting purposes. Nothing of importance was found.

Bayview Mining Co., Ltd. This company was incorporated in March, 1925, with a capitalization of $250,000, divided into 1,000,000 shares of the par value of 25 cents each. The capitalization was later increased to $750,000, with 3,000,000 shares. The registered office is in the Rogers Building, Vancouver. The company's holdings consist of fourteen claims, situated on the east side of Mount Dolly, between the floor of the valley and the crest of the ridge. The camp is at 2,700 feet elevation and is reached by a trail which leaves the Bear River road at the south end of the Bear River bridge. A fairly complete description of the showings is to be found in the 1927 Annual Report.

Work in 1928 was confined to the upper vein on the *Lucille No. 1*. A crosscut and drift, driven a few years ago, had failed to find anything of importance, but it seemed possible that the crosscut had not been driven quite far enough to reach the vein. This year a new crosscut was started a few feet away from the old one and probably 6 feet vertically below the outcrop. The vein was picked up where expected, but it pinched out before reaching the right-hand side of the working. A drift was driven to the right along the strike of the vein, but up to the time of examination it had found nothing at all. It is understood that a vein was picked up later in a crosscut from the end of the drift, but apparently this did not develop into anything of importance.

United Empire Gold and Silver Mining Co., Ltd.

This company was incorporated in February, 1928, with a capitalization of $2,000,000, divided into 4,000,000 shares, to acquire and develop the *Gold Cliff* group of claims situated immediately north and west of the Bayview Company's ground. The claims, some fourteen or fifteen in number, have been surveyed during 1928 and application has been made to Crown-grant a number of them. The camp is at 3,100 feet elevation and is reached by way of the *Bayview* trail, which leaves the Bear River road at the south end of the Bear River bridge.

The main showing is a vein which appears to be the continuation of the upper *Lucille* vein of the Bayview Company's ground. If not the same vein, it is a parallel vein in the same zone. The vein is a narrow shear-zone in highly altered greenstone, mineralized with a little lead, zinc, and iron sulphides, and contains an occasional lens of high-grade silver-lead-zinc ore. It strikes N. 60° W. (mag.) and dips south-west at a fairly steep angle.

The vein has been traced for several hundred feet by a number of open-cuts between 3,400 and 3,700 feet elevation, and is being explored by drift-tunnel at 3,400 feet elevation, which is the lowest point of outcrop on United Empire ground.

A 14-inch sample across the shear-zone at the face of the tunnel (as on August 13th) assayed: Gold, 0.04 oz. to the ton; silver, 14 oz. to the ton; lead, 4.5 per cent.; zinc, 3 per cent. A sample of the remaining 2½ feet at the face assayed 2 oz. of silver to the ton and 0.5 per cent. zinc. Another sample from a cut at 3,550 feet elevation, where the shear-zone is wider and more pronounced, assayed: Gold, 0.01 oz. to the ton; silver, 2.2 oz. to the ton; lead, trace; zinc, 0.9 per cent. Immediately above this cut is a smaller cut exposing about 1 foot of massive sulphides. A specimen from this lens assayed: Gold, 0.04 oz. to the ton; silver, 436 oz. to the ton; lead, 40 per cent.; zinc, 12.4 per cent. At 3,700 feet elevation, just opposite the blacksmith-shop, several cuts expose from 1 to 3 feet of vein. An 18-inch sample from one of these assayed: Gold, trace; silver, 10 oz. to the ton; lead, *nil;* zinc, 2.5 per cent.

About 600 feet north-east of the upper end of the vein a crosscut tunnel was started by A. B. Trites several years ago, when he had an option on the property. The tunnel is now 200 feet long and is expected to hit No. 2 vein (which was not examined) within about 25 feet.

It will be necessary to drive the tunnel another 550 feet to reach the main vein at this level, as the vein dips away from the tunnel at about 60° or 70°.

A short distance below the camp are a number of big iron-stained croppings which have not been thoroughly prospected.

L. & L. Consolidated Mines, Ltd.

This company represents a consolidation of the L. & L. Glacier Creek Mines, Limited, and the Rush Columbia Mines, Limited. The company's holdings consist of fourteen claims, stretching from the North fork of Glacier creek to and beyond the Middle fork. In the past a considerable amount of underground work had been done in a narrow vein in greenstones, outcropping near the tip of the North Fork glacier, on the south side of the creek. These workings consist of drifts on two levels and a connecting raise, and although narrow stringers of high-grade ore were found the lenses were not sufficiently large to be commercial.

During 1928 work has been confined to a vein which outcrops on the south side of the Middle fork of Glacier creek, directly across from the old *Rush Columbia* cabin. The cabin is about 4 miles by trail from the *Dunwell* mill and at an elevation of about 2,250 feet. Two tunnels have been driven on the vein. The upper tunnel, about 400 feet above the cabin, is 300 feet long, the first 50 feet being a diagonal crosscut to the vein and the remaining 250 feet a drift on the vein. Three short crosscuts have been driven into the foot-wall. The drift picked up a few lenses of good-looking ore up to 3 feet wide, but unfortunately the lenses are not sufficiently high grade to be shipping-ore and are too small and too far apart to make a milling-ore. Values are in silver, zinc, and lead chiefly.

The second tunnel is about 175 feet below the first and was over 100 feet long at the time of examination. The first part of this is also a diagonal crosscut and the remainder a drift. Nothing had been found in the drift but massive pyrite, which unfortunately does not carry commercial values.

The vein is a strong one, striking north-east, south-west, and dipping at about 80° north-west. It is unfortunate that better results have not been obtained to date, but it is understood that work is to be continued on the lower tunnel throughout the winter.

Black Hill Mining Co.

This company was incorporated in 1925 to acquire and develop a consolidation of claims situated at the head of the South fork of Glacier creek. The authorized capitalization is $1,500,000, divided into 6,000,000 shares of the par value of 25 cents each. The Bitter Creek Mining Company is to acquire shares in the Black Hill Company for money spent on the property. All of the unissued treasury stock, amounting to 4,000,000, may be taken up by the Bitter Creek Mines under the terms of the option.

The property of the Black Hill Company was not examined, as nothing had been done on the property till late in the fall. The following information is quoted from a report by the firm of R. H. Stewart, H. L. Batten, and associates for the Bitter Creek Company:—

"*Location.*

"This group of claims consists of the consolidation of two groups known as the *Black Hill* group and the *Nellie W.* and *May* group. These groups partially overlap and the full number of claims consist of the *Black Hill Nos. 1, 2, 3, 4*, the *White Silver Nos. 1* and *2*, the *Nellie W. Nos. 1* and *2*, and the *May Nos. 1, 2, 3*, and *4*. They are located at the head of the South fork of Glacier creek below the glacier. This group is a relocation, in part, of the old *Excelsior* group.

"*History.*

"The old *Excelsior* claims, two in the group, were staked many years ago.

"The *Black Hill* group, adjoining these claims and in part overlapping, was staked by John Haahti in 1926. Mr. Haahti sold a one-quarter interest in these claims in 1927 to a Mr. Pedersen.

"The *Nellie W.* and *May* groups were staked in the early part of this year, 1928, by Messrs. Tomie and Haugh over the old *Excelsior* group, the latter having been run out.

"Messrs. Tomie and Haugh gave an option on this latter group to Messrs. Pedersen and Harner. These men did some work on the property and some trail-work. A preliminary survey showed considerable overlap and cutting-up of these two groups, the *Nellie* and the *Black Hill*.

"Arrangements were made to form a company to consolidate all interests and this was therefore done, the company being called the Black Hill Mining Company.

"*Transportation.*

"This property is about 12 miles from Stewart. Four miles of this distance is covered by a good road as far as the *Dunwell* mill. From there a pack-trail is complete to within about a mile of the property. This trail will have to be completed at the earliest moment.

"There is a good grade all the way and this trail could very easily be converted into a wagon-road, and arrangements should be made to do this after a small amount of preliminary work on the property has been done.

"*Geology.*

"The geology of the property is well shown up as there is very little overburden. The oldest rocks in the district are shown here as remnants. These rocks are slates or argillites and have been intruded and thrust up at steep angles by an intrusion of augite porphyrite. There are at one or two places apparent remnants of the Bear River greenstones, which probably occur to the east of this property in greater quantity.

"There have been at least two periods of quartz intrusion. These occur along the two series of fractures lying at about right angles to each other. The north-south fractures have been intruded by a series of quartz veins carrying massive galena, zinc, and massive grey copper with a fairly high silver content.

"The east-west veins vary in width, but many of them are up to 6 and 8 inches wide. They have been slightly mineralized with galena, sphalerite, and grey copper and also by chalcopyrite. The mineral in the north-south veins is in many places almost solid sulphides in massive form. The veins do not average more than about 10 inches to 1 foot in width.

"There is no place where an intersection of these two series of veins had been opened up, and the intersections of these veins offer an attractive possibility on the property. Should the higher grade, north-south vein system have been the latter, or at least have come in after the larger east-west veins, there is a good possibility that the mineralization at the intersections of the two sets of veins will be sufficient to warrant mining both sets of veins at these points.

"*Development.*

"Most of the development-work has been confined to surface-stripping and there are only two short tunnels on the property.

"The No. 1 vein was not seen, but some of the ore which was reported to come from this vein was examined by the writer. No. 1 vein is said to resemble the other veins described below, except that there has been deposition of chalcopyrite in a general shear-zone alongside the other vein.

"No. 2 vein has been stripped for a distance of about 40 feet and shows strongly throughout. This vein averages about 8 to 10 inches in width and the vein-filling across this width is almost solid sulphides, galena, sphalerite, and grey copper.

"No. 3 vein has been stripped for about 30 feet and also has a drift 36 feet in length. This work shows the vein to be continuous and strong throughout and to average from 8 to 14 inches of solid sulphides.

"No. 4 vein has been traced by stripping for a distance of 69 feet. The vein, showing gold sulphides, averages about 1 foot in width, but fracturing has occurred over a width of 2½ feet with some mineralization.

"No. 5 vein averages, where opened up, about 8 inches in width. It has been traced definitely for about 50 feet with stripping and the vein may possibly be visible on the surface over a much greater length, although this is not certain.

"No. 6 vein is not very well exposed, but appears to have the same general characteristics as the other veins.

"Samples from these several veins are recorded in the tabulation at the end of this report.

"The owners have started a small tunnel to tap the No. 1 vein and have advanced this about 30 feet. They have about another 30 feet to go to pick up this vein.

"*Record of Samples taken.*

Sample No.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz.	Oz.	Per Cent.	Per Cent.	Per Cent.
130	Trace	378.0	0.8	16.5	14.5
131	Trace	126.0	Trace	17.5	35.2
132	Trace	124.0	Trace	36.0	33.0
133	Trace	144.0	0.2	11.4	15.4
134	0.02	60.5	0.1	11.2	15.4
135	0.02	29.0	Trace	12.0	33.0

"*Location of Samples.*

"130. No. 5 vein, chip sample over 6 inches.

"131. No. 5 vein, sample of ore from dump near cut in vein.

"132. No. 3 vein, chip sample over 4 inches. This sample is taken about 25 feet along the vein from sample 130.

"133. No. 3 vein, chip sample over 8 inches at face of tunnel, 36 feet from collar.

"134. No. 3 vein, general sample from collar of drift in vein about 1 foot wide.

"135. No. 6 vein, specimen sample not taken for its mineral content, but is fairly representative of the vein, which is about 2 feet wide at this point. This may be at the intersection of one of the east-west veins as there was poor definition."

Dunwell Mines, Ltd.

The company was incorporated in 1922 as a specially limited reorganization of the Nass River Lands, Limited, which was incorporated in 1913. The capitalization of the Dunwell Mines, Limited, was originally $350,000, but this was doubled in 1925 and further increased in 1926 to $1,000,000, divided into 1,000,000 shares of the par value of $1 each.

In 1928 all the known ore reserves were mined, and milled within a few months after the mill was completed. Surface work on the *Ben Ali* vein encouraged the belief that this vein might produce a considerable quantity of gold-copper ore, but underground developments proved to be very disappointing. Since it seemed to be the only possibility left on the property, a contract was let this past summer for driving another 100 feet on the vein, but this additional

work proved to be as disappointing as the earlier work. Later in the summer the whole Dunwell Company's area was investigated by the Radiore Company of Canada, Limited, by electrical prospecting, and it is said that the work is to be followed up with diamond-drilling next summer.

The company owns a fine new mill and a good mining plant which will probably be utilized by other properties in the district, if not by the Dunwell Mines, Limited.

Lakeview (Stewart, B.C.) Mines, Ltd.

This company, whose registered office is in the Pemberton Building, Victoria, has a capitalization of $1,000,000, divided into 4,000,000 shares of 25 cents par value. The holdings consist of four Crown-granted claims east of the *Dunwell*, at an elevation of 2,000 to 3,000 feet above sea-level. An excellent 4-foot trail on wagon-road grade has been constructed from the *Dunwell* to the *Lakeview* camp, a distance of about 2 miles. A description of the showings and plan of the principal workings is to be found in the Annual Report for 1925. No great amount of work has been done since that report was written, but a brief description of the showings is given below.

The main (or "cabin") vein outcrops in a creek-bed immediately south of the old camp at 2,250 feet elevation. Several years ago a section of this vein was stripped and a shaft sunk in the hanging-wall of the vein, but for some unknown reason the stripped section of the vein was covered over with trees and gravel and the vein was not broken into from the shaft at any point. This year the shaft was unwatered and crosscuts were driven back to the vein at depths of 25 to 45 feet from the collar. The upper crosscut found good-looking ore consisting of galena, sphalerite, chalcopyrite, and pyrite, but the vein is not so well mineralized at the lower crosscut. About three years ago a long crosscut was driven to cut the vein at a depth of about 250 feet below the collar of the shaft. A narrow vein was cut at 180 feet from the portal, and a vein, believed to be the cabin vein, was cut at 750 feet from the portal. A total of 175 feet of drifting was done on this vein, finding a number of lenses of silver-lead ore.

Approximately 500 feet east-south-east of the first shaft mentioned is a second shaft, believed to be on the same vein. This is connected with a very shallow crosscut and drift, which expose a lens of milling-grade ore 8 to 10 feet wide and up to 60 feet long. About 300 feet south of the shaft, and 100 feet below it in elevation, is the portal of a tunnel which runs due north for over 200 feet, more or less along the vein, and then north-westerly along the vein for more than 300 feet. This north-westerly section of the working went through a 60-foot lens of fair-grade material. A 25-foot raise driven this year at the south-east end of the ore-shoot encountered low-grade material, and a winze, a little farther along the drift, was in fairly good material for 20 feet. This drift, if continued 300 feet, would be under No. 1 shaft.

During the summer a considerable amount of surface work was done on two or three new veins, but at no point were encouraging values found.

The property is well situated and well equipped with machinery and buildings. The lens of ore near No. 1 shaft would seem to warrant further investigation, for it is said to be of shipping grade and to have a width of 4 or 5 feet.

The crosscut at 250 feet depth does not prove a great deal, as the ore-shoot may plunge either east or west and may have been missed by the working. Before anything could be done underground it would be necessary to clean off the surface and determine the length and values in the ore-shoot.

Mayflower Mining Co., Ltd. (N.P.L.).

This company, with registered office in the Beaman Building, Stewart, was incorporated in March, 1928, to acquire the *Mayflower* group of claims, consisting of the *Tyee*, *Mayflower*, *Mayflower Fraction*, *Mayflower 2*, *3*, and *4*, and the *Alice Nos. 1*, *2*, *3*, and *4* claims. The group is approximately 5 miles from Stewart, on the east side of the Bear River valley. The cabin and showings are at about 300 feet elevation and are reached by a trail which leaves the road into the *Ben Ali* showings of the *Dunwell* property, a hundred yards or so before the road reaches the small creek flowing along the foot of the mountain.

The main showing is a vein in the small stock of granitic material which contains the *Ben Ali* vein of the *Dunwell* property. Both veins are shear-zones in the granitic material, mineralized with quartz, pyrite, and chalcopyrite, and both are known to contain gold values. The *Mayflower* vein on the *Tyee* claim strikes north-west and dips at 65° to 70° north-east. It is exposed just behind the cabin for a distance of 50 feet or less. In the northerly cut it is about 12 feet wide. A shaft, now filled with water, has been sunk on the vein at the southerly cut,

leaving exposed only about 3 feet of the hanging-wall section of the vein. A sample of this 3 feet assayed: Gold, trace; silver, 3.2 oz. to the ton; copper, 1 per cent.

A few feet below camp elevation, in a small creek-bed, is the portal of a 120-foot crosscut tunnel driven towards the vein. Between 27 and 30 feet from the face is a well-mineralized vein, from which a 3-foot sample, taken along the south wall of the crosscut, assayed: Gold, 0.14 oz. to the ton; silver, 1.1 oz. to the ton; copper, trace. Near the face a small stringer was found drifted on to the right in a S. 60° E. direction for 21 feet. A third small vein was cut at the portal of the tunnel.

The samples taken show that gold is found in the vein in encouraging amounts, and it is possible that further exploration might discover better values than are recorded here. Some high gold values are reported from this zone in previous Annual Reports.

Stewart Central Mines, Ltd.

This company was incorporated in June, 1924, with a capitalization of $250,000, divided into 1,000,000 shares of the par value of 25 cents each. The registered office is in the Central Building, Victoria, but the work on the property this year was directed by L. S. Davidson, of Stewart. The holdings consist of ten claims on the south side of Bitter creek, about 2 miles above the bridge. Time could not be found to examine the property this year, but it is understood that the showings are quite promising and worth investigating.

Radio-Stewart Mines, Ltd.

The Radio-Stewart Mines, Limited, was incorporated in 1924 with a capitalization of $1,000,000, divided into 1,000,000 shares of the par value of $1 each. The registered office of the company is in the Central Building, Victoria. The company's holdings consist of the *Radio* group of six claims—*Radio*, *Radio Nos. 1*, *2*, and *3*, *Radio Fraction*, and *Creek*—situated on the north side of Bitter creek, about 3½ miles from the Bitter Creek bridge. The claims cover a strip of the mountain, one claim wide, between elevations of about 750 and 5,000 feet. The Radio-Stewart trail leaves the main Bitter Creek trail about 3½ miles from the Bitter Creek bridge. The main camp is at about 900 feet elevation. Just west of the camp are some cuts in a ledge said to contain values in copper and lead. Nothing was being done on these showings and they were not examined, but a description of them is to be found in the 1925 Annual Report.

Work this year was being done on a group of showings in a gulch at 4,200 feet elevation. On the east side of the gulch is a 1-foot vein in argillites, striking a little west of north, or nearly straight across the contour of the hill. On one wall of the vein is 1 inch of fine-grained galena; the remaining section of the vein is silicified argillites mineralized with occasional specks of galena and sphalerite.

On the opposite side of the creek is a cut, 10 feet wide and 10 feet deep at the face, exposing a wide ledge in the argillites. This ledge strikes in an east-west direction and dips steeply to the south. The foot-wall, 2½ feet, consists of vein quartz and fragments of argillites mineralized with small amounts of sphalerite and pyrite. The remainder of the vein consists of fractured and sheared argillites cut by quartz stringers, together with fragments of a dyke, and lenses of quartz. A sample across the 2½ feet on the foot-wall assayed: Gold, 0.6 oz. to the ton; silver, 1.4 oz. to the ton. About 50 feet easterly similar material may be seen in another shallow cut. North of the big cut is a short hanging-wall lens making away from the vein at a small angle. About 25 feet in elevation above the big cut is an old tunnel, about 75 feet long, which follows the hanging-wall of the shear-zone for about 50 feet, and then turns to the left to pick up a hanging-wall quartz-lens outcropping a few feet south of the big cut.

Mayou Gold Copper Co., Ltd. (N.P.L.).

This company was incorporated on March 16th, 1928, with a capitalization of $1,000,000, divided into 4,000,000 shares of the par value of 25 cents each. The registered office is in Stewart. According to the prospectus of the company, it has an option to purchase the *Mayou* group of claims—namely, *Mayou Nos. 1* to *5*—for an allotment of shares, but it is understood that the *Morgan*, *Ophir*, and *Alberta* groups have been added to the company's holdings. The property is situated on the north side of Bitter creek, above and on either side of the Radio-Stewart. The trail is a continuation of the Radio-Stewart trail. No permanent camp has been built, but there is a good camp-site at timber-line, at 4,000 feet elevation. The summer's work was done from a tent camp at 5,300 feet elevation.

The showings may be divided into three main groups, only two of which were examined. The showings not examined are west of the first big gulch coming into Bitter creek from the

north, and are said to consist of greenstone mineralized with galena. These should be examined from the *Ore Mountain* side of the hill.

The second group of showings consist of a number of galena-showings in argillites. In the big gulch mentioned, at 4,600 feet elevation, are two or three galena veins associated with narrow dykes. One of these has been broken into at two or three points, showing it to be about 4 feet wide, and consisting of sheared argillites with some quartz, and lenses of galena, sphalerite, and grey copper on the walls. A 4-foot sample from the lower cut assayed: Silver, 2.2 oz. to the ton; lead, 2.2 per cent. About 2,500 feet east of this spot, at 5,200 feet elevation, are two outcrops of a vein which is said to line up with the "tunnel vein" on the Radio-Stewart ground. (The "tunnel vein" is the last vein described under "Radio-Stewart" above.) It is apparently a parallel vein, if not the same vein, but nothing has been done on it on the *Mayou* ground.

The third group of showings are approximately 2,500 feet east of the "tunnel vein," and consists of two or more zones in argillites, mineralized with small amounts of quartz, calcite, iron carbonate, and chalcopyrite. A series of four cuts have been made up the hill in a northwesterly direction, between elevations of 5,400 and 5,700 feet, presumably on one zone. About 150 feet from this zone, at 5,400 feet elevation, is a cut on what is taken to be a parallel zone, but the mineralization is not very pronounced and the attitude of the mineral-zone is not apparent. The lowest cut on the main zone exposes 12 to 15 feet of altered argillites containing a number of seams of quartz and oxidized material, having an aggregate width of probably 2 feet. The second cut on this zone, at 5,490 feet elevation, exposes similar material. A few grains of chalcopyrite can be found in the argillites and a number of small strikes and patches of iron oxide are found in the bottom of the cut. No small amount of this iron oxide is an oxidation product of iron carbonate, and not of chalcopyrite, as has been assumed. Another 100 feet higher is cut No. 3, exposing a 6-foot shear-zone in argillites. At the bottom of the cut the aggregate width of iron oxide, stained with copper carbonate, is about 4 inches. The remainder is essentially barren argillites. At the top of the cut there is possibly 18 inches of quartz with chalcopyrite. At 5,700 feet elevation is a cut showing material similar to that in cut No. 2.

Midway in elevation between cuts Nos. 1 and 2, but to the left of the line between the cuts, is an open-cut on a prominent quartz vein, about 3 feet wide, containing a small amount of chalcopyrite. One section of the cut, 1 foot wide, consists of iron oxide only and probably will give place to sulphides as the cut is deepened.

Bitter Creek Mines, Ltd.

The Bitter Creek Mines, Limited, was incorporated in 1928 with a capitalization of $1,500,000, divided into 3,000,000 shares of the par value of 50 cents each, to acquire and develop the *L.L. & H.* group of claims situated on the South fork of Bitter creek. The holdings consist of ten claims, as follows: *Fidelity*, *Fidelity Nos. 1* to *8*, and *H.C.H.*

The Marmot Metal Company took an option on a large block of the treasury shares of the Bitter Creek Mines and started work on the property late in the fall of 1928, driving about 32 feet of tunnel before being forced out for the winter. The property was not examined by the Resident Engineer. The following paragraphs are from a report on the property by the firm of R. H. Stewart, H. L. Batten, and associates for the Marmot Metals Company:—

"*Geology.*

"The mineral-showings on this property are located along silicified argillite-greenstone contacts. The argillites are in bands, it appears, and in some places are mineralized with pyrite over quite considerable areas. The greenstones occur as sills or dykes in the slates. The whole of the above formation has been intruded by an augite porphyrite which is seen in mass along the north side of Hartley gulch. There has been considerable silicification and mineralization along the contacts between the greenstone and argillite.

"The general strike of the argillites is N. 75° W. and the dip is 45° to the north. The bands of greenstone lie in the same general direction.

"There have been considerable faulting and fracturing both along and across the formation.

"*Development.*

"The development which had been done previous to the present year consists of two drifts. These are really crosscuts across a mineralized and silicified zone in the greenstones. This work was sampled by the present management and the results are tabulated at the end of this report.

There are some additional cuts put in on this same zone about 500 feet east from the tunnels, and these cuts were also sampled and the results are shown. This work has shown a mineralized zone over a considerable width, one section, about 12 feet wide, carrying values bordering on the commercial.*

"The prospecting this year disclosed a very prominent fault-zone. This zone has heavy gouge in two sections and shows shearing over about 6 feet. At three points in this zone, galena carrying grey copper which shows good silver values was located over a distance of 700 feet. This fault lies in a very dangerous place to work and open-cuts could not be put in to advantage. It was therefore decided to drift on the fault-zone and 32 feet was advanced this fall in what is shown as tunnel No. 2. Weather conditions prevented any further work.

"The drifting this year did not get out of oxidized material and did not get away from the slates and into the greenstone, where the best values were encountered on the surface."

Lucky Date. This group, owned by McInnes, Younkin & McFadden, all of Stewart, is situated near the head of the North fork of Bitter creek, about 7 miles by trail from the Bitter Creek bridge. The group is supposed to consist of eight claims—*Lucky Date Nos. 1* to *8*—but to forestall certain "fraction hounds" who have been infesting the district ten fractional claims were staked over the eight full claims. The owners brushed out and relocated parts of the North Fork trail and built a new trail into the West branch of the North fork, where some work was done from a tent camp. The main camp, a log cabin, is situated a short distance below branches of the North fork of Bitter creek, on the east side of the stream.

Owing to a misunderstanding as to the position of the upper camp and showings, and because of the illness of one of the partners, I was unable to examine the property. An engineer who did examine it claims the showings are well worth investigating.

Ore Mountain Mining Co., Ltd. This company was incorporated in December, 1924, with a capitalization of $1,000,000, divided into 1,000,000 shares of the par value of $1 each. The registered office is in the Pemberton Building, Victoria. The company's holdings consist of six claims situated on the east side of Bear river, just north of Bitter creek. An excellent cabin has been built on the claim near the principal showings, at an elevation of 3,400 feet. It is reached by a good pack-trail leaving the Bear River road a short distance north of Bear lake.

The vein, which has received the greatest amount of attention in the past, outcrops along a small ridge running nearly parallel to the hillside directly in front of the cabin. A section of the vein near the cabin has been opened by a series of trenches for a distance of 400 or 500 feet, and one cut has been made along the strike of the same zone, several hundred feet northerly, near the junction of the *Little Wonder* and *Ore Mountain* trails. The vein outcrops in argillites and is associated with a number of fine-grained acidic dykes. The strike is N. 25° W. (mag.) and the dip is apparently steep to the south-east. The section of the vein near the cabin contains considerable pyrrhotite, with arsenopyrite and variable but small amounts of sphalerite, galena, and chalcopyrite. In the northerly cut sphalerite is the principal sulphide, but the vein has not been opened sufficiently at this point to determine the strength of the mineralization.

Two crosscuts have been driven to the cabin section of the vein. One has been driven from the easterly side of the small ridge on which the vein outcrops, about 100 feet from the south end of the vein, at a depth of 25 feet below the outcrop. A zone of slightly mineralized argillites was cut at 30 to 50 feet from the portal. A chip sample along the north wall assayed: Gold, trace; silver, 0.2 oz. to the ton. The second tunnel was driven from the westerly side of the ridge and was expected to cut the vein just north of the cabin, at a depth of 125 feet, but although the tunnel is 380 feet long, and is said to have been driven beyond the projected position of the vein, no indication of the vein has been found. A working has been started to the right, at 40 to 45 feet from the face, to get below a stronger section of the vein. It would seem from the evidence in the tunnel that the argillites, occurring as alternating bands with the greenstones, dip into the hill, although the vein itself appears to dip in the opposite direction.

About 1,000 feet above the camp are two parallel veins, 50 feet apart, striking N. 70° W. (mag.) and standing about vertical. The veins are in greenstones and consist of 1 to 2 feet of quartz containing, in places, bunches of galena. A 70-foot tunnel has been driven along the westerly vein, starting on a lens of quartz 1 foot wide.

* Values referred to are from $3 to $4 in gold, with a little silver, lead, and zinc.

Approximately 250 feet higher up the hill a pit has been sunk beside a dyke in a band of sheared argillites, which contain lenses of galena. A little farther south, and on the opposite (westerly) side of the dyke, is another pit in highly fractured argillites. Quite a bit of galena is lying on the dump, but very little is shown in the bottom of the pit. It is possible that a better concentration of sulphides may be found at other points along the dyke, or near some other one of the numerous dykes cutting the argillites.

About two claim-lengths north of the camp, at an elevation of 3,900 feet, is a cut in a vein, striking N. 65° to 70° W. (mag.) and dipping steeply to the south. The vein, which is a fracture-zone from 4 to 5 feet wide, contains 1 to 2 feet of quartz mineralized with pyrite and arseno-pyrite. Values of $8.80 in gold and 2 oz. in silver are reported from this cut.

Little Wonder.

This group of claims, owned by Hunter & Suppelsa, of Stewart, adjoins the *Ore Mountain* property on the north. The trail follows the *Ore Mountain* trail to 3,000 feet elevation; then swings to the left, reaching the camp at 3,900 feet elevation. The camp consists of a small but substantial log cabin, recently constructed.

The showings so far discovered consist of two north-westerly-striking mineral-zones, about 300 feet apart, and two or more smaller north-south veins. The main north-westerly zone outcrops for a distance of several hundred feet, either in or immediately south of the creek that flows by the cabin. The lowermost cut on this zone is a short distance up-stream from the cabin and at about the same elevation. In this cut the zone consists of 4½ feet of highly silicified material containing a small amount of pyrite; then 1 to 2 feet of fractured argillites and stringers of quartz and galena; followed by 4 feet of fractured argillites, with a little quartz and no galena. The vein at this point dips 45° to 50° south-west. The first of the north-south veins outcrops directly across the creek from this cut. It lies in fractured argillites along a fine-grained acidic dyke and consists of a silicified zone, 2 feet wide, mineralized with pyrite, sphalerite, and a little galena and tetrahedrite.

The main north-west zone, a short distance above the lowest cut, is right in the creek-channel and cannot be prospected or examined. This is unfortunate, for many of the boulders in the creek at this point contain considerable amounts of galena, which is said to run high in silver. The galena occurs in a sheared crystalline rock and not in argillites. A short distance farther along, on the south wall of the creek, above a band of argillites, is a broad zone of highly altered and pyritized crystalline rocks, running about parallel to the creek. A tunnel has been faced off in this at a point opposite the second north-south vein. A lens of lead and zinc sulphides had been found above the tunnel, but the face of the tunnel shows nothing but the silicified and pyritized rock. A 5-foot sample from the face assayed: Gold, trace; silver, 0.2 oz. to the ton.

About 300 feet southerly is a cut in the second north-west zone. The cut exposes several feet of silicified and mineralized greenstone impregnated with pyrite. The zone has been prospected very little, but indications of it can be found at a few points along the surface towards the cabin.

The *Little Wonder* ground seems to be well mineralized and is deserving of further prospecting.

Dalhousie Mining Co., Ltd.

The Dalhousie Mining Company, Limited, was incorporated in 1925 with a capitalization of $1,000,000, divided into 1,000,000 shares, but since then the capitalization has been increased to $2,000,000. The registered office is in the Permanent Loan Building, Victoria. The company's holdings in the Portland Canal section consist of the *Dalhousie* and *Rock of Ages* groups, each of eight claims, situated on the west side of Bear river, about 9 miles from Stewart. A good frame camp has been built on a bench at 2,700 feet elevation.

The surface showings are described in the 1927 Annual Report. Mineralized outcrops had been found at a number of places on the hillside and some of these contained decidedly encouraging amounts of copper and gold, but this year's work appears to have demonstrated that these mineralized zones are very short and do not occur along any defined structure. This lack of structural control of the deposits would make it extremely difficult and expensive to locate other lenses underground. Such being the case, it is doubtful if the deposits are commercially important, as far as indicated by the present development.

The Dalhousie Company has secured options on the *Homeguard* group, Alice Arm, and, I believe, on other properties not in No. 1 District, thus giving the shareholders every opportunity of realizing on their investment. The *Homeguard* group is mentioned elsewhere in this report.

A. and T.

This group of eighteen claims, owned by Armstrong, Tooth & Howse, of Stewart, is situated on the west side of Bear River valley, south of Goose creek. The showings examined are at about 2,500 feet elevation in the canyon of the First West fork of Goose creek. They are reached by a poor foot-trail which leaves the *Independence* trail a short distance below the point where the latter crosses Goose creek.

A very conspicuous iron-stained zone outcrops at about 2,400 feet elevation, in the centre of the creek canyon mentioned above. This is up to 100 feet wide and consists of a soft sericitic schist containing a little pyrite, and a silicified zone, only slightly discoloured, mineralized with pyrite and chalcopyrite. No work has been done on this zone up to the time of examination.

On the northerly side of the canyon, at 2,500 feet elevation, is a narrow but pronounced shear-zone, striking about north-south and dipping steeply to the west into the hill. At the point where this is intersected by a less pronounced cross-shear about 8 feet of good-looking copper ore has been developed. North of the intersection the mineralization dies out rapidly and is cut off completely by a granitic dyke within 50 feet. It is said that new cuts south of the intersection found good ore, but it cannot go more than about 100 feet in this direction before being cut off by another wide granitic dyke. The cross-zone is mineralized for some distance below the intersection.

A sample, 9 feet long, representing a vein-width of 5½ feet, near the intersection of the two shear-zones, assayed: Gold, 0.02 oz. to the ton; silver, 8.6 oz. to the ton; copper, 4.6 per cent. The next 3 to 4 feet of the vein would assay 2.5 to 3 per cent. copper. Other samples taken from these cuts have given good gold values.

The shear-zone forming the hanging-wall of the lens cuts through the granitic dyke to the south and apparently extends on up the mountain for a considerable distance. On the strike of it, near the head of the canyon, can be seen iron-stained bluffs. In view of the good copper-showings lower down on the same fracture, the upper end offers attractive prospecting possibilities. Nothing had been done on the upper showings at the time the property was visited and they were not examined.

Independence Gold Mining Co., Ltd.

This company was incorporated in 1924 with a capitalization of $1,500,000, but it is understood that the capitalization has been increased to $3,500,000, divided into 3,250,000 common and 250,000 8-per-cent. preferred shares, the par value in each case being $1. The company's holdings consist of a large block of claims on the north side of Goose creek, about 12 miles from Stewart. The Revenue Mining Company has an option on control of the property and has done a considerable amount of diamond-drilling and underground work during 1928.

The showing on the *Independence* consists of a series of mineralized zones, in greenstone-bands of variable widths, lying between a number of large granitic dykes which cross the country in a north-westerly direction. Values are in silver and zinc chiefly, but the grade of the material as developed to date is low. The principal surface showing on No. 1 vein is in an open-cut about 900 feet north of the cabin, at an elevation of 3,250 feet. Samples over a width of 6 feet in this cut assay as high as 10 oz. in silver, with negligible amounts in other values. A tunnel has been driven along this zone for a distance of more than 500 feet, starting from a point about 400 feet south-east of the cut and 300 feet vertically below it. The first half of the tunnel is in barren greenstone, but some mineralization is found near the collar of the tunnel, and again in a crosscut about half along the tunnel, suggesting that the mineralized zone may be continuous from the portal to the face. Crosscuts, about vertically below the surface cut, show mineralization over a width of 20 feet, but the values are not commercial. It is understood that this zone has been diamond-drilled during the past season by the Revenue Mining Company and that the results were sufficiently encouraging to warrant further underground exploration; consequently a new tunnel is being driven at an additional depth of 190 feet. At the end of 1928 this had been driven about 700 feet and crosscuts were being started towards the mineralized zone.

No. 2 vein outcrops a short distance north of No. 1 vein, but no great amount of work has been done on it.

Nos. 3 and 4 veins outcrop in a creek-canyon several hundred feet north-east of No. 1 vein. They are mineralized zones in greenstones, separated by a granitic dyke. One of the veins contains a lens of massive lead and zinc sulphides, and bunches of sulphides are scattered throughout the other vein.

A fifth vein, known as the "bunk-house vein," is exposed in a few cuts about 600 feet north-west of the cabin. It is similar to the others, consisting of a low-grade mineralization in greenstones.

It is understood that Revenue Company plans to work on the property all winter. Sam Fitzgerald, one of the locators, is in charge of operations.

Terminus Mines, Ltd.

This company was incorporated in 1924 with a capitalization of $1,000,000, divided into 1,000,000 shares of the par value of $1 each. The registered office of the company is at 711 Fort Street, Victoria. The company's holdings consist of the *Terminus* group of six claims, situated on the east side of American creek, between elevations of 3,000 and 4,100 feet. The camp, a two-story frame building, is about 18 to 20 miles from Stewart and a little over 4 miles by trail from the end of the Bear River road. The showings are described in some detail in the 1927 Annual Report.

The principal working is a crosscut tunnel at 3,940 feet elevation, cutting a narrow high-grade vein at a depth of about 100 feet below the outcrop. A small amount of ore has been mined from a short drift to the left of the crosscut, and a raise from a drift to the right of the crosscut connects with a sub-level previously driven from the bottom of a 50-foot shaft. The vein on the main level is a zone of intensely silicified material, containing a narrow lens of high-grade silver-lead ore. It strikes N. 30° to N. 55° W. (mag.) and dips 65° north-east.

About 250 feet south of the main vein is a second mineralized zone, known as the "big ledge." A small amount of surface work has been done on this, several hundred feet south of the shaft, where the vein consists of massive quartz and barite, mineralized with small amounts of sphalerite and galena. During 1928 the main crosscut was continued to explore this vein, and had been advanced a distance of 210 feet at the time the property was examined on August 18th and had cut approximately 20 feet of the "big ledge." This consists of 2 feet of quartz carrying one stringer of galena, followed by more or less sheared and silicified greenstone containing occasional stringers of quartz and calcite. It is understood that the crosscut was to be continued to still another vein and that a drift is to be driven along the hanging-wall sections of the "big ledge."

Heywood Mining and Development Co., Ltd. (N.P.L.).

This company was incorporated early in 1928 with a capitalization of $1,000,000, divided into 4,000,000 shares of the par value of 25 cents each. It has acquired fourteen claims—*T. Nos. 1* to *8* and *F. Nos. 1* to *6*—from H. A. Heywood for a certain number of shares. The vendor's shares are to be placed in escrow for a period of two years. The claims are situated north of Basin creek, a stream flowing into American creek immediately north of the *Terminus*.

The claims were not staked till 1928 and consequently very little work has been done on them. It seems that pieces of silver-lead float had been found on the north side of Basin creek and the claims were staked to protect the ground while a search was being made for the source of the float. One man has been prospecting the ground during the past summer, but has not succeeded in locating anything of importance.

Anaconda.

This group of five claims—*Anaconda Nos. 1, 2, 4,* and *5* and *Anaconda Extension No. 3*—is situated in the upper part of Basin creek, about 2 miles north of the *Terminus*, and is owned by E. G. Raymond, of Seattle; A. L. Mark, of Los Angeles; and E. Davis, of Stewart. A trail has not been built into Basin creek as yet, the present route into the upper part of the creek being via the *Terminus* trail to the *Terminus* camp, and then east along the edge of the basin nearly to the glacier, from where one may enter the basin at almost any point.

The showings are in a narrow band of shales and limestones, which outcrop between bands of massive volcanic rocks at 4,700 feet elevation on the east side of the creek. The band strikes S. 25° E. (mag.) and dips 45° east into the hill. At one point along the top of the limestone-band is a cut exposing a zone, from 2 to 4 feet wide, mineralized with a very light-coloured sphalerite and a little galena. About 50 feet southerly along the limestone-band is a zone containing a little pyrite and a considerable amount of fibrous hornblende, and in a cut 150 feet northerly is a cross-fracture, up to 2 feet wide, mineralized with sphalerite and galena. The cross-fracture and mineralization is confined to the limestones and does not extend into the overlying volcanics, 10 feet above. It is possible that other sections of the limestone-band may contain important sulphide-deposits, but those which have been discovered are much too small to be commercial.

Other mineralized zones have been found in the greenstones below the tip of the Basin Creek glacier, but they have not been prospected and nothing is known of their extent or values.

Mountain Boy (Pat Daly Mining Co.).

This group of claims is situated on the west side of American creek, about 18 miles from Stewart, or 4 miles from the end of the Bear River road. The *Mountain Boy* trail branches from *Terminus* trail about 2 miles north of Bear river and, crossing American creek, follows a low timbered ridge paralleling the valley to the lower camp at 1,500 feet elevation. A trail leads from here across a low depression and up the steep side-hill to an upper camp near the old workings at 2,300 feet elevation.

The property was optioned in 1927 by William Tolan, of Stewart, and the Pat Daly Mining Company was later organized to carry on the development of the property. It is understood that this is being financed in Montreal.

Certain sections of the property had been explored a number of years ago, but no one, apparently, had located the source of the high-grade float which had been found when the property was staked over twenty years ago. The first concern this season was to locate the source of this high-grade float, and although the ground is exceedingly difficult to get over and is inaccessible in places, the prospectors investigated every gulch and hogsback until they found a vein containing lenses of very high-grade silver ore. This was at 2,800 feet elevation in the small steep canyon immediately south of the upper camp. The vein strikes S. 30° E. (mag.) and dips westerly into the hill at about 50°. It is up to 8 feet wide and consists of quartz and jasper chiefly, with some barite, reminding one of the silver veins in the upper Kitsault section of Alice Arm. The high-grade ore consists of bornite, chalcocite, and argentite, with copper carbonates and probably other silver minerals, and occurs as short lenses near faults or at points where the vein is fractured. The vein, a short distance south of "discovery," contains but a small amount of sulphide, but galena is conspicuous in the section north of "discovery."

A sample of the ore which was being sacked from two small open-cuts at "discovery" assayed over 1,700 oz. of silver to the ton, 5.5 per cent. copper, 2 per cent. lead, and *nil* in gold. A 26-inch sample from the hanging-wall of the vein a few feet south of "discovery" assayed: Gold, trace; silver, 2.6 oz. to the ton; and a sample of the remaining 4½ feet at the same point assayed: Gold, trace; silver, 4 oz. to the ton. A sample over a width of 26 inches in a cut on the hogsback immediately north of the canyon assayed: Gold, trace; silver, 20 oz. to the ton; lead, 6 per cent. This represents only a part of the vein and was taken to give some indication of the tenor of the lead ore. About 8 inches on the foot-wall at this point is similar in appearance to the real high-grade ore. For the next 75 feet north the vein carries about a foot of massive galena near the foot-wall. A sample taken across a width of 2½ feet, at a point about 200 feet north of the last point sampled, assayed: Gold, trace; silver, 4 oz. to the ton; lead, 5 per cent. Within 50 feet north of this again the vein pinches out, but it is said to come in again on the other side of the next little hogsback.

I have been informed by engineers who have spent several days on the property that other veins have been found farther up the hill, striking at an angle to the vein just described.

The old workings are on a parallel vein outcropping 500 feet in elevation below the new vein. The vein is up to 20 feet wide and can be seen running along the side-hill for a few hundred feet. A peculiar feature of this vein is that it spreads out against a north-south wall and terminates abruptly. This wall resembles the wall of a vein, but, apparently, it is not a plane along which the vein has been faulted, but is rather a pre-vein slip, or fault, against which the vein has been made. Other sections of the vein were not examined, as it was dangerous to attempt to follow the outcrop while men were working in the cliffs above. Some underground work was done on the north end of the vein in 1910. (*See* plan, 1919 Annual Report.)

Other old workings on the property were not examined. The following descriptions of these are from the 1910 Annual Report:—

"On the *Hard Nut* a tunnel had been driven in about 70 feet on a zone of mineralization about 11 feet 6 inches wide, and somewhat similar in character to the *Mountain Boy*.

"On the *Northern Belle*, in No. 1 tunnel the mineralized body of quartz with galena is about 18 feet wide, and the tunnel and drifts measure about 32 feet. A sample of the galena ore from this tunnel assayed: Gold, trace; silver, 2.8 oz. to the ton; lead, 52.5 per cent."

Rufus Argenta Mines, Ltd.

This company was incorporated in February, 1928, with a capitalization of $3,000,000, divided into 3,000,000 shares of the par value of $1 each. The company represents a consolidation of the Rufus Silver-Lead Mines, Limited, and the Argenta Mines, Limited. The company's holdings consist of a large block of surveyed claims situated on the north side of the upper Bear River valley, about 20

miles from Stewart. The old *Rufus* ground occupies an area west of Erickson creek, while the old *Argenta* holdings extend from Erickson creek east as far as the *Red Top* group. Two good camps have been built on the west side of the creek, one a short distance above the river and the other up near timber-line. It is understood that a new camp was to be built on the *Argenta* ground, where a tunnel is to be driven during the winter. The property was optioned late in the summer to J. F. Duthie, of Seattle, who has been exploring the property since that time.

On September 10th a diamond-drill hole was started towards the Erickson vein, but owing to weather conditions the hole had to be abandoned before it reached its objective. Preparations were also being made to start a crosscut towards the most easterly exposure of the Erickson vein on *Argenta* ground. It is questionable if the Erickson vein on the *Argenta* is the same as the Erickson vein on *Rufus* ground, but that is not a matter of particular importance at the present time.

The most westerly exposure on the *Argenta* section of the vein is at an elevation of about 3,300 feet near the north-west corner of *Vetron No. 3* claim, approximately 1 mile east of the upper camp. At this point the vein appears to be a bedded vein outcropping on the upper side of a series of finely bedded tuffs and tufaceous argillites below more massive volcanic rocks of the Bear River formation. It is approximately 2 feet wide and consists of silicified tuffs, mineralized with considerable hæmatite and some chalcopyrite.

A few more exposures are found at intervals within the next 1,500 feet east along the hillside, between elevations of 3,000 and 3,500 feet. At one or two points the showings are in massive volcanics and not in tuffs, suggesting that more than one mineralized zone may outcrop along the hillside. Nothing whatever has been done to explore the vein or improve the showings at any point, leaving much in doubt as to continuity, width, and values. The best section of the vein as exposed is at the east end, a few hundred feet east of the north-west corner of the *Vetron* claim. On the hanging-wall is a foot of good-looking copper ore, followed by about 3 feet of fine green tuff containing occasional narrow stringers of pyrite and chalcopyrite. Below this again is 20 feet of massive and somewhat silicified ground, mineralized with streaks and bunches of specular hæmatite and occasional grains of chalcopyrite. A 4-foot sample from the hanging-wall assayed: Gold, trace; silver, trace; copper, 3 per cent.

The strike of the vein is about east-west, or essentially parallel to the hillside, and the dip is north into the hill at angles varying between 45° and 90°.

Other veins, said to contain silver-lead ore, outcrop above timber-line, but weather conditions were such that it was impossible to examine the upper showings.

Red Top. This property, owned by J. Connors, James McNeil, and John McNeil, is situated on the north side of Bear river, about 7 miles beyond the end of the Bear River road, nearly opposite the *George Copper* property. The property consists of the *Red Top* group of seven claims—*Red Top, Red Top No. 1, Hector No. 1, Superior, Superior No. 1, Red Top Fraction*, and *Superior Fraction;* and the *Amazon* group of four claims—*Amazon* and *Amazon Nos. 1, 3,* and *4.* The *Red Top* group has been surveyed. A good horse-trail has been constructed to the camp, branching from the main Bear River trail a short distance beyond the point where it crosses to the north side of Bear river.

Showings near the camp consist of disseminated chalcopyrite in greenstones (*see* 1927 Annual Report), and others farther up the hill consist of a lead-zinc vein from 5 to 8 feet wide (*see* 1920 and 1925 Annual Reports). Prior to 1928 a 200-foot crosscut had been driven towards the lead-zinc vein at 3,500 feet elevation, and the face was said to be within 60 feet of the vein.

An option was taken on the property late in the summer and it is understood that the tunnel was continued to the vein. The results, apparently, were not very encouraging, for the work was suspended almost immediately.

George Gold Copper Mining Co., Ltd. This company was incorporated in 1925 with a capitalization of $1,500,000, divided into 1,500,000 shares of the par value of $1 each. The registered office is in the Pemberton Building, Victoria. The company's holdings consist of a large block of claims situated on the south side of Bear river, about 20 miles from Stewart, or 6 miles from the end of the Bear River road. The Consolidated Mining and Smelting Company of Canada has an option on 93 per cent. of the stock, under an agreement which gives the Consolidated control of the company for an expenditure of a certain specific amount. During the past two seasons the Consolidated has drilled several holes,

and it is understood that larger and more powerful drills are to be used next year, permitting the exploration of the vein at greater depths.

The showings consist of three veins outcropping between elevations of 4,300 and 4,800 feet in a series of gently dipping volcanic rocks. The Blue vein is a well-defined fissure from 3 to 10 feet wide, striking N. 70° E. (mag.) and dipping 65° south into the hill. It has been traced for a distance of 500 feet on the surface and averages about 2 per cent. copper and $2 in gold. Values in a short section near the west end will run up to 4 per cent. copper across the width of the vein. The Jasper vein is a foot-wall branch of the Blue vein, about 200 feet long and somewhat narrower and lower grade than the main vein. The White vein is a north-easterly-striking zone containing a number of stringers and bunches of chalcopyrite over a width of a score of feet or more. Some cuts in the zone contain 4 per cent. copper over widths of 10 feet, but other cuts are essentially barren. Gold values are generally lower than in the Blue vein, as arsenopyrite, the sulphide with which the gold is associated in the latter, occurs but sparingly in the White vein.

George Enterprise Mining Co., Ltd., (N.P.L.).

This company was incorporated in February, 1928, for the purpose of acquiring the *Enterprise* group of claims, situated near the head of the Bear River valley, about 23 miles from Stewart, but shortly after incorporation an adjoining group, the *Heather*, was secured for a cash and share consideration. The holdings now consist of twenty-one surveyed claims, which cross the valley from the ridge on the north side to about 4,500 feet elevation on the south side. The *Enterprise* showings are on the north side of the valley at an elevation of from 3,000 to 4,500 feet, and the *Heather* showings are on the opposite side of the valley, slightly north of the *Enterprise*, and at about the same elevation.

Prior to 1928 nothing whatever had been done on the *Heather* ground, so most of the summer was devoted to prospecting and digging into any zone or seam which offered the slightest possibility of containing sulphides. Near the middle of the *Heather No. 1* claim two east-west shear-zones were found and opened in a few places. These are up to 8 feet wide and are mineralized with pyrite, chalcopyrite, and an occasional bit of galena, in a gangue of quartz and calcite. Other less promising showings have been found at various places and a few areas showing some indications of copper mineralization have not been investigated at all thoroughly. It would seem that the *Heather* group is worth further prospecting, although up to the present time no commercial ore has been found on the property.

Showings on the north group of claims are more numerous, and some of them have sufficient indications of commercial possibilities to justify their further exploration and development, both by surface and underground workings. The lowest showing on the group was discovered this year, at 3,000 feet elevation, while widening one of the switchbacks on the trail. It consists of a fairly wide zone of greenstone, slightly mineralized with pyrite and chalcopyrite, and containing a 3-foot zone in which chalcopyrite is more concentrated. A tunnel has been driven under this showing for approximately 20 feet, but it has not been advanced far enough to reach the narrower band of better-grade material.

Approximately 850 feet north-east of the tunnel, and 500 feet above it in elevation, are some old workings in a zone containing a number of small showings of chalcopyrite. An old tunnel, driven years ago when the property was known as the *Lucky Frenchman* group, is about 100 feet long, and appeared to be essentially barren, until a systematic sampling disclosed the presence of 4 feet of material running $3.20 in gold and 2.1 per cent. copper at 35 feet from the portal. By prospecting on the surface immediately north of the tunnel a 5- or 6-foot vein was found, striking towards the ore in the tunnel. A 4-foot 10-inch sample from a cut 90 feet above the tunnel, and about 50 feet north of it, assayed: Gold, 0.80 oz. to the ton; silver, 2 oz. to the ton; copper, 2.3 per cent.

A drift was started along the vein from the tunnel, but within a few feet from the tunnel the vein was offset by a fault, and the faulted section of the vein had not been located by the end of the season. However, a crosscut to the left from the face of the drift, which is 50 feet long, is beginning to find a better mineralization, suggesting that the vein may be fairly close. The vein strikes N. 20° W. and dips very steeply to the north.

Approximately 300 feet north of these last-mentioned workings, and 200 feet above them, is a vein striking N. 78° W. and dipping 33° north. The east end of the vein is cut by another flat vein of similar character, striking N. 20° E. and dipping 30° south. The actual intersection of the two veins has not been exposed. Both veins contain a thick seam of gangue, usually

along the hanging-wall, and consist of highly altered volcanic breccia, mineralized with small bunches, stringers, and occasional grains of pyrite, tetrahedrite, galena, chalcopyrite, and sphalerite. Specimens of tetrahedrite assay high in silver, but none of the cuts to date has exposed a commercial grade of material.

On a fairly flat bench at 4,500 feet elevation are a number of outcroppings of leached and oxidized vein material, but these have not been broken into, except with a prospecting-pick.

A specimen of honeycombed quartz and pyrite from one of these outcroppings assayed 1.4 per cent. copper, suggesting that fair copper values might be found below the leached capping. It is expected that some work will be done on these showings next year.

Montreal. This group of eight claims—*Montreal Nos. 1* to 8—is situated about 27 miles from Stewart, on the north side of Strohn creek, which flows east into Meziadin lake from the Bear River-Nass divide. The group is owned by J. Douville, E. Bernardo, and partners, all of Stewart. A fair pack-trail has been built to a short distance beyond the divide, but the remaining section to the *Montreal* group and to Meziadin lake is poor and should be relocated. A good camp had been built on the property at 1,950 feet elevation, but it was destroyed by a bush fire early in the summer.

Outcropping on the east side of the creek flowing by the camp, at 2,100 feet elevation, is a wide silicified zone in greenstone, striking a little east of north and dipping, apparently, at a steep angle to the west. The zone is slightly mineralized with pyrite and sphalerite and contains occasional stringers of galena. At the creek elevation it is about 30 feet wide, but a short distance uphill it seems to be much narrower. A 45-foot tunnel has been driven along the east side of the ledge, cutting it at a small angle. A chip sample from a few feet of fractured and oxidized material failed to show any values in silver or gold, but a sample from a solid rib in the tunnel assayed 2 oz. in silver and a trace of gold. The base-metal content is negligible.

About half-way between the camp and the upper showing is a 15- or 20-foot tunnel on a shear-zone, in which small amounts of galena have been found. The galena is said to carry good silver values, but the sulphide occurs only in small bunches and the showing is of little importance.

Immediately below the camp are a number of cuts in a wide zone of slightly mineralized volcanic breccia. The sulphides, chiefly galena and sphalerite, occur as narrow stringers and also as dissemination throughout the rock. A chip sample across 15 feet of the zone assayed: Gold, trace; silver, 0.4 oz. to the ton; lead, *nil;* zinc, 1.5 per cent.

At an elevation of about 2,400 feet, in the first creek east of the camp, is a silicified and iron-stained zone about 20 feet wide outcropping for a distance of approximately 100 feet along the creek. Similar material is said to outcrop much farther up the hill. Pyrite is the only sulphide observed in the outcrop or in the numerous boulders of float. A sample from one large boulder failed to assay more than traces in gold and silver.

A number of deeply oxidized zones are said to have been found high up on the mountain between the two creeks. The zones are supposed to be inaccessible and have not been examined, but numerous boulders of float have been found at the foot of the cliffs. A piece of this float, from which everything had been leached but the quartz and galena, assayed: Gold, 0.02 oz. to the ton; silver, 45 oz. to the ton; lead, 43 per cent.

The country in the general vicinity of the *Montreal* group seems to be well mineralized and is worth prospecting very carefully.

Bear Pass Mining Syndicate. This syndicate owns a group of claims situated on the south side of Strohn creek, about 26 miles from Stewart, on the opposite side of the valley to the *Montreal* group. A good camp has been constructed on the flats at the foot of the hill, a short distance from the showings. The showings consist of a series of silicified and mineralized zones in greenstones, mineralized with quartz stringers and variable but small amounts of pyrite, sphalerite, and galena. A main north-south zone up to 25 feet wide outcrops 1,500 feet elevation, or about 100 feet above the valley-floor. A chip sample of the zone at the lower cut over a width of 8 feet assayed a trace in gold and 2.4 oz. of silver to the ton. This sample does not necessarily give any indication of the value of the zone, as it has not been opened up sufficiently well to sample and has been traced along the surface for but a very short distance. Fifty feet or so above the lowest cut a short tunnel is being driven towards the zone along a smaller east-west zone.

About 250 feet westerly along the base of the hill is another east-west zone, which has been drifted on for a distance of 10 feet. This zone is 6 to 7 feet wide and contains a considerable amount of pyrite, but apparently little or no sphalerite or galena.

While it cannot be said that any of the showings on the Bear Pass Syndicate ground are commercial, the ground is well mineralized and is certainly worthy of further prospecting and development.

Bear Pass Exploration and Mining Co., Ltd. (N.P.L.).—This is a private company, holding a group of claims near the property of the George Gold-Copper Mining Company.

Atlas Gold and Copper Mining Co., Ltd. (N.P.L.).—This company has acquired a group of claims in the upper section of the Bear River valley from J. A. Hall and W. R. Tonkin, as trustees of the Bear River Mining Company. The claims involved are the *Chicago Kid Fraction*, *London*, *Paris*, *Kensington Fraction*, and *New York*. The registered office of the company is at 1401 Standard Bank Building, Vancouver.

Salmon River Section.

Premier Gold Mining Co., Ltd.

This company was incorporated in 1919 with a capitalization of $5,000,000, divided into 5,000,000 shares of the par value of $1 each. The *Premier* mine is now, and has been for a number of years, the only steadily producing mine in the upper Portland Canal district, and the Premier Company is doing more to develop other properties in the district than any other individual company. From time to time it has worked on properties in the Salmon River section, but during 1928 it has taken options on three of the most promising-appearing silver-lead-zinc prospects in Portland Canal district and has spent a very considerable amount of money in their exploration. The properties referred to are the *Silverado*, *Porter-Idaho*, and *Prosperity*, all situated on the ridge between Marmot river and the head of Portland canal. Aside from developing the outside properties, the company has mined from its *Premier* mine 275,811 tons of ore, which is nearly 30,000 tons greater than 1927 production. Of this amount, 162,112 tons was milled, the balance being shipped direct to Anyox and Tacoma.

Early in the spring a fire destroyed the bunk-house and other buildings at the main camp. These were replaced immediately by a set of fine new buildings, including bunk-house, store, mess-house, and office building. Formerly, the general engineering office and staff-house had been at No. 1 camp, the old original camp at No. 1 tunnel level, but while replacing the buildings destroyed by fire a new office building was erected with the group. The hospital was also moved from No. 1 camp to a more convenient location west of the main camp at No. 4 tunnel.

B.C. Silver Mines, Ltd.

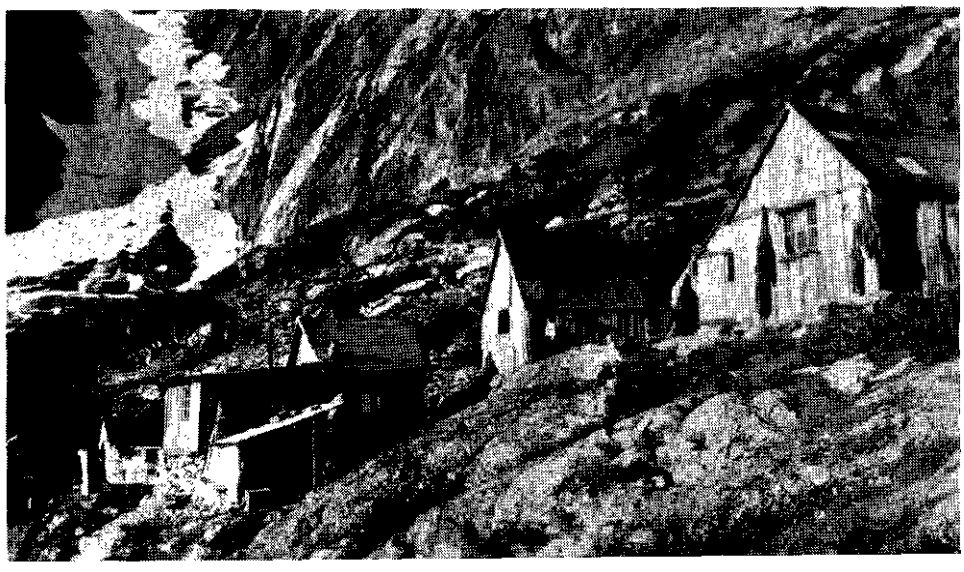
This company was incorporated in 1919 with a capitalization of $1,500,000, divided into 1,500,000 shares of the par value of $1 each. The registered office is in the Pacific Building, Vancouver. The company's holdings consist of two groups of claims—a "south group" adjoining the Premier Company's ground on the south, and a "north group" adjoining the Premier Company's ground on the north, and containing the north-easterly extension of the *Premier* ore-zone. The latter group is the only one that has been explored at all extensively.

Development of work this year consisted of sinking a vertical shaft from No. 3 to No. 6 level and driving of about 100 feet of workings on No. 6 level. The shaft is just a short distance from the north-west corner of the *Premier* ground and has been sunk to permit the exploration of the downward extension of the ore-shoot which has been mined to the end lines of the *Premier* property. The No. 6 level of the B.C. Silver is the equivalent of the *Premier* No. 4 level.

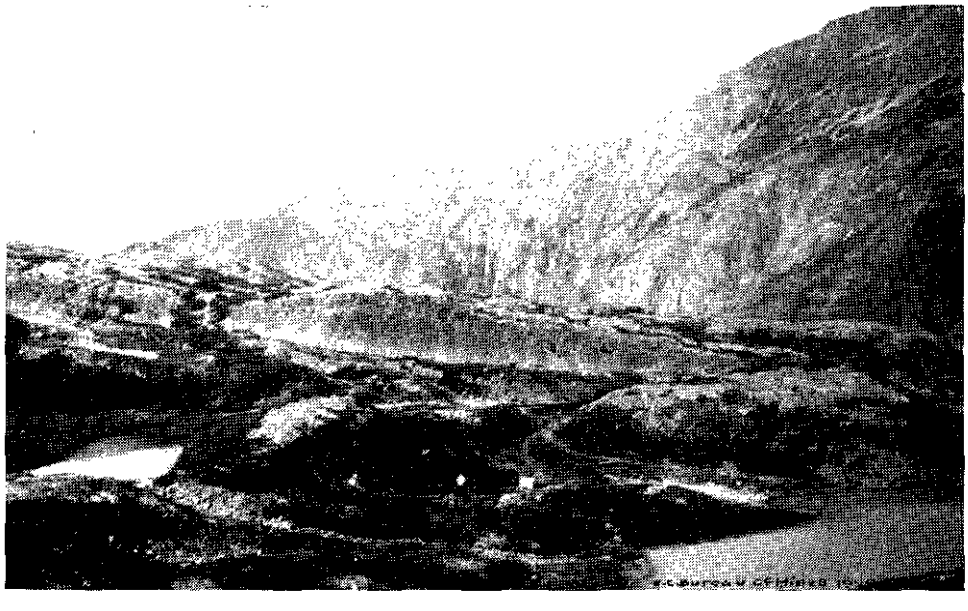
Sebakwe and District Mines, Ltd.

This company was registered in the Province in 1925. The Canadian office is at 612 Pacific Building, Vancouver. The company's holdings in the Portland Canal district adjoin the B.C. Silver Company's "north group" and consist of the old *Bush* property, which was acquired from the National Silver Mines, Limited, for a share consideration. Early in 1927 an ore-zone was cut by a long tunnel which had been driven from Cascade creek to crosscut the country immediately north-east of the end lines of the B.C. Silver ground. During 1927 the ore-body was developed for a length of about 250 feet on the crosscut, or No. 4 level.

In 1928 a vertical shaft was sunk from No. 4 to No. 5 levels, a distance of about 150 feet, and a few hundred feet of drifting has been done on No. 5 level. About 200 feet of this is in the ore-shoot which had been developed previously on No. 4 level. It was expected that the ore-shoot would plunge to the north-east with the overlying capping of barren tuffs, but the develop-



Outland Silver Bar Camp, Portland Canal M.D.



Black Wolf Camp, Kitsumgallum Lake, Skeena M.D.

Porter Idaho Mining Co., Ltd., Portland Canal M.D.

Lorne Creek from Clear Creek Divide, Skeena M.D.

ment on the No. 5 level proves that it plunges to the south-west. In addition to the development of this ore-shoot, a very considerable amount of drifting and crosscutting was done to the north-east under the old *Bush* working, but nothing of commercial importance seems to have been found to date in this section of the ground.

Northern Light Mines, Ltd.

This company was incorporated in 1928 with a capitalization of $5,000,000 to undertake the purchase and development of the *Northern Light* group of claims, situated in the Salmon River valley, north of the Premier and west of the B.C. Silver and Sebakwe properties. The claims in the *Northern Light* group are ten in number, as follows: *Northern Light Nos. 1* to *8*, *Northern Light Fraction*, and *Northern Light Fraction No. 1.*

The *Premier* north-west mineral-zone crosses the south end of the property to the *Woodbine* ground, where so much work has been done during the past two years by the Woodbine Gold Mining Company. This zone was stripped between Cascade creek and the *Woodbine* side-lines, but although considerable sulphide mineralization was found the values were disappointingly low, running about 1 oz. in silver to the ton.

Most of the work was done on the silver-lead vein which outcrops along the bank of a small stream a short distance below the *Big Missouri* road. The vein outcrops in *Premier* porphyry immediately below the greenstones and strikes about N. 80° W. (mag.), dipping 35° or 40° to the south. A crosscut had been started towards the west end of the vein, but it had not reached the vein at the time of examination. The slightly mineralized wall-rock through which the tunnel is being driven carries up to $2 and $3 in gold over widths of several feet. It is expected that the developments on this vein will be continued through the winter.

The showings on the *Northern Light* are described in some detail in the 1927 Annual Report.

Bush Consolidated Gold Mines, Ltd.

This company represents a consolidation of a number of claims, groups, and small companies in the Salmon River section of British Columbia and Alaska. The properties included in the consolidation are the *Border* and *Sunshine* claims, the *Exchange* group, Extenuate Gold Mines, Limited, Chief Metals Company, a one-sixth interest in *Cobalt* group, and a number of claims staked for the company near the lower end of Long lake. Some properties are also held on the Alaskan side of the International boundary. The company was incorporated in the State of Delaware in April, 1927, and was registered in this Province in October of the same year. The authorized capitalization is $3,000,000, divided into 6,000,000 shares of the par value of 50 cents each. The head office of the company is at 210 Metropolitan Building, Toronto, and the British Columbia office is at 375 Dunsmuir Street, Vancouver.

The principal showings consist of a number of silicified zones outcropping on the east side of Slate mountain in a series of volcanic rocks. During 1927 three diamond-drill holes were put down on two of these zones near the south end of Long lake, but the results were inconclusive owing to the fractured nature of the ground. Late in 1927 it was decided to drive a crosscut towards the most promising one of the siliceous zones, or veins, outcropping lower down the valley, and a suitable spot was selected for the portal of the tunnel on the *Sunshine* claim. The crosscut intersected the zone this spring at about 470 feet from the portal. At this point it consists of a 3-foot quartz-calcite vein, followed by several feet of slightly pyritized greenstone. A drift has been driven to the right, along the shear-zone, in a north-westerly direction for about 100 feet. At about 100 feet from the main crosscut the drift was being turned to the left and driven in a N. 70° W. direction towards a second mineralized zone. All the lateral workings are in a zone of very highly sheared purple and green volcanics which is at least 20 feet wide. At two or three points along the drift small amounts of sulphides were found, but there is nothing to indicate commercial ore in the workings. The best of three samples taken from the most likely-looking places assayed a trace of gold and 1 oz. of silver to the ton.

The Chief Metals section of the company's holdings is said to have a small but promising showing of galena. The showings on the Extenuate are mentioned in the 1926 and 1927 Annual Reports. Other possible showings on the Bush Consolidated holdings have not been examined.

Woodbine Gold Mining Co., Ltd.

This company was incorporated under the "Companies Act" of the Dominion of Canada with a share capital of 5,000,000 shares without par value. The company was formed to acquire and develop the seven claims and fractions situated on the west side of Cascade creek, about a mile north-west of the

Premier mine. Extending from the south-west end of the *Premier* workings to the *Woodbine* showings is a mineralized zone frequently referred to as the "*Premier* north-west mineral-zone." It is a wide zone along which a number of large exposures of silicified and slightly mineralized rock have been found, and since the commercial deposits of the *Premier* mine extended north-easterly from this zone, there was reason to believe that other commercial deposits might be found at other points along the north-west zone, or more or less closely associated with it. These considerations led to the exploration of a large silicified and pyritized zone outcropping on the *Woodbine* property along the strike of the "*Premier* north-west mineral-zone." During the past two years this exposure has been thoroughly explored by underground workings and diamond-drill holes, but as yet unfortunately nothing of commercial importance has been found. A few small isolated lenses contain a commercial grade of material, but they are much too small to be classed as appreciable lenses of ore.

The work to date proves, rather conclusively, that bodies of commercial ore do not occur in the mineralized zone so far as it has at present been explored. It is not known whether or not other mineralized zones occur on the property along the strike of the "*Premier* north-west zone," but it is a point which should not be overlooked.

Blue Jay Gold Mining Co., Ltd. (N.P.L.).

This company was incorporated on July 5th, 1928, with a capitalization of $1,000,000, divided into 4,000,000 shares of the par value of 25 cents each. The registered office is at 736 Granville Street, Vancouver. The company has acquired the *Blue Jay* group of three Crown-granted claims—*Blue Jay*, *Bluebird*, and *Club Fraction*—from Clara L. Watson and J. A. Barrett for 2,000,000 fully paid-up shares of the capital stock of the company. The claims adjoin the *Woodbine* on the south.

The trail to the property leaves the *Woodbine* trail about 100 yards beyond the point where the trail crosses the new *Woodbine* road. About 400 or 500 feet from the *Woodbine* trail, and about 60 feet to the left of the *Bluejay* trail, is an open-cut in slightly pyritized greenstone. About 100 feet south of this, in the bed of a small stream which parallels the trail, is another cut exposing a silicified and pyritized zone for a distance of 20 feet. A sample of average material at the upper end of the cut assayed: Gold, trace; silver, trace.

Buena Vista Mining Co., Ltd. (N.P.L.) (Big Missouri).

This company was incorporated in September, 1927, to assume ownership of the *Big Missouri* property, situated in the upper Salmon River valley. The Consolidated Mining and Smelting Company of Canada owns 53 per cent. of the stock and the Big Missouri Mining Company, Limited, owns the remaining 47 per cent. The Buena Vista Company is capitalized at $500,000 and the Big Missouri Company at $5,000,000, divided into 5,000,000 shares of the par value of $1 each.

Late in the fall of 1927, shortly after the Consolidated assumed responsibility for the development of the property, a tunnel was started to crosscut the mineralized zone exposed in the "calcite-cuts" and to get under the so-called "*Province* ore-body." By early summer this had been advanced to a depth of 1,783 feet and diamond-drill holes had been drilled through to the opposite side of the ridge from the face of the tunnel, giving a complete cross-section of the *Big Missouri* ridge.

The first section of the tunnel cut some silicified ground, which will probably be investigated later, although it contains practically no values where cut by the tunnel. Much of the remaining distance is barren unaltered breccias and porphyry, but near the face quartz stringers become very numerous. Most of these are absolutely barren, but one narrow stringer, at about 100 or 150 feet from the face, was found to contain free gold, together with a small amount of pyrite, sphalerite, and fine black streaks of undeterminable material. Although the gold is apparently confined to one narrow stringer an inch or two in width, the routine 5-foot sample which included the gold-bearing stringer assayed commercial values in gold. This stringer, or others in the same zone, have been followed north and south for a total distance of 250 feet. The values were intermittent, but gold was still showing in both faces. A 5-foot section of one of the holes drilled from the face of the tunnel assayed fairly well in gold. The crosscut is now being continued to locate and follow these values.

During the summer of 1928 considerable surface work has been done on the "*Province* ore-body," or the mineralized zone outcropping on the *Province* claim. This is a zone containing many silicified and pyritized zones, innumerable quartz stringers, and a number of small flat lead-zinc veins. The silicified zones and quartz ribs are mineralized with small but variable

amounts of sphalerite and galena, and frequently contain fair values in gold and silver. The small flat veins are well mineralized as a rule, and consequently the assay values are generally high. It is said that an average of the samples from all the cuts on the *Province* mineral-zone (prior to 1928) gives a low grade, but commercial value; but, inasmuch as most of the cuts were made on silicified and iron-stained outcrops, it does not follow that the *Province* mineral-zone is a commercial ore-body, for much ground, presumably barren, was not open-cut and not sampled, and hence the negative values from such areas were not included in the average. The Consolidated is breaking into the zone at regular intervals, and certain of the more highly mineralized zones are being followed along this strike. An average of samples from the regularly spaced cuts will give some idea of the average value of the whole zone.

It may be said that the general appearance of the *Big Missouri* has been improved during the past year, but the property is far from being an assured mine of importance. Good surface indications have been found at points not yet explored by the Consolidated, so it is evident that much work is to be done before the possibilities of the *Big Missouri* will have been determined or clearly indicated.

Unicorn. This group, owned by J. Hovland and L. Watkin, of Hyder, Alaska, is situated immediately north of the *Big Missouri*, between Harris creek and the Missouri ridge. The property consists of six claims and four fractions, as follows: *Unicorn, Unicorn Nos. 2* and *3, Unity, Goodhope, Snow King, V. Fraction, H. & W. Fraction, Hope Fraction*, and *Silver Creek Fraction*. Of these, all are Crown-granted except the *V. Fraction* and *Unity Fraction*, and application has been made to have these two Crown-granted.

The showings consist of a number of north-south and east-west shear-zones in volcanic and massive crystalline rocks of the Bear River formation. Most of the showings are found on the west side of the *Good Hope* claim, as indicated on the accompanying plan, and other showings have been found near Harris creek, on the east side of the claim. Harris creek follows a wide and slightly mineralized shear-zone for a short distance on the *Silver Creek Fraction*, and the same zone outcrops again along the creek-bed for a distance of 300 feet, about half-way along the west boundary of the *Good Hope* claim. The shear-zone is well mineralized at two points along this last section, where it is intersected by two mineralized cross-fractures, approximately 250 feet apart. About 200 feet west of the south-east corner of the *Good Hope* claim is a silicified zone mineralized with pyrite, galena, and sphalerite. Although values up to $8 in gold and silver have been obtained from parts of the cut, the distribution of the precious metals is very erratic and the average values from the zone at this point are not commercial.

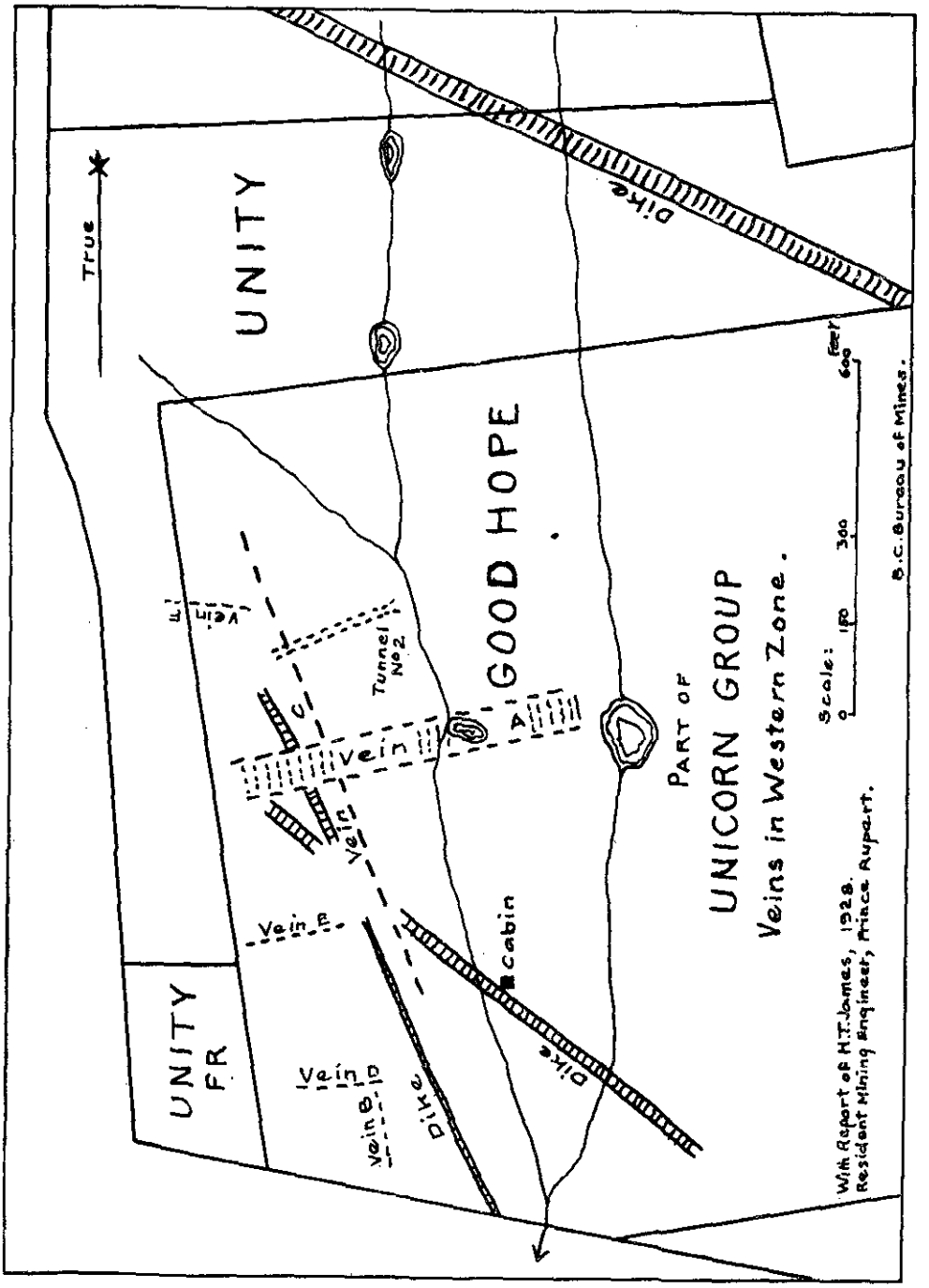
A second north-south zone can be traced south from between the small lakes shown on the accompanying sketch to the forks of the creek. It is a wide, poorly defined zone, somewhat silicified and pyritized, in which low values have been found, where it is intersected by vein "A," an east-west zone from 30 to 40 feet wide. This cross-zone appears to extend 500 to 600 feet west of the lakes, where it intersects another narrow north-south zone, vein "C." Values from several cuts along vein "A" run about $3 in gold and 2 to 3 oz. in silver, although occasionally higher values are found over narrow widths.

Vein "C" is a zone along which a few cuts have found well-mineralized material. Just north of tunnel No. 1 two samples over widths of 2 and 2½ feet assayed $16 and $4 to the ton in gold respectively, and samples from the zone, about on the strike of vein "E," carried values of $4 and $8 in gold over widths of 3 feet. Samples from cuts on veins "D," "E," and "F" gave similar returns over widths of 1 to 3 feet.

Although it cannot be said that commercial ore has been found on the *Unicorn* group, the values in the numerous cuts are sufficiently encouraging to justify considerable systematic exploration.

Silver Tip Mining and Development Co. This company was incorporated in May, 1925, with a capitalization of $1,000,000, divided into 1,000,000 shares of the par value of $1 each. The registered office of the company is at 323 Sayward Building, Victoria. The company's holdings consist of the *Silver Tip* group of five claims—*Bella Coola, Good Hope, May P.J., Silver Leaf*, and *Lady Bird No. 2*—situated in the upper Salmon River valley, about 1½ miles north of the *Big Missouri*.

The showings consist of a north-south vein; several east-west veins, known as the "Clegg Nos. 1, 2, and 3"; and the "Abbey" vein, "Morkill" vein, and the "May P.J." vein. This year's exploration-work has been confined to "May P.J." and the "Abbey" veins and to the



ground along the general band of the north-south vein. The drift on the "*May P.J.*" vein had been driven a total distance of 100 feet up to the date of examination, August 21st, and had encountered one lens of lead-zinc ore about 30 feet long and up to 6 feet wide at its widest point. The remainder of the vein consists of brecciated wall-rock and quartz, with but a small amount of sulphides.

The "Abbey" vein is an east-west vein outcropping west of the north-south vein, about on line with "Clegg No. 2" vein. A short crosscut tunnel exposes about 3 feet of material which is said to run 32.6 oz. of silver and 40 cents in gold to the ton.

Work in the vicinity of the north-south vein on the *Bella Coola* claim consists of number of open-cuts and a short crosscut tunnel. Several open-cuts along a strike of N. 20° W. (mag.) have picked up mineralization, judging from the materials on the dumps, and it is thought that all the cuts are on one vein, but since most of the cuts have sloughed badly it is difficult to determine the width or attitude of the mineralization. Added to this difficulty is the fact that quartz-porphyry dykes make up about half the total volume of rock and intercept the apparent line of strike at a small angle. In this section of the country the dykes are frequently mineralized in preference to the intervening argillites, so it is a question whether or not the vein will prove to be as continuous as it appears. Nevertheless, the values are so encouraging that the zone is deserving of considerable underground exploration. A 4-foot sample from the cut above the short tunnel being driven towards the vein assayed: Gold, trace; silver, 14 oz. to the ton; lead, *nil;* zinc, 2 per cent. This cut contains another 4 or 5 feet of similar material, and since it is said to be one of the lower-grade showings on the vein it would seem that the vein is worth developing.

Outland Silver Bar Mines, Ltd.

This company was organized in 1920 with a capitalization of $500,000, but during the past year the capitalization has been increased to $1,500,000, divided into shares of the par value of $1 each. The company's holdings consist of about a dozen claims situated near the head of the Salmon River glacier, on the west side, about 20 miles from the mouth of Salmon river. The route to the property is via the Salmon River road to the Texas Creek bridge; then along the Texas Creek road about 1½ miles to the *Cantu* trail, which leads through Friday pass to the foot of the Salmon River glacier, a distance of about 2½ miles. The remaining 6 miles to the camp is a very poorly defined route along the glacier to the low shoulder of Mount Lindeborg, which marks the upper end of the lower glacier.

The showings consist of a number of veins and mineralized zones in series of argillites cut by numerous quartz-porphyry dykes. A short distance north of the camp is an irregular outcrop of highly altered argillites, mineralized with considerable amounts of sphalerite, pyrite, and pyrrhotite. This was opened a short distance below the outcrop by No. 4 tunnel, and the downward continuation of the zone has been explored by Nos. 7 and 10 tunnels at depths of 75 and 225 feet below No. 4 tunnel. These two lower tunnels found mineralized ground, but nothing of commercial value.

About 250 or 300 feet south of No. 10 tunnel, and 50 feet below it, is the "gold" tunnel, containing a fair amount of disseminated arsenopyrite. Samples of the more massive sulphides will assay to $20 in gold, but it is doubtful if the zone will average commercial ore. The argillites in which the mineralization occurs is a narrow wedge between two quartz-porphyry dykes, and there is no indication of the mineralization extending through or beyond the dykes.

A few hundred feet north-west of the camp, just above the ice, is an open-cut exposing a zinc vein up to 8 feet wide. A 5-foot sample is said to have assayed 11 per cent. zinc, 1.5 per cent. lead, and $4 to the ton in gold and silver. No attempt has been made to follow the vein along the surface.

Outcropping among the steep bluffs south-west of the camp are a few veins mineralized with galena, sphalerite, and more or less grey copper. No. 8 tunnel is a short tunnel faced off on one of these veins at 4,200 feet elevation. About 50 feet below it is No. 1 tunnel, driven for a distance of about 80 feet along the same vein. No. 6 tunnel is a crosscut 150 feet below No. 1 tunnel, driven to intercept the vein and to cut another narrow quartz vein exposed farther around the hill. This tunnel is 325 feet long and apparently found nothing of importance, but without having surveyed the workings I do not know whether it has reached its objective. The vein at No. 1 tunnel is not particularly strong and may not extend as far as No. 6 tunnel, or it may show up as an inconspicuous shear-zone.

About 300 feet south of No. 6 tunnel, and at about the same elevation, is No. 9 tunnel, driven a short distance on a recently discovered vein which strikes about east-west and dips north at 30° to 40°. The vein is a shear-zone in argillites, up to 3 feet wide, mineralized with quartz, sphalerite, and galena, and is said to contain good silver values.

The showings in the Outland Silver Bar property are numerous, but without having sampled the vein thoroughly it is impossible to say whether or not any of them are commercial or have possibilities of developing commercial ore-shoots. Before doing any more underground work it would be advisable to have the property examined by a competent engineer and future developments carried out under his supervision.

Munro Mining Co., Ltd.

This company was incorporated on March 5th, 1928, with a capitalization of $1,000,000, divided into 4,000,000 shares of the par value of 25 cents each. The company has acquired the *Boundary* and *Munro* groups from A. A. McDonald and J. E. Munro. I wished to examine the company's property during the summer, but nothing was being done on the property and I could find no one familiar with the showings to act as a guide. The *Munro* group is situated on the west side of the Salmon River glacier, immediately north of the Munro glacier. The position of the *Boundary* group is not known, unless it is the *Boundary* group mentioned briefly in the 1911 and 1918 Annual Reports. The showings on the *Munro* group are described in the 1926 Annual Report, page 100.

STIKINE AND LIARD MINING DIVISIONS.*

The Stikine and Liard Mining Divisions are the drainage-basins of the Stikine and the Liard rivers in British Columbia. The Divisions are served through the port of Wrangell, Alaska, which is situated a short distance south of the mouth of the Stikine river. During the time the river is navigable the Barrington Transportation Company maintains a weekly boat service between Wrangell and Telegraph Creek, at the head of navigation on the Stikine river. One of the boats leaves Wrangell on Tuesday mornings after the arrival of the C.P.R. boat from the south. From Telegraph Creek a motor-road has been constructed to Dease lake, a distance of 75 miles, and in 1928 a small "tunnel boat" was being operated on Dease lake and Dease river as far north as McDame creek. During favourable stages of the river the trip can be made from the head of Dease lake to McDame creek in about eight hours' running-time, and the return trip in approximately sixteen hours.

Up to the present time the Division has been known only as a big-game and a placer-mining country, but it has very distinct possibilities of developing into an important lode-mining section, for the section of the eastern contact mineral-zone directly tributary to the Stikine river is about twice as great as the Portland Canal and Alice Arm sections put together. The Stikine river offers a means of cheap transportation for preliminary development-work and for large-scale operations, if necessary, although the river is open for only four or five months of the year. The geology and lode-mining possibilities have been studied for the past three seasons by F. A. Kerr, of the Geological Survey. His maps and reports will be of the greatest value to prospectors going into this section, for at present no geological maps are available, and even the present geographic data are incomplete and unreliable.

The placer production for 1928 is 384 oz., or slightly less than 1927 production. This figure is small, but developments now under way seem to indicate that the production may be increased materially within a few years. The increase is not at all assured, however, for, with few exceptions, preparations are being made for production before the ground has been thoroughly tested with a drill or by some other positive method. On the Clearwater river S. Barrington and associates are drilling possible dredging-ground and have been getting good results, although another successful year's drilling will be necessary before sufficient ground will have been blocked out for a dredge. The Dease Creek Mines Corporation has finished its second year's operations without producing more than a small amount of gold; the Joy Mines Company expects to be producing by the end of 1929; Gibson's, on Mosquito creek, should be ready to mine in the spring of 1929. The Pendleton operations on McDame creek seem to be in an unsatisfactory condition, although the ground itself may be good. Over half the 1928 production was from Gold Pan creek, and it is understood that a section of the creek is to be drilled in 1929 to determine the feasibility of installing machinery.

Clearwater River Section.

The most systematic piece of development in the whole of the Cassiar is the drilling programme being conducted by B. J. O'Reilly on the North fork of the Clearwater river, for S. Barrington, of the Barrington Transportation Company, and associates. This is the second

* W. A. Johnston: Gold Placers of Dease Lake Areas. G.S.C. Summary Report for 1925, Part A.
F. A. Kerr: Dease Lake Area. G.S.C. Summary Report for 1925, Part A.

season now that Barrington has been drilling these leases systematically in an attempt to block out a sufficiently large volume of commercial gravel to justify the installation of a dredge. The ground being drilled is a triangular-shaped area situated on the North fork of the river, about 2 miles above the main stream. The drilling done to date has been towards the upper end of the deposit where a pay-streak, 250 feet wide, has been outlined and followed up-stream towards the canyon for several hundred yards. The best values are found immediately below the canyon, suggesting that the gold has been brought down through the canyon and deposited with the gravels in the lower part of the river. The gold in the section drilled is concentrated on a false bed-rock about 30 feet below the present river-level. Boulders are numerous in the upper 15-foot section, but the lower 15 feet is finer wash, and no difficulty is expected in handling the upper boulders with a dredge. Another year's drilling is to be done on lower ground before the question of installing a dredge is considered.

F. N. Cronholm, of Los Angeles, holding leases 229 and 230 on the North fork of the Clearwater, has prospected his ground with long shallow cuts and shallow shafts, and apparently has obtained good prospects, for he has announced his intention of installing a steam-shovel on the property.

Dease Lake Section.

Dease Creek.

Dease Creek Mines Corporation.

This company was incorporated in Seattle with an authorized capital of $50,000. Its registered office in the Province is at Telegraph Creek and the Seattle office is at 114 East Fifty-fifth Street. The company's holdings consist of a number of leases on Dease creek, between 8 and 10 miles from Dease lake, covering a number of isolated sections of the old high-level channel of Dease creek, between Bucks gulch and California bar. Most of these were worked by hand in the seventies, and it is assumed from this that the same ground can be worked profitably by present-day hydraulic methods. In 1927, after spending a considerable amount of time and money in getting water to the level farthest down-stream, the whole bench was mined in a few days, giving a very small recovery. The 1928 results from piping the next section of the old channel up-stream were somewhat similar, the gold recovery amounting to 100 oz. or between $1,700 and $1,800 for the whole season's operations. A crew of seven men has been left in for the winter to move the plant to California bar, situated on the opposite side of the river and some little distance above Bucks gulch.

During 1927 the Joy Mines Company did a considerable amount of preparatory work, such as building road, camps, and clearing the right-of-way for ditches, on the McCrimmon leases, about 5 miles up Dease creek, but unfortunately the vendors took advantage of a technicality in the agreement and refused to permit the company to continue with its option. This is most unfortunate, for the ground is conceded to have distinct possibilities, and the Joy Mines Company was prepared, and thoroughly competent, to develop and work the ground. Having spent so much money in general preparations, the company optioned other leases on the creek and is going ahead with its general programme of development. A new camp has been constructed, good progress has been made on the ditch, and 40 tons of hydraulic pipe has been taken as far as Laketon, at the mouth of Dease creek. It will be the end of another season before any production may be expected.

Jorgensen and Fraser.

These two men are working on 4-Mile creek, a tributary to Dease creek. At the time of examination a string of boxes was being run up from Dease creek in an attempt to pick up bed-rock on 4-Mile creek. The lower section of the creek has been worked before, but the present owners are hoping to be able to cut through a rock "lip" near the outlet of the creek and to get into virgin ground on the upper side of the "lip." This should be good ground, for the creek appears to cross the upper end of a small isolated remnant of the old Dease Creek channel and should contain a concentration of the gold from the old channel. The small remnant of the old channel is to be worked eventually, but presumbaly not before 4-Mile creek is worked out.

Thibert Creek.

The most important operation in the Thibert Creek section is that of Gibson's, or the Hydraulic Corporations, on Mosquito creek. The lower part of the creek was worked years ago,

but because of a rock "lip" at the lower end of the creek the main part of the creek has never been worked.

A few years ago seven bore-holes were drilled in the 2,000-foot section of the creek above the lip, and five of them are said to have good values on bed-rock, the remaining two being too high on the rim to get values. These holes have demonstrated that the bed-rock above the lip has a very flat gradient, and it is expected that some difficulty will be found in hydraulicking the ground.

During 1928 the operators were engaged in clearing out the lower part of the creek and cutting a drain through the rock "lip," and it is understood that about 35 feet of the drain remains to be completed. In addition, the company has built 300 feet of flume and erected three new bunk-houses. It has a good camp, a small sawmill and compressor, and is going at the work in a methodical and systematic manner. If no unforeseen difficulties arise the property should be producing by the end of another season.

Columbia Northern Mines, Ltd.

This company has a capitalization of $1,000,000, divided into 2,000,000 shares of the par value of 50 cents each. The company's office is at 213 Belmont House, Victoria, and the holdings consist of leases on Vowel creek, one of the upper tributaries of Thibert creek. An attempt was made to take a 10-ton General Motors gas-drill to the creek during the 1928 season, but, although the drill was landed at Telegraph Creek early in June, it had been taken no farther than the foot of Dease lake by the end of the season, with all the really difficult part of the trip ahead of it. The property was not visited, as nothing was being done on it, and the man in charge of the development of the property was not in the district.

McDame Creek.

McDame creek is one of the large streams flowing easterly into Dease river about 40 miles north-east of Porter at the north end of Dease lake. The creek differs from other placer-creeks in the Cassiar district, in that it flows through a mountain range—the Cassiar range—rather than through a section of the Interior plateau. The mountains on either side of McDame creek rise rather abruptly from the creek to elevations of 3,000 feet and more above the creek. At the lower levels the slopes are interrupted by a few gravel terraces, which at one point examined were found to consist of unassorted glacial material, with occasional layers of well-assorted river-wash. The stream boulders consist of quartzite limestone, volcanic breccias, and granitic material. The centre of the valley and the north range as far up-stream as Centreville are underlain by a series of quartzites, metamorphosed argillites, and limestones, striking east-south-east and dipping steeply to the north. I am informed by prospectors familiar with the district that the granitic rocks cross the First North fork about 8 miles above Centreville and that the summit of the ridge south of Centreville is composed of granite. The volcanic rocks are said to cross McDame creek a number of miles north of Centreville.

Operations on McDame creek are not numerous. Crawford and Irvine did a little work at the mouth of the First North fork, attempting to pick up a short section of the old channel. D. L. Wing had three men on Quartz creek, whipsawing lumber and cleaning the ditch.

The Pendleton Gold Mining Company, Limited, attempted to resume operations after two years' idleness, but the old machinery—a drag-line scraper—was in such a state of disrepair that no real work was done. Since much of the ground is below the level of McDame creek, it is unfortunate that a drag-line scraper is to be used. The depth of the ground and the values have not been determined, but it is known that some good values have been found. The Standard Mining Corporation left a No. 3 Keystone drill on McDame creek a few years ago. This could be used to advantage in drilling the Pendleton and other leases in this part of the country. Although certain sections of McDame creek may have distinct possibilities, it is not advisable to install a plant without having some definite information about the values and their distribution.

A short distance below Centreville, Godfrey and Ensoe were driving a drift north into the bank of the stream along a gravel-filled crevice in the bed-rock, in the expectation of finding an old channel beneath the gravels.

EAGLE RIVER SECTION.

One branch of the Eagle river heads in a shallow lake about 12 miles due east of the head of Dease lake and, flowing through a broad flat-bottomed gravel-filled valley from 300 to 500

feet wide, joins the main river about 16 miles farther north. The main river flows into Dease river about two-thirds of the way between the lower end of Dease lake and McDame creek. In 1924 W. Brady and J. H. Ford discovered coarse gold in a stream which flows into the Little Eagle from the east, about 4 miles from the head of the river. The stream was named Gold Pan creek by the discoverers, because two old gold-pans were found in a tree at the mouth of the creek. Since 1924 this creek has been producing a large part of the gold from the Cassiar district, but, even at that, the production is not at all large, amounting this year to only 210 oz. However, it is probable that the rate of production will be increased if present plans are carried through.

It has been thought that the Little Eagle river below Gold Pan creek might contain profitable dredging-ground. During 1928 W. R. Martin and associates took a light drill into the country to test the possibilities of the stream, but, according to reports, they were unable to reach bed-rock with the light machine they were using. The same group of individuals have taken an option on Gold Pan Creek leases held by A. M. Vickey and William Moody, and propose to drill the leases next season to determine the feasibility of working the creek with a "plant" rather than with the hand methods now being used.

Gold Pan Creek.—Messrs. Cambron, Drapich, and Haddock, working ground a short distance above discovery, took out 98 oz. of gold during 1928, while Vickey, King, and Stephen recovered 106 oz. from a short section of their ground—claims 19 to 26 above discovery. At the time the creek was visited, near the end of June, Vickey and partners had completed ground-sluicing a strip of ground about 200 feet long and expected to be "shovelling-in" within a few days. During the season they took out 106 oz. The gold was recovered from a 2-foot band of gravel beneath 3 feet of barren wash. In the lower 100-foot section of the ground being worked the 2 feet of pay-gravel occurs between thin clay-seams, but in the upper section of the ground the lower clay-seam is absent. A 12-foot pit sunk at the upper end of the ground found good values in a rusty solid wash below the level of the lower clay.

ATLIN MINING DIVISION.

The Atlin Mining Division is that section of the Province north-west of the Stikine and Liard river-drainage areas. For the purposes of this report it is divided into three sections, as follows: Rainy Hollow section, Atlin Lake section, and Taku River section.

Although Rainy Hollow is a specific small area on the Klehini river, about 10 miles north of the International boundary, the term "Rainy Hollow section" is used to refer to the general mining section north-west of the head of Lynn canal. The district has been inactive for several years, but following the rediscovery and development of a gold-quartz vein by Stenbratin and Bunting, engineers and prospectors alike have been taking a renewed interest in the district. The point of entry is Haines, Alaska, a small town on the west side of Lynn canal about 15 miles below Skagway. An excellent motor-road has been built from Haines to the International boundary, a distance of 43 miles. When the camp was more active a good wagon-road extended another 10 or 12 miles to Rainy Hollow, but this section of the road is now in disrepair and can be used only for transporting light materials in wagons.

The Atlin Lake section includes the areas surrounding Tagish, Atlin, and Teslin lakes. The principal activity in this section is placer-mining in the creeks flowing into Atlin lake from the east, although attempts are being made to block out bodies of commercial ore on two lode properties in the district—namely, the Engineer mine on Tagish lake and the Atlin Silver-Lead mine on Fourth of July creek.

The Taku River section is the drainage area of the Taku river, a stream which flows into the sea at Taku inlet, a short distance south of Juneau, Alaska. A small amount of placer-mining has been done in this section, but not with very encouraging results. From present indications it may develop into an important lode-mining camp, as work done on the *Tulsequah Chief* group during the past season has been one of the most encouraging pieces of development-work in the whole of No. 1 District.

Rainy Hollow Section.

The Rainy Hollow section was not visited during 1928. The following information has been very kindly forwarded to me by C. L. Munroe, Gold Commissioner at Atlin:—

"In the Rainy Hollow district an option was taken on the *Maid of Erin* group by Messrs. L. B. and C. K. McCornick. A diamond-drill outfit was taken in and several test-holes sunk on

the *Maid of Erin* claim in the vicinity of the old Wiley incline shaft. On the first hole sunk they found 6 feet of ore at a depth of 36 feet and 10 feet at a depth of 71 feet. On this second hole they found ore for 10 feet between 32- and 42-foot depths. These two holes were 100 and 200 feet respectively east of the Wiley incline. At a point 100 feet north-west of the incline they had to abandon drilling at 24 feet as it was costing too much on account of the hardness of the rock. Another hole, on a bench about 100 feet north of the Wiley shaft, was sunk to a depth of 140 feet down to limestone, and as no ore was found in this hole the work was abandoned. In giving up their option on this group the McCornicks do not condemn the property, but simply state that the indications do not point to as large an ore-body as they had been led to expect. It is quite probable, however, that more extensive drilling would show up the property to better advantage, as the drilling done this season covered a very small area. I am advised by the owners that they are negotiating with another company which may be on the ground in the early spring. The wagon-road to this property on the British Columbia side of the line is badly in need of repairs in places, but from Haines to Pleasant camp, on the boundary, the road has now been completed and is in splendid condition for automobile traffic.

"Across the Klehini river from Pleasant camp, on the *Stampede* group, John O. Stenbraten has done considerable work in stripping the vein and extending open-cuts during the past season. This is a promising-looking property, and I am advised that the Alaska Juneau Gold Mining Company has taken an option on the group and will start work as soon as weather conditions permit."

Atlin Lake Section.

The following report on the Atlin Lake section has been received from C. L. Munroe, Gold Commissioner at Atlin:—

"The output of placer gold has again been low this year, as all the larger operators are still engaged in development-work and have produced practically no gold. The total output amounts to about $52,000, and, considering that this is half of the estimated production for the whole Province, is a very creditable showing for the Atlin district.

"On Pine creek the large hydraulic plant operated by Mr. Sostad for the Discovery Mining and Power Company moved about 400,000 yards of gravel and extended the flume 400 feet up-stream. The pay-channel has not yet been reached, but it is hoped that another season's work may open up good ground. About eighteen men were employed throughout the mining season.

"Good progress was also made on Boulder creek by H. P. Pearse, in charge of the hydraulic plant installed the previous year by the Consolidated Mining and Smelting Company. High water caused some trouble in the early part of the season, but this was soon overcome, and it is thought that pay will be struck before the end of another season.

"On Otter creek Henry Maluin, who has been operating for a number of years, has transferred his interests to the Compagnie Francaise Des Mines d'or du Canada, of Paris. This company has started an extensive plan of development-work, which includes obtaining water from Wright and Union creeks. About twenty-five men were employed right up to the end of December in constructing the ditch for this work, and next season will see hydraulicking operations in full swing on the creek. It is the intention to start back on the lake-level and endeavour to pick up the true bed-rock, which has never yet been encountered on this creek.

"On upper Spruce creek Messrs. Morse, McKechnie, and Bratt recovered about $10,500 from their property, and on upper Ruby creek E. Turnquist took out about $14,000. Various small individual operators throughout the district did fairly well, but several did not make wages. On Ruby creek the Lake Surprise Mining Company closed down about the first of August and its future plans are not known. On McKee creek George Adams worked with a small crew, obtaining only fair returns. They have not yet succeeded in locating the rich pay-streak which is believed to exist on this creek.

"On Lincoln creek Mr. Foster, who took an option from local owners, was unable to commence operations this year, but the option is being kept up and it is believed work will start next summer.

"Some prospecting was done this year on Bull creek and on Consolation creek, but no conclusive results were obtained.

"With reference to Squaw creek, results would indicate that there are good values in this creek which will pay if properly worked. The best ground is held by Indians, only a few of whom have any idea of practical mining, and, considering the amount of actual work done, good results were obtained. Coarse gold was found wherever bed-rock was uncovered, one 8-oz. nugget and several running from 2 to 4 oz. having been found. The total gold produced on the creek during the season was about $7,000, but I believe, if worked by practical miners, this would be a paying creek. The great disadvantage of Squaw creek is its inaccessibility, as the trip around by way of White Horse and Champagne takes several days, though this could be shortened considerably if better means of transportation were available. Several men went in by the way of Haines and Rainy Hollow and state that they had little difficulty, although the trail beyond Rainy Hollow cannot be in very good condition.

"On the Atlin Silver-Lead property Mr. Ruffner had a crew working all last winter and spring, but met with considerable difficulty due to cold weather and an excess of water in the workings. The greater part of the work was done drifting on a level 200 feet below the main 2 crosscut tunnel. Considerable faulting and slips were encountered in this work, and operations were discontinued on Mr. Ruffner's being called to New York for a conference with his shareholders. An examination of this property was made last summer by C. H. Poirier, of New York, who has recommended a plan of development which will probably be carried out this year."

The *Engineer* was reopened in the spring and explorations were continued on the lower levels, where good ore is said to have been found along the main vein on the 800-foot level. The property has been closed down again for the winter, but it is the intention of the company to resume operations early in the spring.

Taku River Section.

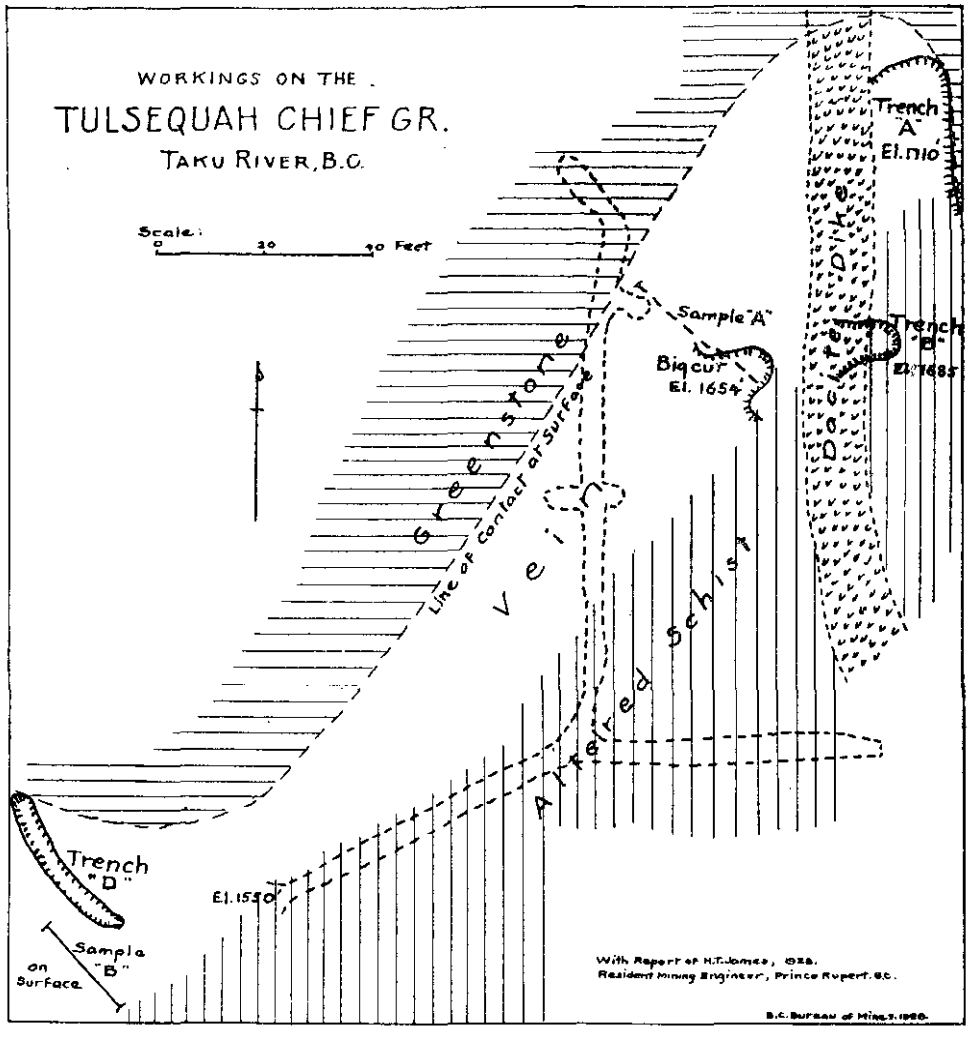
The Taku river drains about 5,000 square miles of the north-western section of the Province, between the Stikine river and its tributaries on the south and east and Atlin and Teslin lakes on the north. It empties into Taku inlet a short distance south of Juneau, Alaska. The river is said to be navigable with small gas-boats as far as the Sloko river, which joins the main stream from the north, about 48 miles from the mouth of the river. Maps of the International Boundary Commission show that the river flows through a broad flat-bottomed valley up to 2 miles wide for the first 25 miles above the head of Taku inlet, and that within this distance the floor of the valley is nowhere more than 250 feet above sea-level. Since the river crosses the eastern contact of the Coast Range batholith at not more than 12 miles above the mouth of the river, it is obvious that the Taku valley affords easy access to a portion of the eastern contact mineral-zone. Tributary streams, flowing into the Taku a short distance east of the Coast Range batholith, makes the eastern contact mineral-zone easily accessible for a length of 25 miles, which is as great as either the Portland Canal or Alice Arm sections of the zone. The most important tributary stream near the contact is the Tallsaykway river, which rises 13 miles north of the Taku in a large valley glacier, and joins the Taku about 6 miles above the International boundary, or 17 miles from the head of Taku inlet. One very promising property, described below, has been located on the Tallsaykway, and it is to be expected that the development of this property will induce prospectors to enter the district and search for similar showings. Now is an opportune time to have the Taku River area contiguous to the Coast Range batholith mapped geologically, so that the prospectors will know what sections of the area to prospect, and the Government engineers may build trunk trails to the best advantage.

Tulsequah Chief.

This group is owned by A. W. Kirkham and partners, of Juneau, Alaska, and is situated on the east side of the Tellsaykway (or Tulsequah) river, 8 or 10 miles above the Taku. The group consists of eleven claims, as follows: *Tulsequah Chief, Tulsequah Bonanza, Tulsequah Bald Eagle, Tulsequah Nos. 2, 3,* and *4, Cascade, Mountain View, Constance, Elva Fraction,* and *River Fraction.* The property was bonded to the Alaska Juneau Mining Company in 1923, which did about 60 feet of underground work without finding commercial values. It is evident from the direction of the tunnel, and from the description of the showings in the 1923 Annual Report, that the vein was thought to follow a dacite dyke which outcrops in one of the main open-cuts. Subsequent work has shown, however, that the dyke crosses the vein at a sharp angle, and the Alaska Juneau tunnel was started in the foot-wall of the vein and driven away from the vein.

During the past year, 1928, the property has been optioned by a group of individuals represented by W. A. Eaton and Dan Williams, a well-known engineer of the north. Under the direction of Williams the old crosscut was turned to the left, and by the end of the season it had intersected the vein at a depth of over 100 feet below the outcrop.

The vein is a replacement vein in a series of altered schists, occurring near the contact of the schists with massive greenstones. It is up to 30 feet wide and strikes N. 10° E. (mag.), dipping to the west at about 70°. Although the vein has been traced definitely for a distance



of only 230 feet, mineralized outcrops have been found about on the strike of the vein 600 feet north of the principal showing, and an open-cut 1,000 feet south is in mineralized material, very similar to the material along the foot-wall of the vein.

I am indebted to Dan Williams for the accompanying plan of the workings on the *Tulsequah Chief* and for the list of samples from which the following data have been compiled. The table below shows that the ore is complex, containing gold, silver, copper, and zinc, but the values and width of the vein are exceptionally good. If the vein is found to have any appreciable length the property will become a very valuable one.

The following table gives an average of assays from the various cuts and workings indicated on the accompanying plan :—

Description of Sample.	Width.	Gold.	Silver.	Copper.	Zinc.
	Feet.	Dols. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
Average of two 15-foot sections across trench "A"	....	1.80	2.05	2.70	7.17
Sample "A" at "Big Cut"	30	4.80	11.20	3.25	10.50
Trench "D"	20	1.90	4.30	0.40	4.63
Sample "B"	24	0.60	0.40	0.00	14.00
Average of seven 5-foot samples at end of north crosscut (represents vein-width of 25 feet)	....	4.97	13.00	0.52	17.55

STIKINE RIVER AREA.

Much interest has been aroused by the work of F. A. Kerr, of the Geological Survey of Canada, in the Stikine River area. Through articles and lectures during the winter of 1928-29, Dr. Kerr has done much to emphasize the importance of the eastern contact-zone of the Coast Range batholith in this area as a probable area of important mineralization; he has repeatedly urged the desirability of prospecting in this section. A geologic investigation of this area was commenced by Dr. Kerr in 1926 and has been carried on during the field seasons of 1927 and 1928. The Summary Report of the Geological Survey of Canada for 1926, Part A, contains a "Preliminary Report on the Stikine River Area" by Dr. Kerr. A further report entitled "Second Preliminary Report on the Stikine River Area" has also been prepared by him and will be printed in the forthcoming Summary Report for 1928 of the Geological Survey of Canada.

Through the courtesy of the Honourable Chas. Stewart, Minister of Mines for Canada, extended to the Honourable W. A. McKenzie, Minister of Mines for British Columbia, a copy of Dr. Kerr's report has been forwarded by the Director of the Geological Survey of Canada to the Provincial Mineralogist, with permission to publish it in the Annual Report of the Minister of Mines for 1928. As the subject-matter of this report is of decided interest to prospectors, engineers, and exploration mining companies, it has been considered advisable to publish it.

When Dr. Kerr's report is issued by the Geological Survey of Canada it will be accompanied by a geologic map of the area, but this is not available for publication in this Annual Report. In order, however, to illustrate the geographic area discussed by Dr. Kerr, a sketch-map prepared by the Geographic Division of the British Columbia Department of Lands is attached to Dr. Kerr's report as an insert.

SECOND PRELIMINARY REPORT ON STIKINE RIVER AREA, BRITISH COLUMBIA.

By F. A. Kerr, Geological Survey of Canada.

INTRODUCTION.

Since preparation of a final report on the Stikine River area will require considerable time, it has been deemed advisable to issue in advance a brief synopsis primarily designed for the prospector. The chief purpose is to point out those areas which are likely to be most fruitful and also indicate the best methods of reaching and travelling through the sections designated. The first preliminary report on this area for 1926* gives considerable general information and a detailed description of the Devils Elbow deposits which will not be repeated here.

MEANS OF TRAVEL AND ACCESSIBILITY OF VARIOUS SECTIONS OF THE MAP-AREA.

As indicated in the report of 1926, ready access can be gained during the open season to any point along Stikine river between its mouth and Telegraph Creek by established means of transportation. The river is swift and dangerous, and, except for men skilled in navigating such waters, the regular passenger and freight boats afford the only sensible means of travel. Small boats can be navigated down-river by skilled rivermen with ease, but to move against the current is a slow and difficult process and in most cases the amount of time lost and the dangers involved nullify anything gained. However, for some work a small boat may be necessary. The more or less standard type of craft that has been developed after much study on the part of boat-builders and operators is undoubtedly the most suitable for general use. It is flat-bottomed and shovel-nosed with considerable beam. The length varies according to the need, though 24 feet is in general the most appropriate. Such boats can best be procured at Wrangell or on the river. Since time is, in most cases, of value the boat should be powered with an outboard motor. Ordinarily an engine of about 8 horse-power is the most satisfactory; it will drive the boat at sufficient speed to ascend, without assistance, all the rapids ordinarily encountered and at the same time not overpower the boat so as to make navigation unduly dangerous.

* Kerr, F. A.: Geol. Surv., Canada, Sum. Rept., 1926, Pt. A.

The regular passenger and freight boats will stop at almost any point along the main river-channel, but the river has many distributories (sloughs) and it is sometimes impossible to land on the mainland at or near the exact point which it may be desired to reach. As a rule the mouths of tributary streams form the best base from which to start operations. When approaching the river for the purpose of taking passage on one of the boats, it is essential to pick some point where the main channel is close to the valley-wall, otherwise there may be intervening waterways which will be a serious hindrance to progress, and, in any case, the valley-flats are covered with a dense matted jungle through which travel is extremely difficult.

From Telegraph Creek south to Shakes creek it is possible to use horses to some extent since there are a few trails on the lower wooded slopes, and above timber-line the surface over large areas is not too rugged to permit of travel by this means. As far south as Little canyon, dogs were used in the present undertaking to very great advantage as packers. In this section of the map-area a good dog can go almost anywhere, though, in the lowlands, it may be necessary to follow the crude trails of the trappers. A dog will carry up to 50 lb., and with very little assistance and proper treatment has staying-power superior to a man. His load of course is all gain, except for a small quantity of emergency rations, since his equipment is of negligible weight and the rather abundant game affords his complete food-supply. Throughout the rest of the map-area, under present conditions, back-packing is the only feasible means of transporting supplies.

There are few well-defined routes of travel in the area. In general, besides the established trails, there are two courses which it is best to pursue—either proceed directly to timber-line, which is usually at about 4,500 feet, and travel the open spaces above this, or follow the streams. The latter course, however, is suitable only in wide glaciated valleys where the streams have not cut deeply into the glaciated surface.

From a point opposite Glenora a road and trail, along which horses can be used, afford access to a large area between First South Fork river and Glacier river (1 mile below the mouth of Shakes creek). This section can also be reached by the trail along the east bank of First South Fork river.

A trail, now in very bad shape because of much fallen timber, commences at the road crossing of 4-Mile creek (6½ miles below Telegraph Creek) and leads to the headwaters of the same stream.. This area as well as that farther south is somewhat more accessible from Glenora or from Shakesville by a trail to the junction of the two branches of Brewery creek, thence up the ridge between these and along the West fork. Two other routes are: One from the telegraph trail north of Telegraph Creek up a tributary of Tahltan river; and the other by trail from Shakesville up Shakes creek to Shakes lake at its source. The latter route is also the best for reaching the headwaters of North Fork river, which joins Clearwater river 7 miles above its mouth, and a large area tributary thereto. The mountain between Shakes creek and the lower part of North Fork river can be reached by a side-trail.

Ready ingress to Glacier lake, at the head of Glacier creek, has been made possible by the construction of a trail suitable for pack-horses from near the mouth of Pritchard creek, 4½ miles south of the mouth of Glacier creek. A trail from the mouth of a creek 2 miles up-river from mouth of Clearwater river, up the mountain to timber-line, and then around the southern slope affords entry to a large upland area extending towards Glacier creek.

During the greater part of the summer Clearwater river can be navigated by powered boats with considerable danger to a point about 12 miles or so above its mouth and at high water probably as far again. By use of a motor supplemented by lining over riffles it is possible to take a well-loaded standard boat to this point at almost any stage of water and possibly beyond for a distance, said to be 10 miles, to Clearwater lake at the head of the river. In this way considerable quantities of supplies can be laid down anywhere along the valley without serious difficulties or excessive expense. From Clearwater Landing to the west side of North Fork river a fair road used by motor-trucks provides a safer means of transportation as far as it goes. From the end of the road trails continue to several points: to the mouth of North Fork river; for some distance up the Clearwater valley; along a creek joining the North Fork on the west side, half a mile south of end of road; and a short distance up North Fork valley, so that a large area in this vicinity is readily accessible. A good bridge crosses North Fork river, so that the road could be extended to the west for many miles without much more expense than that necessary for clearing and the construction of bridges over tributary streams. The valley

of the river joining, from the south, Clearwater river 3 miles above the mouth of North Fork river can be more easily traversed on its east side. For 6 or 7 miles above its junction with the Clearwater the best route would seem to lie on the relatively gentle slope at 500 to 1,000 feet above the river through heavy timber where travelling is probably fairly good and trail-construction should not be difficult. Above this first stretch, where the river flows in a canyon, the valley-floor is wide, with extensive gravel-bars, and should for many miles furnish no serious travel obstacles. The valleys of the next above two larger tributaries, from the south, of Clearwater river are somewhat similar and should offer fair routes. The Clearwater valley therefore forms a main traffic artery for a large area of rugged mountainous country. From the mouth of the Clearwater a trail up the ridge to the west is a means of entry to the highlands at the head of Fish creek, though a somewhat more direct way is over the ridge opposite the mouth of Dochdaon river.

A good trail leads east up Kirk creek, which enters the Stikine from the east, 1 mile above the mouth of Clearwater river. Another trail from the mouth of Kirk creek runs to and up the next tributary to the north. The trail from Jackson, at the mouth of Dochdaon river, south to the claims on Devils Elbow mountain is well maintained. From this mountain it is possible to drop down into the valley on the east side and, from it, by traversing a low pass to reach the wide glaciated valley of the upper Dochdaon river and the mountains about its head. A more difficult route is offered by a blazed line commencing on the east side of Stikine river, at the mouth of the second creek, 3½ miles above Little canyon. It leads to and across a low pass east of the mountain north-east of the mouth of the creek. A branch line follows the creek to its head. From just below Little canyon a trail follows Ochsakieen creek for about 8 miles.

Scud river can be navigated by powered boats, with some lining and considerable difficulty and danger, for about 17 miles. The river along the lower 25 miles spreads into many channels over a wide gravel bottom and probably under no conditions is good for navigation, though it is probable that with considerable lining, for which the gravel-bars are well adapted, fairly heavily loaded boats could be taken at least 25 miles (possibly much farther) up-stream. Since the Scud flows nearly due west and has many wide, glaciated tributary valleys it affords a means of easy entry into an extensive, largely unknown area.

Travel on the south side of Patmore creek for many miles is fairly good since there are extensive gravel-bars and a more or less continuous bear-trail.

The valley of the larger creek, coming from the east about 2 miles north of the mouth of Anook river, gives access to several large mountains and, by a low pass at its head, to a deep timbered valley which probably drains to the Scud. It is said that by a pass in this general vicinity Indians travelled regularly by well-timbered valleys from the Stikine to the Iskut, reaching the latter at a point above the canyon. Those familiar with the story are of the opinion that the Anook valley was the route for leaving the Stikine. The supposition that a fairly easy route to the headwaters of the Iskut river from this general vicinity does exist is not at all unreasonable. One of the largest tributaries of the Iskut has its source in the same area as the Scud. Other tributaries of the Iskut below this creek probably have the same south-east trend and head up just east of Anook river. Further, since the ice-movement in this area was in general southward, unusually low north-south passes are common, so that the probability is very great that at least one such exists between the Stikine and upper Iskut drainage systems. This is an extremely important consideration since it is feasible to reach the upper Iskut river by a fairly good route from Stewart, and if a road or railway were constructed to this point a new means of entry to the great area between the Scud, Stikine, and Iskut rivers would be afforded.

Anook river for a short distance above its mouth flows through a canyon in the base of a narrow valley and therefore is not easily traversed; its drainage area will therefore be difficult to explore.

Porcupine river is similar to the Scud, but being somewhat smaller does not appear to be easily navigable, though it is probable that boats could be tracked up-stream for 10 or 12 miles. Travel by foot would seem to be better on the south side since the two large tributaries from the north may be serious obstacles. A short distance above the foot of the glacier a low pass leads north-east to the valley of a tributary from the east. By means of this pass the canyon at the mouth of the tributary is avoided. The valley of the tributary is low, wide, well wooded, and extends far north-east.

STIKINE RIVER AREA
BRITISH COLUMBIA

SKETCH-MAP

To accompany Report by F. A. Kerr, Geological Survey of Canada, 1928.
Prepared by Geographic Division, Department of Lands, British Columbia.

Scale of Miles

South of Porcupine river to the Iskut the tributary valleys are occupied by glaciers at no great distance from the Stikine, and the streams from these, except that flowing along the south base of Warm Spring mountain, are small and for the most part flow in valleys which present serious difficulties to the traveller. The long ridges in this section afford by far the best travelling, though that of Eagle Crag is somewhat of an exception to this rule. For a considerable part of the area on the west side of the river no detailed description of routes has been given since it is unlikely that there will be much desire at present to travel there. In general the glaciers or valley-flats offer the best courses to pursue in this section.

CLIMATE.

The Stikine River area extends from the heart of one physiographic province well into another, and its climate therefore shows considerable diversity. In the Coast range, as far up-river as Little canyon, precipitation is heavy throughout the year and as a consequence accumulation of snow is very great. Summer is considerably advanced before much of the area above timber-line is denuded of its blanket of snow and it would seem inadvisable to attempt general prospecting in this section before June, though work on discovered properties might well be started in April. During May, June, July, and August weather conditions are the most favourable for working. September weather is very uncertain and there is usually considerable rain. After October 1st snow settles on the peaks and gradually works down the slopes. Precipitation is said to be heaviest between the International boundary and Flood glacier, and of course is greater in the mountains than in the valleys.

Up-river from this zone precipitation decreases until the minimum is reached at Telegraph Creek. Whereas in the central part of the range the snow accumulation during the winter may amount to 20 feet, at Jackson, at the mouth of Dochdaon river, it is reported to be about 6 feet and at Telegraph Creek probably somewhat less. The mountains north and west of Jackson are comparatively free of snow much earlier than those near the axis of the range. Prospecting could be commenced early in May and from that time till the middle of October conditions are very favourable for travel and work. There is little rain during the summer and snow does not begin to stand below timber-line until well on into October. Despite the small general precipitation, there are, because of the fairly high mountains in this section which attract somewhat more rain and snow, few places where sufficient water for ordinary purposes cannot be found.

WATER CONDITIONS ON STIKINE RIVER.

During the winter Stikine river generally freezes from Telegraph Creek to near salt water, though on rare occasions the winters are so mild that open spots occur where the current is particularly swift. As a rule the freezing has progressed far enough by the first of January to permit of travel on the river. The ice usually goes out between the middle of April and the middle of May. The water then is at a very low stage and the bars of the river, being only shallowly covered, make navigation difficult, and sometimes, particularly if very cold weather continues, the regular boats are delayed several days. With the increase of temperature toward summer, the river rises and during June is very high, generally reaching the maximum in the latter half of the month. In July and August water is maintained at a high stage and the largest boat at present on the river can navigate to Telegraph Creek with little difficulty. In September the supply of water generally decreases fairly rapidly, so that shortly after the middle of the month it has reached a very low stage, when navigation by the regular river-boats is difficult. However, this period, if it comes at all, is usually short, for late September rains raise the level and navigation is fair until about the middle of October, when with increased cold the precipitation assumes the form of snow and the river-level is lowered. For one to two months after this the river is navigable by small boats.

The river drains a very large area and its vagarities are pronounced. Storms may cause precipitation in one part of the area, thus raising only certain tributaries; and sections may be subjected to excessive sunshine, causing increased melting, while others protected by clouds are relatively cool. During the greater part of the summer the main river is not subjected to rapid changes in level, though in the fall, when it is low, a rise of 6 feet in one night has been known to occur in narrow sections after a heavy rain. On rare occasions (possibly once in ten or more years) the lake on Flood glacier breaks loose and a tremendous amount of water, suddenly released, carries everything before it and undoubtedly would seriously menace any craft on the

river below this point. The outbreaks are reported to occur late in the summer. There is no way to predict their coming nor is there much warning, but such catastrophes are so rare as not to be a consideration for the ordinary river service.

The high water in the spring is a menace mainly because at extreme stages it loads the river with numerous drift-trees and other debris. With care a boat can, in most places, easily steer a course to avoid these. In Little canyon the river is confined in a narrow gorge and the water is driven through with tremendous force, developing many powerful boilers and eddies. Under these conditions navigation at best is difficult and with the added menace of much drift becomes unsafe. This condition has seldom obtained sufficiently long in recent years to cause important delays.

During the fall, winter, and spring, tributary streams contribute a very small load of silt, the water becomes clear and is able to pick up material from its own channel to be transported farther down-river. At this time the stream becomes confined to definite channels which are fairly well cleaned out. Most of the soft sand-bars in the channel are removed, but gravel-bars, owing to the decreased force of the water, remain unaffected. With the coming of high water so much more material is carried from the very swift tributaries into the comparatively slow-flowing Stikine that it is unable to carry the load and throughout begins to aggrade its channel; bars are built up wherever the water is slack; the river is greatly constricted opposite stream-mouths; and changes its channel considerably, especially in the lower reaches, where the material is relatively fine and easily moved. These and concomitant factors contribute greatly to the difficulty of navigation. With the falling of the river-level in the late summer and fall and the consequently decreased carrying capacity, new bars appear to tax the boatman. Low-water stages, though offering many stretches in which the current is relatively slow, afford in general the poorest and most dangerous navigation conditions. In the lower reaches snags and sand-bars are numerous; in the upper section gravel-bars, riffles, and boulders menace even the most experienced voyageur.

Water conditions on Clearwater river do not follow exactly those on the Stikine. High stages of water may come much later since they derive a large portion of their supply from glaciers. Hence a spell of hot weather at any time will very considerably increase the quantity of water. Also, autumn rains, because of the heavy precipitation in the mountains which the Clearwater drains, affect the river considerably more than the main river. Low water comes somewhat earlier. The Scud river has the same changes of water conditions as the Clearwater, though their periodicity may not conform. In general the tributaries are subject to much more rapid and greater changes than the main river. Those from glaciers show, especially in hot weather, a marked daily variation which is not apparent on the main river. To the traveller this is an important consideration since a stream which can be forded in the morning may be quite impassable by evening. Furthermore, conditions for navigation on either the Scud or the Clearwater may be favourable one day and by the next be adverse.

VEGETATION.

Due to the diversity of climate, vegetation is fairly definitely of two types. In the wet belt below Little canyon the river-flats are a veritable jungle; large cottonwood-trees stand out above a tangled mass of willows, cranberry-bushes, and devil's-clubs. The lower slopes, wherever conditions are favourable, are heavily clothed with a mature forest of spruce, balsam, and hemlock. Travel through this is as a rule easy. Where the trees are sparse or absent there is generally a thick underbrush of alders or devil's-clubs which greatly impede progress. In many places, however, where the slopes are steep the rock is entirely bare. Gullies and protected spots where the snow accumulates and lingers are generally fairly free of vegetation and afford the best routes for ascent. Timber-line throughout the wet belt is low, probably averaging about 3,500 feet, though in localities favourable to growth it extends up to 4,500 feet.

Above Little canyon the vegetation somewhat resembles that of the dry belt. The valley-flats are slightly more open than in the lower part of the river. On northerly slopes that are protected from the sun the vegetation differs only slightly from that in the wet belt, but elsewhere there are fewer trees; pines, birches, and poplars are present and in places are the most abundant types. Underbrush is less luxuriant and in general virgin forests are open and park-like. Unfortunately, there are few sections which have not been burnt over in the last fifty years and as a consequence there is much fallen timber and secondary growth which

seriously obstruct passage. Steep southern slopes such as those along the north side of Clearwater valley are in many places practically barren except for the more hardy shrubs. Timber-line in general is about 4,500 feet, though in favoured positions it extends to 5,000 feet.

GAME AND FISH.

On the west side of the river, from 7 miles north of Little canyon and on the east side north of Scud river, goats are abundant above timber-line. South of Patmore creek on the west side they are very rare. Moose are fairly plentiful north of Clearwater river, but to the south they are rare. Sheep are found in the north-eastern part of the area. Bear are fairly numerous everywhere.

In the late summer and fall salmon are abundant in the main river and many of the tributary streams. Cut-throat trout and Dolly Varden can be caught in the river and are abundant in some of the streams north of Clearwater river.

GENERAL GEOLOGY.

The map-area is essentially a strip along the eastern contact of the Coast Range batholith. The rocks are divisible into two main groups—the intrusives, which make up the batholith, and the non-intrusives. The latter group consists of Pre-Permian metamorphosed sediments with some volcanics, Permian limestone, Triassic and Jurassic volcanics with some sediments, Cretaceous conglomerate capped by volcanics of the same age, Eocene volcanics with interbedded shales, sandstones and conglomerates, and Pleistocene flows. The group naturally presents an extreme range in character of materials, both because of wide lithological differences in the original rocks and because of a greatly varying degree of metamorphism. The batholith in the map-area also presents great heterogeneity since it is composite and the various intrusives show considerable inherent diversity as well as modifications due to their influence on one another.

NON-INTRUSIVES.

Pre-Permian.

The Pre-Permian rocks are found throughout the map-area in more or less discontinuous masses. Generally they occur at the contact of the batholith and lie between it and the Permian limestone or the Mesozoic volcanics, though in the north-eastern part of the area there is a large mass some distance from the batholith. They are in the main metamorphosed sediments. Dark grey is the dominating colour, though green is also fairly prevalent. In general, schists, slates, and quartzites predominate, with lesser quantities of calcareous materials and volcanics. They are, as a rule, well bedded and by this characteristic can in most cases be distinguished from the other formations. As exposed in different parts of the area the Pre-Permian series exhibit diverse assemblages of materials. On the Stikine river below Grand rapids there is a considerable thickness exposed which is highly calcareous and differs from the overlying Permian limestone mainly in being somewhat more argillaceous and darker in colour; the rocks are mainly light to dark grey, highly calcareous schists or schistose limestone. The argillaceous content has been metamorphosed to micaceous minerals, whereas the carbonates are mainly crystalline, though in some places these two have been altered, especially near the contact with the batholith. Between Scud river and the mountain at the head of Ochsakieen creek there appears to be an even greater thickness of calcareous beds; otherwise this type of material is unimportant. On the south-eastern slope of Devils Elbow mountain, in what appears to be a lower series than that just below Grand rapids, the calcareous element is practically absent, and quartzites predominate, with some slates and schists. However, in most places the two latter types of rock are the most abundant. Rarely, Pre-Permian rocks show a character not greatly different from that of some of the Jurassic and Triassic materials, being made up largely of altered igneous rocks. Some of the clearly volcanic materials, however, show more metamorphism than is common in the younger series. In many places the true character of the rocks cannot be so easily indicated since metamorphism, deformation, and intermingling of intrusives has created heterogeneous complexes which are not readily deciphered.

Permian.

The Permian limestone when present forms a relatively narrow band between the older Palæozoic sediments and the younger Mesozoic volcanics. The latter generally lie to the north

or east. Owing to the fact that a pronounced unconformity occurs between the Palæozoic and Mesozoic rocks, the limestone is in many cases entirely absent. Because of this and the complexity of structure the individual masses have great irregularity in shape and size. They occur throughout the area and are most extensive on Clearwater river, on Stikine river near Grand rapids, in the vicinity of the head of Ochsakieen creek, east of Pereleshin mountain, in a roof-pendant north of Patmore creek, and in a broad north-south band lying some distance east of the map-area and crossing Anook river.

The Permian limestone is a fairly uniform light grey and as a consequence stands out prominently against the other rocks except where it is in contact with the lighter phases of the batholith. In the main the material appears to be a fairly pure limestone, now largely crystalline. In places, notably near the batholith, it shows some beautiful marbled and coarsely crystalline phases. Some of these are pure white, whereas others show irregular tinting and variegated effects common to much marble used for decorative purposes. In part the limestone is well bedded with individual strata from a fraction of an inch to a foot in thickness. Elsewhere it is massive and gives no clue as to the direction of bedding. Practically everywhere it is intensely folded and much broken and fractured. While chert or silicified beds are fairly common in the series and in general appearance very closely resemble the limestone. A somewhat darker grey chert is distributed in irregular masses in some sections.

The structure of the Palæozoic sediments, which is most clearly brought out by the distribution of the Permian limestone, seems to indicate that these strata were first intensely folded, with axes trending north-east and south-west. Some of the folds thus developed were very close, especially in the vicinity of the Clearwater-Stikine River junction. Secondly, there was folding with a north-west and south-east trend which developed an anticline in the batholithic area, so that the cross-folds there are now turned up and truncated in a manner which leaves a pattern crudely suggestive of a frill.

Triassic, Jurassic, and Lower Cretaceous(?).

Overlying the Permian limestone is a great thickness of volcanics which includes a series of Triassic age, another of Jurassic, and possibly some early Cretaceous. Since they are not readily divisible into their various groups, the description of the distribution of the individual members would serve little purpose in a preliminary report such as this. North of Clearwater river and north and east of Devils Elbow mountain, with the exception of sections already noted and others which will be noted, Mesozoic volcanics occupy almost all the area of non-intrusives. Other smaller masses occur throughout the southern part of the map-area.

The Triassic volcanics rest upon Palæozoic rocks of different ages with, in most places, no conglomerate intervening. As is usual in materials of this type, they show a great heterogeneity. Green is the predominating colour; dark greys are common, and red, purple, black, and light greys are present. There are also various colour combinations and mottlings. Diversity in texture is equally marked, ranging from that of coarse-grained igneous rocks through the different types of extrusives to that of argillites and slates. Coarse breccias, agglomerates, and conglomerates are fairly common. A great part of the series is made up of massive flows, some of which show well-defined bolster structure. Associated with them are masses of well-bedded tuffs which in places are of little thickness and limited length, being more or less lenticular in shape. Elsewhere the thickness is considerable and the same group of strata may be observed over a distance of many miles. In the lower part of the series north of Clearwater river there is considerable thickness of weirdly coloured, green, grey, and purple, well-bedded quartzites with some argillites. Elsewhere there are black and dark grey argillites, slates and schists, with, in places, a high calcareous content. Limestone occurs throughout the series associated with a great variety of materials, though the total amount is very small. In the volcanics there are bedded lenses of a few to several hundred feet in length; small concretions are scattered through great thicknesses, giving an appearance suggestive of conglomerate; a calcareous content is fairly common in many of the clastics. In the sediments there are fairly pure limestone-beds as well as many which are definitely calcareous.

Separation of the Triassic and Jurassic volcanics cannot be made except by working out the structure and tracing the unconformity between the two series or by the discovering and determination of fossils. The base of the younger series is in many localities marked by conglomerate. West of the Stikine, opposite Pritchard creek, this basal member is exceptionally extensive, thick

and coarse, and contains a large percentage of granitic boulders. Stratigraphically above this in many places there is a series of calcareous sediments, including some fossiliferous limestone. With the exception of a thick member of bedded jasper, the rocks of Jurassic age resemble very closely those of the previous period. Early Cretaceous volcanics may be present, but as yet have not been differentiated.

The Mesozoic volcanics so far referred to are for the most part greatly deformed and in many places show close, possibly isoclinal, folds. Metamorphism is also extensive but much less intense than in the older Palæozoic rocks.

Upper Cretaceous.

From First South Fork river to 4-Mile creek and on the tops of the mountains opposite the mouth of the Clearwater, strata of Upper Cretaceous age occur. This series rests with a marked unconformity on the older complex. On one of the mountains it is made up essentially of conglomerate, which throughout has many beds with well-rounded boulders ranging up to 1 foot in diameter. The materials which constitute them are largely igneous. Eastward the sediments become finer in texture and on First South Fork river conglomerates with pebbles up to 1 inch in diameter predominate. Interbedded with these are thin beds of sandstone. Both types of material are light grey. The pebbles of the conglomerate are well rounded and the matrix is mainly fairly fine grains of quartz. The sandstones are similar to the matrix and rarely are fine-grained. On a mountain opposite the mouth of the Clearwater the thickness of the series exceeds 2,000 feet, whereas on First South Fork river there is not much more than 100 feet exposed. The strata everywhere are practically horizontal in marked contrast to the underlying rocks. The relative positions of the various masses suggest a general dip east or north-east. On the top of one mountain opposite the Clearwater the sediments are capped by a thin layer of volcanics, which, owing to its position, is of very limited extent.

Eocene.

Eocene rocks occur along the river just north of Shakes creek. The base of the series is marked by a very coarse conglomerate made up largely of the underlying volcanics. Above this there is exposed in one place about 100 feet of fine conglomerate, standstone, and shale. These are interbedded, the first mentioned predominating and the last occurring only as a few thin beds. They too are made up largely of materials from the underlying volcanics and may be in part tufaceous. Near the mouth of the first large creek from the east north of Glacier creek some highly carbonaceous sandstone is exposed. This almost assumes the aspect of coal and is said to be sufficiently combustible to use in a forge. A few inches of this material appear in a bed of grey sandstone which is mainly quartz. The sediments are overlain by a number of lava-flows interbedded with tuffs. The whole series is considerably deformed. Beds opposite the mouth of the creek mentioned above are vertical and at no place were they found to be even nearly horizontal. They have been subjected to considerable faulting, probably accompanied by some tilting of the blocks, but whether this is the cause of all the deformation is not clear. They may also have been somewhat folded. They appear to be much more deformed than the Upper Cretaceous rocks.

Tuya Lavas.

The horizontal lavas which cover a large part of the Interior plateau, and their associated cinder cones, have previously been described. A few small areas occur along the river for 2½ miles below Telegraph Creek. They represent, probably, remnants of what was once a complete filling of the river-valley between these two points. Just above Shakes creek there are two other small masses. These may have been part of the flows as near Telegraph Creek. They are undeformed and lie directly across faults that cut all the other rocks.

INTRUSIVES.

Intrusive rocks occupy in general the western section of the map-area. They constitute a part of the great Coast Range batholith, which extends along the coast throughout British Columbia and southern Alaska.

In the map-area the contact between the intrusives and non-intrusives cannot be indicated by a single well-defined line. In many places it is marked by a zone in which from east to west there is a gradual increase in the percentage of igneous rock from an insignificant quantity to

practically the entire content. Within the batholith there are numerous roof-pendants, whereas east of the main contact, both within and beyond the area mapped, there are many small intrusive masses which are closely related to the main body.

The batholith in the Stikine River area is composite in that it was developed during several intrusive periods rather than one. Because of this it shows a considerable diversity of character in various sections and cannot well be described as a whole. In the north, between Clearwater river and a point about 4 miles north of Patmore creek, the mass, with the exception of an irregular and discontinuous border, the product of an earlier intrusive period, is of fairly uniform character. The rock here is a granite, is light brown and mainly very coarse-grained. Orthoclase, oligoclase, and quartz occur in about equal proportions, with orthoclase predominating only slightly over oligoclase. Ferromagnesian minerals have only a very small representation. This phase of the batholith is the most acid noted. From the mountain south of Patmore creek to the Great glacier on the west side of the river there is another large area of fairly uniform material. This is light grey, medium to coarse grained, and granodiorite in composition. The irregular and discontinuous fringe bordering these two areas to the east and the section between them show a pronounced heterogeneity of materials. Two or more distinct intrusive phases other than those mentioned above seem to be represented. The rocks range in colour from light grey to black, in texture from coarse to dense, and in composition from granodiorite to basic phases which show very little, if any, feldspar. In places they exhibit considerable metamorphism and the original character is often entirely masked. Shearing and fracturing is pronounced in some sections. At the contact in places, notably in the vicinity of the Devils Elbow claims, alteration of both the intrusives and non-intrusives has proceeded to such an extent that it is often difficult to differentiate the two.

The satellites to the east of the main batholith exhibit a diversity of character. Generally each shows some marked similarity to one of the phases of the main mass.

The effect of the intrusions on the adjacent rock is markedly diverse, with different phases of the batholith and with various sections of the same phase, even on one type of rock. Of course the variety of materials greatly increases the number of modifications. The changes brought about range all the way from those which are not perceptible to the development of entirely new materials which offer little clue as to their original character.

The composite nature of the batholith clearly indicates that its development took place over a long period of time. Granitic masses cut Palæozoic sediments and Triassic volcanics, while dykes which may have originated with such masses penetrate even Upper Cretaceous sediments. The basal member of the Jurassic series contains an abundance of granitic boulders, clearly indicating that part of the batholith had been developed and unroofed before that period. While there may have been intrusives of even Palæozoic age in this section, it is believed that development of the Coast Range batholith proper began early in the Triassic and continued throughout the greater part of the Mesozoic era. Possibly dying phases of this igneous activity may have contributed in some small way at even later periods. In the map-area it has been possible to separate the batholith into sections which are clearly of markedly different ages, but there does not appear to be any systematic arrangement of these sections.

ECONOMIC GEOLOGY.

The greater part of the map-area lies within what may be called the eastern contact-zone of the Coast Range batholith. This zone has long been regarded as favourable for the occurrence of mineral-deposits and has already produced well-known mining camps such as Portland Canal, Alice Arm, and Atlin. On the basis of the general geology there seems to be no apparent reason why the Stikine River area should not have potentialities as great as any other section.

Mineralization throughout this zone has been in general attributed to the intrusions which developed the batholith. In the map-area the extensive Devils Elbow deposits* and others of a similar nature have been definitely traced to one of the earliest phases of intrusion. There is considerable additional evidence which suggests that mineralization was extensively associated with this phase. What is thought to be the latest intrusive body—the light-brown granite-mass—does not in general show much evidence of associated mineralization, though in some places it contains seemingly related pyrite veins. However, it is believed that the contacts observed are

* Kerr, F. A.: Geol. Surv., Canada, Sum. Rept., 1926, Pt. A.

by nature unsuitable for showing signs of mineralization: therefore even slight manifestations may be favourable.

Though definite evidence has not been forthcoming, there is much to suggest that other intrusive periods were also productive of mineralization. The significance of these observations is twofold: First, it stands to reason that since there has been more than one intrusive period and consequently more than one mineralizing period, potentialities are greater than if the batholith were simple; secondly, the fact that the batholith itself has been reintruded by each later phase makes potential mineral bearers of all the parts so affected.

Of the intruded rocks, limestone is undoubtedly the most favourable for the reception of mineral-deposits, but equally valuable occurrences may be found in any other type of material. The known deposits and other evidences of mineralization have been noted in a great variety of rocks.

Few discoveries have been made in the area, which is not surprising since very little prospecting has been done. In 1873 and during the following years the Cassiar gold-rush attracted many prospectors to northern British Columbia, but practically all of these passed through the map-area without pausing to do any work. The Stikine and the tributaries in the vicinity of Telegraph Creek were tested for placer deposits and some of the bars of the main river were very producive for a short period. Following 1898 there was another rush of prospectors up the Stikine, but they all had their eyes fixed on the distant Klondike. There is nothing to indicate that either of these influxes induced any extensive search for minerals in this area. All important streams have undoubtedly been tested for placer gold and some desultory hard-rock prospecting has been done in the areas immediately south of Telegraph Creek, but there is ample evidence to show that the work done in any section was not adequate to give a fair idea of its possibilities. However, there have been sufficient discoveries to support clearly the contention that mineralization does occur over an extensive area. Furthermore, during the field operations of the present work many evidences of this mineralization, both *in situ* and in float, were observed throughout the area.

The important discoveries include the following types of deposits: Silver-lead (galena)-zinc (sphalerite with some copper (chalcopyrite)); copper (mainly bornite); copper (chalcopyrite with pyrrhotite); copper (tetrahedrite); free-milling gold and placer gold. Small veins have been observed of chalcopyrite, of pyrite, and of arsenopyrite—the latter two with gold and silver values. Also small deposits of magnetite and of hæmatite have been noted. Float specimens suggest still other types of deposits.

The most important known deposit in the map-area at the present time is one of placer gold at the mouth of the canyon on North Fork river, owned by Captain Sydney Barrington and associates. During the last two years a very well-planned programme of drilling has been carried out. The results have been sufficiently encouraging to warrant a continuation of the explorations. Since the working of this ground will involve considerable difficulties, profitable operations will be largely dependent on securing suitable equipment and maintaining efficient management. The properties had already produced over $20,000 worth of gold from hand operations. The gravel was removed from among boulders in pits which undoubtedly required much labour, yet the undertaking is reported to have been profitable.

The deposits on the North Fork river owe their origin to a peculiar set of circumstances. Probably many streams in this area had considerable gold concentrations previous to the Pleistocene period, but with the advent of glaciation the ice removed the concentrates and scattered them far and wide. In the North Fork River area, however, most of the ice from the upper section moved through Shakes Creek valley, so that a part of the North Fork valley between Spann creek and the mouth of the canyon was not subjected, during the glacial period, to the same intense scouring and cleaning-out process as others. Hence gold that accumulated during the pre-glacial and interglacial periods, especially that in the canyon, was not disturbed. The post-glacial activity of the river-waters has removed to some extent the old accumulations and has carried them down-stream beyond the canyon. The natural tendency there, since the gradient and water velocity was somewhat less, was for the gold to be dropped not far below the canyon and to work its way down into the gravel, which is of considerable thickness. If this theory is correct, the best values should be obtained near the canyon and there should be a general decrease with an increase of distance from it, which seems to be the case. The Clearwater valley, which the North Fork river enters just a short distance below the canyon, has been

extensively glaciated, so that any accumulations found there are derived from a reconcentration of glacial drift or brought in by the North Fork river, and in either case are not likely to be very great. The decrease in gradient toward the Clearwater and the presence of a thick unconsolidated channel base would militate greatly against the gold being transferred far from the canyon, though the current certainly is sufficiently strong to move considerable fine and some fairly coarse gold.

The possibilities of finding other placer-gold deposits in the map-area are not very good. Other locations where the pre-glacial or interglacial accumulations were preserved probably do exist, but their location would be difficult, and for the average prospector the time that might be spent in searching for such localities is not warranted by the possibilities.

The Devils Elbow deposits have already been described.* Since then, however, the Apex property south of these claims has been visited. The mineralization is of somewhat the same character as that of the other claims. The intrusive, however, was not observed and is believed to be at some depth below the exposures. The mineralization with associated altered limestone represents an irregular patchwork across the face of a fairly large cliff exposure. It appears as though the country-rocks had been irregularly broken and solutions passing along the fractures and bedding-planes caused mineralization. The rock so affected, in section across the face has a net-like arrangement. Though the rock is in this way rather intimately mineralized and though fine specimens can be picked from many points, it is doubtful whether the material as a whole is sufficiently rich to be of value, and owing to the irregular distribution of the richer portions in small masses they could not be mined separately. However, since in other sections mineralization increases toward the contact and since the exposures on this property may be at some distance from the intrusive, it is possible that valuable deposits may occur near by.

New showings have been discovered in this general area during the last two years, which further emphasizes the widespread mineralization described in the previous report.

At Kirk's mine (*August* claim), on the western slope of the mountain drained by Kirk creek, an adit has been driven into the hill and turned in the shape of a horse-shoe to tap a deposit exposed in a steep gully. The rocks here are green Triassic volcanics. On the surface there are two or three separate mineralized zones of lenticular shape. None is much over 200 feet in length, with a maximum width of about 15 feet. Mineralization seems to have taken place along fractures in sheared or shattered zones. The most important minerals are bornite and chalcopyrite, which in exposed parts are mainly altered to malachite. Assays in general average about 2 per cent. copper with some gold and silver.

The *Mountain Goat* claim, at some distance to the north-east, shows much the same type of mineralization. The zone is said to be narrow but fairly long.

Other deposits examined are not of sufficient importance to warrant description in a brief report of this type.

CONCLUSIONS.

No lode deposit has so far been discovered or brought to a stage of development which clearly indicates a prospective future value, though certainly some of the known deposits have possibilities. There is much which augurs well for the district as a whole, and it seems to present a great amount of territory that warrants careful prospecting. Included in this category is practically the whole area of non-intrusives mapped and much beyond. The least favourable section is that immediately adjacent to Telegraph Creek, which may lie too far beyond the batholith to have been penetrated by mineralizing solutions.

Roughly, the average width of the most favourable zone from the main contact eastward or north-eastward is probably about 25 miles, though from point to point with varying conditions this factor undoubtedly changes considerably. Which sections of this zone offer the greatest possibilities is difficult to say, though in general calcareous sediments afford the best country-rock. Furthermore, areas containing a fair number of satellites and a variety of intrusives (since this may indicate several intrusive periods and consequently several mineralizing periods) would seem to be preferable. Prospecting already done has been more extensive in the area east of North Fork river and north of Clearwater and Dochdaon rivers. Coincidentally this is the section which conforms least with the conditions described above as being the most

Op. cit.

favourable, yet, though its possibilities have been only scratched, some results have been obtained.

Roof-pendants are favourable for mineralization. Mineral specimens are somewhat abundant in the morainal material of the glaciers which come from the large pendant in the south-western part of the map-area. However, this mass is relatively inaccessible and the evidence of mineralization does not seem to be sufficient to warrant prospecting there at present. In the north-western part of the area, however, conditions are ameliorated and roof-pendants there should not be overlooked.

The above delineated sections seem to offer by far the best opportunities and afford sufficient area to keep many prospectors occupied for some time. The variety of known mineral occurrences and the composite character of the batholith indicate clearly that a great diversity of deposits may be expected, and prospectors should keep in mind that any one deposit they see is not necessarily representative of the next one they may encounter.

NORTH-EASTERN MINERAL SURVEY DISTRICT (No. 2).

By Douglas Lay, Resident Mining Engineer.

INTRODUCTORY.

The North-eastern Mineral Survey District consists of Omineca, Cariboo, Quesnel, and Peace River Mining Divisions, and occupies a large portion of Northern British Columbia, having an area of nearly 100,000 square miles. The northern, western, and southern boundaries of this district are the arbitrary boundary-lines of the Mining Divisions, but these, where practicable, always follow the watersheds of the country. The eastern boundary is the British Columbia-Alberta boundary-line. The western boundary is roughly 100 miles from the Coast, while the northern and southern boundaries are about 200 miles from the respective Provincial boundaries.

A brief explanation of the form followed in the compilation of the annual report of this district seems advisable. Under the heading "General Summary" the aim is to give first a concise but comprehensive statement embodying in a few paragraphs the salient features of the year. Next follows special mention of any matters of particular interest, such as "Prospecting," "New Discoveries," and so forth. Lastly follows the detailed report under the main headings of the Mining Divisions, subdivided into sections, as given below. As far as practicable, a section is named after the chief town or place therein. It will be obvious where this is not the case.

Omineca Mining Division—Skeena section; Hazelton section; Smithers section; Telkwa section; Houston section; Topley section; Burns Lake section; Sibola section; Manson section; Fort Grahame section.

Cariboo Mining Division—Prince George section; Barkerville section.

Quesnel Mining Division—Quesnel section; Likely section; Keithley section; Horsefly section.

Peace River Mining Division.

A general description of the geographic, geologic, and topographic features of the district was given in the Annual Report of the Minister of Mines for 1917. In the 1927 Annual Report a list of the more important reports on this district was given. During 1928 the following reports on the district were issued:—

Name of Author.	Publication.	Year.	Page.
Douglas Lay	Minister of Mines' Report	1927	116
Douglas Lay	Preliminary Review and Summary of Mining Operations for the Year 1928. British Columbia Department of Mines	1928	.....
T. C. Phemister	Geology of Topley Area. Transactions of Canadian Institute of Mining and Metallurgy	1928	.....
V. L. Eardley-Wilmot	Diatomite: Its Occurrence, Preparation, and Uses. Publication No. 691, Mines Branch, Department of Mines	1928	.....

GENERAL SUMMARY.

Important features of the busiest year this district has yet experienced are the widespread and active development, the increase in production of both lode-mineral and coal, the large amount of construction-work, and the keen search by operators for promising prospects, followed by optioning of many.

Important additions to existing plant have been made by Duthie Mines, Limited, at the *Henderson* mine, Hudson May mountain, near Smithers, including the installation of a 500-kw. Curtis steam-turbine and direct-connected generator. The considered choice by this company of the steam-turbine in preference to the Diesel engine is of decided interest.

The Duke Mining Company, Limited, has been busily engaged in constructing a 50-ton flotation-mill and 200-horse-power Diesel-engine power plant, and aerial tram thereto, at the *Silver Cup* mine, Nine-mile mountain, near Hazelton. Completion of construction is anticipated early in the new year.

The production of lode-mineral shows a marked increase, which there is every reason to assume will be further augmented in the future. The production of placer gold shows a decline, to be attributed to the regrettable and unforeseen cessation of operations by the Kafue Copper Development Company's dredge, to a decreased production from Cedar creek, and to the fact that John Hopp Mines on Lowhee creek had no fall "clean-up," due to a slide over the flume at the end of the season. Notwithstanding this, the future outlook is favourable.

The production of coal, all from one colliery (Telkwa Collieries, Limited), shows an encouraging increase. The agreement to purchase the property of this company in the latter part of the year by English interests, likewise the optioning of the Zymoetz (Copper) River coalfield by British Pacific Industries, Limited, would appear to portend important developments in the future.

In lode-mining the results of underground development have, generally speaking, been encouraging, although there have been a few exceptions. Noteworthy are the promising results in depth obtained at the *Henderson* by Duthie Mines, Limited; at the *Silver Cup* by Duke Mining Company, Limited; at the *Ferguson*, Ingenika river, by Ingenika Mines, Limited; and at the *Emerald* by the Consolidated Mining and Smelting Company of Canada, Limited. Many other properties in a less advanced stage of development than the instances cited have also responded well to development, mention of which will be made in the body of this report. Much exploration, both by excavational development and by diamond-drilling, has been carried out at the *Richfield*, Topley, by Topley-Richfield Mining Company, Limited. Important strikes in diamond-drill holes were announced by this company towards the close of the year, which are being followed up by excavational development as rapidly as possible.

Of far-reaching importance to the district is the fact that the Consolidated Mining and Smelting Company of Canada, Limited, during the year entered the field in real earnest, retaining an examining engineer in the district throughout the year and maintaining in addition prospecting parties in the field. As the result of the examination of a large number of properties, options were secured and development-work started on the following: *M. & K.* and *M. & M.* on Legate creek, near Pacific; *Duchess* and *Contention*, Howson basin, near Telkwa; and the *Harvey* and *Judge* on Driftwood creek, near Smithers. This company also carried on development at the *Emerald* on Sweeney mountain, in the Sibola section, which was optioned in 1927.

Among the operations of private individuals who embarked on mining enterprises during the year, those of F. H. Taylor are noteworthy. In addition to carrying on development at smaller properties, he secured options on practically every property of known importance in the vicinity of Owen lake, including the *Silver Queen*, *Diamond Belle*, and *Midnight* groups. A sawmill and various mine supplies have already been placed on the ground, and active operations are contemplated this winter by the Owen Lake Mining and Development Company, Limited, the company organized in connection with this enterprise.

Of interest is the reopening of two well-known properties which have been inoperative for some years—namely, the *Rocher Déboulé*, Hazelton, and the Cronin property in the Babine mountains.

In placer-mining the disappointment occasioned by the unforeseen shutting-down of the Kafue Copper Development Company's dredge is offset by the reopening of the well-known *Bullion* by Carinelle Placers, Limited, on a scale commensurate with the magnitude of the undertaking. Another gratifying feature is the fact that John Hopp Mines, the large hydraulic on Lowhee creek, has entered good virgin ground and appears to have a productive period ahead. The usual activity has been evinced by the smaller hydraulic properties and some Keystone-drilling was carried out on Swamp river by the Consolidated Mining and Smelting Company of Canada, Limited.

No spectacular new discoveries have been made during the year, but much painstaking prospecting has resulted in useful finds, which throw light on the mineral occurrence in several different regions.

The Topley area was the subject of detailed study by G. Hanson and T. C. Phemister, of the Geological Survey.

An inspection and reconnaissance of Fulton River water-power site was made by R. C. Farrow, Field Engineer of Water Rights Branch of the Department of Lands. His report thereon, known as "Hazelton Water District: Power-site No. 58," is now available.

Summing up the results of the year, it may be stated that, although some disappointment has been experienced, very distinct progress has been made. Active development of many promising and diverse modes of mineral occurrence is now taking place at widely separated points. This fact appears to afford ample warrant for the belief that the future will witness steady expansion of the mining industry in this district.

The writer desires to express his thanks to the prospectors, operators, and mining men of the district for many courtesies extended.

Production.

Lode-mineral.—The following is a list of shipping-mines in the No. 2 District for 1928:—

Name.	Crude Ore shipped.	Ore milled.	Lead Concentrates.	Zinc Concentrates.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Tons.	Tons.	Tons.	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.
Omineca Mining Division—									
Henderson	.....	14,980	718	848	324	319,421	.....	781,712	727,627
Silver Cup	48	208	45	35	5	15,754	.....	64,500	38,763
Mohawk	.....	69	18	18	2	8,125	.....	21,899	21,863
Victoria*	23	.....	.....	.....	146	.....	.....	.....	.....
Diadem	1	.....	.....	.....	.....	1	52	.....	.....
Maple	1	.....	.....	.....	.....	61	.....	325	.....
Sunset	2	.....	.....	.....	.....	291	.....	259	.....
Totals	75	15,257	781	901	477	344,653	52	868,695	788,253

* Contained $759 worth of cobalt and arsenic.

Placer Gold.—The placer-output of No. 2 District for 1928 was 4,371 oz. gold, valued at $94,307, as compared with $99,569 in 1927.

Coal.—The output of coal was 1,668 long tons (all from Telkwa Collieries, Limited), as compared with 1,691 long tons in 1927.

Roads and Trails.

The widespread activity was reflected in the large number of applications for assistance with mining roads and trails. Substantial aid in this connection was given by the Department of Mines at all points throughout the district. Among the major items may be mentioned the following:—

Omineca Mining Division.—Chimdemash Creek trail, Usk; Nine-mile Mountain road, Hazelton; Driftwood Creek road, Smithers; branch road from Duthie Mines road to *Victory* group, Smithers; Topley–Babine Lake road, Topley (serving *Richfield* group); Houston–Owen Lake road, Houston; road from Finlay river to *Ferguson* mine (*Trout Lake* group); road from Fort St. James to Manson creek.

Cariboo Mining Division.—Cunningham Creek road; Ahbau Lake trail.

Quesnel Mining Division.—Quesnel-Little Lake road; Likely to Keithley road.

In addition to the foregoing, it should be understood that assistance was given in connection with a very large number of trails throughout the district.

It might be added that, of the projected roads and trails, two appear to be affected by issues of Provincial importance, apart altogether from those which primarily concern the Department of Mines. These are:—

(1.) The road northwards from Vanderhoof via Fort St. James to Manson creek, following the Williams reconnaissance railway survey line to the Peace river via Finlay Forks; the object of which is to ultimately give service to the northern Omineca and Peace River Mining Divisions, but the completion of which, with funds available solely under the "Mines Development Act," cannot be expected for many years.

(2.) The completion of the Sakumtha Pass route from Kimsquit, on the Dean channel (within twenty-four hours of Vancouver by Coast steamship), to Canadian National Railway points.

A full description of this route will be found on pages 147, 148, and 149 of the 1926 Annual Report. The completion of this route involves construction of 25 miles of pack-trail—an expenditure of, say, $10,000—from the Sakumtha river (the point to which the trail has already

been advanced from Kimsquit) to Eutsuk lake. This route is of importance to the mining, agricultural, and lumbering industries, and incidentally possesses such unique features in the way of diversity of scenery, big-game hunting, and fishing, so close to the large centres of population on the Pacific coast, that its completion seems a matter of urgent advisability; and all the more so in view of the small cost compared with the advantages gained.

New Discoveries.

Among new discoveries of interest may be mentioned the following:—

(1.) *Trade Dollar*, Hudson Bay mountain, near Smithers—a discovery of remarkably clean galena, 2 feet 6 inches in width, by Angus Chisholm, Alex. Chisholm, and E. Hassard.

(2.) *Snowstorm*, near Owen lake—a discovery of a somewhat widespread, although sparse, mineralization of zinc-blende, galena, and iron pyrites in a quartz-feldspar rock of alaskite type, by Helmer Larson.

(3.) *Cup*, Topley—a discovery by Matthew Sam of a small vein showing much grey copper.

(4.) *Jack Rabbit*, near Topley—a discovery by Matthew Sam and Johnny Davis of chalcopyrite showing good gold values.

(5.) *Randolph*, near Topley—a discovery by Chris. Wold and R. J. Jennack of a copper mineralization.

While the commercial significance of these, except the first mentioned, remains to be demonstrated, all are interesting and useful, throwing light on the mineral occurrence in their respective regions. These discoveries will be fully dealt with in the body of this report.

Among other discoveries reported at the close of the season, but which it has been impossible yet to investigate, is one of what was stated to be anthracite coal at Cedarvale. It may be said, however, that a sample submitted yielded the following analysis: Moisture, 4.3 per cent.; V.C.M., 4.5 per cent.; fixed carbon, 68.2 per cent.; ash, 23 per cent. This analysis does not indicate a commercial fuel and the appearance of the sample was that of a graphitic material, but not a true coal.

Prospecting.

Discoveries of the past two or three years render evident that this district offers great opportunities to prospectors. Moreover, the present demand for good prospects is very keen, and the owner of such probably never had a better opportunity than now for effecting ready sale. It is also desired to stress the fact that many of the areas which offer a promising field for the prospector lie comparatively close to transportation facilities and search in these areas involves no great expense or hardship. The importance of keen scrutiny of these before going farther afield is evident.

In the Annual Reports for the years 1917, 1921, and 1923 very full general information will be found on the subject of prospecting, likewise a detailed account of the physiographic and geologic features of the district. In the 1926 Annual Report will be found a fairly full account of the Nechako plateau and of the Fort Grahame section. These reports should be carefully studied by those interested. Information of great value will also be found in "Geology and Economic Minerals of Canada," by G. A. Young, published by the Geological Survey of Canada. The latter has also recently published a geologic map of the Finlay River area, known as Map No. 207A.

It is unnecessary to repeat herein the detailed information given in the above-mentioned reports, but attention is directed to the importance of the following:—

(1.) The areas more immediately adjacent to the contact of the Coast Range batholith, or injection tongues therefrom, with the volcanics and sedimentaries of the interior; e.g., both sides of the Skeena river, between the mouths of the Zymoetz (Copper) and Kitwanga rivers; the headwaters of the Telkwa river; the Sibola section.

(2.) That portion of the Nechako plateau west of Fraser lake, or, in other words, both sides of the Canadian National Railway line between Houston and Fort Fraser. Within this area lie the important mineral-deposits of Topley and Owen lake. It is suggested that search in this region be first directed to the location of any intrusions of granitic or plutonic rocks, followed by a more intensive search in such regions. Molybdenite prospects are becoming important. Commercial deposits of this mineral are to be expected in granitic tongues, or in quartz veins in immediate proximity to such. One noteworthy molybdenite prospect (the *Stella*) has

already been found in this area, and it is quite possible, even likely, that there are others. Prospects for other mineral discoveries are equally good.

(3.) Fort Grahame section. In this connection Map No. 207A will be very useful for reference. In addition to the area more immediately adjacent to Fort Grahame, it is evident that the fringes of the Omineca batholith, which are to be found at or near the headwaters of the Omineca, Osilinka, Mesilinka, and Finlay rivers, should be likely areas, although they are at present somewhat inaccessible.

(4.) The most promising areas for mica are the two Mica mountains, one being situated opposite Fort Grahame and the other at Tete Jaune, on the Canadian National Railway.

(5.) The placer-gold sections of the district—namely, the Cariboo and Quesnel Mining Divisions and the Manson section and vicinity of McConnell creek in the Omineca Mining Division—afford a field for investigation. In the Cariboo and Quesnel Mining Divisions the field is rather for investigation by drilling to prove or disprove certain possibilities, rather than for actual prospecting. However, that portion of the Cariboo Mining Division north of the Cottonwood river, between the Willow and Fraser rivers, still appears to offer a field for prospecting for any large areas suitable for dredging and for any hydraulic possibilities. The Manson section has probably not been so thoroughly prospected as the Cariboo and Quesnel Mining Divisions, but it has reached the testing stage and certain possibilities can only be proved or disproved by drilling.

Smelting Rates.

Attention is drawn to the fact that under date of October 1st, 1928, the Consolidated Mining and Smelting Company of Canada, Limited, modified its schedule for zinc ores in favour of the shipper. Particulars of the new schedule can be obtained upon application to the company. Under date of December 26th the company further announced that, commencing with shipments received on that date, no zinc penalty would be charged on lead ores.

Subsidy on Powder used by Prospectors.

Bona-fide prospectors are reminded that a subsidy is paid by the Department of Mines to the extent of 25 per cent. of the legitimate retail cost on powder actually used in prospecting. Copy of the regulations can be obtained upon application to the Department of Mines, Victoria.

Cost of Transportation.

The following figures are representative of average costs prevailing in this district:—

Railway Transport.—Six cents a ton-mile for L.C.L. lots; 2½ cents a ton-mile for car-load lots. Transport of ore depends upon the value and is as low as ¾ cent a ton-mile.

Motor-truck Transport.—For large quantities of freight on good mountain roads, from 22 to 42 cents a ton-mile. On bad roads the cost may greatly exceed this.

Pack-horse Transport.—For large quantities of freight over good trails, $1.25 a ton-mile. For small quantities of freight an approximate figure is $2 a ton-mile.

Water Transport on Swift Rivers.—With large craft plying, up-stream rate from 24 to 50 cents a ton-mile; down-stream rate about one-quarter of the foregoing.

Addresses.

During the winter addresses were given by the Resident Engineer, as usual, at various centres throughout the district on matters connected with developments and prospecting, for the purpose of disseminating information helpful to prospectors and others interested in mining in the district.

OMINECA MINING DIVISION.

Skeena Section.

Usk.

Properties tributary to the town of Usk, on the Canadian National Railway, 107 miles east of Prince Rupert, have witnessed much activity during the year. For maps refer to 1914 and 1924 Annual Reports.

Valhalla and Kleanza.

These groups, situated on the east side of the Skeena river, 3 miles below Usk, are under active operation by Columario Gold Mines, Limited. A branch road, about half a mile in length, leads to the camp buildings from the Usk–Terrace highway, from a point just south of Kleanza creek. During the year a portable compressor was installed and camp buildings erected. A maximum number of twenty men was employed.

Inspection made on July 1st was confined to the more important exposures and workings, which are situated on the lower western slopes of Kleanza mountain, at elevations of between 1,720 and 2,050 feet above sea-level. Other exposures occur at very considerably higher elevations.

The mineral occurrences consist of nine parallel gold-bearing quartz veins, which vary in width from a few inches up to 6 feet, striking about N. 50° W. (mag.) and dipping north-easterly at angles varying between 30° and 60°. The distance between these veins varies from about 70 feet to somewhat over 200 feet and all are contained in a strip of country about 1,250 feet in width. The mineralization is mainly pyrite and a little chalcopyrite. No. 5 vein contains some galena. These veins are named in order of number from west to east, No. 1 being the most westerly and No. 9 the most easterly. Reference to the map accompanying the Annual Report for 1920 will facilitate study of the text.

These veins have been well exposed by various strippings and open-cuts and at the time of inspection one tunnel had been started on No. 1 vein, known as *Valhalla 2* tunnel, and two tunnels on No. 6 vein, known respectively as *Tenderfoot* and *Dakota* tunnels. The topography is such that all these veins can be developed by adit-tunnels to great advantage.

In the region inspected the country-rock appears to be a volcanic flow-rock of andesitic type, intruded by granodiorite, and the structure exhibited by the flow-rock is anticlinal, such that the bedding in the northern portion of the area dips in the opposite direction to that in the southern. Thus, while all veins, which are shear-zone fissures, dip in the same direction, those in the former region—e.g., in the *Tenderfoot* tunnel—dip in the same direction as the bedding of the country-rock, whereas in the southern region the vein dip is in the opposite direction to that of the enclosing country-rock—e.g., in the *Dakota* and *Valhalla 2* tunnels.

In the *Valhalla 2* and *Dakota* tunnels the shear-zones are somewhat wide, possibly 30 feet, and extend considerably beyond the quartz-seams. It is to be expected that, under such conditions, offsetting or minor faulting of the quartz-seams will occur, and such is the phenomenon exhibited. This would appear to be an occurrence in echelon rather than true faulting. No fault-throw beyond the limits of the shear-zone was noted.

Portions of the veins are barren, or nearly so, and others show fair value. At the time of inspection it was evident that a considerable amount of development would be necessary to form an intelligent opinion as to commercial possibilities, but it was equally apparent that such development was warranted in the anticipation of developing ore-shoots of milling grade.

At the time of inspection it seemed advisable to discontinue the *Tenderfoot* tunnel and start instead an adit on No. 4 vein. The latter was commenced in July, and the management states that since then a considerable amount of drifting has been performed on this vein, with promising results. From this adit-drift a crosscut was run a distance of 210 feet to No. 5 vein and another crosscut a distance of 73 feet to No. 3 vein. It is further stated that, following inspection by H. L. Batten, consulting engineer, in the fall, it has been decided to carry out 1,000 feet of drifting in the vein system at this horizon and another 1,000 feet of drifting at a level 125 feet below that under attack.

It is apparent that this property possesses many favourable features conducive to low operating cost, such as favourable topography permitting of great depth being obtained by adit-drift tunnels, abundance of mine-timber, near-by water power on Kleanza creek, and nearness to transportation. Refer also to Annual Reports for the years 1920, 1921, 1925, and 1927; also to Summary Report, 1925, Part A, Geological Survey, page 117.

Emma and Four Aces.

On these groups, which are situated on the east side of the Skeena river, about half a mile from Usk, small-scale operations were carried on during the year by A. J. Lowary. A detailed description of these groups is given in the Annual Report for 1927. Work during the year comprised a certain amount of crosscutting, the reopening of the adit-tunnel run some years ago, and improving the trail from Usk.

To probe the mineralization exposed at 930 feet elevation (refer to 1927 Annual Report) a crosscut was started a short distance below the exposure and continued for a distance of 110 feet. The crosscut starts on a bearing N. 70° E. (mag.), then bends to the right, finishing on a bearing S. 10° E. (mag.). Close to the face there was passed through what is apparently the downward continuation of the shear-zone exposed on the surface above. This showed a strong-looking seam of quartz, and although only slightly mineralized calls for further investigation.

Subsequent to this work, it is understood that the old adit-tunnel at 550 feet elevation, described in the 1914 and 1927 Annual Reports, and which had caved, was reopened.

The management advises that a small portable compressor has recently been installed and that winter operations are contemplated. Refer also to the Annual Reports for the years 1914, 1918, 1923, 1924, and 1927, and also to Geological Survey of Canada, Summary Report, 1925, Part A, page 116.

Diadem.

This group, owned by B. Shannon, is situated just west of Nicholson creek, about 1 mile south-west of Hanall, a flag-station on the Canadian National Railway, 2½ miles east of Usk. A good road leads from Usk to the property. During the year small-scale operations were carried on by Canadian-American Consolidated Mining Company, Limited, which obtained an option. After a few months work was discontinued for reasons not known.

The mode of mineral occurrence is that of a number of approximately parallel shear-zone replacement fractures in a silicified volcanic rock. These have an average strike of N. 40° E. (mag.) and dip south-east at about 55°. The distance between fractures varies from 100 to 200 feet and all known fractures of significance are contained within a strip of country about 650 feet in width, although it is quite possible that others will be found outside these limits. Exposures are by open-cuts and shallow pits within elevations of 890 and 1,130 feet.

The essential mineralization is chalcopyrite with pyrite and in places a little bornite. The gangue is quartz and altered country-rock. A feature of the mineralization is that a sparsely mineralized outcrop quite frequently shows, at a depth of a few feet only, a marked improvement. Topography permits of development by adit-drift.

Some of the fractures seem of doubtful commercial importance. The most important are known respectively as No. 1 vein and No. 2 vein, and of these attention has been focused on No. 1, which shows the strongest mineralization.

No. 1 vein is exposed by a shaft 12 feet deep at 890 feet elevation. At the bottom of this shaft a width of 4 feet of quartz is heavily mineralized with chalcopyrite. The better half of this, 2 feet in width, assayed: Gold, trace; silver, 1 oz. to the ton; copper, 8.5 per cent. Distant about 650 feet in a south-westerly direction, at an elevation of 1,080 feet, an open-cut on what appears to be the continuation of this vein shows a width of 2 feet of quartz, chalcopyrite, and pyrite. A sample across this width assayed: Gold, trace; silver, 2.2 oz. to the ton; copper, 4 per cent. The ground rises somewhat sharply beyond this open-cut to a knoll, the summit of which (elevation 1,130 feet) is about 750 feet south-west of the shaft above described. Between this knoll and the main mountain range is a deep draw.

No. 2 vein is exposed by an open-cut at 1,030 feet elevation, at which point a width of 1.5 feet of quartz is well mineralized. A sample of the best portion assayed: Gold, 0.01 oz. to the ton; silver, 12 oz. to the ton; copper 8.5 per cent. The distance between No. 1 and No. 2 veins is about 220 feet, the latter vein being the more northerly.

Between No. 1 vein and No. 2 vein, at an elevation of 960 feet, an open-cut exposes another shear-zone replacement fissure, 8 feet in width, which, although sparsely mineralized, appears to warrant further investigation.

No. 4 vein is distant upwards of 600 feet from No. 1 vein; an open-cut at one point shows a width of 1 foot of mineralized quartz, a sample of which assayed: Gold, trace; silver, 2.4 oz. to the ton; copper, 4.5 per cent.

It was intended to develop No. 1 vein by an adit-drift started a short distance below the bottom of the 12-foot shaft on this vein described above. For reasons not known, operations were discontinued shortly after commencement of this tunnel. Two trial shipments, each approximately ½ ton, were made from this point, one to the Granby smelter, which assayed: Gold, 0.015 oz. to the ton; silver, 0.8 oz. to the ton; copper, 6.08 per cent.; and one to the Trail smelter, which assayed: Gold, 0.02 oz. to the ton; silver, 2.4 oz. to the ton; copper, 5.55 per cent. The management states that in getting out these shipments the full vein-width of 4 feet was mined and approximately one-fourth by weight of waste was sorted out.

It is apparent that the mineralization carries low precious-metal values and that concentration prior to shipment is necessary. No evidence so far has been obtained as to continuity of ore-shoots and the advisability of continuing the tunnel started is indicated. The property is well situated so far as transportation is concerned and the surrounding features lend themselves to low operating costs. Refer also to Annual Reports for years 1923, 1925, 1926, and 1927.

Telkwa River, Omineca M.D.

Legate Creek—Zona May Claims, Omineca M.D.

Placer-working on Parsnip River, Omineca M.D.

Finlay River Mining Co.—Testing Black Sand at Pete Toy Bar.

Jackie. This group, owned by A. A. Stewart, J. Bell, and associates, is situated on Kitsalas mountain, about 5½ miles distant by trail from Usk. The showings occur in the beds or on the banks of some small unnamed creeks, which flow down the steep, and in places precipitous, mountain-sides into Lowrie creek.

At 1,875 feet elevation, in the bed of one such creek, there is exposed at intervals over a length of upwards of 300 feet a shear-zone replacement fracture in schisted, silicified, porphyritic volcanics. The width varies from 2 to 4 feet and the mineralization consists of zinc-blende, pyrite, and a little galena, and is somewhat sparse. The fracture strikes N. 42° W. (mag.), which approximately coincides with the creek. The dip is north-easterly. A sample of the best mineral-showing assayed: Gold, trace; silver, 1.2 oz. to the ton; lead, *nil;* zinc, 7 per cent.

At an elevation of 3,040 feet in an adjoining creek there is said to be a distinctly better showing, in a somewhat inaccessible place, which could not be found in the absence of A. A. Stewart, one of the owners. This property appears to merit further investigation.

Phoenix. This group, owned by J. L. Bethurem and associates, is distant about 6 miles from Usk and is situated on a mountain-spur between Lowrie and Nicholson creeks. At elevation 3,000 feet, in the immediate vicinity of an intrusion of granodiorite into the volcanics, there outcrop several quartz veins. Close to the top of the spur, on the sides sloping to Nicholson creek, there is a prominent outcrop of quartz, mineralized with pyrite, a little zinc-blende, and molybdenite. A sample of the more heavily mineralized portion assayed: Gold, trace; silver, trace; molybdenite (MoS_2), 0.2 per cent. There are other showings on the property which, owing to lack of time, could not be inspected, but it is evident from the surrounding geology that prospects are favourable for molybdenite and further work is warranted.

Copper King. This group of five claims, owned by P. Brusk, is situated on the densely timbered, steep southern slopes of Kitsalas mountain, above Hankin (Phillips) creek. The property is distant about 5½ miles from Vanarsdol Station, from which a good trail leads to the cabin on the property situated at an elevation of 2,160 feet.

The mode of mineral occurrence is that of a number of more or less parallel quartz veins, varying in width from 1 to 4 feet, which have a general north-east (mag.) strike and north-west dip. The various members of the vein system are some considerable distance apart from each other. The country-rock is volcanic, of the order of diabase and andesite, and is intruded in places by granodiorite. At one point the bedding-planes of the volcanics are sparsely mineralized near such an intrusion. The quartz veins are mineralized with pyrite and chalcopyrite.

A detailed description of the showings follows: At an elevation of 1,450 feet on the left bank of Hankin creek, at and near the water's edge, in the near vicinity of a granitic intrusion, the bedding-planes of the volcanics are very sparsely mineralized with small amounts of chalcopyrite and bornite. Assay showed merely traces of values and this mineralization does not hold out commercial possibilities. In this vicinity several old workings, most of which are now caved, had apparently as their objective the following of these mineralized bedding-planes.

On the left bank of an eastern tributary of Hankin creek, at an elevation of 1,885 feet, there is exposed a quartz vein, well mineralized with chalcopyrite, striking N. 60° E. (mag.) and dipping south-east. This has been followed by an adit for a distance of 40 feet and a width of 14 inches of mineralized quartz shows in the face. A sample of selected ore from this working assayed: Gold, trace; silver, 2.4 oz. to the ton; copper, 10.5 per cent.

At 2,330 feet elevation and above the last-described working there is exposed by open-cuts a quartz vein 2.5 feet in width striking N. 40° E. (mag.) and dipping north-westerly. A sample across 2.5 feet assayed: Gold, 0.34 oz. to the ton; silver, 1.1 oz. to the ton; copper, 1 per cent. About 100 feet vertically below this showing the owner has done upwards of 200 feet of tunnelling in an endeavour to intercept the downward continuation of this vein, but without success. This may be due to faulting, change of dip or change of strike, and the reason could only be determined by an exact survey. By continuing open-cuts down the hill from the upper surface exposure, doubtless much information would be disclosed. Gold values in this vein appear to be higher than those in other veins inspected, and the owner would appear to be well advised to concentrate attention on this vein for the present.

About 250 feet east of the above-described vein, at 2,460 feet elevation, there is exposed in the banks of the headwaters of a small unnamed creek flowing into Hankin creek a vein 3 feet

in width, containing a seam of quartz on the hanging-wall and another on the foot-wall. Both quartz-seams show some copper pyrites. This vein strikes N. 60° E. (mag.), with a steep dip to the north-west.

At 2,680 feet elevation, at a higher point on the last-mentioned creek, there is exposed a quartz vein between 3.5 and 4 feet in width, well mineralized with pyrite. A sample of this exposure across 3.5 feet assayed: Gold, 0.06 oz. to the ton; silver, 0.4 oz. to the ton; copper, *nil.* This vein has similar strike and dip to that just described. Between the two last-mentioned veins occurs an intrusion of granodiorite.

At 2,060 feet elevation, on the left bank of the same creek, a quartz vein 1.5 feet in width is exposed by open-cut and shaft 15 feet deep. The quartz is well mineralized with chalcopyrite and pyrite. A sample of selected ore assayed: Gold, 0.06 oz. to the ton; silver, 3.4 oz. to the ton; copper, 13 per cent. Refer also to the Annual Report for 1923.

Nugget. This group, consisting of three claims owned by P. Brusk, is distant about 3½ miles from Vanarsdol Station. It is reached by a branch trail from that to the *Copper King.* At 1,910 feet elevation, on a small unnamed creek flowing into Hankin creek, there is exposed a quartz vein 3 feet in width, of which 1.5 feet is well mineralized with chalcocite and malachite. This strikes N. 25° W. (mag.) and dips south-west *at an angle of about 30°. A sample of selected portions of the vein assayed: Gold, 0.20 oz.* to the ton; silver, 2.4 oz. to the ton; copper, 5.4 per cent. About 20 feet below this exposure a tunnel has been run a distance of 15 feet in the right bank of the creek on a bearing N. 10° W. (mag.) to penetrate and follow this vein north-westwards.

Lucky Luke. An option on this property was acquired by R. W. Seelye in the late fall of 1928 and it is understood that operations are to be carried on during the winter. For accounts of this property refer to the Annual Reports for the years 1918, 1919 (under *Lucky Loop*), 1923, 1924, and 1925, and also to Geological Survey, Summary Report, 1925, Part A, Page 116.

Kleanza Creek.

Lucky Jim. This property is situated close to the 12-Mile post on the Kleanza Creek trail and is distant about 13½ miles from Usk. A full description was given in the Annual Report for 1923. It is unnecessary to repeat the detailed information given in that report.

The principal showing is on the *Idaho.* The mineral occurrence appears to be that of mineralized volcanic beds of andesitic type, striking about N. 70° W. and dipping at a flat angle north-easterly, crossed by a parent fracture more heavily mineralized, and striking more northerly than the volcanics and dipping at about 65° south-westerly. At the junction there is developed an impressive mineralization of bornite, with lesser amounts of chalcopyrite.

Development consists of an open-cut and short adit-tunnel 42 feet in length at the junction. The adit, at an elevation of 2,035 feet, for the first 15 feet follows a bearing N. 70° W. (mag.) and for the remaining distance of 27 feet a bearing of N. 15° W. (mag.). For the last 27 feet the tunnel appears to cross the mineralization and the west side of the tunnel is well mineralized for this distance.

The grade of the copper mineral in precious metals will be seen from the assays given in the 1923 Annual Report. This property is one which merits further development, and it is understood that an option on it was secured by J. F. Tener in the late fall of 1928. Refer also to Annual Reports for the years 1920, 1923, 1924, 1925, and 1926; also to Geological Survey of Canada, Summary Report, Part A, 1925, page 114.

B.X. This group, owned by W. Meggerson, is situated on the banks of Kleanza creek, about 6 miles up from its mouth, and is reached by a branch from the Kleanza Creek trail from Usk, from which it is distant about 8 miles. At an *elevation of 845 feet several more or less parallel quartz veins well mineralized with pyrite,* and in one case some molybdenite in addition, outcrop on both banks of Kleanza creek. The country-rock is schisted volcanic of andesitic type. The most important vein appeared to be one 4 feet in width, striking N. 70° E. (mag.) and dipping north-westerly. A sample of this failed to show gold or silver values, but a little further prospecting of this and neighbouring veins might disclose some molybdenite values worth following.

Peerless. Work was done on this group during the year by the owners, Amos Wells and partners. For description refer to Annual Reports for the years 1914, 1917, and 1920; also to Geological Survey of Canada, Summary Report, 1925, Part A, page 114.

Chimdemash Creek.

Shenandoah. This group, owned by R. W. Seelye and associates, is situated on the mountain range between the North fork of Chimdemash creek and St. Croix creek and is distant about 12 miles from Usk. The property is reached by following the main Chimdemash Creek trail to the North fork, at which point a branch trail follows the right bank of the North fork to a base camp at elevation 1,470 feet. From this point a steep trail, with numerous switchbacks, leaves the creek, following the steep mountain-slopes on the north side of the creek to a mine camp just above timber-line at elevation 4,555 feet. The showings are at elevations of over 5,000 feet, extending to the summit of the divide between the North fork of Chimdemash creek and St. Croix creek. On both sides of the sharp, narrow summit the mountain-slopes are steep and in places precipitous.

On the described summit at 5,500 feet elevation natural agencies have exposed a vein, 1.5 feet in width, striking N. 85° E. (mag.), dipping southerly at 45°, somewhat irregularly mineralized with zinc-blende, galena, and associated copper minerals. A sample across 1.5 feet at the most heavily mineralized part assayed: Gold, trace; silver, 14 oz. to the ton; copper, 6 per cent.; lead, 2 per cent.; zinc, 8 per cent.

At elevation of 5,340 feet on the North Fork slope a tunnel had, at the time of inspection on August 10th, been advanced a distance 75 feet from the surface to intercept the downward continuation of this vein. This vein does not appear to exhibit any marked evidence of strength or continuity.

Distant about 1,500 feet east of the above adit-tunnel, at elevation of 5,290 feet, another vein approximately parallel to that above described, striking N. 70° E. (mag.) and dipping northwesterly, was at the time of inspection exposed by natural agencies only. The management states, however, that this vein has been well prospected since inspection, and has proved remarkably continuous and has been found to average 3 feet in width for a length of 1,800 feet. The mineralization is almost entirely chalcopyrite and malachite. The vein-width was not exposed at the time of inspection, but a sample was taken of the best portions of the exposure, which assayed: Gold, trace; silver, 1.2 oz. to the ton; copper, 2 per cent.

Between the above-described exposure and the adit-tunnel, at elevation of 5,050 feet, another vein 6 feet in width was exposed by natural agencies. This appeared to have a northwesterly strike and north-easterly dip. The essential mineralization was chalcopyrite. The management states that since inspection this exposure has also been followed, but with disappointing results, and it is the intention in 1929 to continue development of the vein mentioned above as having shown continuity.

Silver Basin. Work was done on this property by the owners, Amos Wells and partners, during the year. For description refer to Annual Reports for the years 1923, 1924, and 1925; also to Geological Survey of Canada, Summary Report, 1925, Part A, page 113.

Legate Creek.

Properties on Legate creek are reached from Pacific, a divisional point on the Canadian National Railway. From the east side of the Skeena river at Pacific, the river being crossed by boat-ferry, a good trail, 12 miles in length, with a grade of little over 100 feet per mile, leads to "Brown's Cabin," elevation 1,700 feet, at the junction of the South fork with the main creek. "Brown's Cabin" forms a convenient stopping-place, from which short trips may be made to the various properties in the vicinity.

Zona May. This group, owned by J. R. Smith and W. L. Jordan, is situated at the head of the South fork of Legate creek. The mineral occurrence is that of a quartz vein, the outcrop of which is almost entirely covered by the glacier in this region at all seasons of the year. At the time of inspection on July 15th the vein was well exposed at the eastern edge of the South Fork glacier in the east wall of the basin at an elevation of 3,950 feet, and also at the top of the basin at this point at an elevation of 4,200 feet. It is also said to be exposed on the western edge of the glacier at a point about 2,000 feet west of that inspected, and also at a point upwards of 1,000 feet east of that inspected.

At the eastern edge of the South Fork glacier, at elevation 3,950 feet, a cross-sectional exposure of the vein is afforded in the east wall of the basin, or glacial cirque. The height of the wall of the basin above the glacier is about 250 feet at this point. Here in the near vicinity of an intrusion of diorite in the andesitic volcanic country-rock the width of the well-mineralized quartz vein is 4 feet. The strike is N. 85° E. (mag.) and the dip southerly at about 80°. The mineralization consists of zinc-blende, galena, and grey copper, and shows copper-stain. An acid dyke 15 feet in width parallels the vein on the south side, and on the north side there is a band of bleached rock, possibly diorite. A sample across 2 feet of the most heavily mineralized portion of the vein assayed: Gold, 0.28 oz. to the ton; silver, 95.2 oz. to the ton; lead, 3.4 per cent.; zinc, 11.5 per cent.

At the top of the basin-wall at this point, at elevation 4,200 feet, the vein is again exposed. The width of the main seam of quartz is 2 feet, but there are in addition some small quartz stringers. The vein in this region lies wholly within diorite, and on the south of the vein are exposed two parallel acid dykes. A sample of selected mineral from the vein at this point assayed: Gold, 1.21 oz. to the ton; silver, 1.7 oz. to the ton; lead, 5.6 per cent.; zinc, 3.8 per cent.

This vein would readily invite and justify development were it not for its situation. The latter, coupled with the topography, renders the only practicable development by crosscut. A site for a crosscut of reasonable length could probably be found on the east side of the South fork, but unfortunately such seems to be impracticable owing to the snowslides which sweep down this creek. For reasons of safety, choice for a crosscut tunnel-site must be a point on the left bank of the main creek, which would obviously mean a crosscut of great length. Refer also to Geological Survey of Canada, Summary Report, 1925, Part A, page 112, under "White Bear and South Fork Claims."

M. & K. This group, owned by M. Orr and partners, is situated on the north side of the East fork of Legate creek, and subsequent to the date of inspection was taken under option by the Consolidated Mining and Smelting Company of *Canada, Limited. This company commenced small-scale operations on the "Upper Showings"* mentioned herein, comprising surface-stripping and the running of a tunnel. Work was discontinued in the late fall of 1928 and will be resumed next spring.

On this property occur two separate modes of mineral occurrence known respectively as the "Lower Showings" and the "Upper Showings."

"*Lower Showings.*"—The mineral occurrence is that of a vein of quartz, about 1.5 feet in width in diorite country-rock, which is exposed over a length of somewhat over 100 feet by open-cuts and a shaft 10 feet deep. Mineralization extends somewhat beyond the vein into the bleached diorite hanging-wall, the total mineralized width being 3 feet in places, but heavy mineralization is confined to a width of about 15 inches. This vein strikes about N. 20° W. (mag.) and dips south-west at 60°. The elevation of this exposure is 3,500 feet. A sample taken from the shaft across a width of 15 inches assayed: Gold, 0.02 oz. to the ton; silver, 17.4 oz. to the ton; lead, 0.2 per cent.; zinc, 0.6 per cent.

"*Upper Showings.*"—These lie between elevations of 4,510 and 4,760 feet. In this region several approximately parallel veins, varying in width from a few inches up to 3 feet, strike into the mountain-side at a small angle. The strike varies from due north and south (mag.) to N. 30° E. (mag.) and the dip is about 30° south-easterly. The mineralization is an intergrowth of galena and bornite, and in addition many other copper minerals are present and striking and beautiful specimens may be obtained. From this region some 123 tons of float-ore was shipped in 1917, assaying approximately: Silver, 25 oz. to the ton; copper, 20 per cent.; lead, 25 per cent.

These veins appear to conform in strike and dip with the enclosing andesitic country-rock and the mineral occurrence exhibited is apparently that of mineralized volcanic beds, the strike and dip of which are approximately the same as the slope of the mountain.

At elevation 4,760 feet one such vein, 3 feet in width, is well mineralized. The strike is N. 27° E. and the dip south-easterly. A sample of selected mineral assayed: Gold, trace; silver, 4.2 oz. to the ton; copper, 7.3 per cent. At 4,630 feet elevation another vein, 1.5 feet in width, of similar strike and dip to that last mentioned, is also well mineralized. A sample of this across 1 foot assayed: Gold, trace; silver, 0.3 oz. to the ton; copper, 3.6 per cent. At 4,640 feet a tunnel starting from the surface follows more or less the strike of mineralized volcanic beds for a distance of 60 feet. It is understood that this tunnel is being continued by

the Consolidated Mining and Smelting Company of Canada, Limited. Refer also to the Annual Reports for the years 1916, 1917, 1919, and 1925, and also to Geological Survey of Canada, Summary Report, 1925, Part A, page 111.

M. & M. This group, owned by R. Moore, was also optioned during the year by the Consolidated Mining and Smelting Company of Canada, Limited. It is situated on the south side of the East fork of Legate creek. A fairly full description of this property is to be found in the 1925 Annual Report. Since then additional work has been done to better expose the largest shear-zone at an elevation of 4,500 feet, where it outcrops on the precipitous slope of the main creek. The width of the shear-zone here exposed is 20 feet. The filling is largely bleached diorite, with seams of quartz mineralized with zinc-blende, galena, grey copper, and malachite. The strike is N. 57° W. (mag.) and the dip 70° south-west. While mineralization is on the whole sparse, silver values are good. A sample of selected mineral from this exposure assayed: Gold, trace; silver, 66.6 oz. to the ton; lead, 8.6 per cent.; zinc, 0.8 per cent.

While mineralization in this vein system is slight, the silver grade is good, and it is to be borne in mind that all exposures are all more or less at the same horizon. It was understood at the time of inspection that the owner was making a well-advised attempt to discover the outcrops of these veins near the base of the mountain. Refer also to Annual Reports for 1917 and 1925; also to Geological Survey of Canada, Summary Report, 1925, Part A, page 112.

Frisco. This group, owned by M. Orr, is situated on the south side of Frisco creek, which flows into Legate creek about 1½ miles below "Brown's Cabin." On the east side of Legate creek, at the junction with it of Frisco creek, a cabin is situated, from which a good trail, upwards of 4 miles in length, leads to the showings.

The mineral occurrence exhibited by the principal showings appears to be, as in the case of the *M. & K.* group, mineralized volcanic beds in the vicinity of a granitic intrusion.

At elevation 4,510 feet the andesitic volcanics are intruded by a granitic sill (quartz feldspar) about 100 feet wide on a steep and precipitous mountain-side. Immediately above the sill a width of 40 feet of the volcanics is sparsely mineralized with copper minerals, mainly bornite, chalcopyrite, and malachite. At the top and bottom of this mineralized belt is in both cases an enriched zone. An adit-tunnel has been run a short distance following each zone. These tunnels are about 75 feet apart horizontally and 40 feet apart vertically and about 45 feet in length, and are run on a bearing about N. 75° E. (mag.). In each tunnel small seams of copper mineral a few inches in width follow the bedding and jointing planes of the volcanics. Mineralization is somewhat irregular. The volcanics strike about N. 30° W. (mag.) and dip north-east. The quartz-feldspar sill strikes N. 20° W. (mag.), dips at from 30° to 45° north-east, and can be seen extending for many hundreds of feet. A sample of one of the best seams of mineral, 9 inches in width, from the upper tunnel assayed: Gold, trace; silver, trace; copper, 2.7 per cent.

From this place a shipment of 10 tons of ore was made in 1917, which assayed approximately: Gold, trace; silver, 33.5 oz. to the ton; copper, 42.2 per cent.

At a point about 1,500 feet east of the above showing, at elevation 4,450 feet, is exposed another sill-like granitic intrusion, and above this a width of about 15 feet of the volcanic rock is oxidized and ribboned with stringers of quartz. One of these shows grey copper and copper-stain. The oxidized band of volcanic rock strikes N. 85° W. (mag.) and dips south-west. A sample of the quartz stringer, 4 inches in width, showing grey copper assayed: Gold, 0.02 oz. to the ton; silver, 72.6 oz. to the ton; copper, 5.2 per cent. A little further work at this point by the owner would seem advisable. Refer also to Annual Reports for the years 1916, 1917, 1920, 1923, and 1925; also to Geological Survey of Canada, Summary Report, 1925, Part A, page 111.

Ritchie.

Canadian Swede. This group of eight claims, owned by August Johnson, is situated about 2½ miles west of Ritchie, a flag-station on the Canadian National Railway. A trail leads to the group from the railway-track at a point about 1½ miles west of Ritchie. On the right bank of the Skeena river, between elevations of about 630 and 1,060 feet, are exposed, by open-cut and one adit-tunnel, several quartz veins of width varying generally from 2 to 6 feet. One 12 feet in width was noted. These have a north-easterly strike and dip both south-east and north-west. The vein-structure in main exhibited is that of

ribboned quartz, the remainder of the filling being argillite, which is the enclosing country-rock. The quartz is slightly mineralized with pyrite and in places is stained with iron oxide. Samples taken showed no appreciable values.

At the time of inspection, at elevation 630 feet, an adit-tunnel had been advanced a distance of 20 feet, preceded by a length of 15 feet of open-cut, following a ribboned quartz vein, of which the width exposed at the face was 6 feet. The strike is N. 25° E. (mag.) and dip 70° south-east. The country-rock is graphitic argillite. A sample across 6 feet at the face showed no values. The rusty quartz, sampled separately, showed traces only of gold and silver.

At an elevation of 700 feet, in the banks of an unnamed creek, is exposed a width of 12 feet of ribboned quartz in argillite. A sample taken across this 12 feet assayed: Gold, trace; silver, 0.4 oz. to the ton.

At an elevation of 1,050 feet on the *DeWet*, open-cuts expose two quartz veins, each about 2 feet wide, distant from one another about 100 feet. A sample of the more easterly showed traces only of gold and silver. Both these veins strike north-easterly and dip north-westerly.

Seven Sisters Mountain.

Hughie.

This group, owned by M. Orr and J. R. Smith, is situated on the lower slopes of Seven Sisters mountain and is distant about 3 miles from Cedarvale. It is reached by a short branch trail from the main trail from Cedarvale to the *Seven Sisters* group. The mode of mineral occurrence is that of three shear-zones, each about 5 feet in width, whose strike varies from N. 25° W. (mag.) to N. 65° W. (mag.), dipping at from 60° to 70° south-west. The enclosing country-rock is an argillitic rock. Mineralization consists of zinc-blende, galena, and a little chalcopyrite, and is on the whole somewhat sparse, except at one point. Nevertheless, the fissures are strong and merit investigation.

At 1,715 feet elevation a short adit crosscut exposes a strong-looking but very sparsely mineralized shear-zone, which strikes N. 55° W. (mag.) and dips south-west at 60°.

Distant about 300 feet in a south-easterly direction from the above exposure there is exposed on the surface another shear-zone 8 feet wide in places, which strikes N. 25° W. (mag.) and dips south-west at 50°, at elevation 1,800 feet. In this zone seams of fairly compact zinc-blende and galena occur, but the widths of the individual seams are only a few inches. At an elevation of 1,775 feet two crosscut tunnels are run at points about 120 feet apart with the intention of penetrating the shear-zone. Only the more northerly reached the objective, the other being discontinued before doing so. The length of the former is 60 feet, and at 40 feet from the portal the brecciated shear-zone was penetrated. This is 5 feet in width. A drift a few feet only in length follows it north-westerly, and it is stated that in the bottom of this drift some good ore was found.

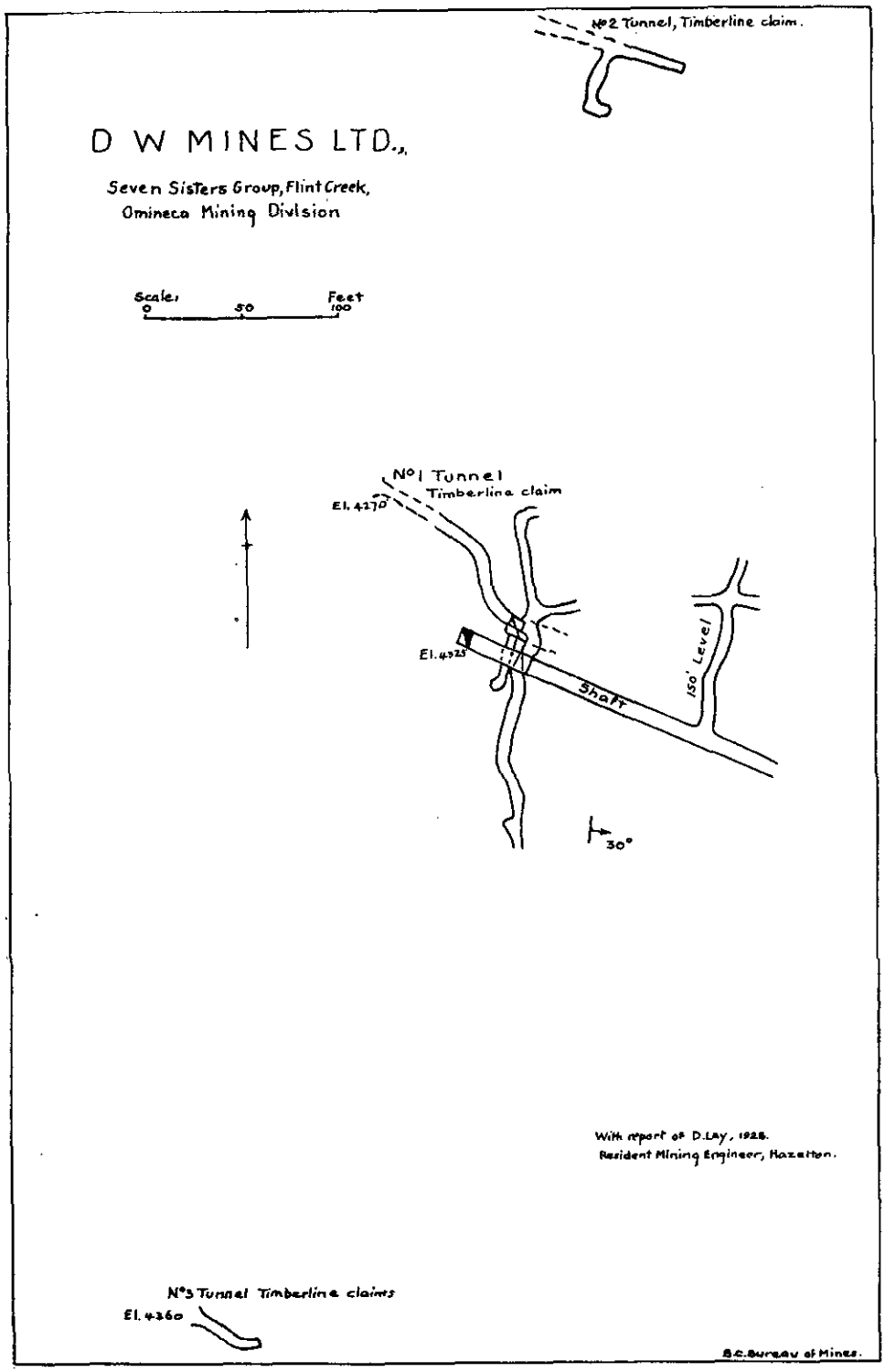
Distant from the above tunnel about 400 feet in a direction S. 57° E. (mag.), at elevation 1,875 feet, is exposed by open-cut a well-mineralized shear-zone, striking N. 65° W. (mag.) and dipping south-west at 70°. At the time of inspection the width exposed was 4 feet, but the true width may exceed this somewhat as the foot-wall was not exposed. A seam of fairly compact zinc-blende and galena shows at this point, with some mineral scattered throughout the remaining width. A sample taken across this seam, the width of which is 8 inches, assayed: Gold, trace; silver, 2 oz. to the ton; lead, 7 per cent.; zinc, 14 per cent.

The shear-zone filling consists of mineralized quartz and brecciated country-rock characteristic of shear-zone replacements. The last exposure mentioned is within 50 yards or so of the *Seven Sisters* trail and well merits further investigation. Refer also to the Annual Reports for 1925 and 1927.

Seven Sisters.

This group, owned by Steve Young, is under option to D.W. Mines, Limited. Except for a short period in the early spring, this company has carried on steady operations throughout the year. A full account of the property, with map, will be found in the Annual Report for 1927.

Work done during the year comprises underground development, which is shown on the map accompanying this report, and also a systematic and thorough investigation, by open-cuts, of the vein-outcrop north of the *Galore* for a distance of some 4,000 feet. The open-cuts are thirteen in number. North of the *No. 2 Timberline* tunnel these open-cuts did not disclose any material amount of galena, the predominant mineralization being pyrrhotite with some sphalerite. The width of mineralization exposed by these open-cuts varies considerably. For instance, an open-cut on the *Sam Slick* claim shows a width of 8 feet of vein, of which a width of 2 feet on the


No 2 Tunnel, Timberline claim.
D W MINES LTD.,
Seven Sisters Group, Flint Creek,
Omineca Mining Division
Scale:
0
50
Feet
100
No 1 Tunnel
Timberline claim
El. 4270
El. 4325
Shaft
150' Level
30°
With report of D.Lay, 1928.
Resident Mining Engineer, Hazelton.
No 3 Tunnel Timberline claims
El. 4360
B.C. Bureau of Mines.

hanging-wall is compact pyrrhotite, likewise a width of 6 inches on the foot-wall, and the filling between these seams is sparsely mineralized. Again, an open-cut farther north at the base of the prominent iron-stained area shows only a width of about 6 inches of pyrrhotite and zinc-blende.

Going northward the pyrrhotite-zinc-blende mineralization appears to reach a maximum in the *Pacific* tunnel. An old open-cut on the *Pacific* has been continued as a crosscut tunnel for a distance of 55 feet. For the first 15 feet of its length this tunnel shows a fairly solid pyrrhotite-zinc-blende mineralization. From this point onwards not much zinc-blende is in evidence, but pyrrhotite continues almost to the face. This is an impressive mineralization and calls for further investigaion.

Underground development in *No. 1* and *No. 2 Timberline* tunnels has not so far disclosed any noteworthy continuity of the ore encountered. The shaft (which extends downwards from *No. 1 Timberline* tunnel and upwards to the surface from this level) is now down approximately 200 feet on the vein, and it is proposed to continue it to a depth of 250 or 300 feet and to drift north and south at this horizon. Such evidence as is available in *No. 1 Timberline* tunnel appears to indicate a northerly trend of the ore in depth in this region. Data are, however, insufficient to form any definite opinion.

No. 3 Timberline tunnel, near the portal, passed through a well-mineralized vein 7 feet in width, of which a width of 4.7 feet assayed: Gold, trace; silver, 1.4 oz. to the ton; lead, 1 per cent.; zinc, 8 per cent.

While development to date has been somewhat disappointing, the strength and persistence of the vein on the surface and the promising mineral which has been found at various points justify further development. When seasonal conditions permit, further work at the north end of the property, on the pyrrhotite-zinc-blende mineralization on the *Pacific*, would seem advisable. Refer also to Annual Reports for 1925, 1926, and 1927.

Kitwanga.

Two Laddie. This property, owned by J. Lamont, is situated close to the railway-track, somewhat over 1 mile east of Kitwanga, on the Canadian National Railway. Work has been done during the year with, it is reported, promising results. An account of the property is to be found in the Annual Report for 1925 under *Laddie*.

HAZELTON SECTION.

Important features of the year's progress in this section were: The construction of a 50-ton all-flotation concentrator at the *Silver Cup* and the promising underground developments at that property; the reopening of the *Rocher Déboulé;* and the satisfactory results obtained at the *Mohawk*.

Nine-mile Mountain.

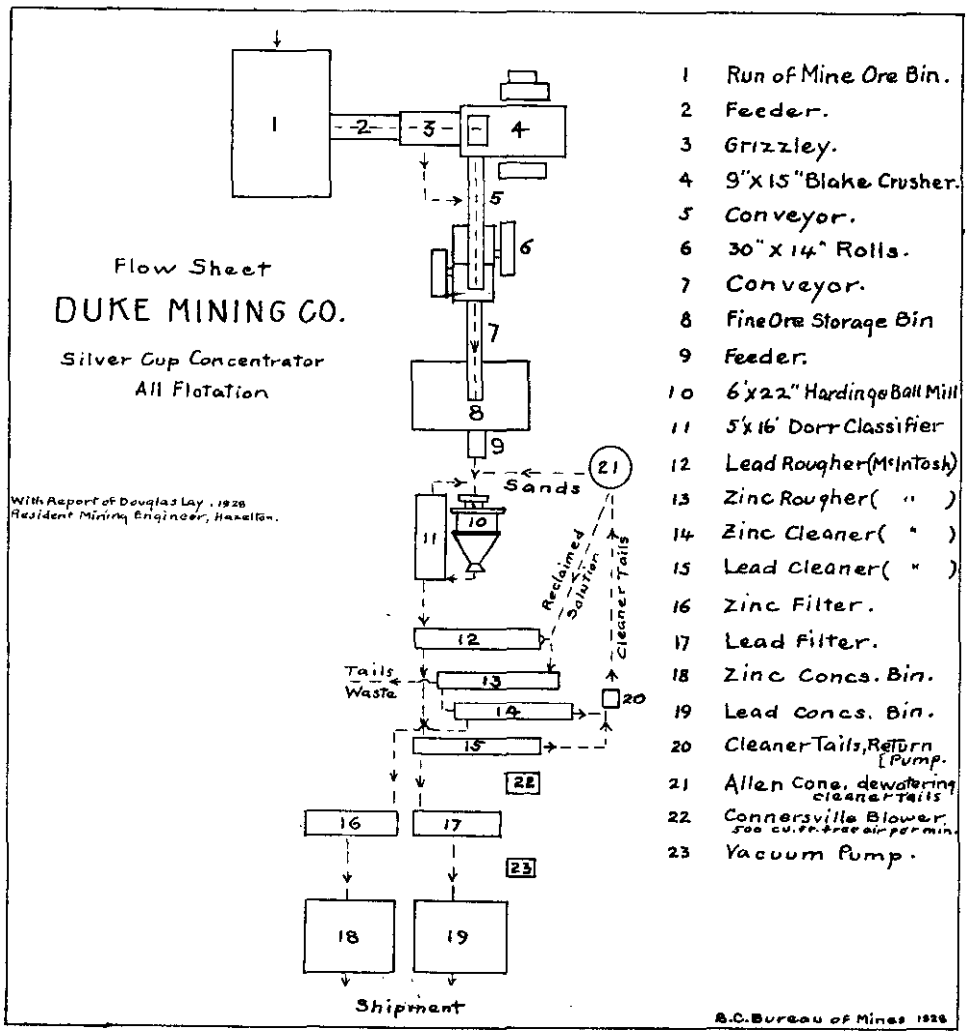
Silver Cup. Following a careful sampling of this property by H. F. S. Woolverton in April, an important programme of construction was subsequently inaugurated by the Duke Mining Company, Limited. Completion of this is anticipated early in 1929. Construction comprises a 50-ton-daily-capacity all-flotation concentrator, aerial tram thereto from No. 4 level at the mine, a 200-horse-power power plant, and additional buildings at mine and concentrator.

The concentrator is situated, with power plant in close proximity, just below and west of the *Silver Cup* basin. The elevation of the top (crusher) floor of the concentrator is 3,095 feet and that of No. 4 level 4,598 feet. The water-supply for milling is obtained from *Silver Cup* basin, a concrete dam at this point supplying 4- and 3-inch pipe-lines to the concentrator under a head of 115 feet. The machinery installed in the concentrator is clearly shown in the flow-sheet accompanying this report. From this it will be noted that MacIntosh flotation-cells are employed. This is one of the newest types of flotation-machines and has commendable features. Illustrated descriptive articles concerning it are to be found in the *Engineering and Mining Journal*, issue of November 10th, 1928, and also in the *Canadian Mining Journal*, issues of November 2nd and 23rd, 1928.

The power plant consists of one 120-horse-power Fairbanks-Morse Diesel engine direct-connected to a 90-k.v.a. generator, and one 80-horse-power Fairbanks-Morse Diesel engine

direct-connected to a 60-k.v.a. generator. Current is transmitted at 2,300 volts to mill motors. The 2-bucket aerial tram from No. 4 level to the concentrator is 4,000 feet in length.

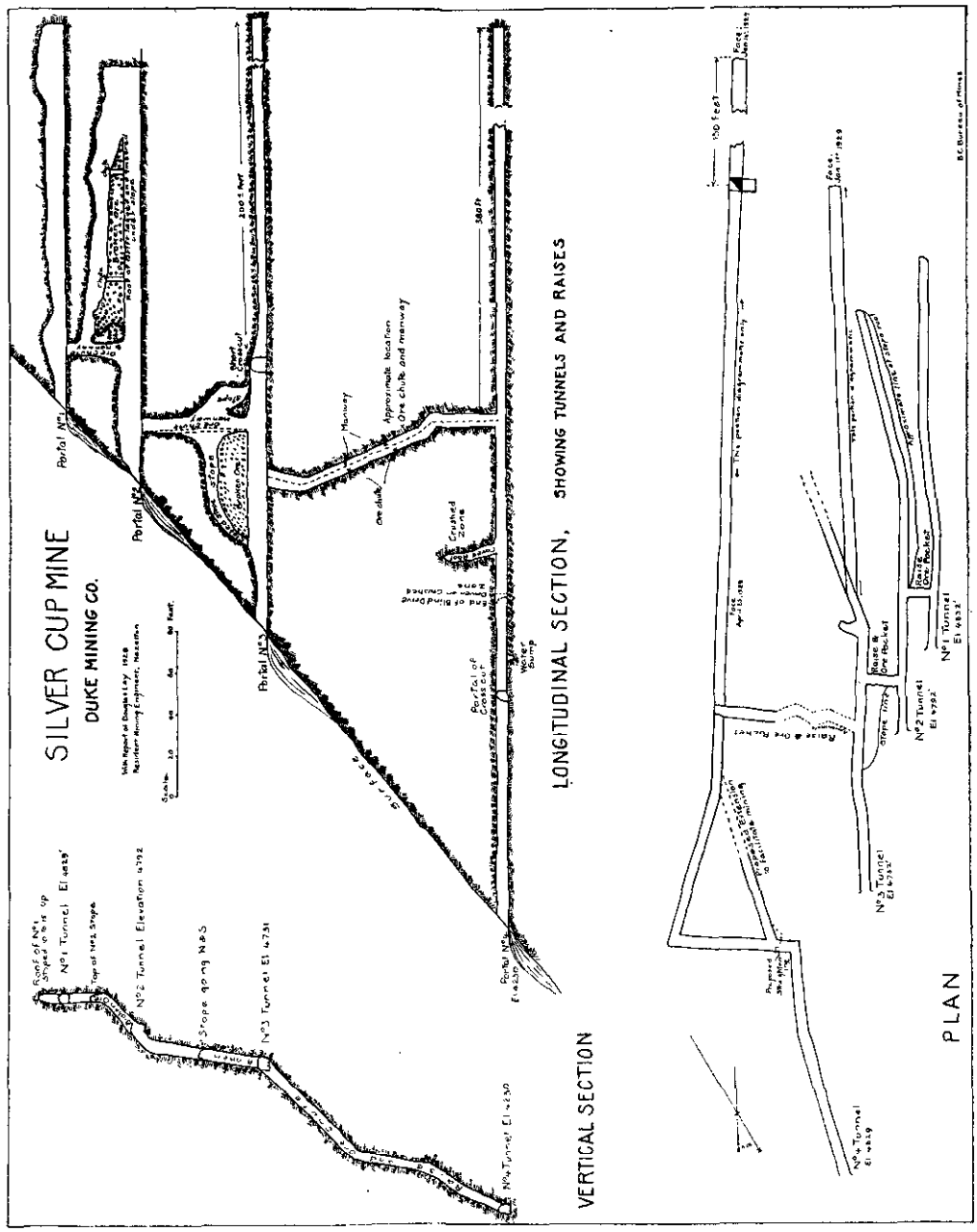
In the mine important developments have taken place during the year. In the Annual Reports for 1914 and 1927 will be found full accounts of the geology, vein system, and other descriptive particulars. It is unnecessary to repeat information therein given, in this report. Development during the year has been almost entirely confined to the advancement of levels 4 and 3. The mine was last inspected on November 11th, on which date level 4 had been advanced 300 feet from the point of commencement, and it was stated that continuous ore had been



encountered during this distance, although it narrowed to a mere stringer in places, the average width being about 1.5 feet. The face on date of inspection showed a width of 3 inches of ore. A raise from this level, 50 feet back from the then face, at 35 feet above the level showed a width of 2 feet of nice ore. A sample across this width assayed: Gold, trace; silver, 52 oz. to the ton; lead, 2 per cent.; zinc, 18.6 per cent. Level 3 had been advanced a distance of 170 feet, and it was stated that on this level also continuous ore had been encountered during the advance, although it narrowed to a stringer at times. The average width encountered was about 1.5 feet. The face showed a width of 9 inches of ore. A sample taken on level 4, at 50 feet beyond the raise to level 3, across 2.2 feet, assayed: Gold, trace; silver, 9 oz. to the ton; lead, 3 per cent.; zinc, 9 per cent. A sample on level 3 taken at 85 feet beyond raise from level 4, across 2 feet,

assayed: Gold, 0.01 oz. to the ton; silver, 122.4 oz. to the ton; lead 21 per cent.; zinc, 18 per cent.

In April the face of level 2 (there has been no advance on this level since that date) showed a width of 1.2 feet of ore, a sample of which assayed: Gold, 0.02 oz. to the ton; silver, 59.6 oz. to the ton; lead, 14 per cent.; zinc, 10 per cent. The face of level 1 has also not been advanced



since April, when only a narrow stringer of ore showed in the face. But a short distance from the face, the back shows a width of 3 feet of ore and appearances generally are favourable for stopes above this region.

The connecting raise from level 4 to level 3 shows a little ore at the bottom, but none for the greater portion of its length. It is possible that it is in the hanging-wall up to the flattening

point and southerly bend, where a vein appears to be passed through. It is also to be noted that on level 3, just south of this raise, when viewed in April, the ore-bearing vein seemed to be running about S. 15° E. (mag.) as though this might be a branch; level 2, somewhat farther south, also showing this tendency to bear east and differing from level 1, as will be seen by referring to the map. When survey of level 3 is brought up to date there may be indicated the advisability of search at the points of easterly deviation for another vein. The raise from level 3 to level 2 appears to be in the hanging-wall and the back of the stope in this region is somewhat lean. Just ahead of this, of course, development on level 3 indicates good stoping-ground above this level. The stope above level 2 shows very good ore. A sample taken at about the best portion across 2.5 feet assayed: Gold, 0.02 oz. to the ton; silver, 109.6 oz. to the ton; lead, 15 per cent.; zinc, 19 per cent. It should be noted that the above samples are taken across ore only, and at a very few points, and are not to be taken as being indicative of the grade of mill-feed which might be expected where they originate. The economics of mining will call for shrinkage-stoping methods, which for various reasons cause unavoidable dilution with waste. Furthermore, it is to be borne in mind that in actual mining operation there are always periods when development faces produce material which, while not up to strict milling grade, contains sufficient mineral to be routed to the mill-feed bin. These factors must be duly considered in computing the grade of mill-feed.

As the result of a systematic sampling of all parts of the mine in April last, H. F. S. Woolverton gave the average assay as: Silver, 43.82 oz. to the ton; lead, 9.98 per cent.; zinc, 9.67 per cent.; and the average width as 1.82 feet. This represents the result of about seventy channel samples. These samples are indicative of a good grade of mill-feed and the silver ratio per unit of combined lead and zinc indicates a good grade of lead concentrate in silver. It is to be noted, however, that the antimony content of this ore is considerable and a factor to be borne in mind in flotation. It is not known what results were obtained in connection with preliminary flotation tests.

Generally speaking, the mine presents a healthy appearance and a productive period is indicated. It is well opened up and there are several points at which stoping can commence at any time. Inasmuch as the present connecting raise between levels 4 and 3 did not encounter ore, to afford greater insight into the region between these levels it would seem advisable to continue the raise, already started south of the connecting raise, to level 3 at an early date.

The technical staff of this company consists of: G. L. Koist, mill superintendent; I. T. Morris, mine foreman; and W. B. Benson, assayer. The president and general manager is Wm. B. Dornberg. From this property during the year was shipped 256 tons of hand-sorted ore.

Barber. This group, owned by W. S. Harris and associates, is situated at the lower end of the *Silver Cup* basin, on the east side, at an elevation of about 4,000 feet in timber. In the walls of the basin there is exposed, by surface-stripping, open-cut, short adit-tunnel, and shaft, in the enclosing sedimentary tuffs, a flat-dipping vein striking N. 60° W. (mag.), dipping north-east at about 18°. The width varies from 4 to 6 feet. The mineralization consists essentially of antimonial galena and zinc-blende, with some arsenopyrite, and is confined to a width of about 2 feet on the foot-wall, the hanging-wall portion being more quartzose.

At 4,080 feet an adit crosscut 40 feet in length, preceded by 15 feet of open-cutting, is run, and at the end of the tunnel is a winze said to be 19 feet in depth, but which was full of water at the time of inspection. By the winze the vein dip appears to steepen.

A sample taken across 2.5 feet by the portal of tunnel assayed: Gold, 0.06 oz. to the ton; silver, 24 oz. to the ton; lead, 7 per cent.; zinc, 9 per cent. A sample taken across 2 feet by the collar of winze assayed: Gold, 0.06 oz. to the ton; silver, 11.5 oz. to the ton; lead, 11 per cent.; zinc, 7 per cent.

The vein is exposed by surface-stripping for a length of about 150 feet and the workings mentioned appear to be in the most promising portion of this exposure. The association of galena and zinc-blende is intimate and fine-grained. Further development of this property is warranted. Its situation is such that winter operations could be readily carried on.

Bennie. This group (formerly *Silver Bell*), owned by W. S. Harris and associates, is also situated on the eastern walls of the *Silver Cup* basin, which are steep and precipitous at this point. At 4,800 feet elevation there is exposed by open-cuts and natural agencies a flat-dipping vein, striking N. 35° E. (mag.) and dipping south-east.

The foot-wall is sedimentary tuffs and the hanging-wall granodiorite. At this point the vein is 2 feet in width and well mineralized with antimonial galena and zinc-blende. A sample across this width at the point of heaviest mineralization assayed: Gold, trace; silver, 9 oz. to the ton; lead, 12 per cent.; zinc, 8 per cent.

In a south-westerly direction the vein appears to widen and steepen, as evidenced by a short crosscut at 4,780 feet elevation, which shows a steeply dipping vein 6 feet in width, but not so heavily mineralized as the first-mentioned exposure. Some years ago a short aerial tram was constructed for the purpose of transporting ore from the first-mentioned exposure to a lower point in the basin, but most of the towers have collapsed.

Silver King. This group, owned by W. S. Harris and associates, adjoins the *Silver Cup* on the north and east. In the eastern walls of the *Silver Cup* basin, at 4,565 feet elevation, an open-cut shows a vein 2½ feet in width, striking N. 15° E. (mag.) and dipping north-west, well mineralized with antimonial galena and zinc-blende. A sample across this width of 2½ feet assayed: Gold, 0.20 oz. to the ton; silver, 13 oz. to the ton; lead, 2 per cent.; zinc, 18 per cent.

About 150 feet west of this point, at elevation 4,610 feet, another vein is exposed by open-cut and very short tunnel. This strikes N. 5° W. (mag.) and dips south-west and is well mineralized, its width being 2½ feet. Mineralization is similar to that of the first-mentioned vein. This property merits further investigation.

Four-mile Mountain.

Mohawk. Steady small-scale operations have been carried on at this property during the year, chiefly by the Mohawk Mining Company, Limited. For a short period the property was under option to the Federal Mining and Smelting Company, and when that company relinquished its option operations were again resumed by the Mohawk Mining Company, Limited.

Useful and successful development was carried out at the level of the main crosscut tunnel. The sparsely mineralized vein originally penetrated by that crosscut was followed north-eastwards for some 300 feet, disclosing but little mineral, but indicating one or two points as calling for further investigation. From the face of this drift a crosscut was run about 100 feet in a direction S. 62° E. (mag.), entering granodiorite at this point and penetrating, in immediate proximity to the contact of the sedimentary tuffs with the granodiorite, another vein 4.5 feet in width, which was subsequently followed a distance of 88 feet north-easterly. At this latter point a gradually improving seam of ore opened out to a width of 2 feet. A sample across this width assayed: Gold, 0.04 oz. to the ton; silver, 162 oz. to the ton; lead, 15.6 per cent.; zinc, 33.8 per cent. The main mineralization was with antimonial galena, zinc-blende, and grey copper.

It was decided to raise on the ore at this point, giving connections for purposes of ventilation and general development with the surface. Further advance in the drift was deferred until ventilation was secured in the manner described or by installation of a fan. Such ore as was struck in the drift can readily be hand-sorted to shipping grade, and it is understood that similar ore was encountered in the raise; consequently preparations were made to sort and ship this ore in the course of raising or any further development.

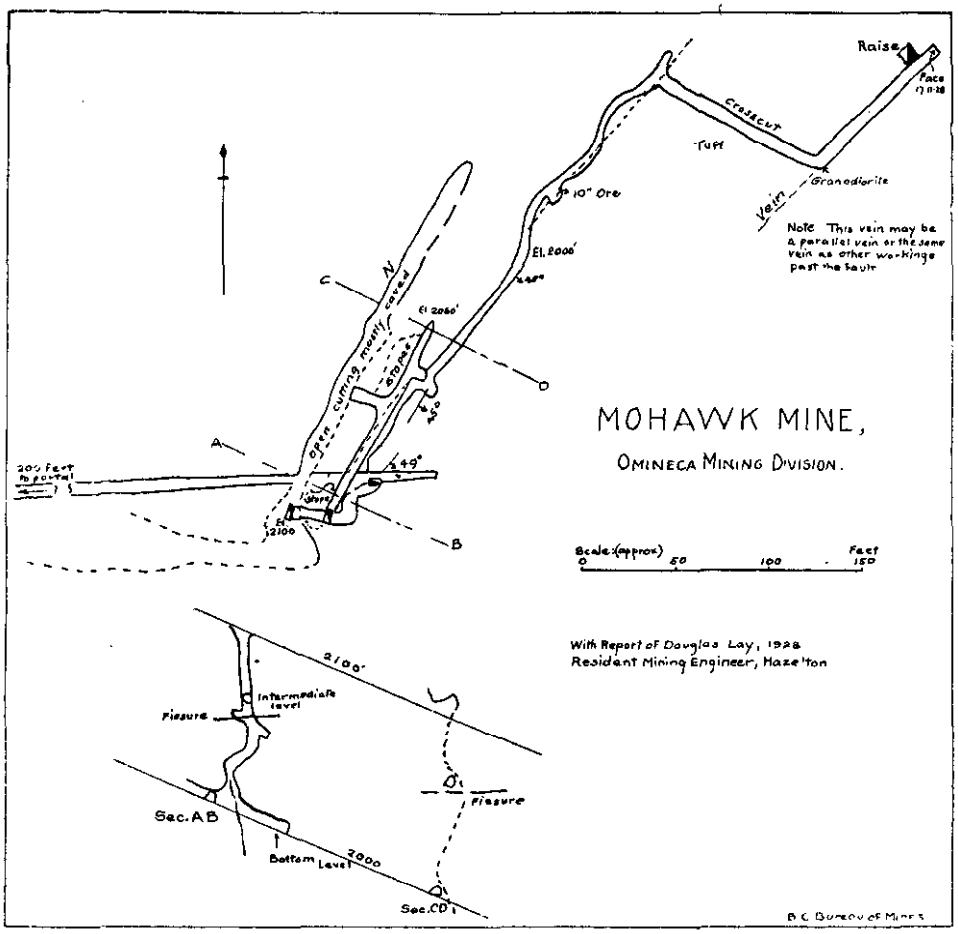
It might be mentioned that the wall-rock of the first vein followed from the main crosscut, and also that of the crosscut from this vein to the more easterly vein was sedimentary tuff. The north-easterly drift on this latter vein was likewise wholly in the sedimentary tuff, but the thickness of the latter on the hanging-wall side of the vein is probably under 2 feet, granodiorite paralleling the vein at this point. Both these veins are approximately parallel and dip south-easterly at 40° to 50°. It seems possible that the veins followed at this level are the dislocated portions of two veins, one of which corresponds with the ore-bearing vein followed by shaft and drift above, and the other has not been yet found at and above the fault.

It may transpire that there is yet a third vein. On the surface, about 825 feet north-east of these workings at elevation 2,185 feet, a shaft is said to be sunk a distance of 50 feet (it was half-full of water when inspected). This is known as the Kinman shaft. There is here exposed a vein striking N. 25° E. (mag.) and dipping south-easterly in sedimentary tuffs. A few feet below the collar of the shaft a width of 1.5 feet of ore assayed: Gold, 0.04 oz. to the ton; silver, 40 oz. to the ton; lead, 0.3 per cent.; zinc, 0.9 per cent. This vein appears to be east of the

veins followed at the horizon of the main crosscut, but it might conceivably be a faulted portion of the more easterly. It would appear advisable to locate the Kinman shaft exactly by transit survey, so that its position in relation to the more westerly workings is known exactly.

Reverting to the westerly workings, it might be mentioned that the upper drift from the shaft has now reached a point 117 feet north-east of the shaft. The face shows a brecciated quartz vein 3 feet 6 inches wide, dipping south-easterly at 45°. At the bottom of the drift the fault, dipping 50° north-westerly, cuts off the ore. This face is well mineralized and well merits continuation.

When opportunity offers it would seem highly advisable to continue the drift on the more westerly as well as the more easterly vein, by reason of the fact that in parallel veins ore-shoots frequently occur directly opposite one another.



Generally speaking, this property is responding well to development. While this ore is of such a grade that it can be hand-sorted or hand-jigged and shipped direct, nevertheless it would doubtless be beneficiated by milling. The property merits a systematic plan of development directed to determining whether sufficient ore can be disclosed to warrant the erection of a mill. During the year this company erected an ore-sorting house and installed a hand-jig.

During the year 69 tons of hand-sorted and hand-jigged ore was shipped. Operations are being conducted under direction of T. B. Lewis, with H. A. Harris in charge at the mine. Refer also to Annual Reports for 1914, 1920 (under *Eric* group), 1925, and 1927.

Comet. This group, owned by J. Dyer, adjoins the *Mohawk* on the south and extends from the Bulkley river up the southern slopes of Four-mile mountain. It is distant about 5½ miles from Hazelton, from which place a motor-road leads to the property. Chief exposures lie between elevations of 1,210 and 1,580 feet.

The mineral occurrence exhibited by the main showings is that of several intersecting and paralleled mineralized shear-zones in granodiorite, and one vein in the sedimentary tuffs into which the granodiorite intrudes. The mineralization is not very heavy and apparently somewhat irregular, and in the granodiorite takes the form of narrow seams of fairly compact admixtures of arsenopyrite, galena, jamesonite, and zinc-blende. The shear-zones in the granodiorite strike north and south and also north-west. The vein in the sedimentary tuff strikes more east and west.

All shear-zones were sampled separately, and sampling disclosed apparently that shear-zones striking north and south (mag.) carry mineral of markedly higher silver content than those striking north-west (mag.). This difference may not persist, but it is a point which investigators would apparently do well to bear in mind. Exposure is by open-cut and adit-tunnel.

At 1,210 feet elevation a very crooked tunnel follows apparently in its various twists three intersecting shear-zones in granodiorite, which strike respectively north-west (mag.), north (mag.), and north-east (mag.), and dip respectively north-east, east, and south-east. These show in places compact seams of mineral, but in general mineralization seems somewhat irregular. A sample of selected mineral from the shear-zone striking north and south assayed: Gold, 0.02 oz. to the ton; silver, 44 oz. to the ton; lead, 12.6 per cent.; zinc, 18.2 per cent. The total length of this adit is about 209 feet.

At 1,250 feet elevation a shaft is sunk 15 feet on a sparsely mineralized shear-zone 6 feet wide, striking N. 25° W. (mag.) and dipping north-east. A sample of selected mineral assayed: Gold, trace; silver, 14 oz. to the ton; zinc, 4 per cent.

At 1,300 feet elevation a tunnel is run 50 feet, following a shear-zone in granodiorite, striking N. 25° W. (mag.) and dipping north-east. The vein is 4 feet in width, fairly well mineralized at the portal, but pinches towards the face. A sample of selected mineral assayed: Gold, trace; silver, 1 oz. to the ton; zinc, 5 per cent.

An open-cut in granodiorite 20 feet east of the above shows another shear-zone in granodiorite, striking north (mag.) and dipping east, and fairly well mineralized. A sample of selected mineral assayed: Gold, trace; silver, 89 oz. to the ton; lead, 7 per cent.; zinc, 16 per cent.

Within a few feet of the last-mentioned exposure, in the sedimentary tuffs, a small vein strikes N. 75° W. (mag.) and dips north-east, and shows a seam of mixed galena and blende 3 to 4 inches in width. A sample of this assayed: Gold, trace; silver, 2.2 oz. to the ton; lead, 8 per cent.; zinc, 4 per cent. This exposure is the most easterly, and it would seem well advised to drift along it north-westerly, not only because such will intercept the continuation of shear-zones in granodiorite, or at any rate the majority of these, but also because such a vein in similar geological surroundings at the adjoining *Mohawk* has been found productive.

At 1,580 feet elevation a shaft is sunk 15 feet, following a shear-zone in granodiorite, 6 feet wide, showing a somewhat sparse mineralization of arsenopyrite. A sample of selected mineral from this assayed: Gold, trace; silver, 1.8 oz. to the ton.

At 990 feet elevation, just above the Bulkley river, a tunnel is run 78 feet, following a quartz vein at the contact of a granodiorite tongue with the sedimentary tuffs. This quartz vein shows a very small amount of molybdenite. While the geological conditions are favourable for the occurrence of molybdenite, the showing is hardly good enough to warrant following. It is quite possible that in the vicinity prospecting might disclose more favourable showings of molybdenite. This property merits investigation. Refer also to the Annual Report for 1920.

Rocher Déboulé Mountain.

Rocher Deboule. At the end of November an option was secured on this property by Aurimont Mines, Limited, and following an examination by H. L. Batten the mine was reopened with a force of ten men under the direction of W. S. Harris. This property has been closed down since October, 1918. In the Annual Report for that year will be found a full account of it as it existed then. Nothing having been done since, this represents also the underground conditions as existing at the time of commencement of the present operations. Surface plant and machinery were unfortunately dismantled and removed in 1925 and

1926 (refer to Annual Report for 1925); therefore the present operators had much preparatory work to do before actual mining operations could be started. However, the management states that ore was being extracted at the end of the year.

Present operations focus on No. 2 vein on the 1,002-foot level, on which it is stated that good showings of ore exist which can be hand-sorted to shipping grade. Such, therefore, is the plan of operations which has already been put into effect. The ore mined on and tributary to this level will be dropped down the connecting raise to the long crosscut adit, known as the 1,200-foot level, from which point it will be hauled by the connecting road to Skeena Crossing Station on the Canadian National Railway.

Study of the Annual Report for 1918 must render evident that with the present strong copper market much is to be hoped from the reopening of this property. Refer also to the Annual Reports for the years 1914, 1916, 1917, 1918, and 1925, and also to Geological Survey of Canada, Memoir 110, by J. J. O'Neill.

Victoria (Hazelton View).

This property is also referred to under "New Hazelton Gold-Cobalt Mines, Limited," and under "Aurimont Gold Mines, Limited." It was operated during the year by Aurimont Mines, Limited, and a shipment of approximately 23 tons of gold-cobalt-arsenic ore was made. Operations consisted in lengthening the aerial tram and also in underground work.

The aerial tram, the upper terminal of which is close to the portal of the old main tunnel on this property at elevation 5,525 feet, was lengthened to 1,900 feet. The lower terminal is now at 4,400 feet elevation and is only a short distance from the camp at elevation 4,125 feet. A wire ropeway delivers sacked ore to the upper terminal from the working-tunnel, the portal of which is at elevation 5,930 feet.

Mining operations consisted in continuing the upper tunnel. This is an adit-drift following the vein, whose apex outcrops on the Juniper Creek ridge at elevation 6,130 feet. At the time of inspection on July 29th the adit had advanced 170 feet from the portal on an average bearing N. 48° E. (mag.) following the shear-zone, dipping north-west at about 50°. A small amount of stoping had also been done over the drift. The seam of gold-cobalt ore varied in width from 3 to 18 inches, but proved "bunchy," and hand-sorting was rendered difficult in consequence. From this drift and stope was obtained 25 tons of gold-cobalt ore. This ore contains a remarkable, if not unique, association of minerals; gold, cobalt, nickel, molybdenum, and arsenic are present. Hand-sorted ore runs 4½ to 5 oz. gold to the ton and about 4 per cent. cobalt. Payment is received for cobalt values at the rate of 1s. 10d. a pound of metallic cobalt. Further particulars will be found in the 1927 Annual Report.

Red Canyon.—This group, owned by C. Cox and T. Hanna, is situated on Clifford creek, a north-flowing tributary of the Babine river, and is distant about 10 miles from Kisgagas, or 58 miles from Hazelton. The owners report having cut a trail up Clifford creek to their property and having done some work on the showings.

Smithers Section.

Noteworthy events in this section during the year were the developments in connection with the *Henderson*, operated by Duthie Mines, Limited; the optioning of the *Harvey* and *Judge* groups by the Consolidated Mining and Smelting Company of Canada, Limited; and the reopening of the property of the Babine Bonanza Mining and Milling Company, Limited. A considerable amount of development was also carried out at other properties on Hudson Bay mountain, and some activity was manifested in the Babine mountains.

Hudson Bay Mountain.

Henderson.

At this property Duthie Mines, Limited, in addition to milling 14,980 tons of ore and carrying on development, both excavational and by means of diamond-drilling, commenced during the last half of the year the installation of an entirely new power plant and new camp buildings. The power plant consists of a 500-kw. Curtis steam-turbine and direct-connected generator. The fuel to be used for raising steam is wood and the plant is located by Aldrich lake. Electric current will be transmitted to the mill at 2,300 volts, and there stepped down to 440 volts for the operation of all mill machinery and a Bury cross-compound air-compressor of 1,500 cubic feet of free air a minute capacity. The completion of this installation will permit of a material enlargement in the scope of operations.

In the mine the results of development during the year have been highly satisfactory. As viewed in the beginning of November, the following appeared to be important features of the results accomplished:—

(*a.*) The mill tunnel level had been advanced beyond the compressor level, and at 185 feet north of the Thompson fault and some 600 feet below the surface showed a width of 3½ feet of ore, in which were present primary ruby silver and grey copper to a very gratifying extent.

(*b.*) By diamond-drilling the presence of high-grade ore was indicated 100 feet below the mill tunnel level, in the region immediately below the raise to the compressor level in the Fault Plane vein. Extremely rich ore was met with in the Fault Plane vein just above the mill tunnel level, but diamond-drilling indicated the rich ore referred to below this level as being probably in a branch from the Fault Plane vein rather than in the latter.

(*c.*) The opening-up of a new stope in the McPherson tunnel, north of No. 11 chute.

(*d.*) From a few feet north of No. 9 dyke the mill tunnel level followed for 150 feet a wide vein, fairly well mineralized, strike of which appeared to differ from that of the main vein, likewise in other features it exhibited. It was by following a stringer apparently diverging from this that the ore-bearing main vein was picked up again and the ore mentioned in (*a*) above discovered. It seems, therefore, that the following-up of this vein mentioned under the present heading (*d*) (named by the management "The Big Stranger"), likewise that mentioned under (*b*) above (named by the management "The Little Stranger"), affords additional possibilities.

In a circular issued to shareholders at the close of the year, Duthie Mines, Limited, announced radical changes of policy, comprising the doubling of the share capital to finance a more extensive scheme of exploration and development and the temporary suspension of milling operations. Effect was given to these changes at the end of December,

The following is quoted from this circular:—

"The property has recently been examined by three independent engineers representing the Atlas Exploration Company, which is a highly responsible Eastern concern and of which Senator George P. Graham, late Minister of Federal Railways, is president, and Dr. J. Mackintosh Bell is managing director. The investigation of these engineers indicates that a more extensive scheme of exploration and development of the company's numerous veins is warranted.

"The Atlas Exploration Company, with which will be associated the Mining Issues Corporation, Limited, of Toronto, which is composed of prominent Eastern capitalists, are enthusiastically supplying such further funds as are required for this increased programme and for the completion of the steam-electric power-plant and the motorization of the mill and mine. The power-house is of sufficient size to allow for increased production.

"To provide for the necessary financing, your directors have decided to immediately increase the capital of the Duthie Mines, Limited, to $2,000,000 by creation of 1,000,000 new shares of $1, which will be issued to the Atlas Exploration Company and the Mining Issues Corporation as funds are required.

"Mr. Duthie has retained his interest in the company of which he remains president: Mr. C. A. Banks has been appointed managing director; the Atlas Exploration Company and the Mining Issues Corporation will each have a representative on the Board; H. A. Gould is appointed secretary of the company and the head office is now 612 Pacific Building, Vancouver, B.C.

"The new steam-turbine electric-power plant was placed in operation a few days ago, and it is expected that the new power plant, with the complete motorization of all mill machinery and compressors, will be completed within the next sixty days.

"By order of the Board.

"H. A. Gould, *Secretary.*"

Under date of January 19th, 1929, C. A. Banks, managing director, kindly supplied the following information regarding plans for the immediate future:—

"The immediate plans are the sinking of an internal 3-compartment shaft, which will be fitted with a 2-drum electric winding-engine. Development will be pushed on the Henderson and Fault Plane veins on the mill tunnel level, and we are crosscutting to the Ashman vein at that level.

"The mill closed down on December 23rd and will remain down for several months.

"A sorting-belt is being installed for the mill, and when we commence milling again we will be largely changing over to shrinkage stoping. The electric-power house is practically com-

pleted, and by the end of this month the new camp will be in use, and all the old upper camp, air-compressing plant, and so on, will be closed down. There will be no immediate increase in the mill tonnage, but the tonnage mined will probably be increased, and the sorting-belt will really have the effect of increasing the mill tonnage."

Refer also to the Annual Reports for the years 1922 to 1927, inclusive.

Victory. After doing a considerable amount of development on this property, the optionee, J. J. O'Brien, suspended operations. Since November, 1927, the total amount of development carried out has comprised: In No. 1 tunnel, 374 feet of drifting and 358 feet of crosscutting; in No. 2 tunnel, 100 feet of drifting and 46 feet of crosscutting.

In No. 1 tunnel the main vein fracture was followed for only a comparatively small distance; thereafter diagonal fractures were followed. Finally it was decided to crosscut on a bearing N. 68° E. (mag.) to get approximately vertically below the portal of No. 2 tunnel. The length of this crosscut was 358 feet, which at 186 feet from the starting-point passed through a vein striking N. 20° E. (mag.) and dipping north-west at 85°. This was drifted on mainly north-easterly for a total distance of 100 feet. The north-eastern face shows a seam of mixed galena and zinc-blende 8 inches in width, a sample of which assayed: Gold, 0.12 oz. to the ton; silver, 8.2 oz. to the ton; lead, 9 per cent.; zinc, 10 per cent. Continuation of the crosscut another 172 feet showed at 25 feet from the face a slightly mineralized band 5.5 feet in width, striking N. 45° E. (mag.) and dipping south-east. Assay across this width disclosed only traces of metallic values. In the diagonal fracture followed immediately before crosscutting was started a stringer of mixed galena and zinc-blende shows in the back.

In No. 2 tunnel the main vein was followed for 100 feet and crosscutting was carried out both north-west and south-east, totalling 46 feet. The result of this was to show that the length on this level of uninterrupted ore-shoot is about 80 feet, averaging about 2 feet in width, well mineralized throughout. Beyond this there is an apparent barren region, but some mineral shows in the face of the drift. The first crosscut to the north-west shows promising mineral, close to 4 feet in width, apparently belonging to a diagonal fracture, and merits investigation. Diagonal fracturing is a characteristic of this vein.

The results obtained at this property are therefore inconclusive. Undoubtedly the greatest ore strength is exhibited by the region on and above No. 2 tunnel, and it seems unfortunate that more work was not done in this region.

It might be mentioned that from the portal of No. 1 tunnel the vein is trenched on the surface for a distance of over 100 feet and the main vein here appears very well defined, striking about N. 22° E. (mag.) and dipping about 70° north-west. Higher up again is an unmineralized shear-zone, probably the continuation of the main vein; this also dips north-west. Whereas the dip in No. 2 tunnel is south-east. This would appear to raise the question if the two fractures are the same. Refer also to the Annual Reports for the years 1914, 1922, 1923, 1925, and 1927.

King Tut. This group, owned by R. L. Gale, was under option to J. J. O'Brien and F. H. Taylor during the year. After carrying out 350 feet of crosscutting and 50 feet of drifting they relinquished the option. Time did not permit of examining this property after this work was accomplished. Refer also to the Annual Reports for 1924 and 1927.

Empire. This group, owned by D. C. Simpson, is situated on the South fork of Simpson creek. A good trail leads to it from Smithers, from which it is distant about 6 miles. There are mineral-showings on both sides of the basin in this region. Those on the north side are described in the Annual Report for 1925.

At the time of inspection the attention of the owner was directed to the south side of the creek. The basin-walls are here precipitous. At elevation 4,735 feet a crosscut is run 75 feet on a bearing S. 20° W. (mag.), penetrating a vein 14 inches in width, which had been followed 30 feet in a direction S. 45° E. (mag.), which is the bearing of the vein. The dip is south-westerly. The objective is to reach the intersection of this vein with another striking N. 78° W. (mag.), which seems to be the continuation of the vein on which the tunnel is run on the north side of the creek. This intersection of the veins on the south side can be seen on the surface above the tunnel. The owner states that about 500 feet above this point a tunnel was run on this vein south-east of the intersection for a distance of 50 feet, and from it 3 tons of ore was

shipped assaying 245 oz. silver to the ton and 40 per cent. lead. Present operations would therefore appear to be well justified.

The owner also states that there is another much larger vein, which extends on the north side of the creek above the basin-walls. Refer also to the Annual Report for 1925.

Snowshoe. This group of eight claims, owned by G. Raymond, P. Berg, and H. C. Wade, is situated south-east of the *Empire* and lies due west of Smithers. It is reached by a branch trail from the *Empire* trail, the distance from Smithers being about 4½ miles.

At elevation 4,470 feet, at the base of a cliff-like exposure of andesitic volcanics, a replacement fracture mineralized with pyrite, galena, and zinc-blende, varying in width from about 7 inches to 2 feet, cuts across the bedding-planes of the volcanics. The fracture strikes N. 60° W. (mag.) and dips at about 45° south-west. Exposure is by open-cut and surface-stripping over a length of about 25 feet. A sample of selected mineral assayed: Gold, trace; silver, 2.4 oz. to the ton; lead, 1.5 per cent.; zinc, 11.3 per cent.

About 300 feet north-west of this point a small creek has cut down to a depth of about 50 feet in the altered and somewhat mineralized volcanics, but this cut is probably not deep enough to expose this fracture, and its continuation should probably be found somewhat lower down the mountain.

Yukon. This group is owned by A. Chisholm and associates and is situated on the north side of the North fork of Simpson creek. The chief mineral-showing on this property is that of a shear-zone in the volcanics which are intruded by diorite. This occurs at elevation of about 4,770 feet and is exposed for a length of about 250 feet by surface-stripping, open-cuts, and short tunnel. Mineralization is somewhat sparse and consists of arsenopyrite, pyrite, pyrrhotite, and zinc-blende. Gold values are noteworthy. Average width is 5½ feet.

The most recent work done by the owner is at elevation 4,620 feet. At this point there is exposed at various points, over a length of 35 feet, by open-cuts and shallow pits a small vein of quartz and arsenopyrite striking about N. 35° W. (mag.). A sample of arsenopyrite only assayed: Gold, 0.2 oz. to the ton; silver, 0.1 oz. to the ton. A tunnel, the portal of which is on the line of strike and distant about 75 feet from the exposure, has been advanced 15 feet on a bearing N. 78° W. (mag.). The country-rock in which the arsenopyrite veins occur is apparently bleached diorite. It would seem advisable to endeavour to trace the main shear-zone above referred to, and expose it at this point, where it seems likely that its intersection with the most recently discovered vein will be found. Refer also to Annual Report for 1925; also to Geological Survey of Canada, Summary Report, 1925, Part A, page 137.

Jessie. This group, owned by L. S. McGill and associates, is situated between the North and South forks of Simpson creek, at elevations of between 4,300 and 4,700 feet, and is distant about 4½ miles from Smithers. A very considerable amount of useful surface-stripping has been accomplished during the year, with promising results, which warrant further development. A commendable feature of development to date is that the operators have confined themselves to surface work with a view to exposing the lateral extent and direction of the vein system, and have not made the mistake of undertaking premature underground development.

The essential mode of mineral occurrence, as disclosed by recent development, is that of several intersecting replacement fractures in the enclosing volcanic rocks in the immediate vicinity of an intrusion of diorite. Generally speaking, therefore, geological conditions may be said to be favourable. Mineralization consists essentially of arsenopyrite, zinc-blende, and galena.

Of these veins, No. 2 vein appears to be the most important; it strikes about N. 60° W. (mag.) and dips south-west into the hill at an angle of between 30° and 45°. It is well exposed by surface-stripping for a length of 335 feet. The total mineralized width will average perhaps 5 feet, but in places mineralization is sparse. In the vicinity and south-east of the junction with this vein of No. 3 vein a heavy mineralization of arsenopyrite, zinc-blende, and galena occurs. A sample taken at this point across the more leady portion, representing a width of 1.5 feet, assayed: Gold, 0.3 oz. to the ton; silver, 29.5 oz. to the ton; lead, 24 per cent.; zinc, 5 per cent.

A sample of the more arsenical portion, representing a width of 2 feet, assayed: Gold, 0.38 oz. to the ton; silver, 4.1 oz. to the ton; lead, trace; zinc, 7.5 per cent. The total width of mineralization at this point is 4 feet.

No. 3 vein diverges from No. 2 vein at an angle of about 25°, striking approximately due west (mag.) and dipping southerly at a flat angle of not over 30°. Its average width is about 15 inches, but it exhibits a compact mineralization of arsenopyrite, zinc-blende, and galena of an average width of about 9 inches. The vein is well exposed by surface-stripping for about 250 feet from its junction with No. 2 vein. A sample across the best-mineralized portion, representing a width of 10 inches, assayed: Gold, 0.28 oz. to the ton; silver, 7.6 oz. to the ton; lead, 0.8 per cent.; zinc, 11.3 per cent.

No. 1 vein appears to be of minor importance and is only a few inches in width. As shown by surface-stripping, it crosses No. 2 vein, continuing above the latter to join No. 3 vein. Thereafter, apparently, No. 3 vein and No. 1 vein continue as one vein in a westerly direction. This vein has been traced by eight open-cuts at intervals in an almost due westerly direction from No. 2 vein for several hundred feet. Appearances disclosed by these open-cuts are hopeful and further work is warranted. A sample taken in one of these open-cuts across a width of 6 inches of arsenoprite and zinc-blende assayed: Gold, 0.56 oz. to the ton; silver, 2.1 oz. to the ton; lead, trace; zinc, 4 per cent.

While there is some evidence of the existence of another vein, known as No. 4 vein, lying to the south-west of No. 3 vein, the practical aspect of affairs at this property is that of the development of No. 2 vein, and one other, the United No. 3-No. 1 vein.

Prior to any underground development it is recommended that further open-cuts be made on No. 2 vein with a view to tracing the latter in a southerly direction towards the South fork of Simpson creek, evidence to date indicating the heaviest mineralization in that direction. Refer also to Annual Report for 1927.

Glacier Gulch.

This group, owned by S. F. Campbell and G. E. Loveless, is situated at the head of Glacier creek and is distant about 6 miles from Smithers. An option was acquired by F. H. Taylor during the year, but after the work described below the option was relinquished, but perhaps not altogether because of dissatisfaction with results obtained.

At 480 feet vertically above the bed of the creek a shaft was sunk in the mineralization by F. H. Taylor, which at the time of inspection in November had reached a depth of 23 feet. The bearing of the shaft is S. 55° W. (mag.), which appears to be approximately at right angles to the strike of the mineralization, which is a replacement fracture cutting across the bedding-planes of the enclosing volcanic rocks. The pitch of the shaft is 55°; the mineralization appears to straighten up in depth and was continuous in the shaft. Near the collar of the shaft there is exposed a width of 1.5 feet of fairly compact mineral assaying: Gold, 0.04 oz. to the ton; silver, 179 oz. to the ton; copper, 0.3 per cent.; lead, 12.6 per cent.; zinc, 16.8 per cent. The greatest width met with in the shaft was about 16 inches, and in the bottom the width is 9 inches, which is almost entirely pyrrhotite, a sample of which assayed: Gold, 0.06 oz. to the ton; silver, 0.6 oz. to the ton; copper, trace. It is doubtful if the walls of the mineralization are exposed in the shaft-bottom.

High precious-metal values warrant persistence in following this mineralization, which has so far proved somewhat irregular. The shaft might well be continued to 75 feet and some prospecting done from this by crosscut and drift, as mineral occurrence indicates advisable. The topography readily permits of development in depth by adit to a depth of about 500 feet below this point. Such extensive development is not, however, justified until the existence of a definite objective has been proved. Refer also to the Annual Reports for 1926 and 1927.

Mount Evelyn Mines, Ltd.

The property owned by this company lies north of Toboggan creek and, with certain additional claims, was formerly known as the Carroll property, under which name it is described in the Annual Report for 1917 (page 114). The property is reached by a branch trail leading off the Silver Lakes or Schufer trail from Smithers, from which place it is distant about 9½ miles.

Present plans focus on driving a crosscut tunnel started last year. At the time of inspection this year this tunnel, at elevation 4,060 feet, had advanced 120 feet from the portal on a bearing N. 42° W. (mag.). The first 80 feet of this tunnel was closely lagged. The face is in andesite country-rock. It is stated that at 108 feet from the portal a small vein 16 inches in

width was penetrated and that the tunnel has been advanced since inspection a total distance of 200 feet from the portal.

Above this tunnel, at elevation 4,230 feet, an old shaft and open-cut, now caved, disclose a vein striking S. 60° W. (mag.) and dipping north-west at a steep angle, which the continuation of the crosscut tunnel should penetrate.

It was also noted that on the surface of this property occur extensive intrusions of granodiorite and aplite in the volcanics; and, generally speaking, therefore, the surrounding geologic conditions are favourable for mineralization. Refer also to Annual Report for 1917 (under Carroll property) and 1927.

Trade Dollar. This group of four claims, owned by Angus Chisholm, Alex. Chisholm, and E. Hassard, is a new discovery made during the year. Its effect is to direct attention to the elevated plateau of Hudson Bay mountain, which lies at an elevation of from 6,500 to 6,800 feet immediately above and south of the Schufer property. The plateau covers several hundred acres in extent, is not overlain by any glacial drift or vegetation, and contains one small glacial lake. Its surface, in places almost level, slopes gently upwards towards the south at an angle of between 10° and 15°. In such situation the country-rocks with any enclosed veins have, as the result of natural agencies, merely weathered and shattered *in situ*, leaving the solid formation overlain with debris to a depth of several feet, but the exact thickness of the overlie has only been ascertained in one place, at the *Trade Dollar*. The thickness is here about 6 feet. Under such conditions it might be expected that it would be a comparatively simple matter to trace and prospect the veins, which undoubtedly exist in place immediately below their shattered outcrop. Tracing is simple, but investigation is not so simple as might appear. The upper portion of debris has had the effect of insulating the lower portion, likewise the rock in place, which latter has remained frozen for ages. If a pit is opened, giving warm air access, the amount of water caused by melting frost forming in a shaft in solid formation is such as to impede progress and almost renders a pump necessary.

On the *Trade Dollar*, at elevation 6,650 feet, a shaft sunk 8 feet deep exposes a vein 34 inches in width, of which a width of 30 inches is remarkably clean galena, under an oxidized capping a few inches in thickness. This vein strikes N. 85° W. (mag.) and dips north-east at about 75°. A sample taken across 2.5 feet assayed: Gold, 0.14 oz. to the ton; silver, 90 oz. to the ton; lead, 64 per cent.; zinc, 0.2 per cent. A sample of the oxidized capping assayed: Gold, 0.34 oz. to the ton; silver, 57 oz. to the ton; lead, 36 per cent. About 135 feet north-west of this point in the direction of the strike, and about 25 feet below the collar of the shaft, some galena-float shows in the debris. This shaft is close to the south-western boundary-line of the *Silver Lake No. 2* claim and the north-western continuation of this vein probably enters this claim.

At the precipitous western edge of this plateau, at the upper edge of Loring basin, there is exposed a mineralized band of rock about 20 feet in width, which strikes N. 45° E. (mag.) and dips at 65° south-east. This shows at the upper edge of Loring basin a good mineralization of chalcopyrite. What is apparently the continuation of this mineralized band can be traced across the plateau and possibly extends to the upper edge of the Big Toboggan glacier. This band is about 1,000 feet or so south of the shaft previously mentioned.

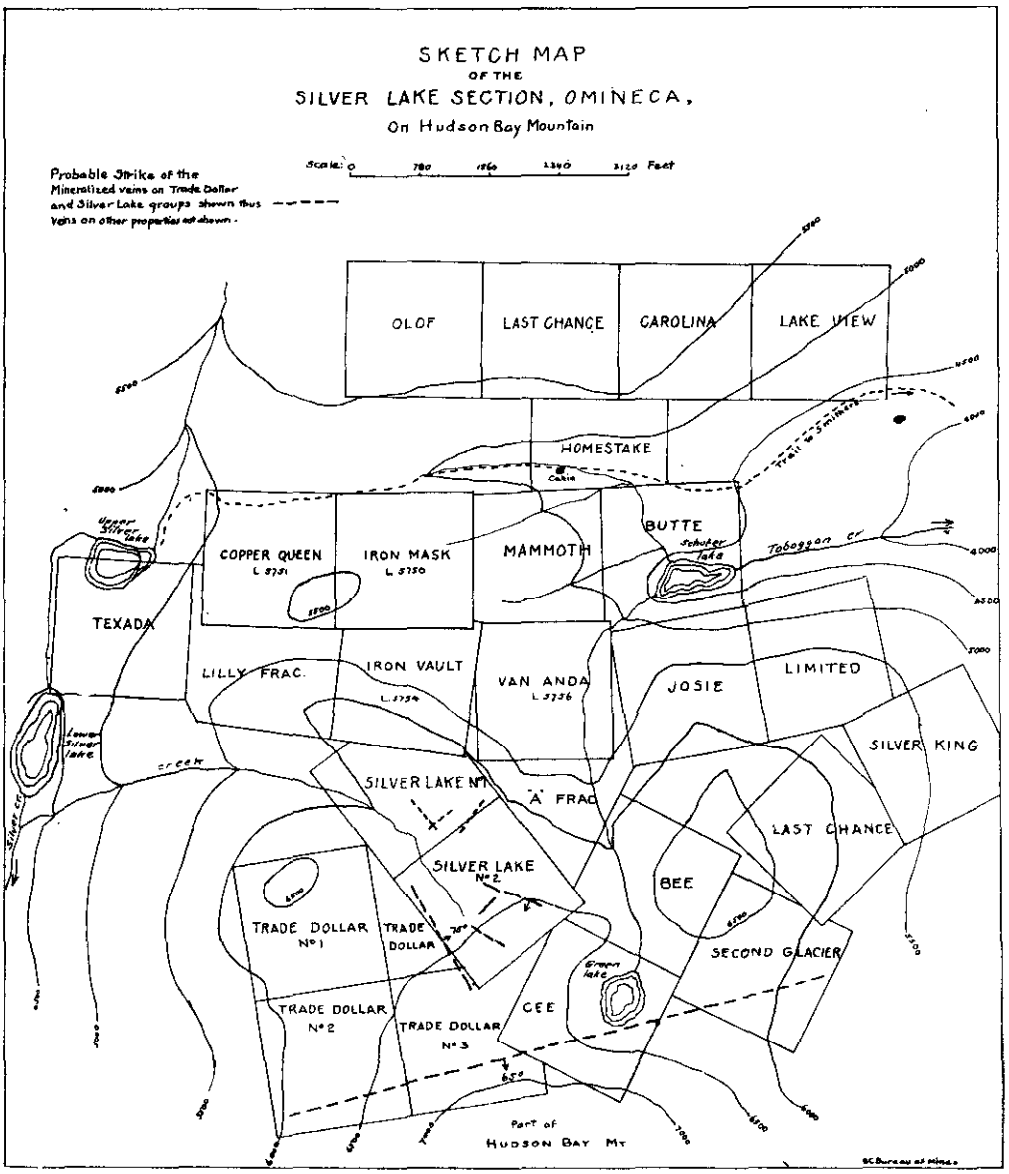
This group well merits investigation and is, together with neighbouring claims on this plateau, commended to the attention of those interested.

Silver Lake. This group, owned by L. S. McGill and P. Schufer, is described in the Annual Report for 1926; also certain of the subject-matter under *Trade Dollar* above applies to this group. Additional work since 1926 has been done in further open-cutting in the loose overlie and some nice float has been discovered, which from its position indicates a vein striking about N. 72° E. (mag.) and dipping south-east. These open-cuts are distant about 600 feet north-west of the *Trade Dollar* shaft. About 300 feet south-west of the open-cuts occurs a band of limestone. Refer also to Annual Report for 1926.

Babine Mountains.

Harvey. This group, owned by C. G. Harvey and associates, is situated between Lyon and Driftwood creeks and is distant about 13½ miles from Smithers. The Driftwood Creek road leads to within 1½ miles of the property and there is a good trail from the road for the remaining distance. The property was optioned during the year by the Consolidated Mining and Smelting Company of Canada, Limited.

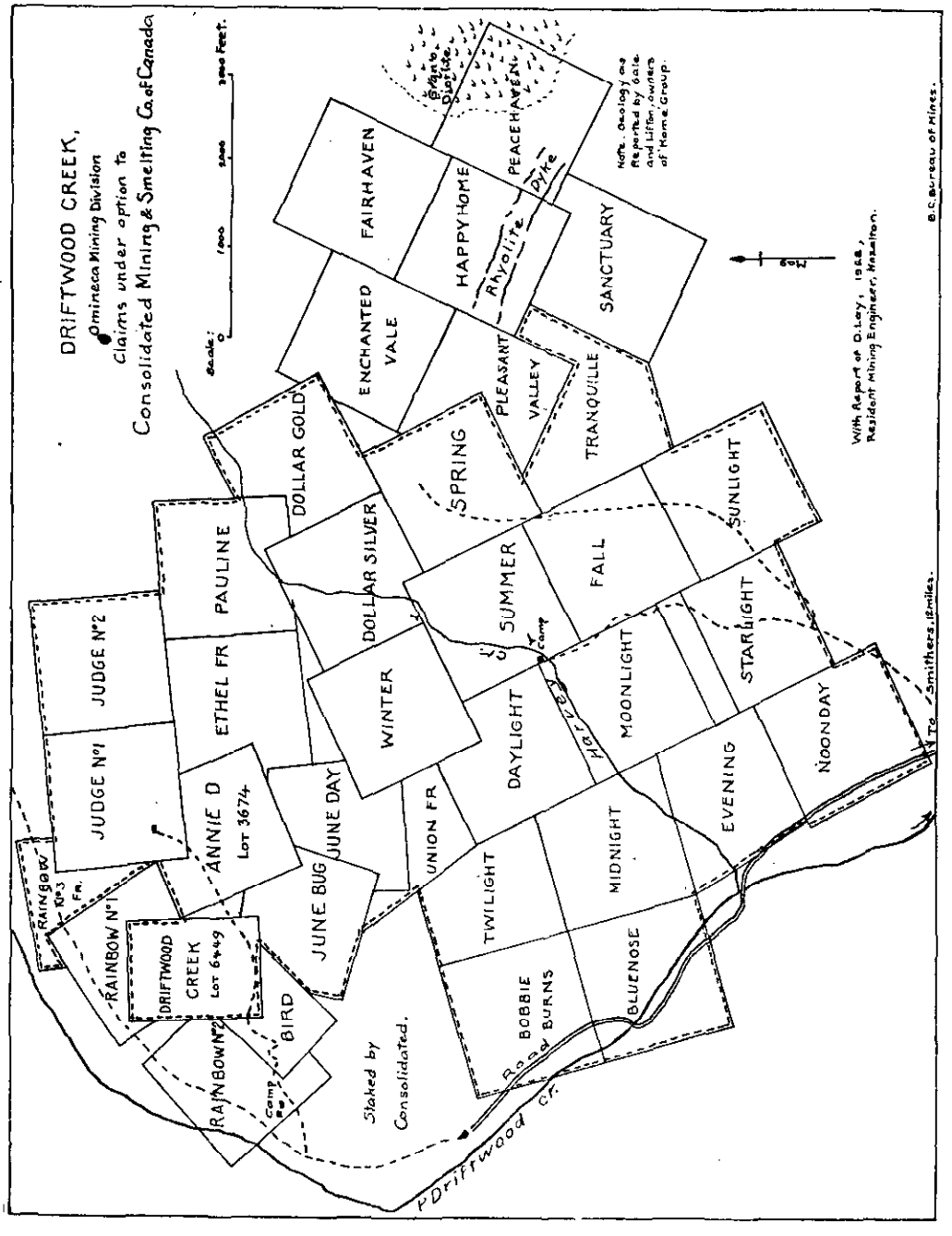
The mode of mineral occurrence is that of a number of more or less parallel replacement fissures in andesite, which strike roughly north-west (mag.) and dip north-east and appear to conform with the bedding-planes of the enclosing volcanics. In a strip of country about 1,500 feet in width there are ten such fissures, and one other, not inspected, is said to lie several hundred feet to the north of this. The mineralization is essentially copper, the important minerals being chalcopyrite and grey copper, although other copper minerals and some galena are present in places.



Although mineralization is on the whole somewhat sparse, as an offset to this the silver ratio is high, averaging probably from 10 to 15 oz. of silver to the unit of copper. In places there are rich lenses and the owners have been able to hand-sort and ship a small tonnage running up to $200 a ton in gross values. While such rich lenses may prove narrow and irregular, the width of mineralization is in most cases very considerable, so much so as to suggest that possibilities may be found to exist along the lines of a large tonnage of low-grade material. However, development as yet is in such an elementary stage that any definite con-

clusions on this aspect are premature. In fact, work so far, up to the time of inspection, had been confined almost entirely to only two of the fissures and most of the others are quite unprospected. The dip appears to be mainly at flat angles of perhaps 30°, and for that reason surface exposures may give an exaggerated idea of true widths.

As throwing further light on the surrounding geology, it is interesting to note that the owners of the *Home*, R. L. Gale and H. C. Lifton, report the existence on that group of a large outcrop of granodiorite and also that of a large dyke trending north-west. As will be seen from the map, the *Home* adjoins the *Harvey* on the west, but it has not yet been inspected.



The cabin on the property is situated at elevation 4,330 feet. All elevations given are by aneroid.

All outcrops occur on a steep mountain-slope on both sides of Harvey creek, which has deeply dissected the mountain-side. Exposures are mainly quite close to the creek. At elevation 4,450 feet, in the bed of Harvey creek, a vein is partly exposed, striking N. 40° W. (mag.) and dipping north-east. At 4,500 feet a crosscut tunnel is run 243 feet on a bearing N. 58° E. (mag.); thereafter 35 feet on a bearing S. 55° E. (mag.), the objective of which is the penetration of the downward continuation of vein No. 1. On the surface 50 feet above the tunnel a replacement fissure very sparsely mineralized strikes N. 15° E. (mag.) and dips at a flat angle south-east.

Vein No. 1. At 4,610 feet elevation a short adit-drift is run to meet the downward continuation of a shaft 25 feet in depth, sunk following the mineral from a higher point. The shaft is continued a short distance below the adit. Seams and disseminations of copper mineral occur here over a width of apparently about 24 feet, but, the dip being very flat, the true width may be much less. The strike of this mineralization here seems to be about N. 30° W. (mag.), with a flat dip north-east.

Vein No. 2 lies about 40 feet from vein No. 1. At 4,660 feet elevation a shaft is sunk about 60 feet and a drift has been run south-east from the shaft. Good ore was taken from this working and the width of the fissure seems to be about 4 feet. The strike is N. 30° W. (mag.).

Vein No. 3 lies close to vein No. 2; it is about 15 feet in width, very sparsely mineralized, a little galena showing, and strikes N. 50° W. (mag.) and dips south-west at a steep angle.

Vein No. 4 is distant about 150 feet from vein No. 3, and is exposed at elevation 4,740 feet and strikes N. 65° W. and dips north-east. This appears to be the widest vein. Exposures were inadequate to form an exact idea of the true mineralized width, but it is certainly very considerable. The total vein-width on the surface appears to be about 40 feet.

Vein No. 5 strikes N. 65° W. (mag.) and dips north-east and is distant about 20 feet from vein No. 4.

Vein No. 6 is 50 feet from vein No. 5 and strikes N. 40° W. (mag.) and outcrops at 4,960 feet elevation.

Vein No. 7 is in schisted andesite and is close to vein No. 6. A short adit is run on it. The strike is N. 15° E. and dip south-east.

Vein No. 8 is 100 feet distant from vein No. 7, and vein No. 9 is 100 feet distant from vein No. 8. Vein No. 10 lies, it is stated, 700 feet north of No. 9, but this last-mentioned vein was not inspected.

Time did not permit of sampling the last five mentioned veins or of a highly critical examination, but most are little more than exposed by natural agencies. In almost every case, however, exposures seemed to show some mineral and the majority exhibit strength.

Favourable surrounding features, such as topography permitting economic mining, abundance of water for milling, abundance of timber, nearness to transportation, coupled with mineral-showings, combine to make this prospect attractive. Refer also to the Annual Reports for the years 1918, 1921, 1925, and 1926, and also to Geological Survey of Canada, Summary Report, 1924, Part A, page 34.

Babine Bonanza Co. In October arrangements were made to reopen this well-known property (Cronin mine) by the Babine Bonanza Mining and Milling Company, Limited, and a small crew commenced repairing the sleigh-road from Telkwa to the mine. It was stated by the management that actual mining operations in a small way were commenced towards the end of the year, and that it is intended to ship a limited tonnage of hand-sorted ore while certain machinery was being hauled to the mine.

This property was last operated in 1923 and full accounts of it will be found in several Annual Reports from 1914 to 1923. Refer also to Geological Survey of Canada, Summary Report, Part A, 1924, page 30.

Silver King. On this group, at the head of Driftwood creek, assessment-work on the various claims was carried out by the owning company, Babine Silver King Mining Company. For descriptions of this property refer to Annual Reports for 1919 to 1926, inclusive; also to Geological Survey of Canada, Summary Report, 1924, Part A, page 35.

Victoria. It is stated by the owners that preparations have been made to continue the new adit-tunnel during the winter. A company to be known as Lorraine Copper Silver Mines, Limited, is understood to be under organization for the

purpose of operating this property. For descriptions of this property refer to the Annual Reports for the years 1918, 1922, and 1926, and also to Geological Survey of Canada, Summary Report, 1924, Part A, page 32.

Structural Materials.

Smithers Brick Yard.—During the year Axel Anderson and partner, under the name of "Smithers Brick Yard," started a brickyard on the bank of Kathlyn creek, 1 mile from Smithers on the Hazelton road. The year was mainly occupied in experimental work and installing the necessary plant. The production for the year amounted to 24,000 brick, all of which was used in Smithers. The brick appear to be of good quality. The brick-making machine installed has a capacity of 12,000 for an eight-hour day. This is operated by a 21-horse-power tractor, which also serves for hauling clay.

TELKWA SECTION.

Chief interest in this section during the year centred in the optioning of the *Duchess* and *Contention* groups in Howson basin by the Consolidated Mining and Smelting Company of Canada, Limited, and in the agreement to purchase the Telkwa Collieries, Limited, by Frank S. Taggart, representing English interests (further referred to under "Coal" in this report).

Howson Basin.

This basin is situated at the headwaters of the South fork of the Telkwa river and is distant about 30 miles from Telkwa. A car can be taken as far as the South Fork bridge, a distance of about 17 miles from Telkwa. The remaining distance is served by a pack-trail. A full description of topographic and geologic features is to be found in the Annual Report for 1917, to which reference is invited.

Duchess and Contention.

Owing to the necessity of repairing the road and trail, which were badly damaged by high water in July, actual mining operations were not started by the Consolidated Mining and Smelting Company of Canada, Limited, which has these groups under option, until the middle of September. It is understood that the lower tunnel on the *Duchess* is being advanced and that mining operations will be continued throughout winter. Refer also to Annual Reports for 1916 and 1917, and also to memoir published by the Geological Survey of Canada: "The Telkwa River and Vicinity, B.C.," by W. W. Leach.

Telkwa River.

Time did not permit of visiting this section. The chief properties are the *Big Four*, owned by Alex. Chisholm (*see* Annual Reports for 1914, 1917, 1920, and 1926), and the *Kitchener*, owned by Goodwill, Gillespie & Wilson, a description of which appears in the 1925 Annual Report. A new discovery of lead and copper ore is reported by John B. Goodwill on Bonanza mountain, on which the *Kitchener* is situated.

Deep Creek.

Deep creek flows into the Bulkley river about 2½ miles above Quick. Mineral properties situated at the headwaters are conveniently reached from Telkwa, from which place a car can be taken as far as Smith's ranch (unoccupied in 1928), situated on the creek, at a point about 7 miles from its mouth and 17½ miles from Telkwa. From Smith's ranch a good trail with an easy grade leads northwards as far as Dome mountain.

Deep Creek.

This group is owned by T. Brewer and T. Brandon and is distant about 3½ miles from Smith's ranch, the distance from Telkwa being about 21 miles. The mineral occurrence exhibited is that of mineralized volcanic beds. Mineralization consists of pyrite, chalcopyrite, and zinc-blende, and is sparse on the whole, although there are bands up to 5½ feet in width fairly well mineralized. These bands are heavily stained with iron and the presence of a little manganese is indicated. Various open-cuts and pits indicate a mineralized width of not less than 56 feet and a length of not less than 500 feet. Mineralization appears to conform in strike and dip with the bedding-planes of the enclosing schisted andesite, which strike N. 50° W. (mag.) and dip north-east.

The elevation of the exposures is 4,140 feet and the topography is that of hilly country transitional between mountains and plateau, which unfortunately does not lend itself to the cheapest modes of development. Nevertheless, it is an occurrence which merits further investigation and is readily accessible.

A sample taken across 5.5 feet, representing the most heavily mineralized band, assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, 0.2 per cent.; zinc, 1.5 per cent. A sample of selected mineral assayed: Gold, trace; silver, 4 oz. to the ton; copper, 1.5 per cent.; zinc, 2 per cent.

The mineralization may be due to some near-by granitic intrusion, and it would seem advisable to search for such, which if found might throw further light on the occurrence.

Ivanhoe. This group is owned by T. Blythman and is situated about 4 miles north of the *Deep Creek*. A trail about 8 miles in length leads to it from Smith's ranch. The showings lie at elevations of between 4,400 and 4,500 feet in hilly country, containing numerous rounded knolls. From the top of one of these knolls Black mountain and Huckleberry mountain near Topley are seen to lie in a direction N. 87° E. (mag.) and Dome mountain lies N. 55° W. (mag.).

On the summit of a round-topped hill at elevation 4,495 feet occurs a strong-looking, somewhat sparsely mineralized fissure 6 feet in width in andesite, striking N. 40° E. and dipping south-east at about 60°. On this a shaft is sunk 10 feet deep. The mineralization is with tetrahedrite, malachite, and azurite. Chalcopyrite is also present. A sample taken across 6 feet assayed: Gold, trace; silver, 1.8 oz. to the ton; copper, 0.6 per cent. It is stated that mineral carrying good silver values has been taken from this shaft, which is quite possible.

Distant from this shaft in a southerly direction about 500 feet a band of volcanic rocks about 11 feet in width shows a slight copper mineralization. A sample taken across this width assayed: Gold, trace; silver, 1.8 oz. to the ton; copper, 0.5 per cent.

Distant from the shaft about 1,200 feet in a westerly direction occurrs an intrusion of granitic rock, and in the more immediate vicinity of this occur some small veins which show some copper mineralization in a quartz gangue. A sample of one vein, 9 inches in width, assayed: Gold, trace; silver, 2 oz. to the ton; copper, trace. An option has been taken on this property by Alex. Chisholm.

Grouse Mountain.

Grouse Mountain properties are conveniently reached from Telkwa, the main Provincial highway passing at the base of the mountain, about 16 miles distant from Telkwa. A branch road leads off the main road to the summit of the mountain, the distance being about 5 miles.

Hidden Treasure. This group, owned by Walter Skelhorne, is situated at the top of the steep north-eastern slope at elevation 4,600 feet. A small well-mineralized vein occurs in schisted andesite in the immediate vicinity of a felsite dyke. The vein appears to strike S. 70° W. (mag.), with south-easterly dip, and to be broken over at the surface. A tunnel 43 feet in length, run just below the surface exposure, failed to encounter much mineral, and appearances rather suggest that it may be in the foot-wall of the vein. The tunnel passes through the flat-dipping felsite dyke, which averages about 4½ feet in width and which disappears into the floor near the face. The dyke is slightly mineralized with chalcopyrite. The mineralization in the vein is galena, zinc-blende, and chalcopyrite. A sample of selected pieces of galena assayed: Gold, trace; silver, 5 oz. to the ton; copper, 1.5 per cent.; lead, 24 per cent.; zinc, 11 per cent. A sample of selected pieces of chalcopyrite and pyrite assayed: Gold, trace; silver, 1.6 oz. to the ton; copper, 4.3 per cent.

Lakeview. This property is owned by Louis Schorn; an account of it will be found in the 1925 Annual Report and map in 1926 Annual Report. From the face of the 80-foot tunnel mentioned in the 1925 Annual Report a crosscut has been run to the hanging-wall, which did not disclose any material amount of ore. This property, however, merits further investigation.

Cornu Copia. On this group, owned by J. Oakes, a rich stringer was struck in 1925. The owner has since carried out additional work in this region, including an adit-tunnel 23 feet in length, but without any important result. There are several brecciated quartzose shear-zones on this property, slightly mineralized, on which the owner would appear to be justified in doing further work; in particular on one at 4,600 feet elevation, close to a small lake, where a width of 2½ feet of quartz is exposed, of which a width of 1 foot on the foot-wall shows some copper mineral. Unfortunately the topography is flat in this vicinity and prospecting is rendered laborious.

Joe B. On the *Rainstorm* (*see* 1926 Annual Report) and on the *Black Fox* (*see* Annual Report for 1925) further work was done during the year by L. H. McLean, one of the owners. This group is situated on the south-eastern slopes of Grouse

mountain at elevation 3,460 feet. There is exposed a flat-dipping quartz vein 9 inches in width, showing grey copper, malachite, and azurite. The strike, N. 5° W. (mag.), and dip, 20° south-west, approximately coincide with the slope of the mountain and surface erosion appears to have removed the vein southerly in this region. Northerly, the continuation might be followed in view of the presence of grey copper. A sample across 9 inches assayed: Gold, trace; silver, 16 oz. to the ton; copper, 0.7 per cent. For further information regarding Grouse Mountain properties refer to Annual Reports for the years 1914, 1916, 1923, 1925, 1926, and 1927.

Walcott.

Some mineral-showings were investigated in the vicinity of Walcott, a flag-station on the Canadian National Railway about 17 miles east of Telkwa. These showings are situated about 5 miles east of Walcott and lie 2 miles west of the railway-track, at elevations of between 200 and 700 feet above the latter, in the vicinity of the creek known locally as Sunrise creek. The latter has cut down deeply, at one point flowing through a canyon several hundred feet in depth.

Confederation. This group is owned by V. A. Sahlstrom, A. Thompson, E. Aston, M. Krubovchak, and W. I. Hemstreet. At an elevation of 2,550 feet on the summit of the spur immediately east of Sunrise creek, at the contact of rhyolite and basaltic volcanic rocks, the bedding-planes of which strike approximately true east and west and dip north at about 50°, there occurs a mineralization in the basalt. The mineralization consists mainly of magnetite, with a little chalcopyrite, and does not suggest commercial possibilities. A selected sample of the most heavily mineralized portions assayed 0.3 per cent. copper and showed only traces of gold and silver. On the same group, at the top of the Sunrise Creek canyon, the walls of which are 500 feet high at this point, the volcanics show a little chalcopyrite.

Vaino. This claim, owned by A. K. Hemstreet, is situated on Sunrise creek. On the left bank of the creek, at elevation 2,000 feet, a small open-cut discloses some chalcopyrite and copper-stain in altered volcanic rock, probably andesite. A sample of the most heavily mineralized portion assayed: Gold, 0.04 oz. to the ton; silver, 7.6 oz. to the ton; copper, 3.2 per cent. Further work by the owner at this point is advisable, to enable an opinion to be formed as to the trend and width of the mineralization.

HOUSTON SECTION.

Of major importance in this section were the activities of F. H. Taylor, who, having optioned the *Silver Queen*, *Diamond Belle*, and *Midnight* groups and acquired adjoining claims by option or direct staking, commenced preparations in the early fall for winter operations. He also retained the services of J. M. Turnbull and H. L. Batten, mining engineers, for the purpose of making an examination and report on these properties.

A new road on an excellent grade from Houston to Owen lake has been partially completed, forming in its present condition a sleigh-road throughout. The Departments of Public Works and Mines assisted F. H. Taylor in contributing towards the cost of this road. A company called the Owen Lake Mining and Development Company, Limited, has been incorporated for the purpose of operating these properties.

Owen Lake.

Owen lake lies somewhat west of due south of Houston, from which place it is by the new road about 25 miles. The new road leaves the Houston–Francois Lake road just before the sharp descent to Buck River Crossing and passes north of previous routes going through a pass known as the Wardner pass. The grade is good and uniform. As determined by aneroid, the level of Owen lake is 2,425 feet, referred to Houston as 1,950 feet; that of the *Diamond Belle* cabin, 3,115 feet; that of No. 1 vein on the *Silver Queen* (the lowest vein in the bottom of Wrinch creek), 2,815 feet; outcrops of No. 3 vein on the *Silver Queen* on the north-west side of the creek, about 3,015 feet.

Owen Lake Mining and Development Co., Ltd. As will be seen by reference to the accompanying map, the most important holdings of this company are the options on the *Silver Queen*, *Diamond Belle*, and *Midnight* groups; neighbouring claims are held in part by staking and in part by option. The *Silver Queen*, owned by H. C. Wrinch, is fully described in the Annual Reports for the years 1916, 1923, and 1924, and briefly referred to in the Annual Reports for 1925 and 1927. No work, apart from cleaning out tunnels, has been

done on this property since 1924. There are remarkably good showings on this property, both underground and on the surface, which amply warrant development.

The *Diamond Belle*, owned by J. Cole, is described in all essentials in the Annual Reports for the years 1916 and 1923 and referred to in the Annual Reports for 1925 and 1927. Recent work on this property has been largely confined to the most northerly of the veins, which has now been stripped on the surface for a total length of 300 feet, of which a length of 173 feet is one continuous stripping, and in the remaining length there are two strippings between 20 and 30 feet in length. These show a well-defined and well-mineralized vein striking about due east and west (mag.) and dipping steeply south. There are certain clearly defined turns in the vein, strike varying from about N. 85° W. (mag.) to N. 75° E. (mag.). A sample was taken across 3 feet at one point, which appeared to be more or less representative of the best-mineralized portion; this assayed: Gold, trace; silver, 2.6 oz. to the ton; lead, 9 per cent.; zinc, 12.5 per cent. A sample of selected mineral assayed: Gold, trace; silver, 7.8 oz. to the ton; lead, 24.5 per cent.; zinc, 24 per cent. This vein is heavily stained with oxides of iron and manganese; the rhodonite content of the vein is noticeable.

The *Midnight* group was originally the Chisholm property and is fully described under that name in the 1916 Annual Report. It was relocated as the McLean property and is described under that name in the 1923 Annual Report. This year it was again relocated as the *Midnight* and is owned by Alex. and Angus Chisholm. No work whatever has been done on this property since 1916. The property was, however, visited this year. A sample was taken at the collar of the 10-foot shaft of selected mineral, which assayed: Gold, 0.30 oz. to the ton; silver, 20 oz. to the ton; lead, 1 per cent.; zinc, 18 per cent. This confirms the view expressed in the 1916 Annual Report that the silver values do not appear to be associated to any very great extent with the galena.

The manganese content of this vein is evidently quite material, so much so as to form the source of a small deposit of wad, which is to be found about 75 feet west of the 10-foot shaft underlying the soil and vegetation. A sample of this upon analysis was found to contain 35 per cent. manganese. Clearly, the veins in this region being known to contain manganese, the occurrence of wad may be a useful guide in prospecting.

In October F. H. Taylor, having acquired options on these properties, made active preparations to commence actual mining operations during the coming winter. Various mine supplies, including a sawmill, were hauled to Owen lake via Francois lake and the Nadina River road, and camp buildings constructed at Owen lake. Machinery comprising, mainly, one 35-horse-power Novo semi-portable engine and compressor, one 18-horse-power Novo hoist, one 105–115-horse-power Petter semi-Diesel engine, and one 750-cubic-foot Gardner cross-compound air-compressor is being hauled in on sleighs from Houston over the new sleigh-road.

The plan of operations is to run a long crosscut tunnel at a point about 100 feet above the level of Owen lake to probe in depth the *Silver Queen* and *Diamond Belle* vein systems.

It is estimated that the length of crosscut required to reach the latter will be 6,500 feet; the approximate depth given by this crosscut will be seen by reference to the elevations given under "Owen Lake" above. The management expects to encounter other veins before the *Silver Queen* system is reached, and states that from surface indications the first vein will be struck in the crosscut at approximately 125 feet from the portal.

While the main tunnel is in progress it is the intention to sink a prospect-shaft to a depth of about 120 feet on the *Diamond Belle* and to then drift about 100 feet east and west at the bottom of the shaft. When this has been done the equipment used will be moved to the *Midnight* and similar preliminary development carried out on that property. This enterprise gives promise of becoming an operation of major importance.

Snowstorm. This group of four claims, owned by Helmer Larson, is a new discovery this year. It is situated about 1½ miles due north of J. Cole's cabin, almost at the top of a hill, the summit of which is at an elevation of 4,250 feet, rising to a height of somewhat over 1,000 feet above the surrounding plateau-like country.

The mineral occurrence is that of a very sparsely mineralized rock of alaskite type. At 4,200 feet elevation, on the north slope almost at the top of the hill, a number of open-cuts in a direction N. 45° E. (mag.) show a sparse mineralization of zinc-blende, pyrite, and galena for a distance of about 200 feet. A sample of selected portions of the rock assayed: Gold, trace; silver, trace; lead, *nil;* zinc, 1 per cent. The mineral does not appear to follow any definite

seams; crystallization of ore and rock minerals appear to have been contemporaneous. While exposures to date do not indicate mineral of commercial occurrence, it is none the less interesting. The country-rock is sheared in places and outcrops of the same occur on the *Midnight*.

Bob Creek.

Bob creek flows into Buck river from the east at a point distant from Houston by motor-road about 8 miles.

Horseshoe. This group is owned by G. W. Smith, E. E. Barnum, and A. and M. DesBrisay. It is a relocation of what is known locally as the "Porphyry Dyke," which has for some years past at different times exercised the minds of various investigators. An account of it will be found in the Annual Report for 1916. Since then, however, some work has been done this year, which, while not extensive, throws a little further light on the occurrence.

Bob creek has cut down deeply and about 1 mile above its junction with Buck river flows through a canyon-like gorge, walls of which are many hundreds of feet in height. In this region there is exposed a wide belt of highly altered, kaolinized, white-coloured rock, stained with iron oxide on the surface and mineralized mainly with pyrite and zinc-blende, the gold contents of which, there is every reason to suppose, originated a placer deposit of subordinate importance at and below this point on the creek. The exact nature of this rock cannot be determined without microscopic analysis of a thin section. It may be highly altered volcanic or intrusive of alaskite type.

On the right bank of the creek just above the creek-level the present owners during the year drove an adit on a bearing magnetic north for a distance of 43 feet. This shows throughout a white decomposed and kaolinized rock, sparingly mineralized with pyrite, zinc-blende, and a very little galena. This mineralization occurs not only throughout the rock-mass, but also in small seams ½ to 2 inches in width, which appear to strike at right angles to the bearing of the tunnel and dip south. A sample of these seams only assayed: Gold, 1.4 oz. to the ton; silver, 2.2 oz. to the ton; lead, 0.4 per cent.; zinc, 18 per cent. A general grab sample taken along the walls of the tunnel over a length of 30 feet assayed: Gold, trace; silver, trace; lead, *nil;* zinc, 3 per cent. At the face of the tunnel a sample was taken on the east side where mineral seemed a little more prevalent. This assayed: Gold, trace; silver, trace; lead, *nil;* zinc, 4 per cent.

About 300 feet above this tunnel, another tunnel 15 feet in length is run in the left bank of the creek. At this point a stringer 3 inches in width assayed: Gold, 0.06 oz. to the ton; silver, 41 oz. to the ton; lead, 3 per cent.; zinc, 11 per cent. This tunnel appears to be at the upper end of the most highly altered zone. The width of the most highly altered region appears to be about 600 feet.

While the deposit of placer is probably of no importance, nevertheless the many old workings indicate that evidence of the likelihood of a profitable deposit was obtained, or it would not have been followed with the persistence which is apparent.

As possibly having some influence or bearing on this mineralization, it might be mentioned that on the *Risk* and *Hope* (described later) there occurs what may be a continuation of this altered belt of rocks and in the vicinity of an intrusion of pyroxenite. This is distant in a south-westerly direction about 1 mile from the *Horseshoe*.

While the mineral occurrence on the *Horseshoe* does not show obvious commercial possibilities, it is quite possible that further investigation, which appears warranted, might reveal such. It is apparent that mining costs would be very low. This and other favourable surrounding features are factors which justify close scrutiny of its possibilities.

Risk and Hope. These claims are owned by R. Hayes and are situated on the ranch owned by him, through which passes the wagon-road from Houston to Francois lake. The distance from Houston is about 10 miles. Mineral-showings are distant only a few hundred yards from the road and are distant about 1 mile in a south-westerly direction from the "Porphyry Dyke" described under *Horseshoe* above.

On the banks of an unnamed small creek flowing into Buck river from the east, several open-cuts show a slight mineralization of pyrite and zinc-blende in a rock of alaskite type, iron-stained, which may be a continuation of the altered belt on the *Horseshoe* described above.

An outcrop of pyroxenite occurs some distance west of the altered iron-stained rock, extending in a north-and-south direction. A sample of the best portion of the altered rock on this property assayed: Gold, trace; silver, 0.4 oz. to the ton; lead, trace; zinc, 3 per cent.

Buck. This group, owned by J. Carter, J. Quinn, W. Raymond, and T. Rush, is described in the 1927 Annual Report. This year the adit-tunnel had been advanced a distance of 15 feet, at the time of inspection, on a bearing N. 65° E. (mag.). While very little mineral showed in the face, the good silver content of the galena on this property justifies some persistence on the part of the owners.

Topley Section.

Noteworthy in this section was the large amount of development-work and diamond-drilling carried out at the *Richfield* by the Topley-Richfield Mining Company, Limited. Small-scale operations were carried out at the *Golden Eagle* by Topley Silver, Limited. Much painstaking prospecting took place in this section during the year and some interesting new discoveries made, notably those on the *Jack Rabbit* and *Cup*.

Richfield. Besides doubling the capacity of its power plant (bringing this up to 100 horse-power in two Vickers-Petter 50-horse-power units), the Topley-Richfield Mining Company, Limited, carried out much development-work and diamond-drilling. At the end of November this company announced that important results had been obtained, both from excavational development and from diamond-drilling. In consequence further diamond-drilling was suspended pending the sinking of the main shaft in order to explore the ore indicated by diamond-drilling.

Excavational development during the year has been concentrated upon: (*a*) The quartz vein which follows with persistence the andesite-topleyite contact; (*b*) the East vein; (*c*) the mineralization in topleyite.

(*a.*) The quartz vein was followed both north and south of the shaft by No. 1 drift N. and No. 1 drift S. respectively. While this vein showed strength and continuity, more especially north of the shaft, and was at times fairly well mineralized, no commercial ore was disclosed at this horizon. This vein dips westerly.

(*b.*) The East vein is referred to in the 1927 Annual Report under (4) on page 143. This vein was first stripped on the surface for some distance where it is seen as a well-mineralized vein, dipping east, and suggesting commercial possibilities. It was accordingly followed by crosscutting from the north drift mentioned under (*a*) above. What may be the downward continuation of this vein was followed northwards by a drift from this crosscut, but, inasmuch as the vein followed by this drift is a narrow weak vein, showing no commercial ore, it seems more likely that faulting has dislocated the East vein farther east at this horizon. It is also understood that diamond-drilling from the surface in the vicinity of the mineralized East vein showed negative results in depth.

(*c.*) The mineralization in topleyite: The important work in this consisted in advancing No. 4 crosscut W. (*see* plan, 1927 Report), one of the workings started by the Standard Silver-Lead Mining Company. This working was advanced subsequent to inspection. H. L. Batten, mining engineer in charge, in a report dated November 24th, issued to the press, comments on results gained as follows: "This crosscut is in mineralized topleyite, carrying fair values, and shows extension in width of the main mineralized topleyite zone. The country exposed in this crosscut is mineralized topleyite with dark quartz and carries values of commercial grade. This crosscut passes through the hanging-wall bank of mineralized topleyite and is development-work in a block of ground carrying good values that has very interesting possibilities. Work is now being concentrated on this block, which consists of mineralized topleyite with values in bands. It is probably the downward continuation of the zone exposed in the Taylor tunnel. This block of ground has been resampled and shows a probable average of about $12 a ton in gold and silver values for a length of about 130 feet. The width on the level is probably over 50 feet, but the true thickness of ore is expected to be very much less. The large horizontal section at the level is due to the very flat dip at this horizontal section. The dip of the mineralized bands as a whole is probably about 60°. Downward continuation of this block is very strongly indicated by results of drilling. The shaft is now being sunk to prove up the results of drilling, and work on the lower level, if successful, will block out a tonnage of ore. The commercial possibilities

of this block of ground are excellent and definite information on tonnage should be obtained during the next four months."

Diamond-drilling.—Important results were obtained in hole No. 3 U, collared in No. 1 cross-cut east. The strike is S. 80° W., dip minus 40°; depth drilled, 168 feet. H. L. Batten, in his report cited above, makes the following statement concerning the results of this hole: "This hole passes through the mineralized topleyite zone. The hole starts in the topleyite. At a depth of 40 feet below the level (vertically) the following assays were obtained:—

"Across 6 inches: Gold, 0.20 oz.; silver, 10.2 oz.; copper, 0.1 per cent.; zinc, 1 per cent.

"Across 3.5 feet: Gold, 0.46 oz.; silver, 52.2 oz.; copper, 0.3 per cent.; zinc, 3 per cent.

"Across 3 feet: Gold, 0.50 oz.; silver, 93.5 oz.; copper, 0.3 per cent.; zinc, 5.4 per cent.

"Another mineralized zone was encountered about 100 feet vertically below the level and the following assays were obtained:—

"Across 4.5 feet: Gold, 0.08 oz.; silver, 3 oz.; copper, 0.1 per cent.; zinc, 1.1 per cent.

"Across 2 feet: Gold, 0.9 oz.; silver, 114 oz.; copper, 0.2 per cent.; zinc, 6.7 per cent.

"Across 12 inches: Gold, 0.46 oz.; silver, 9.9 oz.; copper, 0.1 per cent.; zinc, 0.8 per cent.

"Across 3 feet: Gold, 0.15 oz.; silver, 6.2 oz.; copper, 0.1 per cent.; zinc, 1 per cent.

"A composite assay of this material was: Gold, 0.45 oz.; silver, 39.8 oz.; copper, 0.15 per cent.; zinc, 2.2 per cent. Another composite sample assayed: Gold, 0.50 oz.; silver, 74.8 oz.; copper, 0.2 per cent.; zinc, 4.3 per cent. These samples were not weighted so are not a true average, but they show that the average across about 10 feet in the drill-hole is about $10 in gold and over 30 oz. silver to the ton. The true thickness will be considerably less than the widths in the hole, as the hole makes a fairly acute angle with the dip of the zone, but it is distinctly encouraging to obtain these two bands in this hole at 40 and 100 feet below the level."

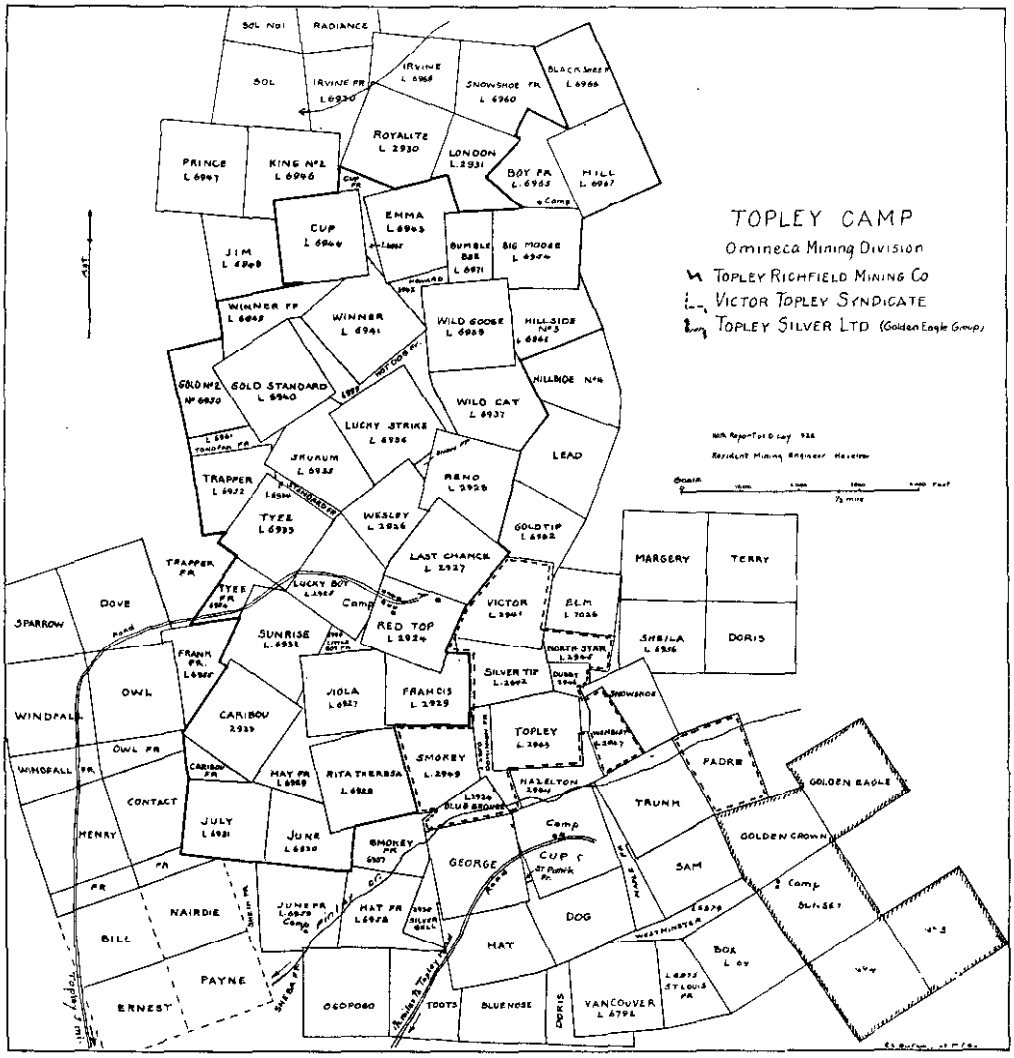
Excavational development to date in the mineralized topleyite areas discloses a complicated geologic structure caused by extensive faulting, apparently block-faulting. In the circumstances it is evident that diamond-drill results require most carefully studied interpretation, and it is obviously advisable that they should be followed up with excavational development as promptly as practicable, so that the true conditions may be disclosed. It is also evident that this is a property which in particular calls for skilled technical direction, and it is a matter for gratification that in this respect it is in competent hands.

It might be added that the management voluntarily supplied the Resident Engineer with the logs of all underground diamond-drill holes. Refer also to Annual Reports for 1926 and 1927.

Golden Eagle. This group, owned by D. Heenan and C. Matheson, is under option to Topley Silver, Limited, which company has carried on small-scale operations during the year. The property is reached by a branch road from the Topley–Babine Lake road and its distance from Topley is about 7 miles. It is situated on comparatively flat ground lying at an elevation of just under 4,000 feet in the pass between Huckleberry and Black mountains.

The mineral occurrence is that of a vein 4 feet wide, containing a quartz-seam showing good silver values, striking N. 60° W. (mag.) and dipping at a flat angle of between 30° and 45° to the north-east. The maximum width of the quartz-seam is about 1½ feet and the mineralization is with grey copper, galena, and zinc-blende. Some very beautiful specimens of green zinc-blende have been obtained at this property. The country-rock is andesite breccia and on the foot-wall it is bleached in the immediate vicinity of the vein.

The vein is developed by two shafts somewhat over 100 feet apart and by a few open-cuts at somewhat long intervals over a length of several hundred feet. The more northerly of these shafts is said to be 30 feet deep, but was full of water at the time of inspection. It is stated that it encountered good mineral, which pinched in the bottom. Present operations focus on sinking the more southerly of the shafts to a depth of 200 feet or so and drifting in both directions from the bottom of the shaft. When inspected the shaft had reached a depth of 75 feet. In the bottom the quartz-seam was 1 foot in width and was well mineralized with galena, zinc-blende, pyrite, and some grey copper. A sample of selected mineral assayed: Gold, 0.04 oz. to the ton; silver, 68.8 oz. to the ton; lead, 21 per cent.; zinc, 4 per cent. Mineralization in the quartz appeared to have been fairly continuous from the collar down to this point. At 60 feet depth a drift a few feet in length had been run north-west, disclosing a width of 1½ feet of quartz, in which mineralization was more scattered than at the bottom of the shaft. A grab sample of a small pile of selected ore lying at the collar of the shaft assayed: Gold, 0.08 oz.



to the ton; silver, 298 oz. to the ton; lead, 14.1 per cent.; zinc, 6.2 per cent.; copper, 1.5 per cent.

This company in the fall of 1928 installed a 25-horse-power Fairbanks-Morse semi-Diesel engine and a small Sullivan air-compressor of 120 cubic feet of free air a minute capacity, also a No. 3 Cameron sinking-pump and a 6-horse-power Novo hoist. A force of about eight men is employed.

The good silver values in this vein and the available information respecting its continuity are favourable features which justify development of the vein. The dip of the vein and surrounding topography are such as to render evident that it could be probed in depth to advantage by diamond-drilling from the surface. Such might be carried out to supplement excavational development. Refer also to 1927 Annual Report.

Victor Topley Syndicate.

This syndicate is controlled by W. H. Nanson and R. L. Gale. The property owned will be seen by reference to the map of claims in the Topley area which accompanies this report. The property was not inspected, but the work done is said to comprise 150 feet of open-cutting and 15 feet of sinking, following a shear-zone trending north and south. Efforts are being made to trace the possible southerly continuation of the East vein of the Richfield.

Cup. This group, through which the wagon-road from Topley to the *Golden Eagle* passes, is owned by Matthew Sam. The owner made an interesting new discovery on the property this year. Reference is invited to the Annual Reports for 1924 and 1927 for a description of this property, except in so far as the new discovery is concerned.

On the left bank of Finlay creek, about 50 feet above the creek-bed and somewhat east of the main workings, a narrow vein a few inches in width has been uncovered by open-cut. This vein strikes S. 15° E. (mag.) and dips north-east at 45°. While narrow it shows much grey copper. A sample across 3 inches assayed: Gold, 0.06 oz. to the ton; silver, 246 oz. to the ton; copper, 2.8 per cent. It would seem advisable to endeavour to trace this in a south-easterly direction up the creek-bank towards its possible point of intersection with the larger flat vein, which has hitherto been the object of attention on this property. Refer also to the Annual Reports for 1924 and 1927.

Sheila. This group of eight claims, owned by E. and B. Hoops and associates, is situated north-east of the *Cup*. It was not possible to visit this property, but the owners report having sunk a shaft 12 feet in an encouraging mineralization.

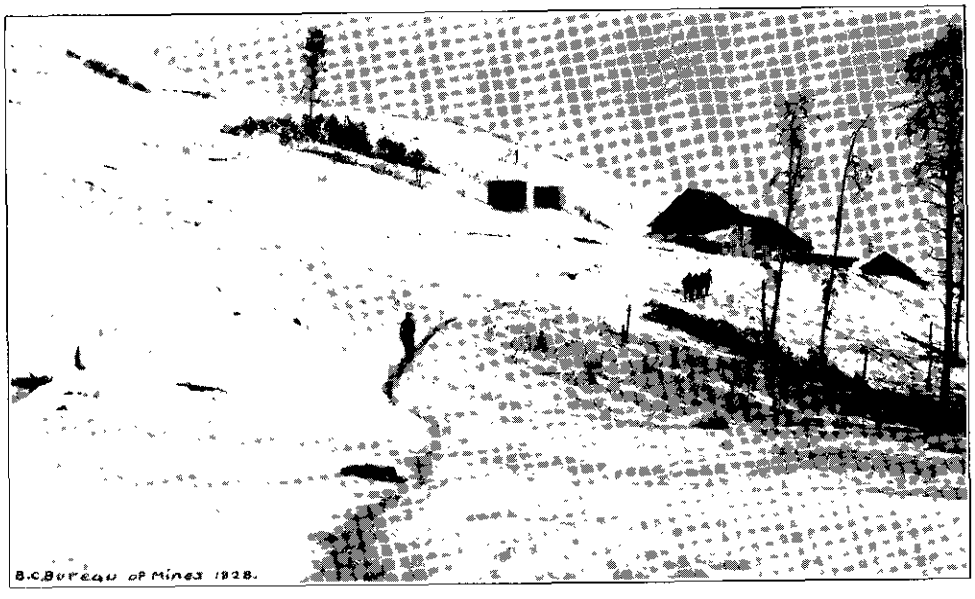
Maple Leaf. This group of eight claims, owned by B. McCrea, L. Kylling, and Wesley Banta, is reached by an easy trail about half a mile in length from the *Golden Eagle*. It lies east of the latter and also in the pass between Black and Huckleberry mountains. A shaft has been sunk 15 feet in a band of altered andesite, showing topleyite, striking S. 15° E. (mag.) and dipping about 70° north-east. The topleyite is slightly mineralized, very small amounts of galena and zinc-blende being visible. A sample of selected portions of topleyite assayed: Gold, trace; silver, 1.8 oz. to the ton; lead, *nil*.

Evergreen. This group, owned by B. McCrea and L. Kylling, was staked some years ago and is one of the earliest recorded in the vicinity of Topley. It is situated on the north-eastern slopes of Huckleberry mountain and is reached from the *Golden Eagle* camp. The mineral occurrence consists of two quartz veins about 150 feet apart, the more easterly of which strikes N. 25° W. (mag.), dips steeply south-west, and varies in width from 1 to 2 feet; the more westerly strikes N. 5° W. (mag.), dips north-east also at a steep angle, and varies in width from 12 to 14 inches. The country-rock is andesite and the veins appear to be shear-zone fissures. The mineralization is generally sparse and consists of chalcopyrite, galena, and a little zinc-blende, and is copper-stained. The more easterly vein is exposed by natural agencies, open-cut, and a shaft 23 feet deep. The more westerly is exposed by natural agencies and two short shafts about 100 feet apart and can be traced on the surface for several hundred feet.

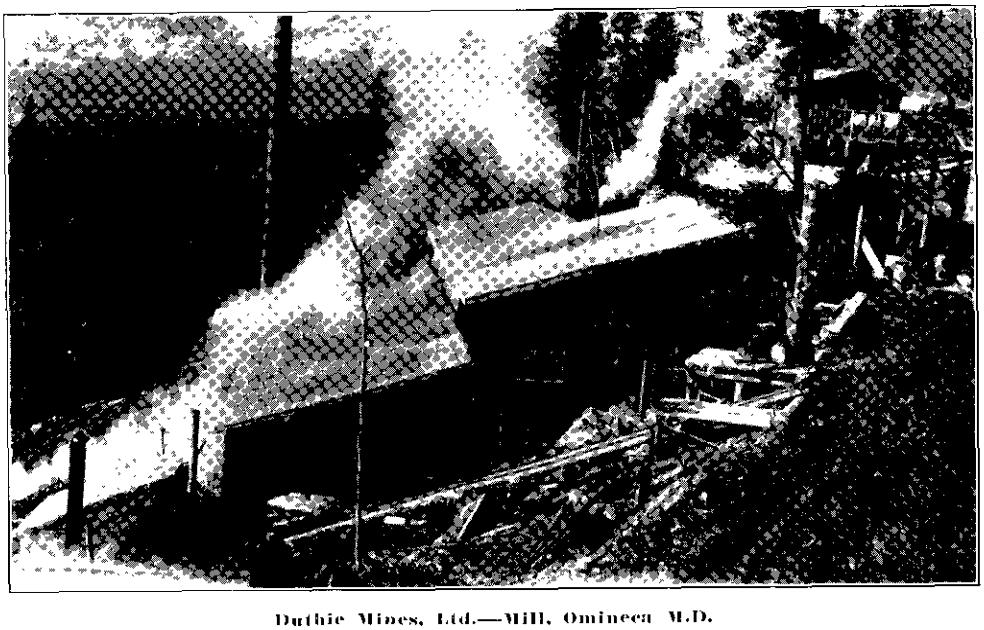
A sample of selected ore showing mainly chalcopyrite assayed 0.2 per cent. copper and only traces of gold and silver. Another sample of selected ore showing mainly galena assayed: Lead, 6 per cent.; zinc, trace; and no gold or silver values. These veins, although narrow, show considerable evidence of continuity and could be developed by adit-tunnel. It is unfortunate that precious-metal values appear to be low. The showings are situated at elevation 4,795 feet.

Rainbow. This group consists of six claims, owned by C. H. and A. E. Watson, and is situated on the hills east of Huckleberry mountain, about 6 miles north-east of Topley in a direct line. The distance from Topley by rough road and trail is about 8 miles. The showings lie at elevations of between 4,500 and 4,600 feet. The mineral occurrence exhibited is that of slightly mineralized bedding-planes of the andesite breccia country-rock at various points. Mineralization is with chalcopyrite and specularite.

A cabin is situated on the property at elevation 4,400 feet. About 300 feet south of this a small mineralized seam occurs in the volcanics a few inches in width. About 350 feet south of this, at elevation 4,470 feet, bedding and jointing planes of the volcanics show over a width of 7 feet a slight mineralization of chalcopyrite. Exposure is by pit. Bedding-planes strike N. 57° W. (mag.) and pitch steeply south-west. A sample of selected mineral assayed 6 per cent. copper and only traces of gold and silver. A sample of selected mineral from a stringer on the surface at this point assayed 1 per cent. copper and only traces of gold and silver. About 400 feet south from the last-mentioned exposure an open-cut in the volcanics, the bedding of which strikes N. 80° E. (mag.) and dips south-east, shows a copper mineralization in small fractures striking N. 18° E. (mag.) and dipping steeply south-east. A sample of selected mineral assayed 2.1 per cent. copper and only traces of gold and silver. The elevation of the last exposure is



Owen Lake Mining and Development Co., Ltd., Omineca M.D.



Duthie Mines, Ltd.—Mill, Omineca M.D.

Nadina Mountain, Omineca M.D.

Owen Lake Mining and Development Co., Omineca M.D.

4,540 feet. Specular hæmatite, of such frequent occurrence in volcanic rocks, was noted in the bedding-planes at several points. It showed a little chalcopyrite, and a sample of pieces of specular hæmatite assayed 0.2 per cent. copper and no gold or silver values.

Some other claims some distance south-west of this group, but not belonging to it, were also examined, but no noteworthy mineralization was perceived.

Partner. This claim, owned by G. Findlay, is situated on the north shore of Graveyard lake, distant 3 miles west of Topley. Highly oxidized beds of volcanic rocks outcrop at this point, but an assay of a sample showed no values.

Randolph and Cat. These and four neighbouring claims are owned by Chris. Wold and R. J. Jennack and are situated about 6 miles due north of Perow on a mountain, the summit of which, at an elevation of 4,370 feet, is a prominent feature of the landscape. A branch road leads off the main road just east of Perow for a distance of about 2 miles to a ranch, Lot 3561, and from this point onward the claims are reached by following an indifferent trail for part of the way, and for the remaining distance there is no trail. At elevation 4,220 feet on the *Randolph*, on the southern slopes of the mountain, occurs an intrusion of diabase in the andesitic volcanics which strike and dip in different places from N. 45° E. (mag.) with south-east dip to N. 30° W. (mag.) with north-east dip. At one point exposed by open-cut the bedding-planes are well mineralized with bornite, chalcopyrite, and copper-stain, and further investigation is warranted. A sample of selected pieces assayed: Gold, trace; silver, 4 oz. to the ton; copper, 6 per cent. Mineralization extends over several feet, but insufficient work has as yet been done to form an opinion as to commercial possibilities.

On the adjoining *Cat*, owned by R. J. Jennack, an open-cut shows volcanic beds striking N. 62° W. (mag.) and dipping south-west, somewhat sparingly mineralized with copper minerals.

Jack Rabbit. This group is owned by Matthew Sam and Johnny Davis and is a discovery made this year. It was taken under option by F. H. Taylor, but subsequently relinquished. The showing, however, appears to merit some further investigation. The property is situated on a tributary of the East fork of Johnny David creek. It is reached by a trail about 4½ miles in length, which runs northwards from the main road at a point about 1½ miles east of Perow.

The mineral occurrence consists of several parallel mineralized fractures, which strike S. 75° E. (mag.) and dip south-west, exposed just above the creek on the left bank. The mineralization is chalcopyrite with a little copper-stain. Of these only one seems to be important. This is exposed by open-cut and is seen to be 4 feet in width, and contains a seam of chalcopyrite and pyrite 15 inches in width. A sample across 4 feet assayed: Gold, 0.30 oz. to the ton; silver, 2.6 oz. to the ton; copper 2.5 per cent. A sample across the 15-inch seam of chalcopyrite assayed: Gold, 1.24 oz. to the ton; silver, 5 oz. to the ton; copper, 9.4 per cent. An adit-tunnel was run about 20 feet below this point and at the time of inspection had advanced a distance of 27 feet. It disclosed nothing of importance, but appearances suggested that it might be in the hanging-wall.

Up-stream from the tunnel for about 35 feet, open-cutting in the creek-bank discloses small parallel copper-stained fractures which are probably not important. At a point 50 feet up-stream from the last-mentioned exposure, for a further distance of about 120 feet, the banks of the creek have been well stripped on both sides of the creek and a slight copper mineralization shows at one or two points.

The country-rock is a coarse porphyritic feldspar breccia with strike and dip varying in different places. Gold values are encouraging and merit following the main fracture with some persistence.

Burns Lake Section.

Taltapin Mining Co., Ltd. The property of this company is situated 3 miles south of Babine lake and distant 25 miles from Burns Lake, on the Canadian National Railway. Early in 1928 this company installed a new 65- to 72-horse-power Diesel engine (manufactured by Campbell Gas Engine Company, Halifax, England) and unwatered the main shaft. The latter and underground workings therefrom were inspected on March 13th. A few weeks after that date it was stated by the management that good ore had been struck in the continuation of the shaft. Unfortunately, shortly after this the management report that owing to the large amount of water in the shaft the equipment had proved

inadequate, and that it had been obliged to abandon operations in the shaft pending installation of an increase in air-compressor and pump capacity. It is understood that no material amount of underground development was subsequently accomplished and that operations were suspended in the fall. The opportunity of revisiting this property subsequent to March 13th did not recur.

As viewed on March 13th, the underground workings comprised a vertical shaft about 112 feet in depth, including sump, and three crosscuts. From the bottom of the shaft three crosscuts were run—one easterly 10 feet, another westerly about 85 feet, and the third southerly a distance of 15 feet, it is stated. A concrete bulkhead had at the time of inspection been constructed in this last-mentioned working at a point about 10 feet from the shaft; consequently it was not open to inspection. The country-rock disclosed by these workings is andesite.

The west crosscut showed nothing of importance. The east crosscut penetrates at the face a vein 3½ feet in width, striking somewhat east of north (mag.) and dipping westerly towards the shaft. A seam in this vein from 6 to 8 inches in width is mineralized with galena, zinc-blende, and chalcopyrite. A sample across a width of 8 inches at the point of heaviest mineralization assayed: Gold, 0.04 oz. to the ton; silver, 14.6 oz. to the ton; copper, 0.3 per cent.; lead, 6 per cent.; zinc, 5.4 per cent. It is stated by the management that good ore of a concentrating character, 3½ feet in width, was struck in the south crosscut. The reason assigned by the management for constructing a bulkhead in this working was to shut off the heavy flow of water struck and facilitate further sinking of the shaft, which it was proposed to continue downward another 120 feet.

Summary.—It seems desirable to briefly summarize the salient features of this property. On the east side of Anderson creek occurs a very large stock of batholitic rock, of which a great many phases are represented and which extends in a northerly direction for some miles. Anderson creek appears to mark the southern edge of the batholith, from which numerous injection tongues run out into the andesite, which latter encloses the vein system on and near Anderson creek. This vein system is more particularly described in the Annual Reports for the years 1920, 1924 (map), 1925, 1926, and 1927, to which reference is invited for details, which it is unnecessary to repeat.

From the description it is apparent that, as was pointed out in the 1927 Annual Report, the surrounding geology is favourable for ore-deposition. That does not signify that ore-deposition on a commercial scale is a certainty, but merely that keen search should be made on the surface in the first instance for mineralized veins, and that a certain amount of probing in depth is justified, such depending upon the extent and values of the surface mineralization.

The occurrence of molybdenite is reported on this property. This mineral has not been seen by the Resident Engineer, but the geologic conditions are entirely favourable to the occurrence of that high-temperature mineral east and north of the main workings in the more immediate vicinity of the batholitic intrusion and dykes therefrom.

The exposure of molybdenite not having been seen, no first-hand opinion can be expressed as to its commercial possibilities, other than the above general statement. So far as surface showings of other minerals are concerned, none has been seen by the writer which exhibits commercial ore, with the possible exception of the vein called the "High Grade vein." Selected samples taken from mineral exposures in other veins on the surface indicated mineral of low silver content. Full particulars of these will be found in the Annual Reports previously referred to.

As to the underground workings, it is stated that at a depth of 35 feet the vertical shaft passed through a mineralized vein, to penetrate which the west crosscut (previously referred to) was run at 107 feet. This crosscut does not show a vein, but possibly was not continued far enough. The small seam of mineral in the vein in the east crosscut is of distinctly higher grade in silver than mineral in surface exposures, with the exception of the High Grade vein. No opinion can of course be expressed concerning the vein in the south crosscut, in which the bulkhead was built, or concerning the ore struck below this in the shaft, neither of which has been seen by the Resident Engineer. Obviously the extent of any ore struck by this vertical shaft which crosscuts the vein system remains to be proved by subsequent development-work.

The company states that certain diamond-drilling was carried out some time ago for the purpose of probing in depth the High Grade vein, and the company makes the following statement concerning the results:—

"The diamond-drill with an inch core was sunk at an angle of 35°, and at a depth of 216 feet went through 7 feet of ore, which assayed: Gold, 0.03 oz. to the ton; silver, 12.6 oz. to the

ton; lead, 7.8 per cent.; zinc, 2.4 per cent.; also at a depth of 303 feet the drill went through the high-grade ore appearing in Anderson creek for 7 feet, which assayed: Gold, 0.03 oz. to the ton; silver, 77.2 oz. to the ton; copper, 1.9 per cent.; zinc, 5.1 per cent."

It may be said of this property that, having regard to the fact that all surface showings of importance are approximately at the same horizon, and in view of the favourable surrounding geology, there are stronger grounds for a certain amount of probing in depth than would be the case were the exposures in steep country. It would seem that originally it would have been preferable to carry out more diamond-drilling prior to excavational development. It is apparent that in the case of any ore encountered the silver ratio per unit of base metal should be carefully studied in order to form an idea of the respective grade in silver of lead and zinc concentrates which would be obtained by milling the ore. This is a point of importance in a case like this where concentrates have to stand a comparatively heavy transportation cost to shipping-point and where the general conditions are not such as to favour low mining costs.

Silver Island Mining Co., Ltd.—It is understood that this company did some work on its property near Babine lake.

Mona. This group of three claims is situated about 10 miles south of Burns Lake Station on the Canadian National Railway. A branch road 1 mile in length leads to the property from the Burns Lake–Francois Lake main road. A company, Mona Mines, Limited, was incorporated this year for the purpose of operating this property, and small-scale operations were started during the summer and have since been continued. A small Sullivan portable air-compressor has been installed of capacity 110 cubic feet of free air a minute for the purpose of operating a compressed-air drill. Workings are situated on the left bank of Deep creek, flowing into Tchesinkut lake.

At the time of inspection at the end of October an adit-tunnel was being run to intercept the fracture previously disclosed by an open-cut made about 45 feet west of the adit. (This is the open-cut referred to in the 1925 Annual Report as No. 1 open-cut.) Preceded by 24 feet of open-cut, this new adit-tunnel had been advanced a distance of 33 feet on a bearing N. 22° W. (mag.), following a small mineralized seam for this distance. At this point there was encountered what was apparently the continuation of the fracture followed by No. 1 open-cut, and for the remaining distance of 10 feet this fracture was followed on a bearing magnetic north. The face showed a mineralization across a width of 6½ feet mineralized with small amounts of galena, zinc-blende, and pyrite. A sample across this width assayed: Gold, trace; silver, 0.4 oz. to the ton; lead, 1 per cent.; zinc, *nil.*

While appearances show an improvement since the date of the last inspection, it is to be borne in mind that so far all mineral encountered has shown very low silver values and development should proceed with the utmost caution. Since inspection it has been reported that another vein about 136 feet west of the described adit has been discovered and is being investigated. Refer also to Annual Report for 1925.

Endako.

Stella. This group is a molybdenite prospect owned by A. Langley, C. H. Foote, J. Braithwaite, and W. Foote, and is situated in a direct line about 5 miles south-west of Endako, a divisional point on the Canadian National Railway. An excellent trail to the property leading off the Endako–Francois Lake road has been constructed during the year, the total distance from Endako being upwards of 10 miles. The salient features of this property are described in the Annual Report for 1927.

The owners have done a considerable amount of painstaking and useful prospecting during the year, the results of which strengthen the good opinion expressed concerning the property in the 1927 Annual Report. Several open-cuts at intervals of about 25 feet have been made in the main vein in a south-westerly direction from the original chief exposure, and the latter has been further exposed. At this point a width of 6 feet is seen to include, besides the quartz vein 2 feet wide well mineralized with molybdenite, a width of 2 feet of granitic rock showing some molybdenite, and a further width of 2 feet of mainly quartz on the hanging-wall which also shows a little molybdenite. A little further work on this hanging-wall at this point would, however, seem advisable.

Further investigation by open-cut has also been made about 750 feet west of the main exposure, where originally promising float was found, but without so far discovering molybdenite

in place. In this region, while no glacial drift underlies the soil, nevertheless the cover of shattered rock is several feet thick and prospecting is therefore laborious.

A very considerable distance in a north-easterly direction from the main exposure, possibly 3,000 feet, good float was found. The size and situation of one large piece suggested that it had not travelled far.

Work done during the year seems to confirm the view originally expressed that there are likely to be several quartz-molybdenite veins trending about N. 45° E. (mag.) which are likely to be found by systematic prospecting.

Fraser Lake.

Sonya-Hectoria. This group is owned by P. C. Banquarel, and Amanda, Paul, Emile, and Adelard Brindamour, and is situated just north-east of the east end of Francois lake on the east side of the Stellako river, and distant about 5 miles south-west of the town of Fort Fraser, from which a road leads to within a short distance of the property.

There is in this region an extensive stock of granitic rock which extends north-eastwards from a point close to Francois lake, intruding the volcanics. The mineral occurrence exhibited on this group is that of several more or less parallel narrow fractures, mainly a few inches in width only, which lie either wholly within granodiorite or at the contact of the latter with the volcanics. Mineralization consists mainly of zinc-blende and pyrite and in some cases a little chalcopyrite, but the total amount of mineral present is small. Assay of selected samples did not disclose more than traces of precious metals. Small bunches of zinc-blende occur at various points. Generally speaking, the surrounding geology is favourable for ore-deposition and further search in the vicinity may disclose more favourable showings.

Nechako. This group, owned by Arthur Goodwin, is situated on the south side of the Nechako river, about 3½ miles south-east of Fort Fraser. A motor-road leads practically on to the property. In the near vicinity of an intrusion of granodiorite in andesite an open-cut shows the bedding-planes of the volcanic slightly mineralized with malachite over a width of 3 feet. The mineralization conforms in strike and dip with the bedding-planes of the volcanic, striking N. 20° W. (mag.) and dipping steeply south-east. A sample taken across the width mentioned showed upon assay no appreciable values. The region is one in which ore-deposition is to be expected and search should be made for more favourable showings.

SIBOLA SECTION.

A detailed account of the topographic and geologic features of this section, together with map and photographs, will be found in the Annual Report for 1916. Refer also to Geological Survey Summary Reports, Part A, for years 1920 (page 81) and 1924 (page 47). This section is readily reached from Burns Lake, on the Canadian National Railway, from which place there is a regular motor-stage service to Ootsa Lake. From Ootsa Lake almost any part of the section can be reached by motor-boat via the lake and river systems. A trail into this section is being constructed from Kimsquit, on the Dean channel, via the Sakumtha pass (refer to 1926 Annual Report), but it is not yet completed.

Emerald. This group, owned by W. J. Sweeney and associates, is situated on Sweeney mountain. Together with adjoining claims, it is under option to the Consolidated Mining and Smelting Company of Canada, Limited. This company during the year advanced the tunnel, started some years ago by J. Cronin, for some considerable distance, with, it is stated, distinctly satisfactory results. Another tunnel several hundred feet below this was started and had advanced about 50 feet, when bad weather compelled cessation of operations for the season. Refer also to the Annual Reports for the years 1916, 1917, 1919, 1924, 1925, 1926, and 1927.

Swannell. This property, situated on Swing Peak mountain, Tahtsa river, was described in the 1927 Annual Report. A company has been incorporated to operate this property—namely, the Tahtsa Mining Company, Limited; the registered office is 510 Hastings Street West, Vancouver. During the year the company constructed camp buildings at the Tahtsa river and also close to the showings, this work being carried out under the direction of C. L. Copp.

MANSON SECTION.

Detailed accounts of the topographic and geologic features of this section, likewise of the routes into it, are given in the Annual Reports for 1921 and 1927. The Resident Engineer did not visit this section during 1928, but following are reports by Stephen H. Hoskins, Gold Commissioner, Smithers, who visited the section to investigate certain conditions, and W. B. Steele, Deputy Mining Recorder, Manson Creek.

With reference to the attempts of G. W. Otterson and W. M. Ogilvie to get machinery into Manson creek from Fort St. James, mention of which is made in the 1927 Annual Report, page 157, both lots of machinery finally reached their respective destinations last winter. The machinery formerly belonging to G. W. Otterson was sold by the Sheriff in 1927, and bought where it lay by R. C. McCorkell, who hauled it in to Manson creek. This is the machinery which is mentioned in both the following reports:—

Report of Stephen H. Hoskins, Gold Commissioner, Smithers.—"On the night of August 7th I left Smithers, arriving at Fort St. James, on Stuart lake, on the morning of the 8th instant, where I procured my guide and outfit.

"Leaving Fort St. James on the morning of the 9th, we proceeded by pack-trail and wagon-road, arriving at Manson creek late in the afternoon of the 13th and at Slate creek at a later hour of the same day, where we met W. B. Steele, the Deputy Mining Recorder for the district, who extended to us every courtesy.

"On Slate creek there are a number of placer leases which were formerly owned and worked by the Kildare Mines, Limited, but which are now being systematically tested with a Union drill by Wm. Ogilvie, who represents Eastern capital, and a crew of men, with apparently very encouraging results.

"On Germansen creek I found that nine creek placer leases had been staked, the owners of which are intending to install a drill next spring, and thoroughly test the ground by that means, before launching out on any extensive plan of installing machinery. A great deal of the ground on this creek now under lease was mined many years ago by the early pioneers, but it has been felt that with our modern methods and machinery it will still produce satisfactory returns.

"On Manson creek it was found that George Otterson and associates had placed on the ground a drag-line scraper, but this was not at work, nor had it been assembled, but a small crew of men were then on their way into the country with a portable sawmill for the purpose of sawing out lumber and building a camp. Since my return I have learned that the men and sawmill arrived, and that the work of building a camp in preparation for next year's operations is proceeding satisfactorily.

"On Vital creek, a distance of some 75 miles from Manson creek, it was learned that Lee Tong and his Chinese associates held placer claims (dry-diggings) and met with the misfortune of their tunnel caving in, which set them back the whole season. There was therefore no return for their work this year.

"In my opinion the whole of the country commonly known as the Manson Creek placer-mining section will from now on be assuming more and more of its former glory, the crude means of transportation being its greatest drawback.

"The so-called wagon-road from Fort St. James, which provided an entirely land haul, requires to be improved by construction of rough bridges, some side-hill cuts, and the removal of some stones and boulders at the upper end. A passable wagon-road at this stage is all that should be required, which would permit supplies and machinery to be taken into the placer-mining fields with more economy."

Report of W. B. Steele, Deputy Mining Recorder, Manson Creek.—"Peters and Ewing, of Prince George, came in and staked about thirty mineral claims, eight claims on Lost Creek mountain. They have 10 tons or more of ore on the dump, said to assay about 55 per cent. lead and 126 oz. silver to the ton. They are coming in early next year to do assessment.

"W. M. Ogilvie is well pleased with his drilling on Slate creek. He has built 3 miles of good wagon-road and got bed-rock at intervals over 3 miles of creek. He intended to work all winter, but was unsuccessful in getting in provisions in time. He went out on November 4th with horses and wagon, intending to come right back if possible.

"R. C. McCorkell's crew arrived in August and have done a lot of good work. They built 3½ miles of wagon-road and hauled all of the machinery down to the mouth of Slate creek. They took 2 tons at a load on bare ground with tractor and sleigh. They have built a house 30 by 20 feet and have cut timbers for the drag-line scraper—264 pieces. The boom is 70 feet long, 2 feet square at the butt, and 18 inches square at the small end.

"There is a store at the mouth of Germansen creek run by a man and his wife, Mr. and Mrs. O. J. Crites. Their prices are the same as at Takla Landing. The weather is very mild here, only one night 3° below and 1 foot of snow so far (December 5th)."

McConnell Creek.

J. F. Tener reports that he has taken an option on the placer leases of P. Jensen on this creek, which is a tributary of the Ingenika river, at the head of the latter. A detailed account of this creek will be found in the Annual Report for 1908, page 66.

Fort Grahame Section.

An account of this section describing topographic and geologic features, and also the means of access, will be found in the Annual Report for 1926. A geological map of the area has also been published by the Geological Survey—"Finlay River Area," Map No. 207A—which will be found of great value.

The chief feature of the year's developments in this section has been the activities of Ingenika Mines, Limited, at the *Ferguson*, which have yielded satisfactory results. Extensive testing of various bars on the Ingenika, Finlay, and Parsnip rivers was also carried out by Finlay River Mining Company, Limited.

Throughout the season the Consolidated Mining and Smelting Company of Canada, Limited, maintained a prospecting party under E. Bronlund in and about Finlay river and tributaries.

R. Blackstock, J. Cornelius, and partner were engaged during the season in rocking bars on the Parsnip river in the vicinity of Finlay Forks, and reported getting from 1½ to 3 oz. gold a day.

It is understood that Frank Perry and associates were also engaged in testing certain bars on the Ingenika river with a table.

Finlay River, Pete Toy's Bar.

Finlay River Mining Co., Ltd.

This company, incorporated for the purpose of staking and operating placer or lode-mineral deposits, has during the year carried out somewhat elaborate testing operations on various bars in the Ingenika, Finlay, and Parsnip rivers.

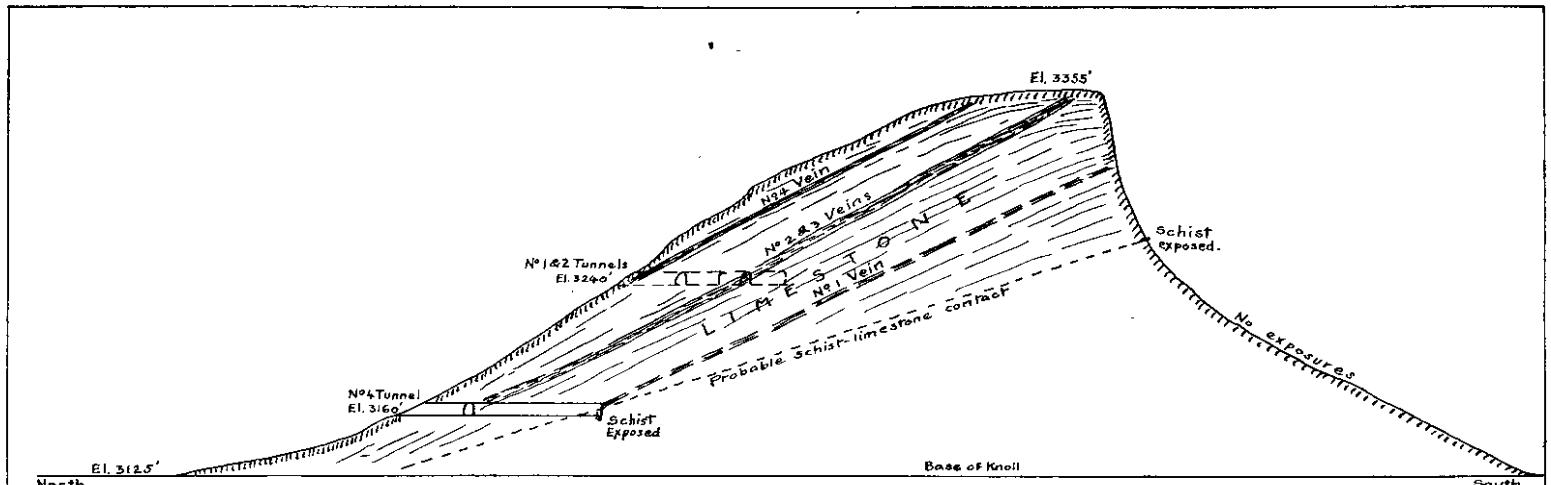
At the time of inspection, testing of Pete Toy's bar, 3 miles above Finlay Forks, was in progress and five men were employed under the direction of R. D. Fetherstonhaugh, the manager of the company. The following is a description of the method adopted and the plant employed:—

A sluice-flume 10 inches deep by 12 inches wide, of length adapted to the size of the bar, in this case 120 feet, and riffled with pole riffles laid on gunny-sacking was set up on rough movable trestles on a grade of 8 inches to 12 feet. At the lower end was an undercurrent with grizzly-bars spaced about ⅛ inch apart. The set-up was so arranged that the tailings passed into the river and the sands accumulated in a pile on the beach. Water was pumped to the sluice by a 5-inch centrifugal pump delivering 600 gallons a minute and operated by an 8-horse-power Cushman gasoline-engine. Four men shovelled into the sluice-flume about the top 8 inches of the bar-gravels, which contain much black sand and a certain amount of platinum and fine gold.

The material caught by the riffles, likewise the sands from the undercurrent, were tabled on a Dominion Ore Concentrating Company's table (also known as a Tracy table) of Wilfley type and of size 12 by 6 feet. The product from the riffles was treated once on the table, that from the undercurrent twice.

The table was operated by a 1½-horse-power Cushman gasoline-engine, which also operated a small centrifugal pump supplying water for the table. The concentrate consists mainly of black sand. In the case of this bar the gravels are platiniferous. Only superficial values are to be expected in a bar deposit, but such values as those cited are encouraging.

Nine hundred and seventy-one pounds of concentrate was shipped to Goldsmith Bros. Smelting and Refining Company, Chicago, which contained 21.362 oz. gold and 0.971 oz. platinum.



Note: The major axis of this knoll trends East and West (True) and the length at the base is about 1,000 Feet. Mineralized bands strike about N 75°W (True) and dip NE at about 30° conforming with Limestone bedding. Structure rather suggests a dome centrally truncated by erosion in an east and west direction.

INGENIKA MINES Ltd.

Omineca Mining Division.

Ferguson Knoll: Cross section through No4 Cross-cut tunnel.

Minor Axis, Approx. N-S.

Scale 0 50 100 150 Feet

B.C. Bureau of Mines.

As a result of the season's work, naturally the operators should be in a good position to form an accurate opinion of the values in the top few inches, the material treated. The management stated that next year drilling of the whole bar was contemplated to form an idea as to whether yardage and values would warrant installation of some form of mechanical excavator instead of manual labour.

Ruby Creek.

The Finlay River Mining Company reports the discovery and staking of a quartz vein upwards of 30 feet in width, carrying chalcopyrite, on Ruby creek, flowing into Finlay river from the north, west of Fox river.

Mica Mountain.

A description of Mica mountain opposite Fort Grahame will be found in the 1926 Annual Report.

General Holding Co.—For a description of this company's property refer to the 1926 and 1927 Annual Reports. No work was carried out by this company in 1928 on its holdings on Mica mountain.

Ravenal Property. This property is owned by H. Ravenal, of Fort Grahame, and is situated at the head of the East fork of Mica creek, at an elevation of 4,370 feet above Fort Grahame, or 6,585 feet above sea-level. The property is shown on the map published in the 1926 Annual Report. It is reached at present by following the good trail from General Holding Company's landing on the west side of the Finlay river just above Fort Grahame to that company's camp, and thence climbing upwards and almost due south. The total distance from Fort Grahame by this route is not less than 12 miles, but a shorter and more convenient trail could probably be built to this property by following upward an unnamed creek flowing into the Finlay river about 1 mile below Fort Grahame.

The chief exposure is that of a pegmatite dyke, about 3 feet in width, striking N. 75° W. (mag.) and dipping south-west, approximately coinciding with the planes of schistosity of the enclosing mica-schist country-rock. Books of muscovite mica are well developed. Some were noted containing crystals which were 70 square inches in area, and it is stated that even larger sizes than this have been obtained. This dyke contains the largest crystals of mica seen by the writer in this Mineral Survey District. While practically no development has been done and the mica is purely surface-mica, it seems to be of good quality. The topography lends itself to economic attack and the dyke could be followed by adit-tunnel. The property appears to merit further development. Refer also to Annual Reports for 1926 and 1927.

Ingenika River.

Ferguson. The company incorporated this year to operate this property is Ingenika Mines, Limited; registered office, 506 Pacific Building, Vancouver. The manager is Ridgeway R. Wilson, the assayer is Athelstan Day, and the foreman is M. Ulvila. Much work has been accomplished during the year. In addition to the development described below, good camp buildings, including an assay office, have been erected at the mine. The Departments of Public Works and Mines constructed a road from the mine to the Finlay river, a distance of upwards of 20 miles. This road connects with the Finlay river about 4 miles below the mouth of the Ingenika river and will greatly facilitate delivery of supplies to this mine, as the difficult and shallow water of the Ingenika will be avoided. A maximum of thirty men was employed during summer and eleven men will be employed this winter.

In the Annual Report for 1926 will be found a general description of the mode of mineral occurrence at this property. Development appears to confirm the view originally expressed that the mineral occurrence is essentially a banded mineralization of galena and zinc-blende following the bedding-planes of the enclosing limestone country-rock. At one or two points there may be a tendency to follow jointing-planes, but this appears to be quite subordinate to the general tendency of the mineralization as a whole.

To briefly recapitulate: Mineral-exposures are on a knoll of roughly elliptical shape, the major axis of which trends approximately true east and west, and with a somewhat flat-topped summit rising to an elevation of upwards of 250 feet above the surrounding rolling, plateau-like country. The size of the top of the knoll is very approximately 660 by 135 feet. On the north side the slope of the knoll is about 30° and on the south side considerably steeper.

Towards the bottom the knoll slopes more gradually on all sides. The limestone bedding-planes and mineralized bands or zones therein also dip northerly and strike more or less true east and west, as will be more particularly described below. The mineralized zones are developed by adit-drifts on the north side of the knoll.

The following elevations were taken by aneroid and are therefore only approximately correct, but will serve for comparison: Ingenika River camp, 2,600 feet; mine camp, 3,080 feet; Delkluz lake, 2,915 feet; No. 4 tunnel, 3,160 feet; Nos. 1 and 2 tunnels, 3,240 feet; summit of knoll and apex of mineral-zones, 3,355 feet; base of knoll, 3,125 feet.

There are four mineralized zones, of which one, the most southerly, is of comparatively subordinate importance, known as "No. 1 vein." Two others, No. 2 and No. 3 veins, are in close proximity and might almost be considered as one, although they are recognized as two separate bands by the management. These are developed by No. 1 tunnel. The fourth band is distant in horizontal section about 75 feet from band No. 3 in a northerly direction. It might be here mentioned that the dip of these bands is not over 30°; consequently, in horizontal section and workings, apparent distances apart and widths are approximately one-half true distances and widths. The fourth band, known as "No. 4 vein," is developed by No. 2 tunnel at the same elevation as No. 1 tunnel. It might be mentioned that the knoll exhibits some evidence of dome-structure in the limestone bedding-planes. These are practically horizontal at the top of the knoll where exposed by natural agencies on the south side. If dome-structure is observed, bands may be expected to trend more southerly as tunnels Nos. 1 and 2 advance.

Tunnel No. 4, approximately 100 feet vertically below Nos. 1 and 2 tunnels, is run as a crosscut for a distance of 90 feet from the portal, but close to the portal there was picked up what is apparently the downward continuation of No. 2 and No. 3 veins, which was subsequently followed south-eastwards (mag.).

To describe these workings in detail: No. 1 tunnel is run on an average bearing of S. 72° E. (true). For its length of 140 feet it shows good ore, which pinches at the face, but a foot-wall crosscut 30 feet from the face shows practically continuous ore.

No. 2 tunnel is run on an average bearing S. 80° E. (true). Fair ore appears to be continuous for the length of this drift, 65 feet. At 18 feet from the portal a crosscut is run a distance of 60 feet diagonally across the limestone-beds.

No. 4 tunnel is run for a distance of 90 feet on a bearing slightly east of true south, emerging from limestone and penetrating a greenish-grey-coloured schist at this point, which is quite likely the downward continuation of the schist-beds exposed on the south side of the knoll on the surface about 100 feet below the summit. Just at the contact of the limestone and schist a zinc mineralization was penetrated. It is stated by the management that a width of 6 feet at this point assays upwards of 30 per cent. zinc. Near the portal at the time of inspection there had been passed through what appeared to be the probable downward continuation of No. 2 and No. 3 veins, and the management states that since then this has been followed by a south-easterly drift for a considerable distance with very satisfactory results.

In the foregoing description distances and bearings are to be regarded as approximate only. No attempt was made, nor was such necessary, to sample the workings. In this connection the management states that the approximate average of over 100 samples was: Silver, 7 oz. to the ton; lead, 15 per cent.; zinc, 7.5 per cent.; and also that the average width of No. 2, No. 3, and No. 4 veins is about 8 feet.

Development indicates the continuation downward of the mineralized bands, a fact which is highly satisfactory. In view of the occurrence of mineralization south of Delkluz lake (more fully referred to below) at a considerably lower stratigraphic horizon in limestone, it would seem advisable to probe by diamond-drilling—say at the level of No. 4 tunnel—the beds more immediately below the region of the knoll.

No causative factor, such as an intrusion of plutonic rock, in connection with this mineralization was noted. It is therefore inferred that such must lie at considerable depth. So far as is known to the writer, the nearest igneous intrusion is the fringe of the Omineca batholith, which must be 18 miles distant in a southerly direction. Having noted about 4 miles south of the *Ferguson* an interbedded chalcopyrite mineralization, the question is raised as to whether this batholith will be found to be the origin of a zonal distribution of minerals.

Showings by Delkluz Lake (Onward Group).—These showings lie almost due south of those above described, about 1¼ miles in a direct line. The topography is that of a flat, rolling,

plateau-like country, which rises to no great elevation above Delkluz lake, except that on the north shore of the lake Lookout mountain rises to a height of about 600 feet above the lake.

Just above the south shore of the lake, at the time of inspection, an adit-tunnel had been advanced a distance of 25 feet on a bearing S. 27° E. (mag.) to penetrate a somewhat extensive area of iron-stained mineralized limestone exposed by open-cut just above the tunnel and about 45 feet vertically above the lake. The tunnel had at the time of inspection not penetrated the limestone or mineralization and was wholly in a schist, the planes of which strike N. 55° E. (mag.) and dip about 30° north-west. The advancement of this tunnel should afford a valuable insight into this mineralization and will enable an intelligent opinion to be formed as to widths and values. There appears to be relatively less zinc in proportion to the galena than in the case of the *Ferguson*. A selected sample of this mineral assayed: Gold, trace; silver, 8 oz. to the ton; lead, 18 per cent.; zinc, *nil*. While the extent of this mineralization remains to be proved, nevertheless it is distinctly encouraging to find limestone-beds mineralized at such a distance from the *Ferguson* knoll, and gives rise to the hope that intervening mineralized beds may occur, and also appears to justify probe for such by diamond-drilling. Refer also to 1926 and 1927 Annual Reports.

Burden. This group, owned by E. H. Burden, is situated on Swannell river, about 4 miles south-east of the *Ferguson*. On the right bank of the river, about 6 miles from its mouth, in a greenish-grey-coloured schist striking N. 85° E. (mag.) and dipping at about 20° north-westerly, a width of about 15 feet shows interbedded bands of quartz and schist. The greatest width of quartz is about 4 feet and it is sparingly mineralized with chalcopyrite and malachite. A sample of selected portions assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, 0.7 per cent. About 20 yards down-stream from this point, in the river, are large pieces of angular float consisting of quartz and chalcopyrite, apparently of local origin. A sample of selected pieces of float assayed: Gold, trace; silver, 1.8 oz. to the ton; copper, 12.8 per cent. No work whatever has been done on this group and some prospecting is clearly justified.

Coal.

The output of coal for the year was 1,668 long tons, as compared with 1,671 long tons in 1927.

Much interest was aroused in November by the announcement by the management of Telkwa Collieries, Limited, of the agreement to purchase the property of that company by Frank S. Taggart, who also acquired on behalf of British Pacific Industries, Limited, an option on the Zymoetz (Copper) River coalfield from the Yorkshire and Pacific Trust Company. British Pacific Industries, Limited, is a company incorporated in England with a capital of £40,000; the registered offices are 1 and 3 Regent Street, London, S.W. 1, and Broad Street House, Old Broad Street, London, E.C. 2. While matters in this connection appear to be in an elementary stage of development, nevertheless it is hoped that these facts portend important expansion of the coal industry in this district.

Not only in the Omineca Mining Division is there evidence of an awakened interest in coal. In the Peace River Mining Division Neil Gething and his sons are making active preparations to ship coal from the Gething leases near Hudson Hope next spring. The local market there has been greatly quickened by the rapid settlement which has taken place in the agricultural section of the Peace River district during the past two years. Further, having regard to the fact that the freight rate on coal from Peace River Station to Winnipeg is $5.90 a ton, Neil Gething intends to investigate the possibilities of that market. Whether for local or more distant market, the coal will be shipped by scows from the mine near Hudson Hope to rail-head at Peace River. Details of activities at the Gething leases will be found in this report under "Peace River Mining Division."

Telkwa Collieries, Ltd. This company maintained a small force of men at its Goat Creek Colliery during the year, mining sufficient coal to keep pace with the growing local market. Development has been directed eastwards with a view to get under the higher ground in this direction. From an inspection of the workings it was gratifying to perceive that, apart from a few purely local and minor disturbances, the width and regularity of the coal-seam were well maintained at all points. A full account of this colliery will be found in the Annual Report for 1926 and mention of it is made in the 1927 Annual Report.

List of Coalfields and Reports thereon.

In view of the interest shown in the coalfields of this Mineral Survey District, a list is given below, together with particulars of reports thereon published in the Annual Reports of the Minister of Mines and of the Geological Survey of Canada:—

Name.	Annual Report.
Groundhog coalfield	1911, 1912.
Bowron River coal area	1914.
Zymoetz (Copper) River coalfield	1914, 1922.
Prince Rupert Coalfields Co.	1917.
Lake Kathlyn coal property	1917, 1926.
Wright Coal Co. (Seaton coalfield)	1916, 1927.
Aveling coal property	1921.
Fraser Lake coal	1921.
Cedar Creek coal property	1922.
Telkwa Collieries, Ltd.	1923, 1926.
Peace River coalfield	1923, 1926.
Quesnel-Alexandria coalfield	1923.

Refer also to Geological Survey of Canada Report, 1907, "The Telkwa River and Vicinity," by W. W. Leach.

The Groundhog coalfield is described at length by G. S. Malloch in the 1912 Summary Report of the Geological Survey of Canada. The Peace River coalfield is fully described by F. H. McLearn in Geological Survey of Canada, Summary Report, 1922, Part B.

PEACE RIVER MINING DIVISION.

An inspection trip was made through this Mining Division during September. A full account of the topographic and geologic features of the Division will be found in the Annual Report for 1923, with full particulars of routes thereto, and the cost of transporting supplies will be found in the Annual Report for 1926, under "Fort Grahame Section." It is to be noted, however, in this connection that the large stern-wheel steamer "D. A. Thomas," formerly plying on the Peace river, was unfortunately wrecked this year. Consequently it is not known what transportation facilities will be available on the Peace river in 1929.

Mining activities during the year were chiefly confined to investigation of the gold possibilities of Mount Selwyn and to the Gething coal leases near Hudson Hope, both of which are more particularly described below.

Very marked activity was noted in the agricultural sections, both in British Columbia and Alberta, and very distinct progress has been made since the last visit in 1926. Since that time it might be mentioned that the Edmonton, Dunvegan & British Columbia Railway has been advanced some miles towards the British Columbia boundary-line. All this activity seems likely to react favourably upon the local coal situation.

Mount Selwyn.

Mount Selwyn is situated on the right bank of the Peace river, between Quartz and Selwyn creeks, about 12 miles down-stream from Finlay Forks. The mountain rises steeply from the river's edge to an elevation of 6,220 feet. At an elevation of 3,750 feet a spur of the mountain runs out in a north-westerly direction for a distance of 2 or more miles from the main mountain mass. This spur lies between Quartz creek and the Peace river, and it is this portion of the mountain which has for some years past been the subject of attention owing to the alleged gold content of the quartzite-beds, of which the spur is in large measure composed.

Owing to the fact that renewed interest was evinced this year in the gold possibilities of Mount Selwyn, a day was spent in the examination of that portion of the mountain above referred to.

Exhaustive sampling of the quartzite-beds was carried out during the summer by E. W. Beltz, acting for R. H. Stewart, H. L. Batten, and associates.

D. Barr, of the Peace River Mining and Milling Company, carried out a mill test in a small experimental plant erected on the right bank of the Peace river. The results are unknown. The operators had left prior to the visit of the Resident Engineer, and the plant being very tightly housed, its nature could not be learned. The method of transporting quartzite to this

plant was, however, evidently the same as that described under "Mount Selwyn," pages 143 to 145 of the Annual Report for 1923. Facing page 120 of that report will be found photographs of milling plant employed during that year.

The spur of the mountain, previously referred to, can be conveniently examined by ascending an indifferent trail from the right bank of the Peace river, opposite the mouth of the Wicked river, and also by following the trail from Quartz creek up the spur's ridge. The former route leads across the quartzite-beds; the latter follows very nearly the strike of the beds. Both these routes were followed by the Resident Engineer in the course of his examination.

The spur, which is well covered with timber, is seen to consist mainly of beds of white quartzite underlain by a greenish-coloured schist. At one point a bed of the latter appears to overlie the former. A prominent feature of the landscape is the outcrop of the broad band of quartzite-beds, many hundreds of feet in width over the full length of the spur, which may be 2 miles or more, and between elevations of 575 and 1,850 feet above the level of the Peace river. The quartzite-beds strike about N. 75° W. (mag.) and dip into the mountain to the south-west at an angle of between 45° and 55°. Weathering agencies result in the quartzite-beds becoming detached in large masses, of which the talus at the base of the spur fronting the Peace river largely consists. The quartzite-beds are white in colour and show no material amount of sulphides, and hardly any sign of iron-stain due to oxidation. In the beds occur numerous small quartz gash-veins of varying strike and dip and equally free from sulphides. The presence of such quartz gash-veins is of common occurrence in quartzite and conglomerate beds and does not necessarily indicate any commercial significance.

As to commercial possibilities, it must be apparent that the presence or absence of gold values in a deposit of this size can only be strictly proved by thorough and systematic sampling, which must occupy many weeks. Much general information may, however, be gained by even a brief inspection. In the first place, the occurrence of gold in such quartzite-beds, while not impossible, is unusual. From the geologic structure it is inferred that gold, if present in the quartzite-beds, is probably of alluvial origin, having been deposited originally in the sands of the then river-bed; the sands with their gold burden having been in the course of the vast stretch of geologic time necessary for the process converted into sandstone and finally metamorphosed to quartzite.

In the course of examination five samples were taken. These were from widely separated points, which had evidently been sampled by other investigators, and one sample represented a width of 100 feet. They were taken at elevations of 2,920, 3,300, and 3,750 feet (elevation of Peace river at base of mountain 1,900 feet). One sample was taken of a small pile of quartzite crushed to about ¾-inch ring lying by the mill. In all cases assay yielded not even a trace of gold.

The results of such a few samples taken from such a large deposit do not necessarily indicate that all portions of the quartzite-beds are equally barren. They do, however, indicate that statements as to any widespread existence of commercial values should be treated with reserve until investigated thoroughly. It may be added that such information as has been received from other impartial investigators does not support the view that any material tonnage of commercial ore is to be found in this deposit. This is unfortunate, because there are many features of this deposit, in spite of its distance from transportation, which must appeal strongly to the operating engineer. Such, for example, as the obviously vast tonnage of quartzite, coupled with the ease with which it could be mined and the abundance of water and mine-timber. Refer also to the Annual Report for 1923, pages 143 to 145 and photographs facing page 120.

Gething Coal Leases.

Very full information will be found concerning these in the Annual Reports for 1923 and 1926, and also in Geological Survey of Canada, Summary Report, Part B, 1922.

Present activities of Neil Gething and sons centre upon Johnson creek seams on the south side of the Peace river. It is their intention to mine and transport coal therefrom by scow to rail-head at Peace River. It is proposed to install a sawmill on Johnson creek, operated by water-turbine, to furnish lumber for the construction of scows and a steamboat. It is anticipated that it will be possible to transport large scows containing between 200 and 300 tons of coal from the mouth of Johnson creek down-stream. At the time of inspection a small force of men was engaged in connection with preliminary work on the water-power site. A dam had been

erected on Johnson creek and excavations were in progress for wheel-pit. The installation proposed is a Samson-Leffel turbine, vertical-shaft type. With the water available under a 14-foot head, it is estimated that 71 horse-power will be developed. It is anticipated that it will be possible to commence shipments of coal next spring.

Rapid recent settlement in the Peace River agricultural sections, both in British Columbia and Alberta, should create a good local market. In view of the excellent qualities of this coal, and the fact that freight on coal from Peace River to Winnipeg is only about $5.90 a ton, it is also hoped to make some trial shipments to this latter market.

CARIBOO MINING DIVISION.

The placer production of the Cariboo Mining Division for the year was $38,879, as compared with $53,125 in 1927. While a decrease is shown, such is more apparent than real, as John Hopp Mines, an important contributor to the output, had no final fall "clean-up" owing to a slide over the head of the flume at the end of the piping season.

The Kafue Copper Development Company's dredge was closed down shortly after commencing operations in Cunningham pass. The reason assigned was that the gold values were found to be practically all on or in lime bed-rock and were consequently not recoverable by dredging. An encouraging feature of the year was the good ground met with on Lowhee creek by John Hopp Mines. The usual activity was manifested by the smaller hydraulics.

In lode-mining the chief activities were those of Mica Mines, Limited, at Tete Jaune and Cariboo Gold Quartz Mining Company on Lowhee creek.

It is interesting to record the fact that during the year the Historic Sites and Monuments Board of Canada erected a monument just outside Barkerville, at the entrance to the town, on the upper side of the road from Quesnel. On this is the following inscription:—

"*Cariboo Goldfields, Barkerville.*

"The centre of old Cariboo, whose goldfields discovered in 1861 have added over forty millions to the wealth of the world.

"Here was the terminus of the great wagon-road from Yale, completed in 1865.

"The story of the Cariboo gold-mines and the Cariboo Road is the epic of British Columbia."

It is not perhaps a digression to state that in the year 1925 the Department of Mines, recognizing that it seemed fit to perpetuate the memory of the pioneer placer-miners in some way, approached various bodies on the matter in the hope that interest might be secured and funds for the purpose provided. Success was not at that time met with in this direction, and it is therefore particularly gratifying that the idea has since been carried into effect.

TETE JAUNE.

Mica-deposits.

For the past thirty years or so the mica-deposits on Mica mountain near Tete Jaune have engaged the attention of various operators at different times, but, for some reason or other, operations have not been continued for any length of time when started and no material amount of development has been done on any exposure. There are on this mountain several exposures, of which two are the more important. This year Mica Mines, Limited, was incorporated for the purpose of working the *Tete Jaune* group of four claims. This property appears to be much the same as that described in the Annual Report for 1920. It is understood that there is, or was, a good exposure in the large glacial cirque, which exists at the top of Mica mountain immediately to the south-east of the *Tete Jaune*, but that this has been recently covered up by a slide. The floor of this large cirque lies at an elevation of about 6,500 feet and the basin-walls rise up steeply for 2,000 feet or so. In the south-east wall of this cirque can be plainly seen from a distance what appears to be a large pegmatite vein, but which on this side is apparently quite inaccessible. Two remnants of the glacier remain which formerly occupied this cirque.

Tete Jaune.

Mica Mines, Limited (registered office, 608–609 Rogers Building, Vancouver), carried on small-scale operations during the year under the direction of E. E. Barnum. Full particulars of the geologic features of Mica mountain will be found in the 1920 Annual Report, which it is unnecessary to repeat here. It might be mentioned that this mountain presents many points of striking similarity, geologic, topographic, and geographic, to the other Mica mountain opposite Fort Grahame. The strike and dip of the

pegmatite-mica dykes are the same in both cases, but the two micas are radically different. Both are apparently muscovite, but the Tete Jaune mica has a greenish cast and exhibits pronounced twinning of crystals.

The showings on this group lie at elevation 7,180 feet on the north slope of Mica mountain, just west of the large glacial cirque previously referred to. They are reached by a trail 3½ miles long from a base camp at elevation 3,920 feet, to which a road 5½ miles in length leads from Tete Jaune. This is evidently the same base camp as that described in the 1920 Annual Report, in which photographs are also to be found.

The chief exposure at 7,180 feet is a large open-cut, which shows the junction of two pegmatite veins, each from 6 to 10 feet in width. The strike is north-westerly and dip south-westerly, conforming with the schistosity planes of the enclosing mica-schist country-rock. Numerous books of muscovite mica showing a greenish cast were exposed. The majority were of good size, up to about 60 square inches in area, but pronounced twinned structure was apparent. The crystals showed no tendency to follow any particular part of the dyke. No crystals of striking size were seen, but it is stated that such occur. The slope of the mountain-side in this vicinity is about 25° and it would doubtless be an easy matter to transport mica mined at this point by aerial tram to a lower point reached by the construction of a new road. Alternatively, mica can now be readily packed down to the base camp on horses. Clearly the latter is the method to pursue until this deposit has been opened up and market established. The pick of the mica from Tete Jaune (whether from this deposit or not is not known) was stated by the Imperial Ministry of Munitions to be of good condenser quality. Mica Mines, Limited, states that offers have been received from buyers varying from $1.50 to $11 a pound. It remains to be seen to what percentage of the total mica such prices would apply. It would seem that development of this property should proceed with caution.

Two other pegmatite dykes were examined on this mountain, but these are not on the property of Mica Mines, Limited, and in any case they did not show mica of very large size at the point of exposure. One showing biotite, crystals of which are about 2 inches square, is exposed at elevation 5,020 feet on the Mica Mines, Limited, trail. It is from 15 to 20 feet in width, strikes N. 62° W. (mag.), and dips south-west at about 60°. At elevation 5,860 feet, close to the trail, at the top of the steep Sand Creek slope, another large dyke is exposed, which shows crystals of clear mica up to about 2 by 2 inches in size.

There is known to be a showing of mica within the glacial cirque, which has been previously referred to. But it is understood that it has been covered by a slide and its exact situation was not known to any of the staff of Mica Mines present at the time of inspection of that property. In the Geological Survey of Canada Report for 1898 J. McEvoy describes a property called the *Bonanza* mica-mine, which from the position marked is within the glacial cirque. The elevation is given as 5,300 feet above the Fraser river (elevation 2,400 feet); the width of the dyke is given as 15 feet, with another dyke, 30 feet below, 40 feet wide. The report says: "The crystals of muscovite, which are frequently 18 inches long and 11 inches wide, are found in greatest abundance near the hanging-wall. The mica is a transparent muscovite with a very slight greenish cast and of excellent quality." Refer also to Annual Report for 1920; also Department of Mines, Canada, Mines Branch Summary Report, 1913.

Longworth.

Mineral-showings in the vicinity of Longworth were examined. These occur on Clearwater creek, a fair-sized creek which flows into the Fraser river, somewhat east of Longworth, from the north, and also on the summit of the range behind Longworth.

Clearwater creek cuts down deeply for some miles and the rocks are well exposed in the deep gorge or canyon through which it flows. In the upper portion of this creek, to within 1½ miles of the railway-track, rocks exposed are limestones, quartzites, and schists. These appear to strike about N. 70° E. (mag.) and dip south-east at fairly steep angles. About 1½ miles from the railway-track volcanic rocks appear, amygdaloidal and andesitic; these have much the same strike and dip as the sedimentaries.

Bonanza. This group, owned by Oscar Eden and Fred Peterson, is distant about 5½ miles from Longworth and is situated at elevation 5,545 feet on the summit of the range immediately above Longworth, which it overlooks. Between two quartzite knolls, with rounded summits rising about 200 feet above the average level, occurs an

irregular mineralization of galena and zinc-blende in small quartz-seams. Some barite is also present. While exposure is mainly by natural agencies, there is nothing to suggest continuity. Further work would be necessary at this point, however, to be certain on the point. Limestone outcrops between the two knolls and the mineralization referred to is in quartzite near the contact with the limestone. A sample of selected mineral assayed: Gold, trace; silver, 0.8 oz. to the ton; lead, 38 per cent.; zinc, 7 per cent.

The more northerly knoll consists of an imperfectly metamorphosed quartzite, and perhaps is better named a sandstone as it is slowly weathering to silica sand of great purity. So white is the product of weathering in the case of both knolls that when viewed from a distance they appear to be snow-capped.

About 1½ miles east of the last-described showing, at elevation 3,425 feet on the right bank of Clearwater creek, which runs in a deep gorge at this point, a tunnel has been run 33 feet on a bearing S. 72° W. (mag.), following a small barite-seam which shows a little galena and zinc-blende. Assay of a sample showed traces of gold and silver, no lead, and 4 per cent. zinc.

A cabin has been constructed by the owners at this point on the creek; they have also built a trail following the creek down to the railway-track and have displayed much ingenuity in construction at various points through the canyon. The distance to this cabin from Longworth is about 5½ miles.

Sweetwater. This group, owned by Arthur E. Read, is situated about 1½ miles from the railway-track on the right bank of Clearwater creek. It is reached by following the trail described above under *Bonanza*. The amygdaloidal volcanics show at one point a very slight mineralization of chalcopyrite. Assays of selected portions failed to show any values.

Prince George Section.

In the vicinity of Pre-emption Lots 1601 and 1602, about 6 miles south-west of Prince George, occur a series of quartz veins which have engaged the attention of various investigators at different times, more especially between the years 1911 and 1918. During these years F. G. Durnford, J. J. McVerney, and H. L. Roper in succession became impressed with possibilities. It is stated that J. J. McVerney sank a shaft to a depth of 90 feet. In 1928 P. J. Skaret and C. Folk reported good gold values on the *Prince George*, situated in the vicinity of the area above referred to. In consequence some local stir was aroused and other claims were staked in the neighbourhood. These claims were inspected in company with P. J. Skaret and C. Folk and samples were taken at the precise spots indicated as yielding good values, but the results were largely negative; the highest gold assay was a trace and the highest silver assay insignificant. There is nothing in the appearance of the veins to indicate values. They occur mainly in schisted carbonaceous shale, showing transverse shearing, and indicating the occurrence of quartz-lenses in echelon.

Prince George. This group, owned by P. J. Skaret and C. Folk, is situated about 6 miles south-west of Prince George in flat rolling country at an elevation of about 2,600 feet. On the *Swede*, at elevation 2,645 feet, an open-cut exposes a quartz vein 14 inches in width. The actual width may be greater than this. This strikes N. 52° W., with almost vertical dip. A sample across this vein showed no gold or silver values. The country-rock is carbonaceous schist.

On the *Mink*, distant perhaps 750 feet in a north-westerly direction from the above exposure, a trench 8 feet deep discloses a width of 13.5 feet of quartz somewhat oxidized. The country-rock is shale. A sample across this vein showed no gold or silver values.

On the *Martin*, distant perhaps 1,200 feet in a north-west (mag.) direction from the last-mentioned exposure, cuts over a width of 19 feet show three veins, of which the widest is 18 inches. A sample taken here across 4 feet of schist and quartz showed a trace of gold and 0.4 oz. of silver to the ton.

Some 300 feet north-west of the above-mentioned exposure a deep trench is run to intersect a prominent quartz-exposure. One seam in the vein shows a little galena and was reported to carry good values. A sample across this seam assayed: Gold, trace; silver, 1.6 oz. to the ton. A sample across a width of 5 feet of quartz exposed at this point showed no gold or silver values.

On the *Richard*, owned by W. K. Nichols and P. Johnson, there is exposed a quartz vein 6 feet in width. This is distant about 500 feet north of the last-mentioned exposure on the

Prince George group. A sample across this vein showed no values. Refer also to the 1914 Annual Report, under *Daisy*.

Six-mile Mountain.

This mountain, the summit of which has an elevation of 3,520 feet, is distant about 9 miles in a direct line from Prince George, from which it lies in a north-easterly direction.

The country-rock appears to be mainly argillite. There is an intrusion of pegmatitic granodiorite near the summit. Several sparsely mineralized, more or less parallel quartz veins occur on this mountain, striking north-east (mag.) and dipping south-east.

Burmah. This group is owned by Paul Tickolees. Within a belt of country about 1,500 feet in width on Six-mile mountain occur six more or less parallel quartz veins. Two are but 50 feet apart; the width of one is 5 feet and that of the other 11 feet. A short distance below the surface exposure of these veins a crosscut tunnel has been driven 30 feet with the idea of penetrating these veins. On the wider vein a shaft has been sunk 8 feet, exposing a quartz vein 11 feet in width, sparsely mineralized with chalcopyrite and a little copper-stain. A sample of selected material showed traces of gold and copper and 0.6 oz. silver to the ton. Such showings hardly warrant development. Some other slender showings were also examined on this mountain.

North Point of Fraser River.

The Canadian Tungsten Mining Company, Limited; the Granite Mining Company, Limited (formerly North Point Mining Company, Limited); and the *Silver* group are adjoining properties and are situated on the right bank of the Fraser river, at its most northerly point, in the vicinity of Averil creek. On the latter is situated the most easterly of these properties, the *Silver*, adjoining which on the west is the property of the Granite Mining Company, and west of this latter is the property of the Canadian Tungsten Mining Company, Limited. These properties are conveniently reached by motor-boat from Hansard Station on the Canadian National Railway, from which they are distant down-stream about 28 miles. Log camp buildings are erected on the Oscar Eden Pre-emption Lot 9606, within 300 feet of the Canadian Tungsten Mining Company's tunnel. There are also log cabins on the *Silver* on Averil creek.

The mineral occurrence exhibited on these properties is that of several quartz veins, which vary in width from a few inches up to in one case over 13 feet. The country-rock is mainly silicified biotite and muscovite schist. The general appearance suggests that it is intensely sheared granite. It is evident that after mineralization the veins became involved in the movement which sheared the country-rock. The veins appear generally to conform in strike and dip with the planes of schistosity of the enclosing country-rock and are for the most part only sparingly mineralized with pyrite and galena. One vein on the property of the Granite Mining Company shows a promising scheelite mineralization, which mineral also shows on the *Silver*, at a point about 1 mile to the east, in what is possibly a continuation of the same vein.

Canadian Tungsten Mining Co. At about 20 feet above high-water level on the Fraser river a tunnel has been run a distance of 211 feet on a bearing N. 57° W. (mag.), exposing at 105 feet from the portal a vein of quartz 4 feet in width sparingly mineralized with pyrite, striking N. 85° W. (mag.) and dipping southerly. Other quartz stringers with similar strike and dip are also intersected by this crosscut.

At 600 feet vertically above the tunnel portal a large quartz vein, the width of quartz exposed being 13 feet with walls not exposed, shows on the surface, striking N. 70° W. (mag.) and dipping south-west. This vein showed no material amount of sulphides and an assay of a sample revealed only traces of gold and silver.

At 800 feet above the tunnel there is exposed by open-cut on the banks of a small creek a quartz vein 3 feet in width, striking N. 65° E. (mag.) and dipping north-west. This vein showed some arsenical pyrites, but a sample of the most heavily mineralized portion disclosed upon assay only traces of gold and silver.

Granite Mining Co., Ltd. On the *Ada* claim at 285 feet above the Fraser river a quartz vein stated to be about 5 feet in width has been prospected by a short drift and shaft 15 feet in depth. These workings were caved and inaccessible at the time of inspection. Quartz lying on the dump shows galena and pyrite. A sample of the more heavily mineralized pieces assayed: Gold, 0.04 oz. to the ton; silver, 4.2 oz. to the ton; lead, 10 per cent.

With the object of penetrating the downward continuation of this vein, a crosscut tunnel approximately 690 feet in length has been run at a point approximately 160 feet vertically below the collar of the shaft. The bearing of this tunnel is N. 20° E. (mag.). At approximately 360 feet from the portal a quartz vein was penetrated, which is apparently not of commercial importance. Near the face the crosscut also penetrated a southerly dipping vein which strikes N. 85° E. (mag.), on which a drift has been run easterly for a distance of approximately 35 feet; this latter is possibly the downward continuation of the vein explored by the upper workings. The dip of the latter is, as mentioned, southerly, whereas it is stated that the dip exposed in the upper workings is northerly. In such an intensely folded country local changes of dip are to be expected. An accurate transit survey would perhaps throw further light on the matter. In the lower working the vein shows much graphite and small lenses of scheelite. A sample across 4 feet at the face of the drift showed upon assay traces of gold and silver and 2.5 per cent. tungsten. This is a showing that merits further investigation. The tungsten can be readily hand-sorted.

Silver. This group consists of seven mineral claims owned by C. Johanson and F. Peterson. On the left bank of Averil creek, at a point about 15 feet below the crosscut tunnel of the Granite Mining Company, there is run a drift some 200 feet in length, following a quartz vein striking S. 75° W. (mag.) and dipping steeply to the south. The general characteristics of this vein are similar to that struck at the face in the Granite Mining Company's crosscut tunnel, save that no scheelite was noted in this tunnel. The vein-outcrop on the steep hillside about 70 feet vertically above this tunnel was seen to contain scheelite. A sample of selected portions showed upon assay 5 per cent. tungsten. About 1,000 feet up-stream, on the right bank of Averil creek, a drift is run a distance of 75 feet, following a small quartz vein striking N. 85° W. (mag.) and dipping southerly. An assay of a sample showed no gold or silver values.

The tungsten-showings on the Granite Mining Company's property and on the *Silver* warrant further investigation. While no tungsten has so far been found on the property of Canadian Tungsten Mining Company, its occurrence on this property seems a reasonable anticipation.

This examination disclosed no evidence of commercial values so far as precious metals are concerned. There appears to be no grounds for anticipating that it will be possible to work any of these veins for the galena content alone. Tungsten appears to offer the best possibility and some further work might be done to afford additional evidence of this. No elaborate capital expenditure is as yet warranted or required. It should be possible to sort out to good advantage by hand any scheelite encountered in development. It would seem to be of mutual advantage if these properties could become vested in a common ownership.

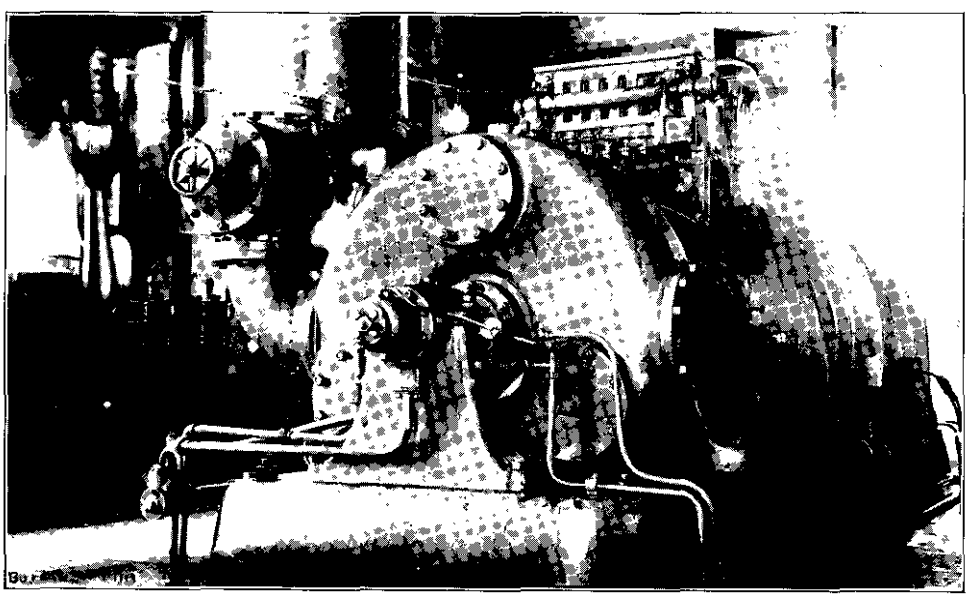
The surrounding conditions are, generally speaking, favourable to economic mining. There is abundance of mining-timber on the properties and the topography renders adit-tunnels possible. Averil creek is a large creek and a valuable source of water-power, should the occasion arise for its development. The situation is such that transportation to rail-head near Hansard could be effected by water-craft at comparatively low cost. The Fraser river in this region even at low water is free from any difficulties of navigation. Refer also to Annual Report for 1922, under "North Point Mining Company" and under *Bull Moose (Silver)*; and also to Geological Survey of Canada, Memoir 118, by Leopold Reinecke, under "North Point Mining Company."

McGregor River.

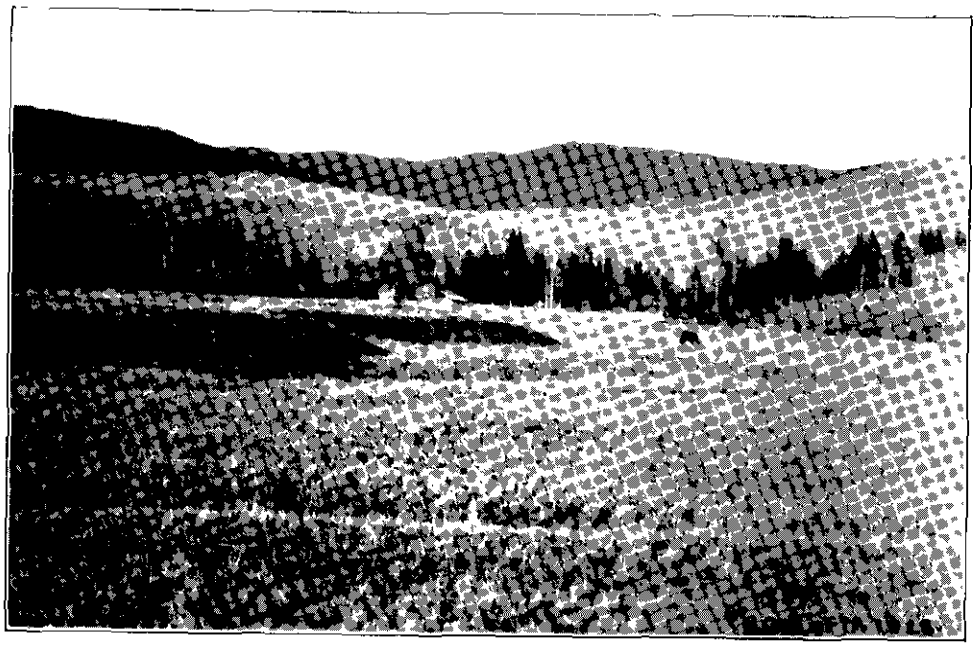
A trip was made about 20 miles up the McGregor river to investigate reported copper-showings in that vicinity. This river is conveniently reached by motor-boat from Hansard. Its junction with the Fraser river is about 11 miles down-stream from Hansard. It is necessary to make arrangements in advance for motor-craft at Hansard. A motor-boat can usually be procured by giving notice to the Al. Johnson Lumber Company, of Hansard.

Copper Gulch. This claim is owned by Martin Framstad, of Prince George. It is situated about 20 miles up the McGregor river from its mouth and is distant from the river about 2½ miles. A moose-trail on good grade leads for the greater part of the way to the showings. The latter are situated on the left bank of an unnamed creek flowing into the McGregor river. These showings are at an elevation of about 500 feet above the McGregor river. At this point a width of 25 feet of schist country-rock shows bands of quartz up to 2 feet in width, with intervening bands of schist in between. The whole is much silicified.

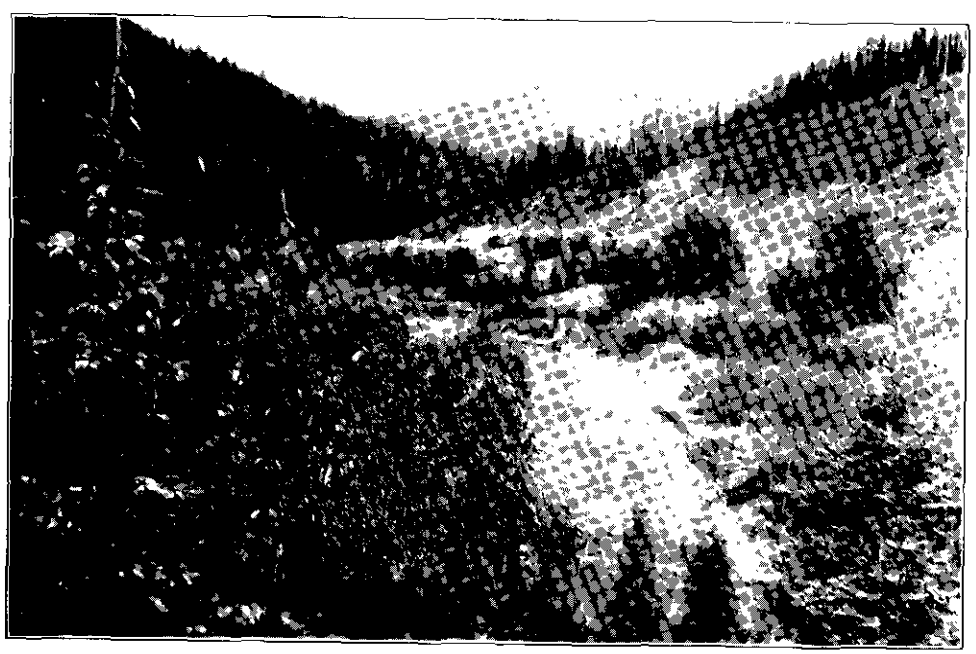
Duthie Mines, Ltd.—Power-house, Aldrich Lake, Omineca M.D.



Duthie Mines, Ltd.—Steam-turbine.



Black Creek Placers, Quesnel M.D.



Trehouse Hydraulic, Cunningham Creek, Cariboo M.D.

One of the bands shows a width of 9 inches of fairly compact chalcopyrite with copper-stain and much siderite. A sample across this width of 9 inches assayed: Gold, trace; silver, 0.8 oz. to the ton; copper, 25.5 per cent.

These bands strike N. 60° W. (mag.) and dip north-east. About 240 feet vertically below this exposure at the creek-level what is possibly the continuation of one of these bands is exposed by the creek and shows much siderite and a little chalcopyrite. Precious-metal values are unfortunately disappointingly low.

Hixon Creek.

It was not found possible to visit this creek during the year, but an account of it will be found in the Annual Report for 1927 and further mention in the Annual Reports for 1918 and 1926. Refer also to Geological Survey of Canada, Memoir 118, by L. Reinecke.

BARKERVILLE SECTION.

Reference is invited to Memoir 149, by W. A. Johnston and W. L. Uglow, published by the Geological Survey of Canada in 1926, entitled "Placer and Vein Gold Deposits of Barkerville, Cariboo District, British Columbia," wherein will be found a detailed account of practically every such deposit in this section.

The operation of major importance in this section at present is that of the John Hopp hydraulic on Lowhee creek.

Antler Creek.

Kafue Copper Development Co.'s Dredge.—This dredge was shut down shortly after beginning to dig in Cunningham pass, the reason assigned being that gold values were found to be practically all on or in lime bed-rock and therefore not recoverable by dredging.

Lease of P. M. McLanders.—This lease is situated on California gulch, a tributary of upper Antler creek. The owner has been busily engaged all the season in installing a water system. A ditch-line three-quarters of a mile long has been constructed and work has been started on a 3- by 3-foot sluice-flume. Refer also to the 1927 Annual Report.

H. E. C. Carry Leases.—Work on these leases, situated on upper Antler creek, has been suspended by the Consolidated Mining and Smelting Company of Canada, Limited.

Guyet Lease.—Work on this property was suspended during the year on account of litigation. For description refer to the Annual Reports for 1926 and 1927.

Cunningham Creek.

Trehouse Hydraulic.

The principal owners are F. J. Tregillus and J. House, but F. de Witt Reed also retains an interest. The property is situated on Cunningham creek, distant about 12 miles from Barkerville. The road to the property has been greatly improved during the year by the Departments of Mines and Public Works. On this property, situated on the right bank of Cunningham creek, there are two bench deposits, one about 25 feet vertically above the other. The up-stream continuation of these benches has engaged the attention of earlier operators from the earliest times dating from the sixties, notably the Standish Company in 1862 to 1865. The Standish works are situated about 1,700 feet up-stream from the upper end of the *Trehouse*. The attention of the present operators is at present directed to hydraulicking the lower of the two benches. Gold occurs in the bed-rock gravels, the thickness of which is upwards of 10 feet, and also in a thickness of between 6 and 8 feet of gravels, which overlie a thickness of about 6 feet of boulder-clay overlying bed-rock gravels. The character of the gold is "flax-seed" gold, which, while well worn and flattened, is readily saved in a comparatively short sluice-flume. Values are stated by the owners to average about 50 cents a yard. Unfortunately at the time of inspection the pit had caved and obscured the strata, the thicknesses of which given above are as stated by the owners.

The prospect for the continuation of these benches down-stream is distinctly favourable, and it is understood that this property covers virgin ground in that direction for some 5,000 feet.

The present ownership has a No. 2 Monitor under a head of 150 feet. The ditch-line has a capacity of 200 miners' inches only. By constructing a ditch-line with carrying capacity of 1,000 miners' inches and installing a larger monitor, the owners anticipate overcoming difficulties under which they now labour. With the present hydraulic equipment, as the gravels are tight,

they require to be blasted occasionally. The owners think there may be a run of gold from their property to the "Bear" pit, situated some 2 miles down-stream and below the sharp bend of Cunningham creek. This is possible, but much remains to be done to prove this, and whether this is the case or not, it does not affect the question of the down-stream continuation of the bench deposits, of which more than two may be found.

It might be added that a certain amount of concentrate is recovered in the riffles at this property. A sample of concentrates was found to assay: Gold, 18.78 oz. to the ton; platinum, *nil.* This property well merits close investigation and is commended to the attention of those interested.

French Creek.

A No. 2 Monitor was installed during the year by J. Wendle and M. Moore and a pit was opened up on each side of the mouth of French creek on the rim of Pleasant valley. This disclosed bed-rock within a few feet of the surface and the gravels thereon were stated to average between 17 and 20 cents a yard. Insufficient work has as yet been done to enable an opinion to be formed as to the extent of such values in the direction of Pleasant valley. The intention next year is to advance the flume to French Creek channel until it reached bed-rock and then commence piping bed-rock gravels. The owners estimate the yardage piped during the year as about 3,000 yards. The gold recovered was 30 oz. approximately. Its character was fine and nuggety and well-worn. The character of bed-rock exposed was schist containing numerous quartz veins.

Lowhee Creek.

John Hopp Hydraulic.

A very encouraging recovery was made by the operators of this property during the year. Had it not been for a large slide over the head of the flume just at the end of the piping season, which prevented a final "clean-up," the output would have been considerably greater. One large nugget was recovered, weighing 11.27 oz. The results of the year strengthen the belief that this property has entered upon a more productive and profitable period. The head of the pit is now about 2,000 feet distant from the head of Stouts gulch.

Slough Creek.

The *Ketch*, *Point*, and Tong Sing Tong hydraulic properties (the last two mentioned being Chinese companies) were operated during the year and each contributed materially towards the total placer-output.

Dragon Creek.

L. Ford and R. McDougall spent the season on their hydraulic in laying pipe-line and constructing dam-penstock 18 feet high and 150 feet of sluice-flume in preparation for the spring run. For description of this property refer to 1927 Annual Report.

Among individual operators may be mentioned R. D. Rees on Shepherd creek and D. McIntyre on Emory gulch.

Lightning Creek and Tributaries.

Among these operators, the chief contributor to the placer-output was M. Sundberg on Donovan creek (refer to 1927 Annual Report). Other operators were Cariboo Eagle Mining Company on Houseman (Eagle) creek (refer to Annual Reports for 1926 and 1927); W. M. Hong on Last Chance creek; J. F. Williams on the *Ah Quay* claim near Stanley; and W. C. Slade on the *Yates* claim on lower Lightning creek. A watchman was retained on the property of the Lightning Creek Gold Gravels and Drainage Company, Limited (refer to Annual Reports for 1923 and 1927).

LODE-MINING.

Cow Mountain.

Cariboo Gold Quartz Mining Co., Ltd.

Small-scale operations were carried on during the year by this company under the direction of F. M. Wells, manager. A crosscut tunnel is being run from the left bank of Lowhee creek at elevation 4,250 feet, the main objective of which is to probe the *Rainbow* vein system, which showed good surface values in gold at elevation 4,650 feet. The estimated length of crosscut required is 1,100 feet, of which, on October 4th, 500 feet had been accomplished. It seems

probable that this crosscut will pass through several, possibly numerous, quartz veins before reaching the *Rainbow;* in fact, some have already been penetrated. It is not necessarily to be inferred, however, that all portions of the region probed by this crosscut are of equal promise. No proof has yet been afforded that any of the veins passed through are of commercial significance, but, as already mentioned, this crosscut has yet to be driven some 600 feet to reach the main objective. The probing of the *Rainbow* vein system at depth seems a reasonable mining speculation.

A detailed account of this crosscut follows: At 156 feet from the portal there was passed through the apparent junction of an interbedded vein and a vein crossing the schist formation, which seems of no commercial significance. At 245 feet from the portal a quartz vein about 1½ feet in width, well mineralized with pyrites, was penetrated. A sample across 1½ feet assayed: Gold, 0.62 oz. to the ton; silver, 0.2 oz. to the ton. Between points 260 and 290 feet from the portal a soft sheared zone was passed through. In this were some quartz-seams which, it was stated, assayed about $20 a ton in gold. Timbering in this section of the tunnel obscured full view, but commercial possibilities do not appear to be very pronounced. A drift follows this shear-zone for about 40 feet, but was discontinued owing to heavy ground. About 15 feet beyond this sheared ground the main crosscut penetrated a quartz vein about 20 inches in width, which showed on the south side only. In the remaining distance to the face, only two quartz veins were penetrated, one of which is 6 inches in width, and the other where exposed does not exceed a few inches in width, but was said to be considerably wider than this in the bottom on the south side, a fact which was noticed when the crosscut was first run. For the first 290 feet this crosscut follows a bearing S. 40° W. (mag.), for the next 100 feet a bearing S. 70° W. (mag.), and for the last 110 feet a bearing N. 87° W. (mag.). It will be continued on this last bearing to its destination. It is for purely mining reasons that it was not run in a straight line from the portal.

On this property is another tunnel, known as the "Law" tunnel, run some years ago, the portal of which is about 90 feet south of the main crosscut just described. The elevation of the portal is practically the same as that of the main crosscut and both are on the main Lowhee Creek trail. The "Law" tunnel is run for 40 feet on a bearing S. 25° W. (mag.) from the portal. At the face a branch is run 40 feet to the right on a bearing N. 75° W. (mag.), and penetrating at about 20 feet from the commencement a quartz vein 4 feet in width assaying: Gold, 0.14 oz. to the ton; silver, 0.06 oz. to the ton. From the face of the main tunnel a branch is run 45 feet to the left on a bearing S. 65° E. (mag.), and penetrating near the commencement two small quartz veins between 10 and 15 inches in width close together (one of which is exposed in places by the main tunnel), and one vein 6 inches in width is exposed at the face. All these veins crosscut the schist formation, the strike of which is followed by the branch tunnels and the dip of which is to the north-east at 42°. At the portal of the main tunnel in the bottom a width of 4 feet of quartz shows, which is possibly the vein encountered by the right branch. Mining operations under the direction of F. M. Wells are being carried on in an economic and miner-like way. Refer also to Annual Report for 1927 (with map).

Island Mountain.

C. J. Seymour Baker had a small force of men engaged for a few weeks in clearing out old tunnels on his property on Island mountain.

Hardscrabble Creek.

Hardscrabble Scheelite-deposit.—This property having reverted to the Government, a lease of it has been obtained by C. J. Seymour Baker, who has repaired the shaft, so that access may be gained at any time. Fortunately an old and lower drain-tunnel prevents water accumulating in these workings. A full report on this property appears in the Annual Report for 1918. No work beyond sampling has been done since. With the aid of the Department of Mines, the road to this property was repaired during the year and a car can now be taken to within about 1½ miles of the property.

Proserpine Mountain.

Independence Group.—E. E. Armstrong states that during the year he sank two shafts 20 feet deep and crosscut 20 feet, with encouraging results.

QUESNEL MINING DIVISION.

The placer production of the Quesnel Mining Division for the year was $28,033, as compared with $39,423 in 1927, a decrease due to the decline in production from Cedar creek, which has figured prominently in the production during the past few years. It is to be hoped that next year the production from Carinelle Placers, Limited, will restore the placer-output to former proportions.

The most important event in this section during the year was the reopening of the well-known *Bullion* mine on a large scale, commensurate with the magnitude of the undertaking, by Carinelle Placers, Limited. This company also has an option on the property of the Morehead Mining Syndicate and much is hoped from its operations.

Quesnel Section.

Construction of a bridge across the Fraser river at Quesnel was started by the Department of Public Works during the year and carried to an advanced stage by the close of the year. The completion of this bridge will be of direct benefit to mining and should greatly encourage development of the diatomite-deposits which lie on the west side of the river. Full mention is made of these deposits in "Diatomite, Its Occurrence, Preparation, and Uses," by V. L. Eardley-Wilmot, published by the Mines Branch, Department of Mines, Ottawa.

Lode-mining.

Black Bear. This group of four claims is owned by G. P. Adams, G. R. Baker, E. Baker, and F. Vaughan. It is distant about 30 miles south-east of Quesnel, on the north side of the Quesnel river. It is reached from Quesnel by following the Hydraulic road to the ferry opposite J. Gravel's ranch. From the latter, on the north side of the Quesnel river, a good trail leads through comparatively flat country a distance of between 12 and 14 miles to the property.

On the right bank of a small unnamed creek flowing into the Quesnel river a knoll rises to a height of upwards of 400 feet above the surrounding country. This knoll is composed of a dark-green-coloured igneous rock, classified as augite porphyrite by the Provincial Mineralogist. A band of this rock about 15 feet in width is sheared and in the zone of shearing occurs a well-defined quartz vein, 2 to 2½ feet in width where exposed, well mineralized with tetrahedrite and azurite. In places some chalcopyrite is in evidence.

This vein is exposed at elevation 3,625 feet by a shaft sunk 35 feet. The vein strikes due north and south (mag.) and dips east at 27° as shown by this shaft. The latter shows the quartz to average between 2 and 2½ feet in width and to be fairly well mineralized with tetrahedrite and azurite, but the vein is pinched in the bottom. A sample across 2½ feet, at a point representing about the average mineralization, assayed: Gold, trace; silver, 6 oz. to the ton; copper, 2 per cent. At 3,785 feet elevation, at the summit of the knoll and the apex of the vein, an open-cut shows quartz with a little chalcopyrite.

At elevation 3,450 feet, or 90 feet above the bottom of the knoll, an open-cut discloses what appears to be the downward continuation of the sheared zone and vein therein. Some further investigation by way of open-cut at this point would be advisable on the part of the owners, as this is a favourable point to develop by adit-drift if appearances disclosed by further open-cutting are sufficiently favourable.

About 3½ miles north-west of the property occurs an outcrop of granodiorite. Further mention of this property will be found in the Annual Report for 1921, under *Copper Queen.*

Copper-showings near Marguerite.

Marguerite is a small settlement on the Pacific Great Eastern Railway, 36 miles south of Quesnel. The elevation of Marguerite is about 1,600 feet and the ground rises sharply east of the railway to an elevated plateau at about 2,800 feet, which is several miles wide and which parallels the railway for some considerable distance north and south of Marguerite. This plateau contains a succession of natural meadows formed by the agency of beavers and constitutes good agricultural land, devoted mainly to sheep and cattle raising. Cuisson lake is situated close to the base of the flat-topped mountains which rise east of the plateau to elevations of about 4,000 feet, and in which the copper-showings occur.

Pollyanna. This group of five claims is owned by F. Conway, Mrs. Conway, T. Thompson, H. B. Hill, and H. F. Hill. It is reached by a motor-road 3 miles in length from Marguerite to the top of the plateau; thence a sleigh-road leads across the plateau a further 4 miles to H. B. Hill's ranch, situated at the foot of the mountains. From this point a trail leads a further 3 miles to the group.

In rolling country at elevation about 4,000 feet sheared granodiorite is exposed. The width of visible shearing is at least 75 feet; the planes of shearing strike N. 55° W. (mag.) and dip north-easterly at about 45°. The workings are disposed on a line whose direction S. 28° W. (mag.) is roughly at right angles to the direction of shearing. A trench 15 feet deep and 20 feet long, partially filled with water, shows a body of quartz about 15 feet wide, stained with azurite and malachite and containing copper pyrites. This dips flatly to the north-east. Distant 30 feet in a north-easterly direction is a vertical shaft, stated to be sunk to a depth of 33 feet, also partly filled with water. The top 15 feet of the shaft was fairly well mineralized with copper-stains and chalcopyrite. The top 13 feet of this was sampled in three sections. The bottom 3 feet assayed 0.5 per cent. copper; the centre 5 feet showed no copper values; the top 3 feet showed 2 per cent. copper. None of the samples showed gold or silver values. A grab sample from the dump representing the ground excavated from the trench, taken in 1925, assayed 3.5 per cent. copper and showed traces of gold and silver. Some cuprite was also noted at this property. About 20 feet north-east of the shaft two other small pits from 5 to 8 feet in depth show slight copper-stains. About 57 feet south-west of the trench an open-cut shows quartz with a little malachite.

It might be expected that the quartz veins would show a strong tendency to follow the shear-planes, as they exhibit that tendency at the points of best exposure, but there is no convincing proof of any continuity in a north-west and south-east direction, either of the quartz veins or copper mineralization. A small pit 45 feet north-west of the trench shows nothing, and another 45 feet south-west of the trench shows quartz but very little copper. Present appearances indicate very short quartz-lenses mineralized with copper, which may follow the shear-planes in depth, but whose lateral extent on the surface is small. Another open-cut might with advantage be made south of the most southerly. •Refer also to the Annual Report for 1925, page 155.

Hill. This group consists of eight claims, owned by H. F. Hill, H. B. Hill, and J. F. Hill, and is situated on a small creek flowing into Cuisson creek. On the left bank of the creek, at elevation 3,050 feet, a trench and open-cut 75 feet in length expose in sheared granodiorite much arsenical pyrites in the granodiorite and chalcopyrite and copper-stain in small quartz stringers. The mineralization appears to follow the shear-planes, which strike S. 75° E. (mag.) and dip south-west. The whole is much oxidized and there is evidence of transverse shearing. The heaviest mineralization is confined to a width of 25 feet, and a chip sample across this width assayed 2 per cent. copper, but no gold or silver values. A sample taken of selected sulphides assayed 4.3 per cent. copper, but no gold or silver values.

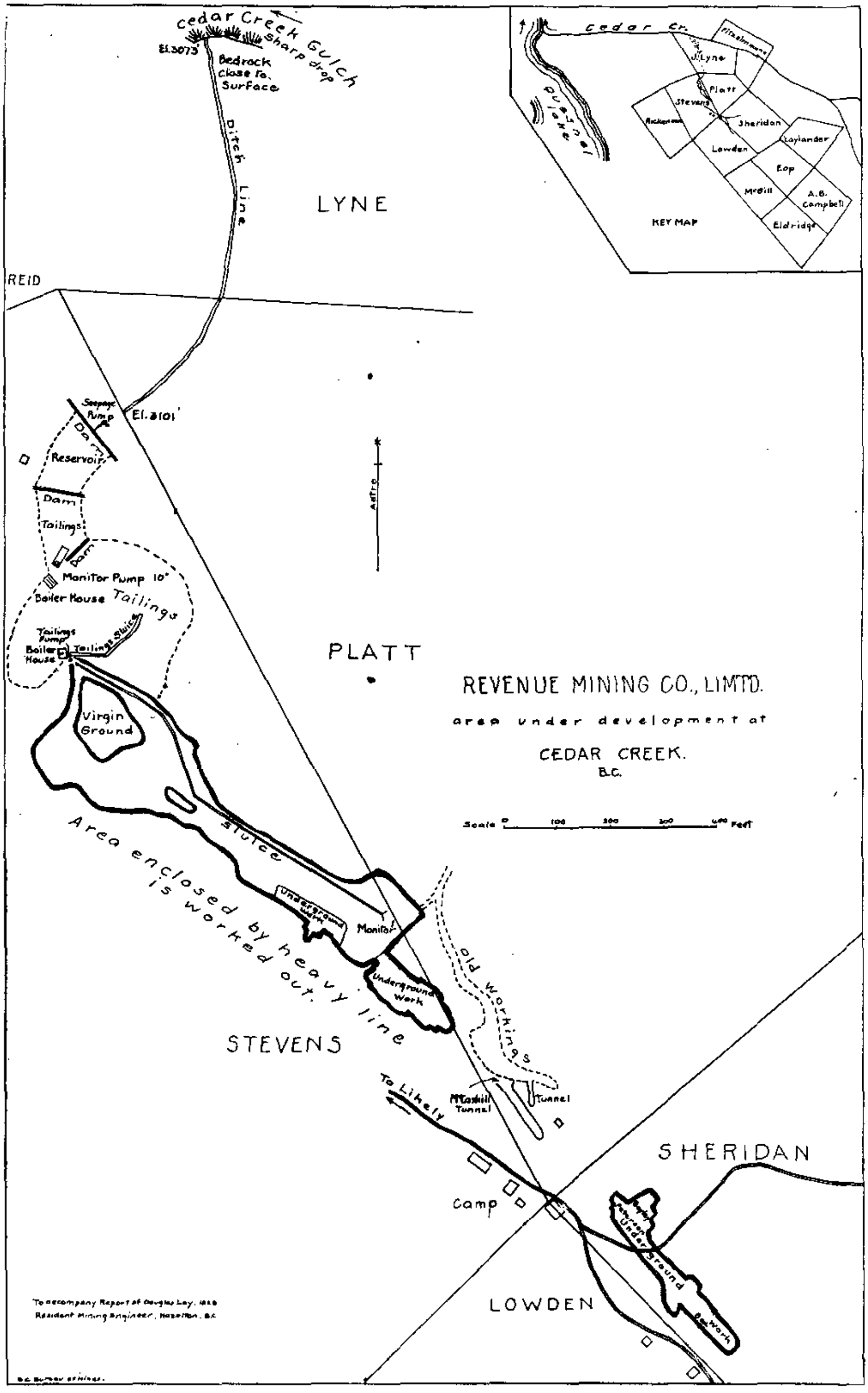
While mineralization appears to follow the shear-planes, the longitudinal direction of which is as given above, in view of the fact that there is evidence of transverse shearing, the sample taken across 25 feet noted above may not be representative of the true width. An attempt should be made to uncover the indicated continuation of this mineralization at a point, say, 50 feet distant south-easterly, so that an idea may be formed as to whether it continues in the direction of the longitudinal shearing or whether in that of the transverse shearing. This is a heavy mineralization, and although precious-metal values are disappointingly low, it merits a little further attention on the part of the owners.

LIKELY SECTION.

Cedar Creek.

Revenue Mining Co., Ltd. The registered office of this company is 801–807 Standard Bank Building, Vancouver. This company acquired last year options on the leases shown on the plan accompanying this report and has carried on pump-hydraulic operations during the year, following the pay-gravel south-eastwards. As will be seen from the map, the trend of this is between N. 45° W. and N. 55° W. (true).

In view of the limited yardage (say, 50 yards per 10-hour piping shift) which can be handled under the present system, it is apparent that the gravels must be rich if a profit is to


REVENUE MINING CO., LIMTD.
area under development at
CEDAR CREEK.
B.C.
Scale 0 100 200 300 400 Feet
Cedar Creek Gulch
Sharp drop
El.3073'
Bedrock Close to Surface
Ditch Line
LYNE
REID
El.3101'
Seepage Pump
Dam
Reservoir
Dam
Tailings
Dam
Monitor Pump 10"
Boiler House
Tailings
Tailings Pump
Boiler House
Tailings Sluice
PLATT
Virgin Ground
Sluice
Area enclosed by heavy line is worked out.
Underground Work
Monitor
Underground Work
Old Workings
STEVENS
To Likely
McCaskill Tunnel
Tunnel
Camp
SHERIDAN
Underground Work
LOWDEN
To accompany Report of Douglas Lay, 1928
Resident Mining Engineer, Hazelton, B.C.
Cedar Cr.
Quesnel Lake
Fitzsimmons
J. Lyne
Platt
Stevens
Sheridan
Laylander
Lowden
Eop
McGill
A.B. Campbell
Eldridge
KEY MAP

be won. It would appear advisable to determine by extensive Keystone-drilling whether sufficient yardage and values exist to warrant consideration of the alternatives of either getting water on the property or mechanically excavating the gravels and delivering them to water. Both alternatives would of course necessitate a heavy capital outlay and would not be justified unless the results of drilling were satisfactory.

A maximum number of twenty-five men was employed during the year, F. Chambers being in charge. Further information will be found concerning this property, and Cedar creek generally, in the Annual Reports for 1921, 1922, 1923, 1924, 1925, 1926, and 1927, and also in Geological Survey of Canada, Summary Report, Part A, 1922, by W. A. Johnston.

Leases of Colin Muir and Rowland T. Morgan.—These are seven in number and are situated on Beaver creek, which flows into Quesnel lake between Poquette creek and Cedar creek. They are reached by a trail about 1 mile in length from the Likely–Cedar Creek road.

In its lower portion Beaver creek has cut down deeply to bed-rock on the steep mountain-slopes, which rise somewhat sharply from the lake on the north shore. At elevation 2,895 feet, or 645 feet above the lake, the grade of the creek flattens more or less abruptly, and above this point the creek flows in a shallow valley in comparatively flat country. When the creek flattens, the left rim continues in sight for some considerable distance, but the right rim disappears. Promising gold values, it is stated, have been obtained in the gravels in the flat portion, and a shaft was sunk on the north side of the creek to a depth of 22 feet, but could not be continued beyond this point on account of water. Appearances suggest the likelihood of there being a buried ancient channel immediately to the north of the modern creek at this point. The Keystone drill affords the only solution of the question and this could be got on the ground quite readily. Having regard to the high runs of gold in the more immediate vicinity, at Cedar creek and on Spanish mountain, and the superficial gold values obtained on these leases, there would appear to be justification for a certain amount of drilling by way of preliminary.

Leases of C. Lackie.—These leases, owned by C. Lackie, are situated within 1½ miles of Likely. A general description will be found in the Annual Reports for 1925 and 1927. This property was equipped with an hydraulic plant during the year and a pit opened up at the base of the property.

Water is taken from Poquette creek by means of a diversion-dam at the entrance to the pass and conveyed in a 3- by 2-foot flume to a penstock by the Likely–Keithley road, which passes through the property. The pipe-line varies in size from 26 inches at the penstock to 15 inches at the No. 6 Monitor. The maximum head available is 150 feet. The face of the pit shows about 8 feet of boulder-clay overlying 15 feet of fairly fine gravels, which latter overlie 5 feet of blue clay on bed-rock. A storage-dam was also constructed in Poquette pass above the diversion-dam.

Black Bear Creek.

Western Canada Gold Mines, Ltd.

The registered office of this company is 712 Standard Bank Building, Vancouver. This company was formed for the purpose of hydraulicking Black Bear creek from the falls upwards and options have been acquired on leases both above and below the falls. The latter are situated about 1½ miles up from the mouth of the creek. In the vicinity of the falls the creek flows on bed-rock in an obviously modern channel. On the right bank of the creek by the falls is a prominent rock bluff, and immediately north of this occurs a morainal deposit. This fact gives foundation for the belief that there may be an ancient buried channel on the north side of the present creek, which was deflected from its source by the deposition of glacial debris in its former channel. Further strength is lent to this view from the fact that above the falls the left rim of the creek is fairly well defined, but the right rim is only visible at long intervals. The elevation of the bottom of the falls is 2,885 feet.

Apparently the possibility of the northern buried channel was recognized many years ago, because an old ditch, the "Frenchy" ditch, was formerly constructed at elevation 3,150 feet for the purpose of taking water from the creek and ground-sluicing this morainal deposit. The present company therefore proposes first of all to endeavour to expose the ancient channel by ground-sluicing, and during the past season six men were employed in cleaning out and repairing the "Frenchy" ditch, the length of which is in the neighbourhood of 2,200 feet. This work was completed in the fall and it was anticipated that ground-sluicing operations would be well advanced before slackening of the water-supply. Should this operation indicate the existence

of a buried channel, it is then proposed to construct another ditch-line on the left bank of the creek, conveying water from a higher point on the creek to operate a monitor, the creek being piped out to bed-rock from the bottom of the falls up-stream.

The present operators state that very thorough sampling of surface gravels has been carried out by them. Pans of gravel were taken on the creek from the rock bluff for 3,500 feet up-stream, and also at intervals up to 200 feet away from and 75 feet above stream-level. Practically all pans showed gold colours as well as a consistent accumulation of galena, and the average of seventy-three samples so taken gave 32 cents in gold to the cubic yard of gravel. Fourteen samples were taken off rim-rock at various points along the eastern or left bank where outcroppings were visible, and these gave an average of $8.90 a cubic yard. It might be added that an old shaft, known as the "Frenchy" shaft, is stated to have been sunk to a depth of 30 feet in the channel a short distance up-stream from the falls and failed to strike bed-rock.

While nothing is as yet definitely proved as to the ancient channel and bed-rock values, nevertheless this operation has a hopeful aspect. A force of six men was employed during the season in charge of W. E. Loveridge.

Spanish Creek.

Spanish Creek Mines, Ltd.

The registered office of this company is 412 Standard Bank Building, Vancouver. This company was incorporated for the purpose of hydraulicking the supposed buried channel of Spanish creek. With this end in view preliminary operations were started in April. These consisted in starting up the company's sawmill, getting out logs, sawing lumber, and erecting camp buildings. Somewhat over 1,000 feet of grade was also built for an overflow-flume to be used in connection with piping water. Operations were suspended in July.

North Fork of Quesnel River.

Quesnel Gold Mining Co., Ltd.

Accounts of the earlier operations of this company will be found in the Annual Reports for the years 1924 to 1927, inclusive. During the year this company opened up another pit at a point about 100 yards down-stream from the original pit. This disclosed bed-rock within a few feet of the surface at all points, within a short distance of the river-bank. The probability of this was indicated by the up-stream pit and the frequent outcroppings of bed-rock at intermediate points.

Matthias Gold Mining Co.

A description of previous operations of this company will be found in the Annual Reports for 1925, 1926, and 1927. This company moved its hydraulic plant during the year to investigate a morainal deposit, the bottom of which is about a quarter of a mile down-stream from the last pit. The top of this deposit is about 450 feet above the river. A ditch-line was constructed from Wolverine creek, conveying water to a penstock at the top of the river-valley. A pipe-line was laid down to a monitor and many thousands of yards of glacial material were piped off. If the existence of an old river-channel was inferred at this point, this work has effectively demonstrated the absence of such a channel.

Spanish Mountain.

Lease of J. Lyne.—This lease is situated on the north-eastern slopes of Spanish mountain and is distant about 5½ miles from Likely. The Likely–Spanish Lake wagon-road passes within a few yards of J. Lyne's cabin. On the gently sloping mountain-side are numerous gulches, some of which are dry or nearly so, others are occupied by very small creeks. In these gulches are found occasional rich spots. The gold is coarse and nuggety, somewhat resembling Cedar Creek gold. Owing to scarcity of water and fairly thick brush and timber, prospecting is somewhat laborious, but it is clear from the nature of the gold and points of resemblance to Cedar creek that the ground offers considerable promise. In view of what was said in the Annual Report for 1927 in connection with the association of mariposite and placer, it is interesting to record the fact that on this property large pieces of float-mariposite are found.

South Fork of Quesnel River.

Nelson-Furler Leases.—An account of these leases will be found in the Annual Report for 1926, page 176, to which reference is invited. During the year J. P. Nelson and E. B. Depue installed a pump-hydraulic plant, comprising a 100-horse-power semi-Diesel engine (Fairbanks-

Morse) and belt-driven centrifugal pump (10-inch suction, 8-inch discharge, capacity 2,900 U.S. gallons a minute). The plant is set up on bed-rock just above the river's edge.

A pit was opened up on bed-rock about 25 feet above the level of the river and some 5,000 yards piped off. Gold recoveries were, it is stated, unsatisfactory, although panning tests indicated good values. If the trouble lies in not recovering gold present, it should be possible to overcome that without much difficulty by adaptation of well-known expedients, such as increasing the length of sluice-flume and installing an undercurrent. These are matters for trial after the nature of the gold has been carefully ascertained. The face of the pit is about 50 feet in height and shows about 20 feet of gravel on bed-rock, overlain by 2 feet of lime-cemented gravel, on top of which is 20 feet of clay and silt.

This engine consumes about 6 gallons of Diesel oil an hour. The cost of this laid down at the plant is 25 cents a gallon, which it is estimated could be reduced to 15 cents a gallon by purchasing in tank-car lots.

Bullion.

This and the adjoining property of the Morehead Mining Syndicate have been acquired by Carlnelle Placers, Limited. The president of this company is N. E. Meilicke, the managing director is Norman C. Stines, and the chief engineer is E. C. Annes. Operations started in May were focused on the *Bullion* mine, the restoration of which constituted a task of magnitude. The chief items involved were: (*a*) The connection of the tunnel previously run from the left bank of the South fork with the floor of the pit; (*b*) improving and restoring water systems.

(*a*.) Connection of tunnel with pit-floor near head of pit: The size of this tunnel is 10 by 10 feet and its total length is 1,500 feet; it is connected at the face by a vertical 8- by 6-foot upraise 119 feet in height, of which the lower 32 feet are in bed-rock and the upper 87 feet in gravel. The connection involved 165 feet of tunnelling and the upraise mentioned therefrom. The upraise was by no means a simple matter. Although the floor of the pit appeared to be dry, the lower gravels were water-logged, setting up those quasi-fluid pressure conditions which are extremely hard to combat. They were successfully overcome in this case, not without some difficulty however, and the connection established.

In this tunnel has been constructed a 6- by 4-foot sluice-flume, lined with 14-inch spruce blocks. The grade of the flume for the first 900 feet is 5½ per cent. and for the last 600 feet 4 per cent. There is also an emergency exit from this tunnel in the form of a 6- by 4-foot raise, which connects with the north side of the pit, and through which passes also a high-pressure water-line for the operation of the concentrator, situated at the mouth of the tunnel, and generator supplying light for pit, tunnel, and other purposes. The tunnel containing the sluice-flume is electrically lighted and an electrically operated service-car runs along the top of the flume. All lumber and spruce blocks used were cut locally near Likely by a sawmill erected by Gavin Hamilton near Likely. All sluice-flume supplies are delivered to a point on the north side of the river opposite the tunnel portal and conveyed across the river by aerial tram to the latter. At the end of the flume there is to be constructed an undercurrent, the underflow from which will be subjected to a concentrating process for recovery of fine gold and metals of the platinum group, which are known to be present in these gravels. The treatment process is one of classification, dewatering and concentrating on Stedman concentrators.

(*b*.) Restoring and improving water systems: In brief, this has involved the connection of Bootjack lake with Morehead lake, and the waters of the latter with Jawbone creek by a long cut 17 feet deep at the upper end. By means of this Jawbone cut Morehead Lake water passes directly into the Morehead ditch and a length of three-quarters of a mile of flume and siphon has been eliminated. All wooden flume has been replaced with Dutcher suspended metal flume. There has also been involved the reconditioning of the pooling-reservoir more immediately adjacent to the *Bullion*. The water rendered available as a result of these improvements is estimated at 3,500 miners' inches, or 5,880 cubic feet a minute, under a head of 380 feet. There remains Polley Lake water, which it is proposed to render available later.

In spite of the magnitude of the task, water was turned into the new system within three and a half months from the commencement of operations—a very creditable performance. By the time of inspection on October 15th some 25,000 cubic yards of bed-rock gravels had been piped off. It should be clearly understood, however, that for this operation the old sluice-flume was used. The head of this is about 1,000 feet from the raise from the new sluice-tunnel. It will be necessary to use the old sluice-flume, of course, until bed-rock gravels have been piped for

this distance up to the raise. The thickness of these gravels varies from 2 or 3 feet at the head of the old sluice-flume to some 80 feet as mentioned at the raise. The old sluice is badly worn and the best results cannot be gained until the new sluice-flume is put into commission next year.

The immense yardage available on this company's properties is obvious. The other factors so essential to success, *values* and *water*, are known in all their details only to the management. Apart from values, a factor vital to the success of the enterprise is the length of the piping season each year, which, short of actual trial, can only be arrived at by careful study of the water-supplies. However, operations to date disclose thoroughly competent engineering ability, and it seems only reasonable to suppose that this same ability has been directed to careful scrutiny of all the factors affecting this large hydraulic enterprise, from which much is hoped.

It is highly interesting to record the finding of perhaps the most authentic fossil remains on record in the gold gravels of the Cariboo. This was found lying on bed-rock in the course of advancing the raise from the sluice-tunnel to the pit. The fossil remains consist of the upper portion of the skull of a kid, with a portion of the convolutions of the brain also preserved. The whole appears to be petrified and conveys a suggestion of modernity. It is not known what was the result of expert examination of this fossil. It was understood to be the intention of the management to send it to the Geological Survey of Canada, Ottawa, for examination. Refer also to Annual Reports for the years 1902, 1921, 1926, and 1927.

Keithley Section.

The Consolidated Mining and Smelting Company of Canada, Limited, carried out some Keystone-drilling on Swamp river, having acquired options on the leases of A. F. Brown and associates. Actual drilling was carried out by A. F. Brown. Six holes were drilled at the mouth of Harvey creek, and two holes 3 miles below the mouth of Cunningham creek.

Yanks Peak.

A description of various properties on Yanks peak will be found in the Annual Report for 1925. It is understood that considerable activity was manifested by prospectors on this mountain during the year, but time did not permit of inspection.

Horsefly Section.

Horsefly River.

Leases of E. I. West and Associates.—These comprise two bench leases in the vicinity of Keystone drill-hole No. 4c, drilled by the Department of Mines in 1920, and six dredging leases situated up-stream from this point. In the Annual Report for 1920 will be found a full account of the Keystone-drilling undertaken by the Department of Mines in 1919 and 1920 and full particulars of values found in hole No. 4c.

E. I. West and associates during the year made preparations to sink on hole No. 4c. At the time of inspection in October a shaft-house had been constructed over the collar of the hole, an 8-horse-power Novo hoist, centrifugal pump, and 28-horse-power Fordson engine to operate the same, had been installed, and a shaft of dimensions 6 by 4 feet in the clear had been sunk 14 feet.

Lease of R. N. Campbell and J. Campbell.—This lease is situated on the Horsefly river in the vicinity of hole No. 4c. At stages of low water the owners are able to ground-sluice certain bars of the river. In this case these appear to represent concentrations of fairly coarse gold on a false bed-rock. At the time of inspection such deposits were being ground-sluiced on the right bank of the river. The pay-streak was a seam of blue gravel upwards of 1 foot in thickness with a little clay at the base. Such deposits are of course reconcentrations, but pieces of carbonized drift-wood therein bear witness to their great age.

Black Creek.

Lease of G. Mackeracher.—Black creek flows into the Horsefly river from the north about 20 miles up-stream from Horsefly. From this place an excellent motor-road runs to and past Black creek. A branch road up which a car can be taken leaves the main road and follows up Black creek to G. Mackeracher's lease. About 1½ miles up the creek from its mouth are falls about 200 feet in height, in two steps of 50 and 150 feet. Immediately above these falls the creek flows through a narrow canyon, some 200 feet in length. The elevation of the upper end of the canyon is 3,115 feet (referred to Horsefly Post-office as 2,450 feet elevation). G.

Mackeracher's lease is situated immediately above this canyon. For a distance of about 1,000 feet above this canyon there is no sign of bed-rock or rim-rock. At various points in this region it is stated that promising values can be obtained in the gravels, and various old workings testify to the fact that a considerable amount of investigation was carried on by early workers. About 1,000 feet above the canyon, rock outcrops in two different places on the right bank, in which a tunnel known as the "Campbell" tunnel was run in the nineties in search of a tributary run at this point, the possibility of which is suggested by the topography and rock-outcrops. The results attained by this tunnel, which is now caved, are unknown. The elevation of this tunnel is 3,215 feet. Just above this point the creek runs over bed-rock and both rims of the creek appear in the banks. The elevation of bed-rock at this point is 3,260 feet, and it is the point considered by G. Mackeracher as being about the most suitable for a dam in the event of its being decided to hydraulic the creek.

About 450 feet higher up the creek both rims again outcrop, and a short distance above this, at elevation 3,300 feet, an old tunnel, now caved, is said to have been run in the sixties and to have yielded ½ oz. gold to the set. This tunnel is run in the right rim. Any recent attempts to sink to bed-rock have failed owing to water encountered. The Keystone drill is the obvious expedient to adopt and could be got on the ground with ease. The creek appears to merit testing by this means. Enough water could be obtained from the creek for a small hydraulic installation, at any rate. It is of course quite essential to ascertain the depth of bed-rock at various points before going to the expense of any hydraulic installation. Appearances suggest the likelihood of there being a pool immediately above the canyon. And in that event, and assuming satisfactory bed-rock values, it would be necessary to blast a channel through the canyon down to bed-rock grade before hydraulicking.

Moffat Creek.

Ancient River-channel cut by Moffat Creek.—In the Annual Report for 1927, page 180, mention is made of the fact that Moffat creek apparently cuts through an ancient river-course. This was further investigated during the year. A short distance below the falls on Moffat creek there is exposed on both banks what appears to be an ancient river-channel. The gravel is residual and is composed almost entirely of well-worn quartz, closely resembling that from the deposit at Star and Triplet lakes, on which are the leases of J. Williams and G. Kuchan, and also that of the old *Miocene* property at Horsefly.

Where intersected by Moffat creek the direction of this channel is N. 65° W. (mag.). The level of the bed of Moffat creek at this point is 235 feet vertically above Horsefly Post-office. On the left bank of Moffat creek at this point the gravel is overlain by volcanic lava-flow, but it is not certain whether the latter is in place. It is understood that some years ago a Keystone drill-hole was put down in this gravel at a point somewhat down-stream from this exposure, but bed-rock was not reached. This is obviously a point at which drilling should be carried out, because of the hydraulic possibilities which may exist, and which can only be proved by ascertaining the depth of the channel at this point as well as the values. Moffat creek would furnish a good supply of water for hydraulicking if the presence of the other conditions essential to success can be established by Keystone-drilling.

Beaver Valley.

Leases of C. R. Carfrae, Mrs. Carfrae, and T. Peterson.—These leases are distant about 6 miles from Horsefly and are situated on the left bank of Beaver creek. At the level of the creek rim-rock is exposed, and overlying this is a bench deposit, the gravels of which are said to average about 18 cents a yard and to contain some black sand showing platinum values. About 10 feet from the edge of the bench a shaft is sunk to a depth of 32 feet, which is said to indicate values of the order mentioned. At another point, about 750 feet west of this, close to the rim of the main valley, a shallow shaft 7 feet deep is said to show about the same values. There appears to be justification for some further work by the owners with a view to further delimit the area over which the values mentioned extend.

CENTRAL MINERAL SURVEY DISTRICT (No. 3).

By H. G. Nichols, Resident Mining Engineer.

INTRODUCTORY.

General.

The Central Mineral Survey District (No. 3) includes the seven Mining Divisions of Kamloops, Clinton, Lillooet, Ashcroft, Vernon, Nicola, and Yale. The district covers an area of approximately 44,000 square miles, or, roughly, one-third of the territory of the mainland of Southern British Columbia lying between the 53rd and 49th parallels of north latitude.

The headquarters of the district are located at Kamloops, a growing city of 5,500 inhabitants, situated at the junction of the North and South Thompson rivers. Other towns, with a population of over 300, serving as centres of supply within the district are Vernon, Merritt, Hope, Lillooet, Lytton, Ashcroft, Clinton, Salmon Arm, Armstrong, and Enderby.

The district is served by six lines of railways, including main lines and branches, as follows: Canadian Pacific Railway from Hope to Three Valley, 276 miles; Canadian National Railway from Hope to Canoe River, 380 miles; Kettle Valley Railway from Hope and Spences Bridge to Brookmere, 124 miles; Canadian National Railway branch, Kamloops to Kelowna, 116 miles; Canadian Pacific Railway, Sicamous to Okanagan Landing, 51 miles; Pacific Great Eastern Railway, Alta Lake to Williams Lake, 237 miles.

This is a total of 1,164 miles of railway within the district. There is also a total distance of about 300 miles of navigable lake waterways. Government roads within the district total 4,126 miles and there is a large and steadily increasing number of roads and trails to serve the especial needs of the mining industry.

The No. 3 District is commonly associated with the Interior Plateau country, but typical plateau conditions are not characteristic of the district as a whole. On both physiographical and geological grounds the district may be divided into four areas, as follows:—

(1.) The Coastal Mountain area.
(2.) The Southern Interior area.
(3.) The Northern Plateau area.
(4.) The Western Mountain area.

The reasons for this subdivision may be understood from a consideration of characteristic conditions in each of the above-mentioned areas. The Coastal Mountain area covers a section of country in which the predominating feature is the intrusion of the Coast Range batholith.

In the Southern area there are widespread exposures of rocks that are contemporaneous probably with the Vancouver series, and are intruded by numerous stocks of eruptive rocks which are also probably related to the coastal batholithic intrusion. An outstanding feature in connection with this area is the extensive fissuring and shearing of both the intruded and intrusive rocks and of composite rock complexes intermediately related to both of them, and a widespread mineralization associated with this fissuring.

The third area is characteristic Interior Plateau country, with an extensive development of Tertiary formations. The fourth area is a part of the physiographical unit that goes under the name of the Cariboo and Columbia mountain system, and its chief characteristic from a mining point of view is the occurrence of Pre-Cambrian rocks.

Broadly speaking, the entire area covered by the district is mineral-bearing country; it lies within the mineralized belt of the Western Cordillera, of which the Rocky mountains and the Coast ranges are the physiographical boundaries on the east and on the west.

From a geological view-point this north-west, south-east geosyncline, with which the Province of British Columbia is identified to a large extent, may be subdivided into two main belts on either side of a shore-line of ancient rocks (Shuswap terrain) that form the eastern boundary of the seas under which the succeeding formations were laid down; and this shore-line lies at a distance of about 100 miles to the west of the Rocky mountains. Between this line and the Pacific ocean is the belt known as the western geosyncline, a belt which includes the whole distance between Oregon and Alaska and possesses characteristic features that entitle it to be

considered as a unit. It contains great thicknesses of sedimentary and volcanic rocks that have been subjected to a series of earth-movements, with thrusts mainly directed from the west; and to intimately related intrusions of batholithic rocks with which the metallic mineralization in British Columbia is mainly associated.

The Central Mineral Survey District comprises a portion of the Coast Range member of the Western Cordillera; a section of the ancient rocks on the east; and about one-half of its total area is occupied by the intruded zone of rocks last mentioned. These in turn are covered in part by later flows of Tertiary lavas.

In so far, therefore, as ultimate possibilities for the discovery of metallic minerals are concerned, the district forms an integral part of the mineralized belt in which the great deposits of copper, lead, zinc, gold, and silver have been found elsewhere in the Province, and it offers every inducement to the pursuit of prospecting and development.

Gold, silver, copper, arsenic, antimony, molybdenum, chromium, nickel, mercury, and tungsten are found in the western section, while silver-lead-zinc minerals are more characteristic of the eastern part.

In the areas overlain by recent volcanic flows a variety of non-metallic minerals occur, including gypsum, soda, epsomite, magnesite, hydromagnesite, and clays. Asbestos is found at several localities. Bituminous coal is mined in the Nicola Mining Division and extensive beds of lignite occur in the Clinton Division.

Interest in the mining resources of the southern interior of the Province, which was a marked feature of the industry in 1927, has been maintained fully during the current year and has been shared to an increasing extent by the general public. This latter fact is evidenced by the number of local companies that have been incorporated for purposes of development, while the prospecting departments of the larger operating companies have been continuing an active campaign in various fields.

While the bigger organizations have been concerned for the greater part with the exploitation of deposits of copper and gold, lesser activities have been devoted to the prospecting and development of lead-silver-zinc prospects, and in both of these directions some notable progress has been made. Active interest is also being manifested in the resources of nickel, molybdenum, and quicksilver, and in the non-metallics of the district.

The district gives undoubted promise of response to serious development, and the fulfilment of this promise has been brought appreciably nearer during the past year by the work that has been inspired largely by conditions of demand resulting from the more favourable outlook in the copper market. In this connection it may be expected that attention will be redirected to areas of low-grade copper mineralization, in which previous operations have indicated the possibility of large tonnage, but have failed, so far, to demonstrate an average grade of ore of sufficient attraction under pre-existent market conditions; among such areas there are the Highland Valley camp in the Ashcroft and Kamloops Divisions; the Coal Hill field south of Kamloops, where two groups of claims—*Ajax* and *Monte Christo*—located on the western section of the granite area, were bonded by the Consolidated Mining and Smelting Company of Canada, Limited, in the late fall, and it is understood that diamond-drilling is to be commenced in the spring; and Aspen Grove in the Nicola Division.

In particular, the Consolidated Mining and Smelting Company has carried out an aggressive campaign of investigation. The year of 1928 also witnessed the introduction of methods of electrical prospecting to areas within the district.

Whatever may be said in regard to present-day scarcity of real prospectors, such reflections have no general application to this district. Tribute is to be paid to the work of the prospectors, particularly in the Shuswap Lake area, where several promising occurrences of silver-lead ore are being exploited; in the North Thompson Valley area; in the country served by the Hope–Princeton trail, where base-metal deposits of some magnitude are being prospected down the valley of the Skagit river; and in the Vernon and Lillooet districts.

Extended trips were made during the season for the purpose of investigating means for opening up new fields for development; among these being the upper Clearwater area, where extensive bodies of gold-bearing quartz occur. Substantial appropriations were made by the Department of Mines for the construction and betterment of roads and trails leading to mining properties and areas.

PROSPECTING.

Company operations of particular interest under this heading are in connection with the following items: The work of the Consolidated Mining and Smelting Company in the Taseko River area, where extensive zones of low-grade copper mineralization with gold values are in course of being proved by tunnelling-work and systematic open-cutting after a considerable amount of work in the way of trail-making and camp-construction. The active campaign that is being conducted by Lorne Gold Mines, Limited, in the Bridge River area, where tunnelling-work on an extensive scale has for its primary object the prospecting at depth of the system of gold-quartz veins in this old-established camp. The exploratory work of Aurum Mines, Limited, in the gold-belt of the Coquihalla area. The diamond-drilling investigations carried out by the Britannia Mining and Smelting Company, Limited, on low-grade copper prospects in the Pemberton area. The work of the Granby Consolidated Mining, Smelting, and Power Company in the Adams Lake area, where a sustained, although not exhaustive, examination was made by diamond-drilling and trenching of promising silver-lead deposits. Further tunnelling-work by Cotton Belt Mines, Limited, on the lead-zinc deposit in the Seymour River area. The driving of a tunnel to penetrate the vein system on Mineral hill at Stump lake by Planet Mines, Limited, with the primary object of opening up the old workings from the *Joshua* shaft. This work constitutes an appreciable advance towards realization of the project for making a mining camp at Mineral hill, with which the name of the late Dr. Dawson is generally associated. Underground exploration by Thelma Mines, Limited, on the silver-lead-zinc ore-bodies on Swakum mountain near Nicola. Tentative investigation of the chrome iron-ore deposits on Scottie creek, near Ashcroft, by the Consolidated Mining and Smelting Company. Work incidental to small shipments of high-grade silver ore from the *Silver Daisy*, on the Hope–Princeton trail, by Hope Consolidated Mines, Limited.

Among items of work conducted on a more individual initiative may be mentioned the exploration of the *St. Paul* silver-lead deposit, of the *Ophir* zinc-zone, and the *Jumbo* gold-quartz vein in the Vernon Division. In general it may be said that the response to prospecting and development work has been satisfactory and some new discoveries of unusual interest have been made.

One of these discoveries is in a section of country surrounding the upper reaches of the Bridge river, in the Lillooet Mining Division, to which attention was directed on account of the result of recent geological investigations carried out by V. Dolmage, of the Geological Survey of Canada. These investigations led to the finding, in the first place, of a body of intrusive rock of more recent age than the main batholith, postulating conditions favourable to mineralization. Immediate advantage of this information was taken, with the result that two attractive veins of chalcopyrite were located by a party of prospectors sent out by the Consolidated Mining and Smelting Company.

These veins are said to be 5 and 7 feet wide respectively; the commercial importance of the ore will depend probably in no small measure upon its gold content, as the occurrence is situated in difficult country at a distance of about 35 miles from the Bridge River auto-road at the mouth of Hurley creek.

Another discovery is that of gold in flaky form in serpentine and associated with arsenopyrite in the workings on the *Aurum*, in the Yale Mining Division. The general similarity of the conditions at the individual points of mineralization exposed in the tunnels, with certain characteristic phases of the pocket mines of the Motherlode belt of California, opens up a wide vista of possibilities, and great activity has been inspired among prospectors and claim-locators by the spectacular nature of the occurrences. The extent, however, to which this discovery may resolve itself into a basis for commercial operations may not yet be predicted.

In the Yale Division, also, a new development of interest is in connection with the extension of the mineral area of Summit camp at the head of Tulameen river. A wide silicified and mineralized zone of fracturing has been located that appears to have a direct relationship to the fissure-vein silver-lead mineralization of this camp, extending over the divide down to the headwaters of Dewdney creek.

The state of prospecting activity is reflected by the statistical figures for the year, which show an increase of 240 per cent. in the number of claims and leases recorded and an increase

of 35 per cent. in the number of certificates of work over those for the preceding year, as shown in the following table:—

Mining Division.	Claims and Leases recorded.		Certificates of Work.	
	1927.	1928.	1927.	1928.
Kamloops	152	269	320	423
Clinton	47	158	66	95
Lillooet	104	417	228	251
Ashcroft	66	80	33	58
Yale	66	692	189	253
Nicola	59	166	59	77
Vernon	67	131	62	91
Totals	561	1,913	927	1,248

Development.

The principal features under this head are as follows: On the *Pioneer* at Bridge river has been proved extended lateral boundaries of the pay-ore both on the 400- and 600-foot levels and the main shaft is being carried down to the 1,000-foot level. The average width and value of the main gold-quartz vein is well maintained and a new vein of high-grade ore has been struck in the foot-wall. The mine is justifying the hopes that have been entertained for it as a steady producer.

The *Planet* workings at Stump lake have been extended down to the 300-foot level, and both in the incline shaft and in the drifts on the 200-foot level a considerable improvement in the silver-lead ore-body has been noted, the tonnage of probable ore having been materially increased by the recent workings.

Thelma Mines, Limited, has exposed a body of silver-lead ore, 5 feet wide, in workings from the 63-foot shaft in the *Thelma* claim, in the Nicola Division, thus opening up possibilities of production from this property on a larger scale than had been indicated previously by the more limited occurrences of shipping-ore.

Cotton Belt Mines drove a total distance of over 1,000 feet in four tunnels on the lead-zinc ore-body of the *Cotton Belt* zone in the Seymour River area, Kamloops Mining Division.

Production.

Mine.	Ore.	Gold.	Silver.	Copper.	Lead.	Zinc.
Kamloops Mining Division—	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.
Iron Mask	5,000	157	320	202,882	.....	.....
Vernon Mining Division—						
Ophir	36	2	110	614	1,583	.....
Lillooet Mining Division—						
Pioneer	14,360	7,730	1,400	.....	.....	.....
Nicola Mining Division—						
Thelma	72	1	1,547	.....	3,997	3,621
Verona	1	.....	48	.....	134	149
Totals	19,469	7,890	3,425	203,496	5,714	3,770

Bibliography.

In addition to the reports of the Provincial Mineralogist and the Resident Mining Engineers that are published in the Annual Reports of the Minister of Mines, general information relating to the district is to be found in the following publications:—

Author.	Title.	Publication.
G. M. Dawson	Southern British Columbia	C.G.S.: Report of Progress, 1877–88.
G. M. Dawson	Mineral Wealth of B.C.	C.G.S.: Annual Report, 1887–88, Vol. 3.
G. M. Dawson	Kamloops Map Area	C.G.S.: Annual Report, 1894, Part B.
J. McEvoy	Notes	C.G.S.: Summary Report, 1895, page 37A.
R. A. Daly	North American Cordillera	C.G.S.: 1912.
R. A. Daly	Geology of the Cordillera	C.G.S.: Guide Book No. 8, Part 2.
R. A. Daly	Golden to Kamloops	C.G.S.: Memoir No. 68.
H. G. Nichols	Mining Progress	Canadian Mining Journal, Vol. 48, 1927.

The following revised list of references to areas and mineral-deposits within the district is arranged alphabetically in relation to the subject-matter:—

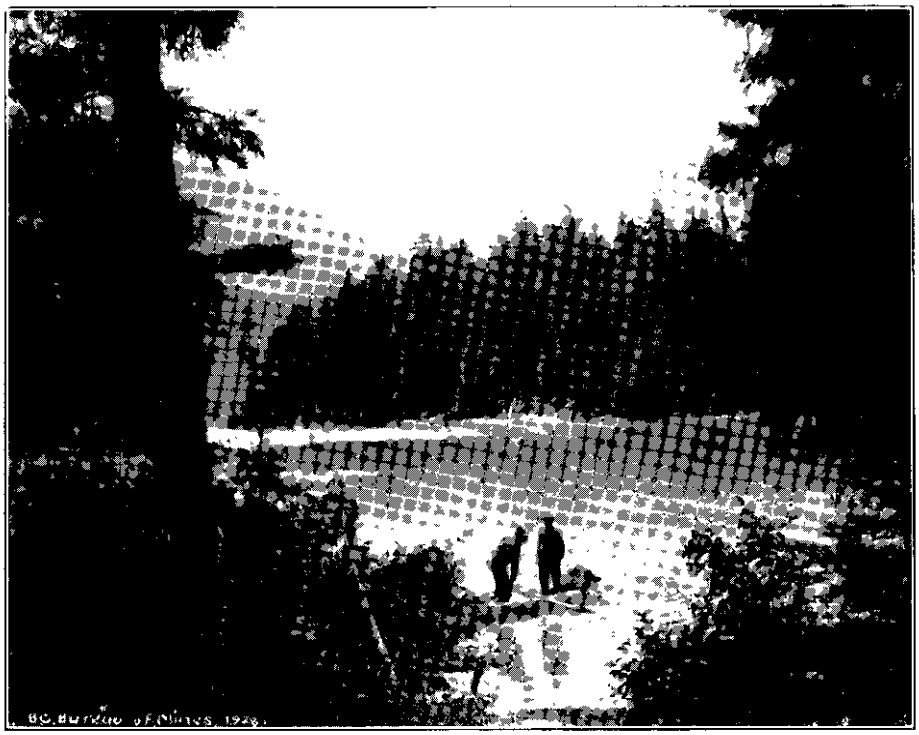
Author.	Subject.	Publication.
W. S. McCann	Bridge River Map Area	C.G.S.: Memoir No. 130.
C. W. Drysdale	Bridge River Area	C.G.S.: Summary Report, 1915.
C. W. Drysdale	Bridge River Area	C.G.S.: Summary Report, 1916.
W. Thomlinson	Chromium	Mun. Resources Commission Report, 1920.
W. F. Ferrier	Chromium	Mun. Resources Commission Report, 1920.
C. Camsell	Clay along Route of P.G.E.	C.G.S.: Summary Report, 1917, Part B.
D. B. Dowling	Coal Areas	C.G.S.: Memoir No. 69, page 280 *et seq.*
C. Camsell	Copper Mountain, Gun Creek	C.G.S.: Summary Report, 1918, Part B.
C. Camsell	Coquihalla Map Area	C.G.S.: Summary Report, Part B.
C. Camsell	Coquihalla Copper	C.G.S.: Summary Report, 1909, page 113.
C. Camsell	Coquihalla Copper	C.G.S.: Summary Report, 1908, page 63.
C. E. Cairnes	Coquihalla Area	C.G.S.: Summary Report, 1922, Part A.
C. E. Cairnes	Coquihalla Area	C.G.S.: Memoir No. 139.
C. Camsell	Diatomaceous Earth along Route of P.G.E. Railway	C.G.S.: Summary Report, Part B, 1917.
V. L. Eardley-Wilmot	Diatomite	Mines Branch, 1928, No. 691.
C. E. Cairnes	Eureka-Victoria Mine, Yale M.D.	C.G.S.: Memoir 139.
R. P. D. Graham	Fluorite	Mun. Resources Commission Report, 1920.
N. L. Bowen	Fraser River below Lytton	C.G.S.: Summary Report, 1912.
L. H. Cole	Gypsum in British Columbia	Mines Branch, 1913, page 91 *et seq.*
B. R. MacKay	Hat Creek Coal	C.G.S.: Summary Report, 1925.
C. W. Drysdale	Highland Valley Area	C.G.S.: Summary Report, 1915.
C. E. Cairnes	Hillsbar Gold Group, Yale	C.G.S.: Summary Report, 1923, Part A.
A. M. Bateman	Lillooet to Chilco Lake	C.G.S.: Summary Report, 1912.
A. M. Bateman	Lillooet Map Area	C.G.S.: Summary Report, 1912.
L. Reinecke	Lillooet to Prince George	C.G.S.: Memoir No. 118.
C. Camsell	Lillooet Mining Division	C.G.S.: Summary Report, 1911.
C. Camsell	Magnesite along Route of P.G.E.	C.G.S.: Summary Report, 1917, Part B.
C. Camsell	Mercury Deposits of Kamloops Lake	C.G.S.: Summary Report, 1918, Part B.
V. L. Eardley-Wilmot	Molybdenum	Mines Branch, 1925, page 32 *et seq.*
C. W. Drysdale	Molybdenum, Lillooet	C.G.S.: Summary Report, 1916.
C. E. Cairnes	Nickeliferous Mineral Deposit, Emory Creek, Yale	C.G.S: Summary Report, 1924, Part A.
W. L. Uglow	North Thompson Valley	C.G.S.: Summary Report, 1921, Part A.
C. E. Cairnes	Pemberton Area	C.G.S.: Summary Report, 1924, Part A.
W. F. Ferrier	Platinum	Mun. Resources Commission Report, 1920.
Bruce Rose	Savona Map Area	C.G.S.: Summary Report, 1912.
R. A. Daly	Shuswap Lake Area	C.G.S.: Summary Report, 1911.
C. Camsell	Skagit Valley Area	C.G.S.: Summary Report, 1911.
V. Dolmage	Taseko Valley	C.G.S.: Summary Report, 1924, Part A.
C. W. Drysdale	Thompson River below Kamloops Lake	C.G.S.: Summary Report, 1912.
C. Camsell	23-Mile Camp, Yale M.D.	C.G.S.: Summary Report, 1911.
C. E. Cairnes	23-Mile Camp	C.G.S.: Summary Report, 1922, Part A.
C. E. Cairnes	23-Mile Camp	C.G.S.: Summary Report, 1923, Part A.
C. E. Cairnes	23-Mile Camp	C.G.S.: Memoir No. 139.

KAMLOOPS MINING DIVISION.

Iron Mask.

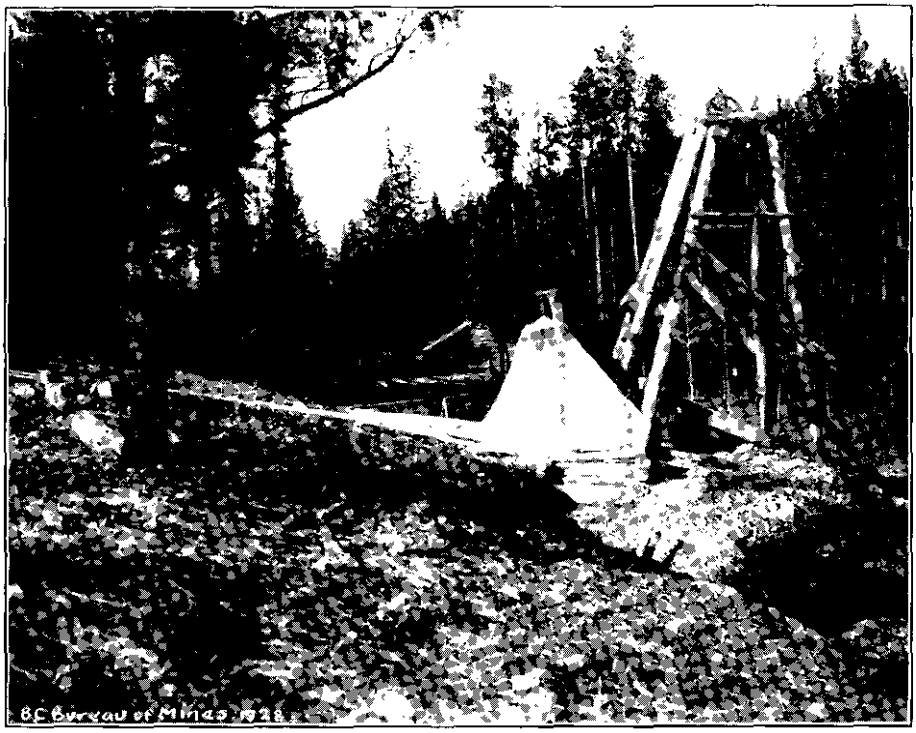
This property, situated 6 miles south-west of Kamloops, has been operated by the Continental Copper Company, incorporated under the laws of the State of Illinois, U.S.A. Following a change of management, the programme of extensive prospecting development that had been in progress for several years past was abandoned in favour of resuming production from the ore-bodies already indicated. The principal source of supply relied upon was a 14-foot vein of ore averaging over 4 per cent. copper that had been encountered in a crosscut on the 750-foot level, in the eastern section of the workings.

Development of this ore-body, however, proved unsatisfactory and other smaller sources of ore had to be relied upon for mill-feed. The flotation plant was run for a period of about three months during the year, producing about 400 tons of concentrate averaging from 22 to 25 per cent. copper. All of this ore was derived from workings on the 750-foot level, and upon the exhaustion of the supply the operations were suspended and the property closed down in the month of November.



Hobson Lake, Kamloops M.D.

White Rock Mine, Kamloops M.D.



Thelma Mines, Ltd., Nicola M.D.

Planet Mines, Ltd.—Transporting Ball-mill, Nicola M.D.

The greater part of the ore extracted during the year was produced from an ore-body lying at a distance of about 900 feet to the north-west of the *Erin* ore-body, that was opened up from the No. 2 crosscut on the 750-foot level. This ore-body had also been found in workings from the *Norma* shaft. (*See* plan accompanying Annual Report for 1926.)

Some high-grade ore was obtained from this vein in the upper workings, but it was only of small extent. On the lower level the ore-shoot opened up was about 120 feet long and was worked to a width of about 12 feet, although much of the material was of low grade. This ore-body was worked to a height of about 90 feet above the level.

Another source of ore was found near the *Iron Mask* shaft station on the 750-foot level, where some high-grade material was found, the extraction of which, however, owing to the broken nature of the ground, entailed the handling of much waste.

Another ore-body was discovered on this level at a distance of about 300 feet farther to the east from the 14-foot vein above referred to. Where this vein was struck on the level the ore was of low grade. It was opened up for a length of 100 feet and chutes were put in preparatory to working when the property was closed down. With the exception of this latter work, no development has been carried on during the past year. Both mine and mill were run on one shift only.

During the early part of the season a cursory investigation was made by electrical prospecting methods, from which a strong reaction indicated the presence of an ore-body lying to the west of the *Iron Mask* workings, and it is to be regretted that the hard-and-fast policy of restricting development did not permit of an attempt being made to prove up this indication.

In general it is understood that the conditions of working in the *Iron Mask* mine itself call for a minimum economic value of 3-per-cent. copper ore. It is not thought, however, that the prospects in regard to the area in general are subject to the same limitations, and, as described in previous reports, there are possibilities for the ultimate development of a considerable tonnage of low-grade copper ore in this section of the country.

Ajax and Monte Carlo. These groups, comprising thirteen claims situated near Jacko lake, in the same area of low-grade copper mineralization as the *Iron Mask*, and owned by G. J. Rogers, of Knutsford, were bonded late in the fall by the Consolidated Mining and Smelting Company, and it is understood that a programme of diamond-drilling is to be carried out in the spring. These properties are situated on one of the mineralized zones to which reference has been made previously. (*See* Annual Report for 1926, page 183.)

A large amount of tunnelling and trenching-work has been carried out in past years and some encouraging features have been exposed. In particular a crosscut tunnel on the *Ajax* demonstrated the existence of a zone about 90 feet wide, in which some seams occur with a fairly high content of oxidized copper mineral. Samples taken from the bottom of a small winze on one of these seams indicated the association of gold and silver values, as a result of which investigation of the greater possibilities was decided upon.

Cotton Belt. Development-work was continued on this property by Cotton Belt Mines, Limited. The property consists of a group of claims covering the south-eastern section of a mineralized belt that stretches across the plateau country lying to the east of the Seymour river at an elevation of approximately 6,000 feet. Options have been held also by the company upon claims located on the north-west section of the belt. All the work has been done within a distance of 1 mile from the north-west end of the belt, where it is exposed on the steep banks of Deep creek, a tributary of the river. The work was devoted to the continuation of the tunnels referred to in the 1927 Annual Report.

The main No. 2 tunnel, which had already been driven for a distance of about 800 feet on the seam, was advanced for a further distance of rather more than 100 feet to a point 300 feet beyond the raise on the ore-shoot that was developed previously. The mineralized seam was found to be fairly persistent and at the face is 3 feet wide.

The No. 1 tunnel, approximatley 100 feet vertically above No. 2, was continued through the ore-shoot that is exposed at the surface over a distance of about 250 feet, and in the No. 2 tunnel, where it was 110 feet long. Some very good ore was opened up in this tunnel, the seam reaching to a maximum width of 7 feet.

No. 3 tunnel was driven in for a total distance of about 400 feet below a promising outcrop, some 3,000 feet north-east of the shoot developed by the upper workings. This ore-shoot is about 100 feet long, having a maximum width of about 4 feet 6 inches.

No. 4 tunnel was driven as a crosscut for 100 feet and continued for 200 feet in a direction corresponding with that of the strike of the ore-zone towards the south-east. These workings were only a few feet below the bottom of a 40-foot shaft that had been sunk on the most north-westerly exposure of mineral. Some good ore was found in this shaft, but in the recent workings below it no mineral was encountered of a similar character. In view of certain structural conditions that may have affected normal continuity of the ore-body it is unfortunate that no crosscutting was carried out from the workings.

In general it appears that the only part of the year's work that has a bearing upon the vital matter of proving up additional tonnage is that represented by the No. 2 tunnel development.

For the rest, the No. 1 tunnel resulted in the further opening-up of an ore-shoot whose limits were fairly well outlined already, the No. 3 tunnel was not at sufficient depth below the outcrop to afford much additional information about the ore-shoot that had been exposed previously on the surface, and the No. 4 tunnel workings were unproductive of any results.

It is to be understood that economic operation of this low-grade lead-zinc ore-body is dependent upon proof of tonnage that would justify operations on a requisite scale. The work was suspended in the month of September, and it is understood that operations will be resumed when provision can be made for hauling in heavy machinery, upon which satisfactory prosecution of development-work depends.

Homestake. No further work has been done upon this property, situated in the Adams Lake section, since suspension of operations in November, 1927. It is understood, however, that plans are in contemplation for the carrying-out of a programme of development looking to the blocking-out of ore of milling grade.

Elsie and White Swan. These mineral claims, situated on Adams plateau, were referred to in the Annual Report for 1927. An option was taken on the property by the Granby Consolidated Mining, Smelting, and Power Company, with the object of carrying out a programme of surface prospecting and diamond-drilling, and this work was done during the latter part of the season, including 694 feet of diamond-drilling, 3,420 feet of trenching, and 52 feet of drifting.

It is understood that the results of this work did not disclose anything that would warrant large-scale operations such as would interest the company, and that the option was relinquished. Neither the diamond-drilling nor the trenching-work can be regarded as conclusive, the investigations having been devoted to mere surface indications, and it is to be regretted that the results failed to afford encouragement for further work. The properties are not without promise.

Lincoln. This property was referred to in the Annual Report for 1927 under the name *Wallace*. The work of development inaugurated by William McAdam was continued and a drift was run along the strike of the ore-body for about 120 feet from a crosscut at a depth of about 100 feet below the outcrop. The results of this work were not held to be encouraging and the major operations were brought to a close, arrangements being made, however, for the parties interested in the property to carry out a certain amount of sinking-work. A winze was then sunk to a depth of about 40 feet below the level and has encountered about 4 feet of ore of a better grade than anything that was found above. This development is held to encourage further work on the property next year.

Mosquito King. A group of eight claims has been located by P. H. Bischoff, of Celista, on the Adams Lake plateau, at a distance of about 5 miles east from the *Elsie*. Two seams from which some good samples of lead-zinc-silver ore have been taken are exposed in a series of open-cuts. A sample taken from one of these seams assayed: Gold, trace; silver, 5.2 oz. to the ton; lead, 20 per cent.; zinc, trace.

Radio. This group of five claims has been located on Scotch creek, at a distance of about 10 miles from the road on the north side of Shuswap lake, by A. Gibson and associates, of Celista. High-grade silver-lead float has been found on the hillside flanking the creek on the east, and it is reported that a 9-foot lead with lead-zinc mineralization has now been uncovered in an open-cut.

Copper Cup. This property, situated on the divide between White lake and Shuswap lake, has been located by J. Rivers. A silicified zone traverses chlorite-schists of the Bastion formation in a north-west, south-east direction, and at several points small bodies of high-grade chalcopyrite are found associated with quartz-seams that cut the formation obliquely.

In several places the schist is found to be well mineralized. A tunnel is being driven by J. Rivers from a point about 175 feet below one of the best exposures on the surface, and in a distance of approximately 200 feet should provide valuable information in regard to the zone of mineralization.

Vimy. This mineral claim, owned by R. Pritchard, of Chase, adjoins the *Copper Cup* on the south-east. Surface workings indicate a mineralized zone in the schist in which silicification is more general, and mineralized seams with notable quantities of chalcopyrite occur. A short surface tunnel is being driven to crosscut the formation and prove the width of the mineral-zone. This is a prospect with some attraction and the results of the work that is being done upon it may have an important bearing upon the possibilities of the area in general. A sample taken from some of the best ore assayed: Gold, 0.01 oz. to the ton; silver, 0.40 oz. to the ton; copper, 14.4 per cent.

Grandview. This property is situated at a distance of about 4 miles north-west from the town of Grindrod and is reached by trail, about 1 mile in length, from a branch road leading from the auto-road between Grindrod and Salmon Arm. The group consists of eight mineral claims, as follows: *Hope, Blackbird, Big Ben, Tommy T., Golden Ledge, Golden Bar, Silver Lode, Silver Bell;* and is owned by E. R. Sutton, of Grindrod, and associates.

On the property there are two wide belts of quartzite that form prominent ridges rising to a height of about 600 feet above the valley, interbedded with a black argillite.

The general trend of the formation is north-south. Mineralization has followed movement that has resulted in the creation of zones of crushing in the quartzite and fractures through the argillites that have a general north-east, south-west direction. The extent of the mineralization, which is represented by gold and silver values associated with pyrite and galena, has not been determined, very little work having been done. A number of samples have been submitted for assay by the owners from time to time, but, with the exception of two selected from narrow seams in the argillite, these samples are understood to have yielded insignificant returns. Returns from samples taken at the time of inspection yielded negative results.

The principal work has been done on the steep face of the eastern belt of quartzite, at about 50 feet below the summit of the ridge, where a crossing zone of fracturing and crushing is exposed. The appearance of this zone, in which there has been considerable deposition of quartz, might afford some hope for big-scale operations on low-grade material, but this possibility is subject to proof of higher average values than have yet been encountered.

The opportunity is presented for doing a limited amount of work, in the first place, on a seam within this fracture-zone that is exposed in open-cut work and which may afford a critical example of the best values to be expected—at any rate, near surface. Should this work prove satisfactory, further development might be considered.

C.M.S.—A group of five claims was located during the year at the instance of the Consolidated Mining and Smelting Company by a party of prospectors in the mineral-bearing country lying to the north-west of Birch island.

Rainbow and O.K. The owners of these properties, situated on Berk creek, in the Barriere River section, did a considerable amount of tunnelling-work during the early part of the season. This work was devoted to exploring an horizon of the almost horizontal formation lying over the beds of heavy pyritic replacement that are exposed in the creek-bottom.

Some silver-lead-zinc mineral was found in the course of this work that encourages the view that at some horizon intermediate between the pyritic beds above mentioned and the extensive bodies of quartz carrying occasional pockets of high-grade silver-lead minerals that occur near the summit of the mountain, lead-zinc replacement of economic importance may be discovered.

The exploitation of this ground presents considerable difficulties to the individual prospector and it would appear that it is a matter for vertical diamond-drilling. The property is one that might be recommended to an organization in search of a field for exploration of this character.

Gold Hill. This property is situated on a mountain rising to an elevation of over 4,000 feet on the east side of Dunn lake, near Chu Chua, on the Canadian National Railway. The mineral claims are situated on the east and west slopes of a southerly ridge of the mountain. A variable gold content has been found at several points along

two zones of shearing in the greenstone formation of the hill. These zones are characterized by the development of a buff-coloured siliceous dolomite and can be traced easily over the surface wherever their outcrops are not obscured by overburden. The two zones are only approximately parallel to one another, the general direction being east and west, with a dip of about 56 per cent. to the north.

Although some high values have been found in spots encountered in some shallow workings on the No. 1 or south zone, the greater possibilities would appear to lie in connection with the No. 2 zone, which had been traced over the surface for a distance of about 1,500 feet and varies from 5 to 15 feet in width. This zone, which is highly silicified throughout, includes numerous seams and stringers of quartz. It was suggested early in the year that a number of short tunnels should be driven along the length of this zone with a view to obtaining an estimate in regard to average values near surface as a first step toward development. A local syndicate was formed for the purpose of carrying out this work, but the work was suspended before completion of the full programme. It is understood that the results obtained from the work so far completed were not highly encouraging.

White Rock.

This property is situated on the south side of the Barriere river at a distance of approximately 20 miles from the Canadian National Railway at Barriere. The mineral occurrences, in the form of quartz veins and stringers carrying silver-lead minerals, are found in a series of fractures, sympathetic to the main fault-zone that is identified with the valley of the Barriere river.

The formation is composed of a series of bands of limestone and schist, and the main series of fractures, which have a north-east, south-west strike, is developed principally in the limestone, cutting the formation almost at right angles.

Work upon this property has been confined to the development of the veins belonging to this major system of fracturing, and an exploratory crosscut tunnel was commenced during the year 1927 with a view to intersecting the system of veins.

Following further work during the current year, in the course of which an exposure of some promise was made in an open-cut on one of these veins, the above tunnel was abandoned in favour of a programme of crosscutting and drifting with a view to developing this vein at a depth of about 100 feet.

The open-cut work above referred to was a surface cut that exposed the foot-wall of the quartz vein to a depth of about 30 feet and over a length on the vein of about 10 feet at the bottom of the cut. The foot-wall thus exposed was plastered with kidneys of galena, more particularly towards the bottom of the cut.

At the time of inspection in the month of June last no attempt had been made to intersect the vein at this point, and it cannot therefore be stated whether the mineral exposed on the wall represented only a foot-wall scale or average composition of the whole vein, which at surface appeared to be about 4 feet wide.

The proposed crosscut and drift to explore this vein at a depth appeared to be entirely justified and could hardly fail to afford valuable information in regard to the ore-bearing possibilities of these vein occurrences.

The property therefore may be considered as a prospect that warrants fully the carrying-out of a limited amount of work, but the character of the fracturing is not one upon which continuity, either of veins themselves or of the mineralization, is to be counted upon without proof.

Silver Mineral.—Prospecting-work was continued on this group by the owner, H. Stephens, of Kamloops, and some bodies of a good-grade silver-lead ore were uncovered near the boundary between this property and the *White Rock* group.

Placer Gold.

The operations that have been in progress on Louis creek by the Noble Creek Mining and Development Company appear to have reached a stage when definite results may be anticipated. Progress has been retarded owing to a variety of causes, and the original plan of working up the creek from the point where operations were commenced two years ago, and where bed-rock is exposed, was abandoned in favour of commencing at a point about half a mile higher up, which was made accessible for hydraulicking-work by the flume and pipe-lines that had been installed already. Difficulty in reaching bed-rock from this point was encountered; but although this

set-back was only temporary, it is understood that it has now been decided to continue the flume so as to enable the original plan to be followed. This would appear to be the logical way to work the ground, the possibilities being considered to be in relation to the creek rather than to the bench leases.

Non-metallics.

Production from the gypsum-deposit at Falkland was continued and an amount of 31,145 tons was extracted by Canada Gypsum and Alabastine, Limited, and shipped to the factory at Port Mann.

CLINTON MINING DIVISION.

Taseko Lake (Whitewater) Section.

Mohawk, Motherlode, and Spokane. The prospecting and development work for which preparations were made during 1927 by the Consolidated Mining and Smelting Company of Canada, Limited, was put into operation during the year and good progress was made. On the *Mohawk* group, where previous surface workings had indicated a wide zone, previously described as a zone of shearing in granite in which gold values are associated with copper, a tunnel has been driven to intersect the ore-body at approximately 100 feet depth. The foot-wall of the ore-body, which occurs in what may be better described as a zonal area of crushing, fracturing, and shearing in the granite, was reached towards the latter part of the season and was penetrated to a distance of about 40 feet, when operations had to be discontinued owing to weather conditions. The total width of the zone appears to be about 70 feet and the ore that was encountered in the crosscut is fully as good in appearance as any discovered on the surface. Silicification and mineralization appear to be general and there are several seams of quartz with chalcopyrite. The economic value of the property depends upon the gold content. In this connection it may be said that a sample taken across a 20-inch seam across the face of the crosscut at the time of the inspection assayed: Gold, 0.1 oz. to the ton; silver, 0.02 oz. to the ton; copper, 2.5 per cent. The ore-body has a length on surface of about 500 feet.

On the *Spokane* group operations were confined to digging a series of shallow trenches with a view to determining the direction and extent of the mineral-zone. This property lies at an elevation of about 7,000 feet at the head of McLure creek. The occurrence also appears to conform to the description of a zonal area of fracturing and crushing in the granodiorite. This zone would appear to be lying in a north-east, south-west direction, dipping at a steep angle to the south-east, and is indicated on the surface to have a length of 250 feet and a width of 150 feet. A sample of material gathered at random from the several open-cuts assayed: Gold, 0.01 oz. to the ton; silver, 1.2 oz. to the ton; copper, 3 per cent. It is understood that considerably higher values have been obtained from this property. It is felt that the results obtained on the *Mohawk* group especially are encouraging, and it is probable that work will be resumed as soon as weather conditions permit.

Buzzer. This group of claims, covering a zone of mineralization that appears to be in all respects similar to that on the *Mohawk* group, has been located by E. J. Taylor, who has single-handed carried out a highly creditable amount of trenching and open-cut work. The zone was first located along the bank of the Taseko river where it has a width of about 120 feet and appears to lie in a direction parallel to the *Mohawk* zone. Trenching has exposed this zone on a low-lying bench to a distance of about 200 feet back from the river-bank. Above this point overburden and fallen timber on the steep hillside reaching up to the *Motherlode* and *Mohawk* properties makes prospecting difficult. The tracing of this zone up the hillside would be highly desirable, as development at the point where it is now exposed would be possible only by shaft-sinking and difficulties would be encountered in regard to water. Meanwhile the general similarity in appearance of the two occurrences is such that results to be obtained on the *Mohawk* ore-body may be expected to have considerable significance in regard to the economic value of the *Buzzer* zone.

The samples from the shallow open-cut workings on this property yielded no more than traces of gold and silver and a copper content of from 0.6 to 0.9 per cent.

Windfall.—E. J. Taylor did a considerable amount of open-cut work looking to the possible continuation of the *Windfall* ore-zone lying towards the south-west and in relation to the contact between the Denain formation and the underlying quartz diorite.

Big Slide. Situated on the bank of the Fraser river at Kelly creek, about 30 miles north of Lillooet, this property was the scene of active operations nearly fifty years ago, having been discovered in the year 1872. A chlorinating plant was erected in an abortive attempt to treat a gold-quartz ore carrying some pyrite from a 2-foot vein, upon which a considerable amount of tunnelling-work was done at three different levels.

More recently the claim was relocated by Smith Curtis, of Savona. During the current year the Big Slide Mining and Development Company, Limited, with a capital of $2,000,000, has been formed to acquire the original *Big Slide* (now called the *Plant*), together with several additional claims that have been located to cover the assumed extension of the *Big Slide* vein and adjoining country. A little open-cut work has been done, in which bodies of quartz from 1 to 2 feet wide have been exposed at certain points over a length of about 300 feet at a distance of approximately 3,000 feet from the *Big Slide* workings, and about midway between a similar quartz vein is exposed in a deep ravine. All of these occurrences appear to be more or less on the direct line of strike of the *Big Slide* vein, but it is to be noted that the granitic rock in which they occur is badly fractured, and it appears probable that the vein-matter represents occasional quartz-filling in this fracturing within a dominant zone rather than a continuous vein from which estimates of tonnage could be calculated.

The values, however, that are reported to have been obtained from these workings in the past are sufficiently encouraging to justify further exploration, but pending more satisfactory proof of continuity for the surface occurrences mentioned above, it would be desirable that such work should be carried out from the lowest level of the old workings. At the present time this tunnel is caved and as a first step it should be cleaned out and rendered accessible for examination.

A sample taken across 2 feet of quartz in the open-cut farthest removed from the old workings yielded negative results in gold and silver. From another small cut at a distance of about 150 feet a sample taken across 1 foot of quartz assayed: Gold, 0.10 oz. to the ton; silver, 0.2 oz. to the ton.

Clinton Hydraulic Mines, Ltd. This company, with headquarters in Vancouver, has been incorporated to operate bench leases situated below Kelly creek, on the east side of the Fraser river, where it is claimed that old channels of the river offer opportunities for hydraulic mining of large accumulations of gold-bearing gravel. The establishment of facts upon which any arguments might be presented in favour of the economic operation of this ground would depend upon the results of testing-work on a greater scale than has yet been attempted.

Placer Gold.

Some placer-mining by individual prospectors was carried on at Ward Bar and Watson Bar creeks.

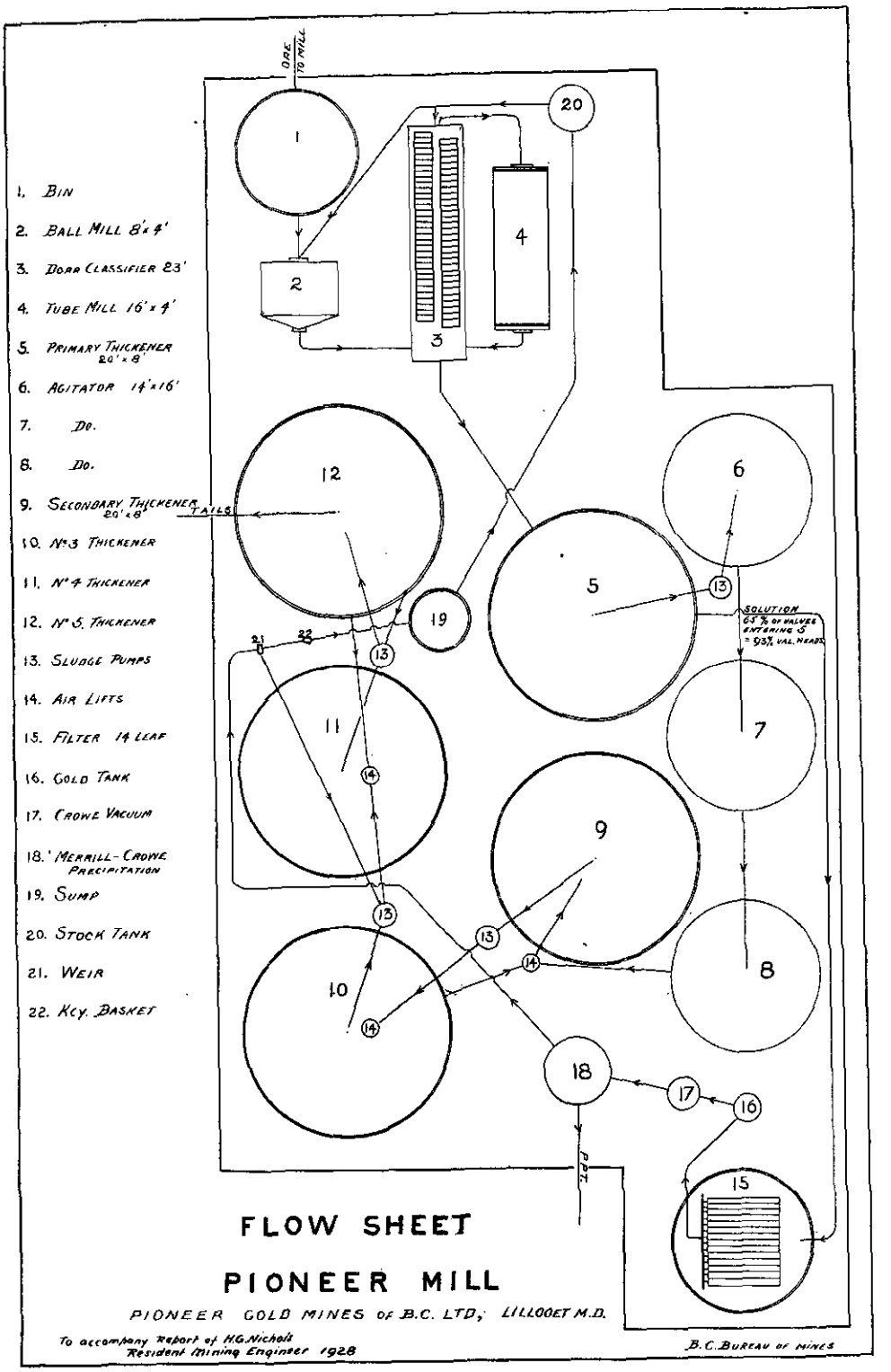
Non-metallics.

B.C. Refractories, Limited, mined and shipped nearly 100 tons of refractory clay from the deposit at Williams Lake. The production was limited by unfavourable conditions in regard to competition with imported material coming in from the United States free of duty.

Dominion Soda Producers, Ltd. This company, with head office in Vancouver, owns or controls under long lease twelve mineral claims covering shallow lakes in which deposits of sodium carbonate occur, north of Clinton, in the Clinton Mining Division. Two hundred and twenty tons of crude soda crystal was shipped during 1928 to local users and about 4,500 tons of the salt has been harvested with a view to production of soda-ash in a treatment plant that has been erected at Lloyd Station on the Pacific Great Eastern Railway. It is anticipated that this plant, which has a capacity of production of 15 tons of soda-ash from 45 tons of crystal a day, can be kept in continuous operation on further supplies to be drawn from these deposits. The company owns also another soda lake in the Ashcroft Mining Division, about 3½ miles south of Spences Bridge, and the erection of another plant in this locality is in contemplation.

LILLOOET MINING DIVISION.

Pioneer. The operations at this property during the year marked another distinct stage of progress. Development of the ore-body was retarded to some extent by difficulties encountered during the early part of the year in completing the requisite connections with the new shaft-workings to provide for the handling and transportation


1. Bin
2. Ball Mill 8'x4'
3. Dorr Classifier 23'
4. Tube Mill 16'x4'
5. Primary Thickener 20'x8'
6. Agitator 14'x16'
7. Do.
8. Do.
9. Secondary Thickener 20'x8'
10. No 3 Thickener
11. No 4 Thickener
12. No 5. Thickener
13. Sludge Pumps
14. Air Lifts
15. Filter 14 Leaf
16. Gold Tank
17. Crowe Vacuum
18. Merrill-Crowe Precipitation
19. Sump
20. Stock Tank
21. Weir
22. Key. Basket
ORE TO MILL
TAILS
SOLUTION
63 % OF VALVES ENTERING 5 = 93% VAL. HEADS
FLOW SHEET
PIONEER MILL
PIONEER GOLD MINES OF B.C. LTD., LILLOOET M.D.
To accompany Report of H.G. Nichols Resident Mining Engineer 1928
B.C. BUREAU OF MINES

of the crushed ore to the mill. For this purpose it was found necessary to drive a new adit-tunnel through heavy ground. The delay thus occasioned to the opening-up of fresh reserves reacted also upon milling progress and production, the mill being kept running to a large extent on accumulations of old tailing. These difficulties have now been overcome satisfactorily and the new shaft is in course of being sunk to the 1,000-foot level.

The development footage for 1928 amounted to a total of 1,420 feet, including 250 feet of shaft-sinking down to the 600-foot level, 570 feet of drifting on the 400- and 600-foot levels, 240 feet of crosscutting, and 360 feet of raising.

In the lateral development on the lowest level the vein was found to extend for 300 feet beyond the previous stoping limits, with a maximum width of over 8 feet.

A certain amount of prospecting-work was also carried on. A north crosscut that was driven for 150 feet from the 500-foot level intersected a small vein at a distance of 100 feet from the main vein and 60 feet of drifting-work was carried out. Although this vein carried some ore of good grade, it was considered to be too small to work at this point.

Another crosscut was driven north on the 400-foot level, which intersected a vein from 12 to 18 inches wide at a distance of 60 feet from the main vein; the ore was low grade. On the same level a south crosscut was driven from a point about 50 feet east of the new shaft, which intersected, at a distance of 30 feet from the main vein, a foot-wall vein carrying high-grade ore which ranged from 18 inches to 3 feet wide; 100 feet of drifting has been carried out on this vein, which may be looked upon as a potential factor of considerable importance in the increase of ore reserve.

In regard to development in depth in general it may be said that the grade of the ore is well maintained in the lower levels, and while the greater portion of the ore in the stopes already opened up between the 400- and 600-foot levels has been extracted already, additional reserves are indicated by the lateral development in virgin ground.

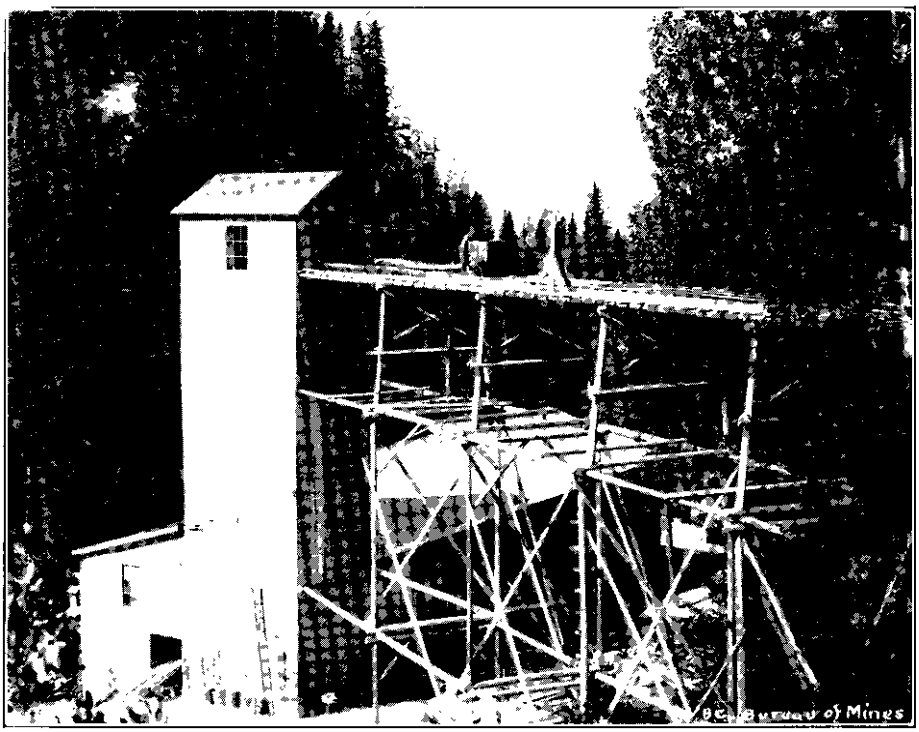
The new all-cyaniding treatment plant was put into commission in the early part of the year and pending completion of the works referred to above was utilized for the treatment of accumulated tailing, the old mill being kept in operation for the treatment of ore extracted through the old shaft. Upon completion of the hoisting and transportation arrangements from the new shaft-workings the old mill was permanently shut down, and from that time the new mill has been working on a mixture of ore from the mine and accumulated tailing, the average grade of the heads being $15.50 a ton. The old tailing had an average grade of $4.10 a ton and the resulting tailing from cyanidation averaged $1.10 a ton. The new plant was in operation for 205 days, for the first sixty-three days of which period it was treating tailing alone; 14,360 tons were milled, of which 10,690 tons was ore and the remainder tailing. The value of the bullion produced from the old mill during the year was $76,190.23 and that produced from the new plant was $84,186.70, and values in untreated slag precipitate and in solution at the end of the year amounted to approximately $10,000.

In addition to the items already mentioned, considerable improvements were made to the mine equipment, including a new assay office and refinery, a new office, sawmill, two new dwellings, and a school-house. The average number of men employed throughout the year was forty-eight.

The property is now held by Pioneer Gold Mines of B.C., Limited, an organization having a capital of $2,500,000, of which Colonel Victor Spencer, of Vancouver, is president; David Sloan, managing director and manager; other directors being General Duff Stewart, Dr. Boucher, Dr. Nicholson, Dr. Thompson, Mrs. A. H. Wallbridge, and A. C. Ball.

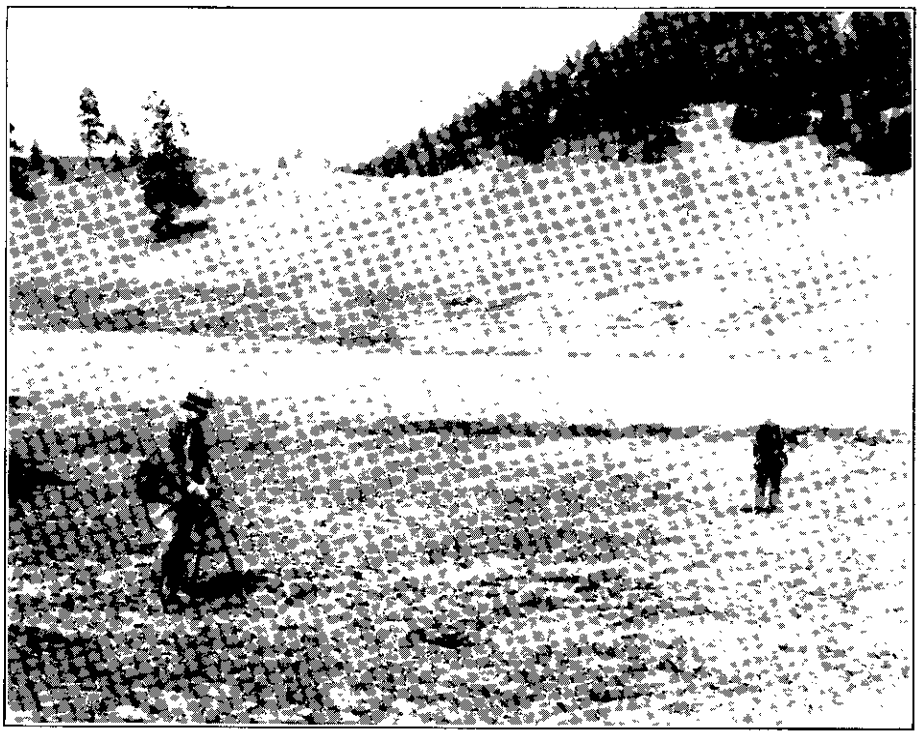
Lorne.

Operations on a big scale are being carried out on this property, which together with *Coronation* and several adjoining claims has been acquired by Lorne Gold Mines, Limited. This company now owns or has under option a total of about fifty claims, mostly Crown-granted and forming a continuous group for over 2 miles along the diorite stock which is the formation in which the valuable deposits in this locality occur. Relying largely upon the generally accepted geological diagnosis in regard to the persistence of the veins of this camp in depth, and upon the confirmation of this view afforded by the favourable results of the development on the adjoining *Pioneer* property, a programme of development has been outlined and is being actively prosecuted, having for its primary object the opening-up of the *Lorne* ore-bodies from a level that is approximately from 800 to 900 feet vertically below the surface workings, which represent the extent of previous development.

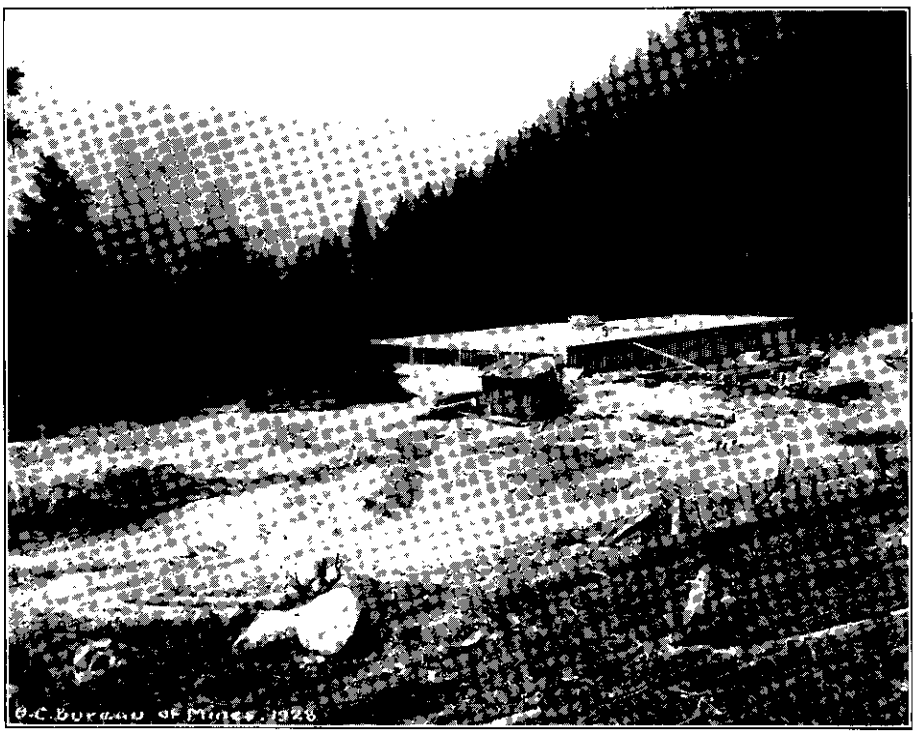


Pioneer Gold Mines of B.C., Ltd.—Mill, Lillooet M.D.

Pioneer Gold Mines of B.C., Ltd.—Tailings-dump, Lillooet M.D.

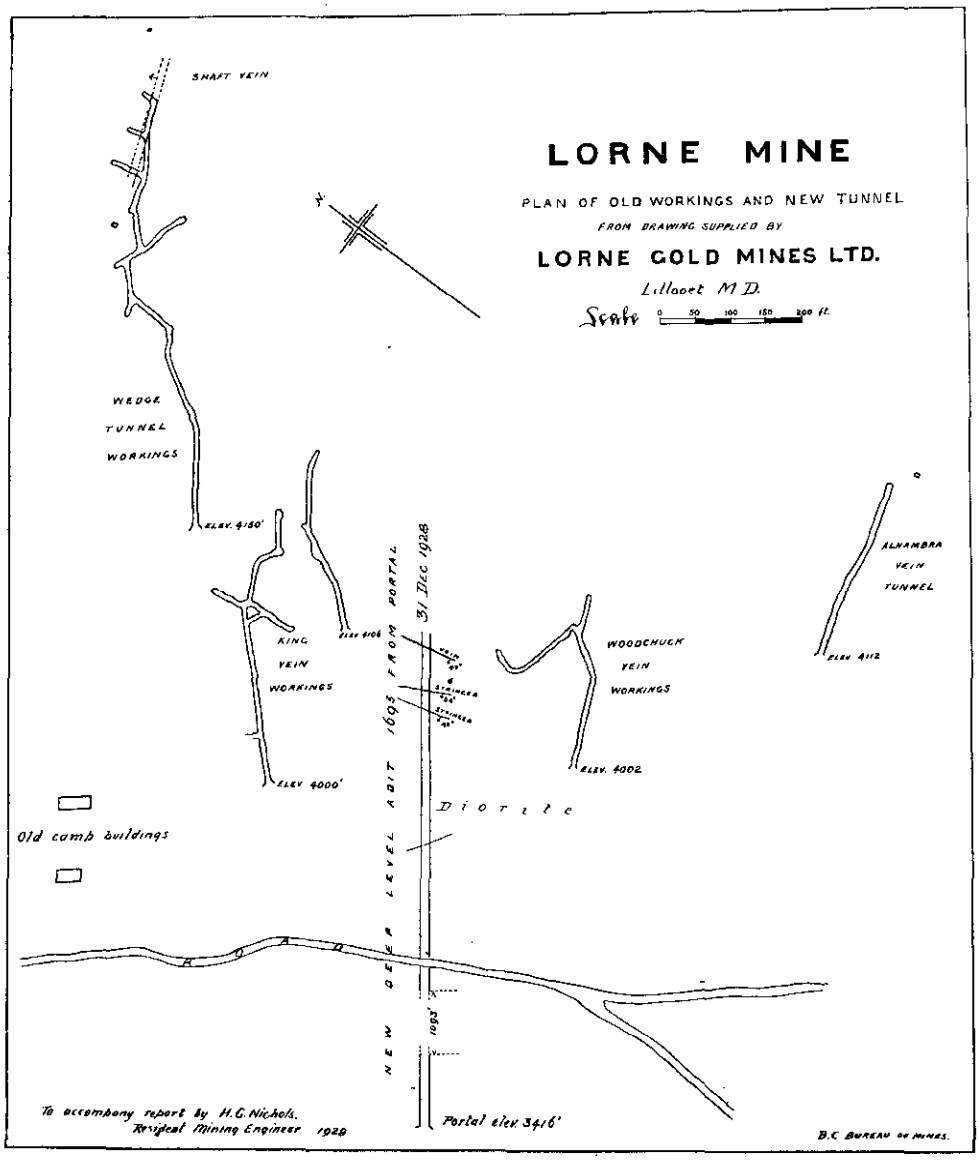


Electrical Prospecting near Stump Lake, Nicola M.D.



Lorne Gold Mines, Ltd.—Mess-house, Lillooet M.D.

The length of the tunnel required to reach the vein of principal attraction, which as exposed on the surface and in some crosscuts from old workings has a width up to 16 feet, is estimated to be something over 3,000 feet, of which distance 1,693 feet had been completed since the commencement of operations by the company in the month of May. A little more than 100 feet of this tunnelling-work was carried out by hand pending the installation of machinery, and the balance has been done during the last two or three months of the year, the present rate of progress being from 16 to 20 feet a day. This work represents a notable achievement and is



alike testimony to the engineering ability involved and to the determination of the sponsors of this enterprise to use every effort in the development of the property on a large scale.

A considerable expenditure has been made in the construction of roads, the erection of a sawmill and substantial camp buildings, and in the installation of power machinery involving ditches, flumes, and pipe-lines, the ultimate intention being to utilize the tunnel that is being driven as the main adit in the development of the veins that are known to exist at surface on adjoining claims.

The following notes dealing with the operations of the company have been supplied by the manager, E. P. Crawford:—

"*Surface Development.*—A small amount of trenching and sampling was done on the *Ida May* group, showing up a constant vein of good width averaging about 3 feet for over 500 feet. Values were interesting, but further work is necessary to prove the existence of regular ore-bodies. A comprehensive survey of all surface and underground workings has been made and samples taken of the exposed ore-bodies.

"*Underground Development.*—A crosscut was driven for about 700 feet to the north-east from the 200-foot level of the *Coronation* shaft, through the diorite, that exposed different veins with some encouraging values. The further development of this ground was postponed in order to concentrate all efforts upon the *Lorne* workings. Two or three veins have been intersected in the *Lorne* tunnel that have not been definitely correlated with any surface exposures. These veins have a strike of about N. 10° to 20° W., and dip from 45° to 60° to the west. One of these veins showed free gold.

"*Construction and Equipment.*—Several acres were cleared for camps and buildings; roads built to various parts of the property and to the main roads; temporary tent camps for summer work and permanent camps for winter work were constructed and will care for around 100 men. Store-rooms, dry-room, office and blacksmith, compressor-house, and four cottages for families and the staff were finished. A domestic water-supply was put into service and a water-power taken from Cadwallader creek, with a total head of about 320 feet, to run sawmill and compressors. This required cleaning out 1½ miles of old ditch with flumes to repair it, building a diversion-dam and headgate, and laying 2,000 feet of wooden pipe from 18 to 24 inches. The sawmill is unusually complete for this sort of operation and about 350 M. feet were cut before cold weather. An electric-lighting system was put in also.

"The underground equipment includes the usual air-drills and ventilation-pipe, a Nordberg-Butler Shuveloader or mechanical mucking-machine, and a storage-battery locomotive of 1½-ton capacity. The blacksmith-shop has oil-forge and compressed-air steel-sharpener. There is an automatic charging-set for the storage-batteries. The sawmill is driven by a water-wheel under 137 feet head and the compressors by a water-wheel under 185 feet head. As stand-by power for winter when the ditch freezes, a 60-horse-power Diesel engine drives a small compressor. The regular compressor equipment is two 500-foot machines, one new and the other one already on the property. The electric generator is driven in the winter by a 30-horse-power caterpillar tractor which is used in summer for many uses. A portable compressor, gasoline-driven, is used in winter to augment the power.

"*Men employed.*—The work started late in the spring and most of the season was used in preparatory work and construction. About sixty men on the average were employed, though at times it went to about ninety men, and at the end of the year, with construction over, it was about forty men."

Bridge River Consolidated Mines, Ltd.—This company, with a capital of $3,000,000, has been incorporated for the purpose of acquiring a number of properties, including the *40 Thieves* and adjoining claims lying to the north-west of the *Lorne*, on Cadwallader creek. It is understood that it is planned to make a survey of all the known mineral occurrences with a view to outlining a comprehensive scheme of development.

Wayside.—This property, to which reference was made in the Annual Report for 1927, was bonded during the latter part of the season on behalf of Vancouver interests, and it is understood that development-work will shortly be commenced.

Marion No. 2. Prospecting for cinnabar is said to have produced some encouraging results on this property, which is situated at an elevation of about 6,200 feet near the summit of the ridge between Pearson creek and Taylor creek, in the Bridge River section. Several knife-blade seams of cinnabar are found in the Bridge River schists, and according to C. E. Cartwright, of Vancouver, under whom the prospecting-work has been in progress, an area has now been located in which a body of ore of commercial size has been exposed in an excavation to a depth of about 25 feet. Seven samples taken over a length of 70 feet from the bottom of this excavation are stated to have yielded results on an assay averaging 9.5 per cent. mercury.

Mineral Mountain Mines, Ltd.—A camp was erected and about 200 feet of tunnelling-work was carried out on the property owned by this company and situated on the east side of

Anderson lake, near D'Arcy, on the Pacific Great Eastern Railway. This work failed to disclose ore of economic importance.

Copper Bear. The prospecting-work upon these claims, owned by T. Charleton, of Owl Creek, that was commenced by the Britannia Mining and Smelting Company, Limited, in 1927 was continued during the earlier part of the year. A number of open-cuts had exposed a narrow belt of limestone in contact with andesitic rocks carrying considerable quantities of chalcopyrite with magnetite, garnet, and epidote.

One hundred and twenty feet of drifting-work was done by the company, in the course of which some good ore was found, following which some prospecting by diamond-drilling was carried out. According to information supplied by the company, three holes were drilled with a total footage of 907 feet. These holes failed to reveal ore in sufficient quantity to be of interest to the company and the option was dropped.

Copper Queen. The following information is supplied by the Britannia Mining and Smelting Company, Limited, which took an option on these claims and carried out some prospecting-work during the year. The property consists of twenty-five mineral claims, running from the Pacific Great Eastern Railway at the Owl Creek hatchery, north, for 3 miles. The claims are owned by the Copper Queen Mining Company, Limited, of Vancouver.

An area of quartz diorite, in which are inclusions of tuffs, has been fractured and to some degree sheared along a north-south line which is now represented by the course of Owl creek. This fractured zone, 300 to 600 feet wide, is mineralized with iron and copper sulphides over a large area. The part of the zone above the level of Owl creek is leached with the development of parallel zones showing copper carbonates over width up to 60. (*See* Report of W. F. Robertson in 1916 Annual Report.)

The zone was first carefully prospected, the best mineralized section picked out, and then three diamond-drill holes put in, in order to ascertain the condition and value of the primary sulphide-zone. These holes showed up to 300 feet of low-grade copper mineralization, but not of a grade sufficiently high to be attractive to the Britannia Mining and Smelting Company, Limited.

Gold King. An option was secured upon this property, situated at the head of Tenquille creek, in the Pemberton area, late in the fall by C. P. Riel, of Vancouver, and associates. It is understood that prospecting by electrical methods, to be followed by a programme of diamond-drilling, is to be undertaken in 1929 as soon as weather conditions permit.

Eureka. This mineral claim, owned by J. K. Mackenzie, is located alongside the track of the Pacific Great Eastern Railway, about 2 miles above the station of Pemberton. Several small quartz-seams occur in a broken and foliated formation of volcanic and sedimentary rocks near the contact with a body of intrusive granite. Some scattered lead mineralization occurs in the quartz stringers, with traces of gold and silver, but no deposits of economic importance are indicated in the limited surface workings.

Placer Gold.

Placer-mining operations have been in progress and are in contemplation on Cayoosh creek, at the outlet of Seton lake, and on the Fraser river between Lillooet and Kelly creek. At the former site the Enterprise Mining Partnership has been doing serious work looking to the recovery of gold from the creek-bed. This project was described in the Annual Report for 1926. A deep channel has been cut diverting the stream through a tunnel cut in the bed-rock above a 300-foot fall. The results from washing the material excavated in this cut were not encouraging, and at the present time operations are devoted to ground-sluicing in the bed of the creek with anticipation of encountering better "pay" when bed-rock is reached.

ASHCROFT MINING DIVISION.

Apart from some prospecting in the Highland Valley area, there has been little activity in this Division.

The option that was held in the early part of the year on gold-quartz claims situated on Steyn creek was relinquished, it being found that, although there were large exposures of quartz, the gold content was very variable and not sufficiently well distributed to justify the plan of operation that had been projected.

Flint. An option has been taken by the Consolidated Mining and Smelting Company on this group covering chrome iron-ore deposits on Scottie creek that were referred to in last year's report. A gang of men has been set to work, and it is understood that shipments of ore for experimental purposes will be made without, at the present time, undertaking any serious development. The amount of ore to be mined in this way is about 60 tons.

Prospecting-work has been continued on claims situated near the head of Texas creek, where grey copper is found in narrow veins, and on the molybdenite properties situated in the same area.

Placer-mining operations on a small scale have been conducted at points on the Fraser river and tributary creeks.

VERNON MINING DIVISION.

St. Paul. Some high-grade silver-lead ore has been shipped from this property, situated on the north flank of Monashee mountain, by the St. Paul Mining Company, which has been carrying on development. The ore occurrence is found in a system of veins with siliceous gangue lying in an argillite formation close to the contact with a body of acid eruptive. The higher-grade ore—from which one sample assayed: Gold, 0.30 oz. to the ton; silver, 190 oz. to the ton; copper, 1.1 per cent.; lead, 8 per cent.; zinc, 2 per cent.—has been found in association with a basic differentiate of the eruptive rock in which much hornblende is developed. In the section of the vein where this high-grade ore is discovered a change of direction is noted on the under-side of an obliquely crossing fault-plane which was mistaken for a wall of the vein, a winze being sunk on it to a depth of about 20 feet.

The vein appears to extend towards the south-east, a 6-foot vein of quartz mineralized with pyrite being found in a crosscut tunnel at a distance of about 150 feet from the recent workings. The property is deserving of further development.

White Elephant. Preparations are being made to reopen this property by a company entitled Pre-Cambrian Mines, Limited. This occurrence attracted considerable attention some years ago on account of the discovery of some high-grade gold bismuth telluride in a body of quartz. The claim is situated at an elevation of about 2,500 feet above Okanagan lake on its west side near Ewing's Landing. The body of quartz, which measures on the surface about 60 by 50 feet, is surrounded by granitic rock. A shaft which is now full of water is said to extend to a depth of 90 feet, with a drift running 200 feet to the north-west. The material on the dump indicates that the quartz in the drift was mixed with country-rock and basic dyke-matter. Other features to be noted are the intense fracturing of the quartz-body and the alteration of granitic rock around its periphery.

Jumbo. On this claim, situated on the outskirts of Vernon, further surface work has been done by H. J. Blurton, of that city. Specimens carrying free gold have been found in a quartz-seam that occurs near the contact of a highly altered rock, that is probably of eruptive origin, with a black argillite. Recent work with the object of proving continuity of this seam indicates that the occurrence is more in the nature of a quartz-filling of an irregular system of fracturing developed in the tuff and dying away on the argillite side of the contact. Samples taken from the open-cut that was excavated during the current year indicate the erratic character of the mineralization; thus, a sample from a 2-inch seam, into which the quartz-body appears to peter out at the contact with the argillite, assayed: Gold, 2.70 oz. to the ton; silver, 0.3 oz. to the ton; while a sample taken across 20 inches near a spot where visible gold occurred in small quantities assayed: Gold, 0.08 oz. to the ton; silver, 1 oz. to the ton; and a third sample taken across 2 feet assayed: Gold, trace; silver, trace.

The vein occurs in flat-rolling country and the best means of prospecting would appear to be to sink on the vein where the best vein-matter is exposed in the open-cut, and, if it continues to a depth of about 80 feet, to drift at that level in both directions.

Ophir. This property, situated on the east side of the North arm of Okanagan lake at a distance of about 8 miles from Vernon, has been acquired by the Ophir Mining Company, with office in Seattle, Wash., from J. Taylor and C. Nelson, who purchased the claims from the original locators.

Five other claims have been located and are held on option. The work of crosscutting the mineralized shear-zone that had been commenced by the original locators was abandoned in favour of excavating a deep surface cut along the zone on its hanging-wall side, where the occurrence of a seam of zinc mineralization was thought to offer the opportunity to extract

ore of shipping grade. This hanging-wall seam is approximately 3 feet wide and a sample taken across it assayed: Gold, 0.06 oz. to the ton; silver, 2.4 oz. to the ton; copper, 1.6 per cent.; lead, 2 per cent.; zinc, 21 per cent.

While this material does not constitute shipping-ore, it may be considered as highly encouraging to the further development of this zone as a potential producer of ore of milling grade. The actual width of this silicified zone of shearing has not been determined, but it is more than 15 feet, and an encouraging feature is to be found in the presence of silicate of zinc in the less mineralized sections. The first step towards the development of this property should lie in the direction of making a deep surface cut across the zone with a view to determining the composite width of the mineralized seams in it. At a later stage development might be attacked from a point on the hillside at a vertical depth of about 200 feet below the open-cut, where good opportunity is presented for such work.

Mission Hill. A local (Vernon) syndicate has been formed to do a certain amount of development-work upon a prospect on the Vernon–Kelowna road at a distance of about 5 miles from Vernon. There is here exposed on the surface a body of quartz in diabase formation close to the contact with an intrusive body of granite. A tunnel is being driven below the road to intersect this body of quartz at a depth of about 50 feet in a distance of approximately 80 feet.

Several other exposures of quartz more or less paralleling the contact with the intrusive have been traced over the hill for a distance of about 6,000 feet. Some of this quartz is well pyritized, and in one open-cut in particular appears as a vein about 6 feet wide, but it is by no means sure that there is any continuity to these several occurrences, and it is more probable that they represent quartz-fillings of a series of disjointed fractures paralleling the intrusive contact. The limited amount of work above referred to, however, is justified.

Two samples from outcrops assayed: Gold, 0.02 oz. to the ton; silver, 5.1 oz. to the ton: and gold, trace; silver, 1.6 oz. to the ton.

NICOLA MINING DIVISION.

Planet Mines, Ltd. Underground development-work from the old *Star* shaft was resumed, the north and south drifts on the 200-foot level being extended to a further distance of over 100 feet in each direction and the shaft was continued down to the 300-foot level. Satisfactory results were obtained in all these headings, a good shoot of ore averaging 3 feet wide being opened up in the north drift, while for the last 60 feet of depth the shaft was in ore with an average width of about 4 feet. Average values of this ore-shoot are not yet determined, but a sample taken across a width of 3 feet 6 inches near the face of the north drift, 200-foot level, assayed: Gold, 1.70 oz. to the ton; silver, 8.5 oz. to the ton; lead, 8 per cent.; zinc, 3 per cent.

These developments indicate a greater degree of importance for the ore-body on this property than might have been estimated from the facts established previously, although it is recognized that pinching and swelling of these veins is a characteristic feature. A factor of greater encouragement in connection with the future prospects of this company is the acquisition of control by interests that are intimately identified with the operations of Planet Mines, Limited, of the adjoining claims on Mineral hill, embracing the properties known as the *Donohoe* mines; and with the evidence of intention to exploit these properties simultaneously with the development of the Planet Mines ore-body. A tunnel is now being driven which will intersect the Planet Mines ore-body at the 300-foot level, and it is understood that this tunnel is to be continued in order to tap the workings from the old *Joshua* shaft, thereby providing means of comprehensive development of the several ore-bodies of which the indications on the surface provide the text for the late Dr. Dawson's favourable forecast in regard to the establishment of a mining camp on Mineral hill.

A well-constructed flotation treatment plant with an estimated capacity of something over 100 tons a day is nearing completion, being sited in a favourable position below the portal of the aforementioned crosscut tunnel.

Stump Lake Mining Corporation.—This company, with offices in Vancouver, has been incorporated with a capital of $1,000,000 to acquire a group of claims situated on and beyond the east flank of Mineral hill. A survey was made of the whole property by electrical prospecting, employing the Schlumberger methods, and it is understood that some promising indications were obtained. Some shaft-sinking work has been initiated.

Mary Reynolds. This property, situated about 2 miles east of Stump lake and from which some high-grade silver ore was shipped a few years ago, was acquired by Primary Ore Mining Company, Limited, an organization with head office in Vancouver. The old shaft and tunnel workings were cleaned out for examination and some surface-prospecting work was done, the results from which were not held to be encouraging.

The ore occurrence on this property has been the subject of several examinations in the past and there is some divergence of opinion upon it. The prevailing country-rock is greenstone of the Nicola formation and sparsely mineralized quartz veins occur in a general north-south direction, with occasionally well-defined walls.

These veins are identified with a light-coloured zone in the greenstone that has an appearance akin to that of ferrodolomite-zones traversing similar formations elsewhere in the district, and the general relation of the fissures appears to indicate structural conditions pertaining to this particular zone rather than a vein-fissure system in the typical greenstone.

Microscopical examination of the material of this zone reveals primary constituents of feldspar and ferromagnesium minerals, with secondary products of quartz, limonite, sericite, and only small amounts of calcite. The development of this property to the extent to which it has been carried proves the mineralization to be erratic.

Aspen Grove.

Although no recent work has been carried on in this camp, it may be well to make mention of the wide distribution of low-grade copper mineralization that is identified with recent volcanic-flow rocks in this area. The camp was reported on by John D. Galloway in the Annual Report for 1913. For the greater part the mineralization is represented by sparse inclusions of native copper, chalcocite, chalcopyrite, and bornite in basalt and in fracture-planes in breccias and amygdaloids. Some zones of shearing are also developed in the underlying Nicola formation. Samples taken from the several claims range in content from silver *nil* to 22 oz. to the ton; copper, 0.2 per cent. to 22 per cent. Higher values may be found under favourable conditions and some shipments of native copper and chalcocite ore have been made in the past.

The mineralized zone covers an area of about 10 miles in length and from 1 to 2 miles wide, more or less paralleling the road between Merritt and Princeton and at a mean distance of approximately 18 miles from the former town. It is identified with a series of ridges reaching to an elevation of approximately 4,500 feet above sea-level that form a distinctive feature of the surrounding rolling upland country.

While no evidence of the outcrop of plutonic rocks, to which the mineralization might be related, has been found in the area, and, in general, it may be said that the mineralization is confined to recent effusives, there is some variety in the nature of its occurrence, as may be gathered from the following notes upon several of the mineral claims:—

Daisy. At the southern extremity of the zone. A shear-zone about 80 feet wide, as exposed in a tunnel and two open-cuts, in dacite or latite. A sample taken across 30 feet, showing fairly general distribution of oxidized copper mineral, assayed: Gold trace; silver, 0.1 oz. to the ton; copper, 0.8 per cent.

Vancouver and Victoria. About 2 miles north of *Daisy*, scattered mineralization in shear-zones in breccia-flow. Two shallow shafts and several open-cuts prove a length of about 350 feet on one zone; at a distance of approximately a quarter of a mile east from these workings a 4-foot zone of shearing with a north-east, south-west strike shows considerable oxidized mineralization where it crosses a band of crystalline limestone.

Tom Cat. In the southern section of the zone; bornite, hæmatite, and native copper occurring in fractures in a recent lava and flow breccia. An open-cut cross-cuts the zone for a distance of 100 feet, reaching to a depth of 15 feet at one point. A sample of the mineralized lava rock assayed 0.2 per cent. copper, while samples of the breccia taken from the deepest parts of the cut assayed 2.8 per cent. copper and 2.1 per cent. copper. There were no gold or silver values.

Portland. Adjoining the *Tom Cat* on the south. A considerable amount of work was done upon this claim many years ago, including the sinking of the shaft, now filled with water, and some drifting-work as well as open-cuts. About 200

tons of material lies on the dump showing a fair amount of mineralization, but this is mostly iron. The formation is recent flow-rock.

Bunker Hill. Located about 1¼ miles north and three-quarters of a mile east of the *Tom Cat;* a wide zone of crushing and shearing with scanty mineralization in a fresh lava formation with considerable development of epidote. It is possible that this mineral has been mistaken for copper. There is an open-cut tunnel and short winze on the property.

Boomerang. Situated east of the main zone. The flow-rocks have a blocky structure; there is considerable development of epidote and copper-stains in joint-planes. Two diamond-drill holes were put down to test this ground, with, it is understood, negative results.

Bluebird. On this claim, which lies in the northern section of the zone, there is an 8-inch seam with a north-east strike with a heavy content of oxidized copper mineral. A sample taken from this seam assayed: Gold, trace; silver 4 oz. to the ton; copper, 22 per cent.

Giant. Adjoining the *Bluebird* to the north-west. Mineralization occurs here as a replacement of the basalt formation as well as in seams and cross-fractures. Calcite, pyrite, and chalcopyrite are in evidence. A sample assayed: Gold, trace; silver, 0.4 oz. to the ton; copper 2 per cent.

Georgia.—This claim is located on the western side of the zone towards the north. There is a large open-cut and shaft. Copper carbonate and some native copper occur in a fractured andesite over a fairly wide area.

June Bug. Adjoining the *Georgia* towards the south. A shaft has been sunk on what appears to be a dyke of more recent origin than the surrounding flow-rock. Some mineralization is found in crossing seams and scattered through the country in general. A little farther to the east there is an exposure of amygdaloidal rock.

Cincinnatti. A 400-foot tunnel has been driven into the hill on this claim, lying on the eastern side of the zone in the northern section, where the formation is a fresh black lava. No mineralization of note was observed with the exception of a flat-dipping oxidized seam at the portal of the tunnel.

Copper Standard. A considerable amount of open-cutting and some shaft-sinking has been done upon this claim, situated in the north-west section of the zone, where quite extensive mineralization is found in a system of seams and fractures in the flow-rock. A general sample of the mineral in these seams assayed: Gold, 0.02 oz. to the ton; silver, 6 oz. to the ton; copper, 8.8 per cent.

Big Sioux. This property, in the northern extremity of the zone, appears to warrant further development. A shaft has been sunk on a 6-foot zone with an east-and-west strike, dipping to the north, in which considerable chalcocite mineral has been found. A sample from the dump assayed: Gold, trace; silver, 1.4 oz. to the ton; copper, 11 per cent. These workings have fallen in and cannot be examined. There has been no other attempt to open up this possible ore-deposit.

Golden Sovereign. This group of claims adjoins the *Big Sioux.* A considerable amount of native copper has been gathered from surface workings, and a shaft, from which some drifting is said to have been carried out, was sunk from a big open-cut where oxidized copper mineral is associated with two crossing systems of fracturing.

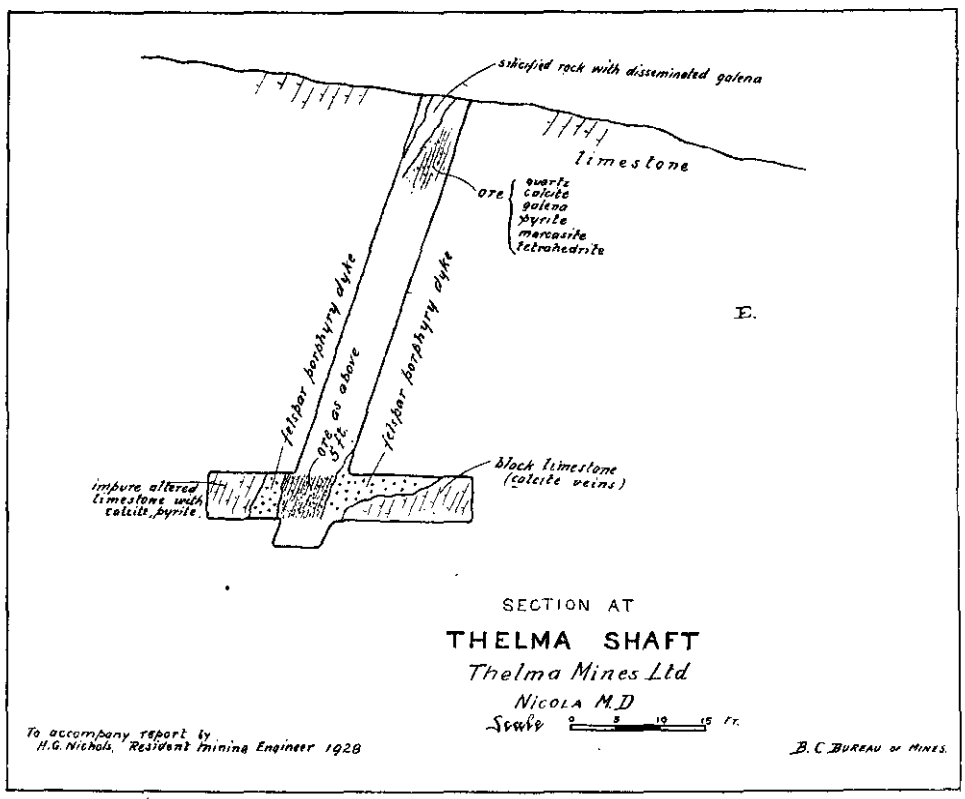
Aberdeen. This property was again reopened under the auspices of Aberdeen Mines, 1928, Limited (N.P.L.). The workings were unwatered and further development-work carried out. This latter work included the extension of the west drift on the 150-foot level for a further distance of about 100 feet and the commencement of a double-compartment shaft from the lowest or 200-foot level that had been driven previously.

The conditions of mineralization that had been found in the upper levels of the mine, from which ore of shipping grade had been extracted in past years, were not found to be repeated on the lower horizons, but as a speculative prospect the property is worthy of further exploration.

The mineralization at the lower horizons, largely represented by sporadic inclusions of native copper, is identified with a body of black rock that has all the appearance of a basic dyke material, but which under the microscope is found to consist of tourmaline-quartz and hæmatite and is therefore to be regarded as vein-matter.

Leadville. The shaft on this property, situated on Iron mountain near Nicola, to which reference was made in the Annual Report for 1927, was carried down on the vein to a depth of a little more than 100 feet, at which level a flat-dipping fault was encountered and the ore was lost. The vein was quite strong just above the fault and indications of drag are to be noted; it is thought that there should be no great difficulty in picking up the vein below the fault, but it is understood that work has been suspended pending investigations by electrical prospecting in the spring.

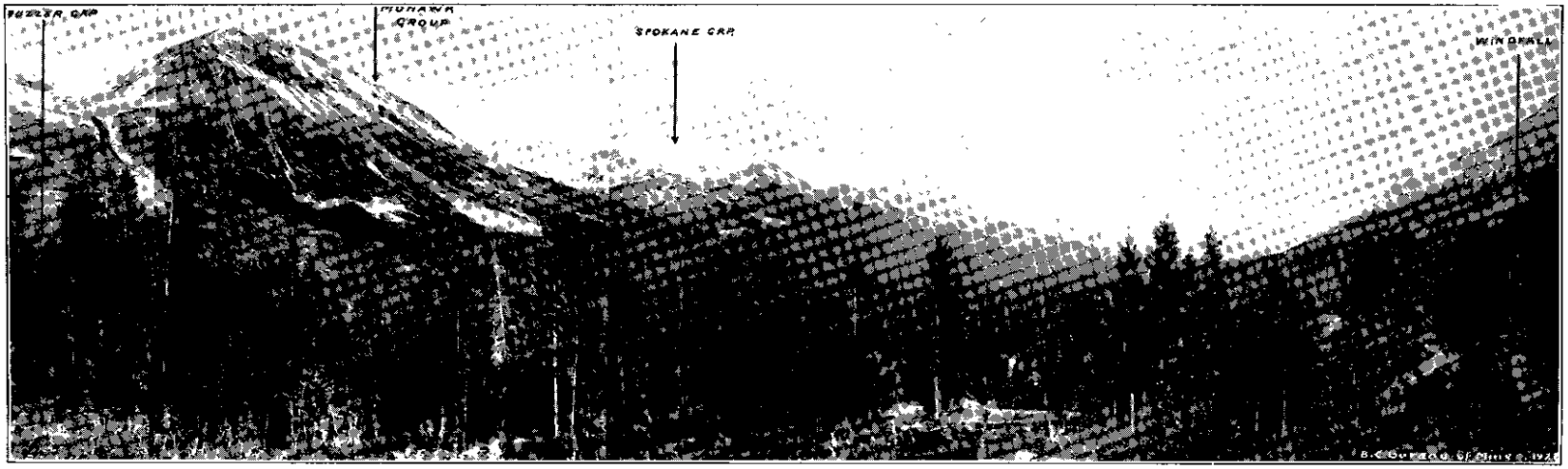
Thelma Mines, Ltd. This property is situated on Swakum mountain, one of the high points of the Nicola plateau, at an elevation of approximately 4,000 feet above the level of Nicola lake. It is reached by wagon-road from the main auto-road and railway at Nicola, in the Nicola Mining Division, the distance being 9 miles. The *Thelma* was held originally by O. Schmidt and partner, of Nicola, and it is understood that it was bonded to Thelma Mines, Limited, for the sum of $40,000, payable in six years, subject to



reductions in respect of 20 per cent. of net smelter returns on all ore shipped and monthly payments of $100.

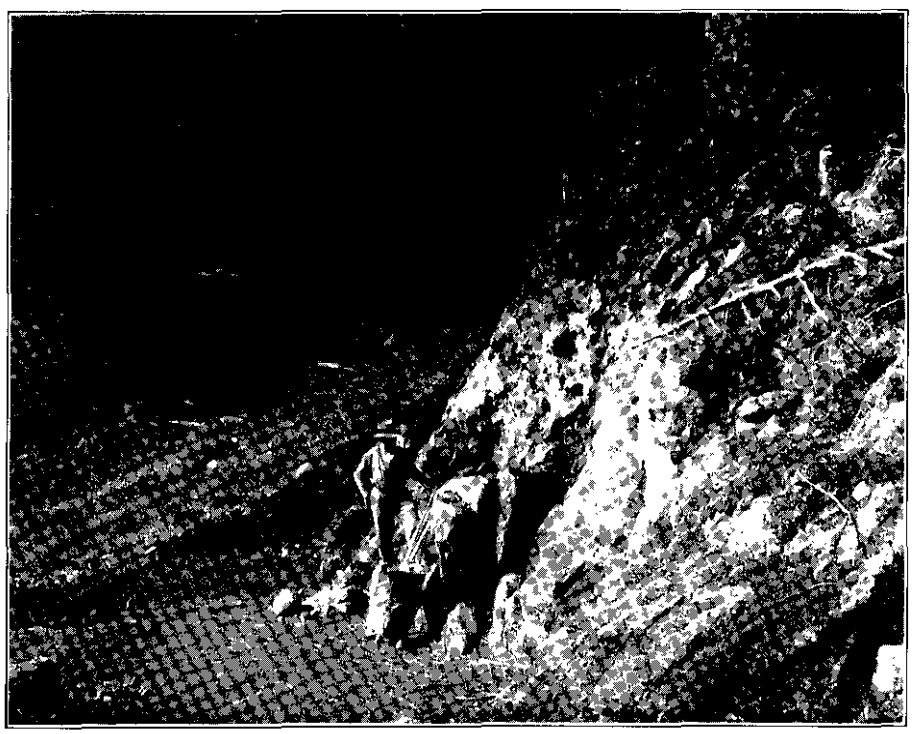
The ore is of the silver-lead-zinc type and occurs as a replacement in a series of beds of limestone lying in a north-south direction. The original work done by the locators consisted of some open-cutting and the sinking of a shaft to a depth of 65 feet. This work indicated a width of mineralized ground of more than 15 feet, in which some ore of shipping grade was found on the foot-wall or the east side. The original holdings of the company comprised three claims—*Thelma*, *Bernice*, and *Evelyn C.*—adjoining one another along the line of strike, the *Thelma* being at the south end; several additional claims have now been staked.

The principal workings carried out by Thelma Mines, Limited, are on the *Bernice* at a distance of about 300 feet north of the *Thelma* shaft, where a shaft was sunk to a stated depth of 61 feet, at which level 30 feet of crosscutting to the east and 70 feet of drifting to north and south are reported to have been driven.



Tuseko River Valley, Clinton M.D.

Aurum Mines, Ltd., Yale M.D.



Emory Creek Nickel Claims, Yale M.D.

A shipment of 31 tons of ore was made from these workings. This ore is reported to have come from two seams, 2 inches and 18 inches wide respectively, on both sides of the north drift. The intervening ground is said to be well mineralized.

At a distance of about 1,800 feet north of the *Thelma* shaft a crosscut tunnel was driven through a body of low-grade mineral and continued into the Nicola diabase. The mineralized ground near the portal of the tunnel is from 8 to 10 feet wide and lies on the hanging-wall or west side of the limestone, adjacent to a body of feldspar porphyry. A similar body of feldspar porphyry is associated with the ore occurrence on the *Thelma*.

Intermediate between the *Bernice* shaft and the tunnel above mentioned, one other open-cut, at a distance of approximately 1,500 feet north of the *Thelma* shaft, has exposed limestone, showing some mineralization, on the same line of strike.

Recent work on the property has been done on the *Thelma* and a further shipment of ore was made from open-cuts and a deep hole near the *Thelma* shaft. This work improves considerably the prospects for tonnage of milling-grade ore, upon which the merits of the property are to be considered.

In addition to this surface work, some crosscutting has been done from the bottom of the shaft, where 4 feet 6 inches of vein-matter has been exposed, from which a sample assayed: Gold, 0.04 oz. to the ton; silver, 95 oz. to the ton; lead, 8 per cent.; zinc, 1 per cent.

In general it may be said that the property represents a prospect of some attraction and calls for development along the lines of demonstrating continuity and tonnage rather than of attention to possibilities for taking out shipping-ore.

The noteworthy features are in connection with the extent of the mineralization in the limestone; the continuity of the limestone-beds in a north-south direction, although it is not proven that these form a continuous belt; and the association of the feldspar porphyry at points where mineralization is evidenced, although it is not thought that this rock is genetically related to it.

Good camp buildings have been erected on the *Bernice;* mine equipment includes a small compressor driven by a Petter engine and a 6-horse-power Fairbanks hoist. The work that has been done evidences a praiseworthy desire to explore the possibilities, and, subject to the remarks submitted above in regard to policy, the further development of the property is justified. Crosscutting in both directions and drifting north at a depth of 100 feet from the *Thelma* shaft is to be recommended in the first place.

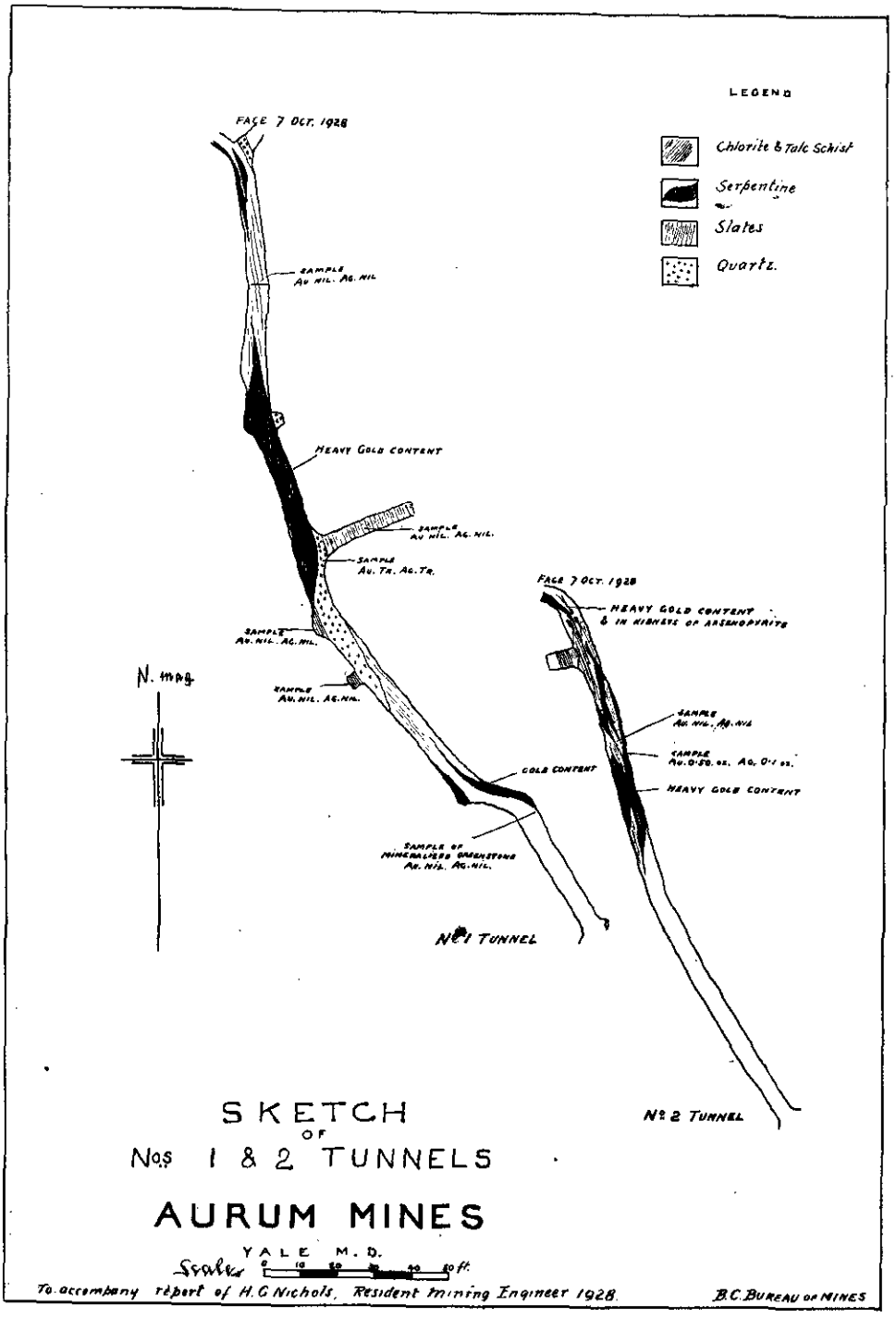
YALE MINING DIVISION.

Aurum.

A considerable amount of tunnelling-work has been done upon this property by the controlling company, Aurum Mines, Limited, with head office in Vancouver. In the course of this work, which has been carried out at three different horizons within a vertical range of about 450 feet, occurrences of high-grade ore carrying much free gold have been exposed.

The ore-deposition is related to bodies of serpentine which have been developed within a greenstone formation intruded by diorite, and, so far as these particular properties are concerned, appears to be identified with the contact between this formation and slates of the Ladner series on the east. Quartz seams and veins with variable gold content are found in the slate formation and a zone of silicification appears to follow the line of contact above mentioned. The presence of arsenopyrite is a notable feature, more especially in relation to the contact-zone. The serpentine and greenstone affords evidence of intense pressure, resulting in the development of a flaky structure in the serpentine and considerable widths of talc and chlorite schist.

With the exception of kidney-shaped bodies of heavy arsenopyrite with heavy gold content, all the ore so far developed in the tunnels is represented by flaky serpentine carrying free gold. Some beautiful specimens have been obtained and in the upper workings the seams have been followed for a considerable distance. It was unnecessary to sample this material as it was clearly of an exceptionally high grade and did not lend itself to sampling, but a series of nine samples were taken of the bodies of quartz, chlorite and talc schist, and slaty material impregnated with some iron mineral exposed in the tunnel-workings, from all of which values were reported to have been obtained. Negative results were obtained from all these samples. It is thus apparent that, in so far as the development of tonnage is concerned upon which an


LEGEND
Chlorite & Talc Schist
Serpentine
Slates
Quartz.
FACE 7 OCT. 1928
SAMPLE Au NIL. Ag. NIL
HEAVY GOLD CONTENT
SAMPLE Au NIL. Ag. NIL.
SAMPLE Au. Tr. Ag. Tr.
SAMPLE Au. NIL. Ag. NIL.
SAMPLE Au. NIL. Ag. NIL.
N. mag.
GOLD CONTENT
SAMPLE OF MINERALIZED SANDSTONE Au. NIL. Ag. NIL.
No 1 TUNNEL
FACE 7 OCT. 1928
HEAVY GOLD CONTENT & IN NIGHEST OF ARSENOPYRITE
SAMPLE Au. NIL. Ag. NIL
SAMPLE Au. 0·50 oz. Ag. 0·1 oz.
HEAVY GOLD CONTENT
No 2 TUNNEL
SKETCH OF Nos 1 & 2 TUNNELS
AURUM MINES
YALE M. D.
Scale 0 10 20 30 40 50 ft.
To accompany report of H. C. Nichols, Resident Mining Engineer 1928.
B.C. BUREAU OF MINES

estimate of commercial value, other than as perhaps a leasing proposition, might be based, the property is still to be considered as in a prospect stage.

A large amount of activity has been engendered in the area on account of the development of this property, and in particular a number of claims have been located covering what is held to be the western contact of the serpentine-belt along which occurrences of free gold have been found to occur. It is probable, however, that, as indicated above, the mineralization will be found to be identified with the peripheries of irregular-shaped bodies of serpentine rather than with a definite line of contact with a continuous serpentine-belt.

Aurum Mines, Limited, has also acquired the *Emancipation* property lying to the east. Some desultory tunnelling-work has been carried on recently upon this property, but from lack of technical guidance has been unproductive of results.

Pipe Stem. This property is located in the Ladner slate-belt on the divide between the Middle fork of Ladner creek and a branch of Siwash creek at an elevation of approximately 4,500 feet. Near the summit of this divide a number of auiferous quartz stringers are exposed in a restricted area where the slates are very much disturbed, and several attempts have been made to prove continuity by open-cut and shaft-workings and a circuitous tunnel. Some high values have been obtained from selected specimens.

A crosscut tunnel has been driven into the hill in a south-westerly direction from a point about 180 feet north-east of the surface workings and 100 feet below them, and some recent work has been done upon two highly silicified seams between well-defined and nearly vertical walls that were intersected at distances of 230 and 256 feet respectively from the portal. A short drift was carried on the first of these seams, which is 3 foot 6 inches wide and from which values have been reported. Samples taken across the full width and from the included quartz stringers failed to yield any returns in gold or silver.

Pride of Emory. The body of nickel-bearing pyrrhotite which occurs on the summit of the divide between Texas creek and Emory creek was sampled during the season. The property may be reached by a rough trail up the valley of Texas creek, which flows into the Fraser river from the west just below Choate Lodge; or by way of Emory creek, which presents the better opportunity for an even grade. By the first-named route the distance from the railway and highway is approximately 8¾ miles, and by the latter approximately 6¼ miles. The ore-body occurs on the western slope of a prominent bluff, about 1,200 feet above the basin at the head of Emory creek.

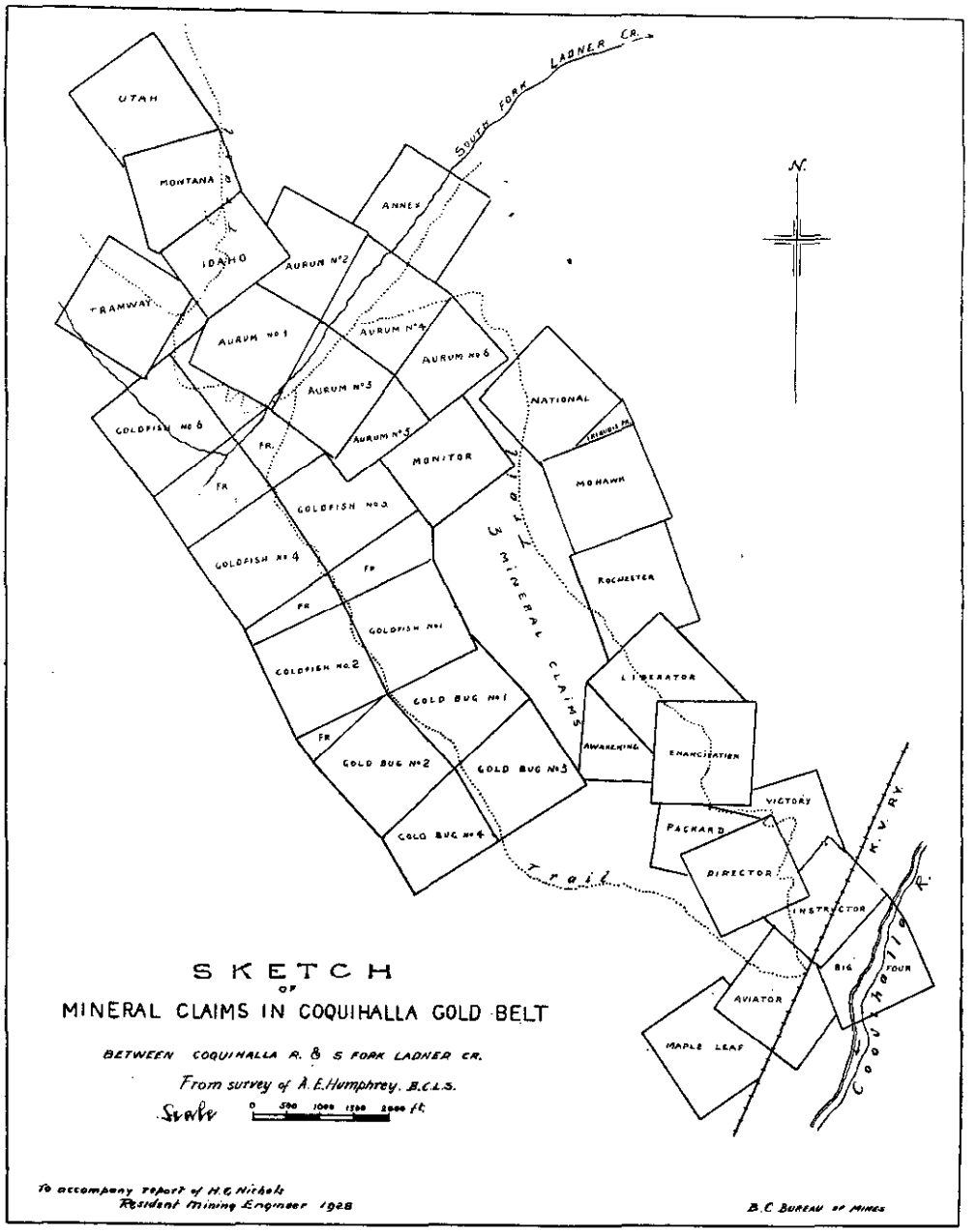
An open-cut has been made, exposing this body of ore over a width of 75 feet across the ridge, and of this total a width of 26 feet 6 inches was sampled, with results as follows: 6 feet on the eastern end of cut, nickel 2.82 per cent.; 14 feet centre of cut, nickel 2.66 per cent.; 6 feet 6 inches west end of cut, 2.82 per cent. A check sample taken from what appeared to be the best-looking ore assayed 2.66 per cent. nickel.

It would appear that the above-stated nickel content represents a fair average for this massive body of ore at surface and would appear to afford encouragement for its further exploitation.

Star of Emory.—This group of claims is situated on the same hillside as the above, and about 1,000 feet vertically below it, but slightly to the west of its line of strike. Heavily pyrrhotized strata are exposed in the bed of a South fork of Emory creek.

Independence.—The option held on this property by the Consolidated Mining and Smelting Company of Canada, Limited, was relinquished, but a considerable amount of further surface work was done by the owners with encouraging results.

Silver Daisy. This property in the 23-Mile camp on the Hope–Princeton trail was referred to in the 1927 Report. It has been acquired by Hope Consolidated Mines, a company with a capital of $500,000, with head office in Vancouver, and operations have been commenced with the primary object of making shipments of the high-grade silver ore exposed in the workings. The management of this company reports that during 1928 the two tunnels, in which the narrow vein which constitutes the principal occurrence of ore on the property so far as developed at present, were advanced a total of 90 feet, while 41 feet of tunnelling-work was done on three other veins occurring at distances of from 20 to 30 feet apart. In addition to this work, a trail has been constructed and two ore-sheds and a blacksmith-shop have been built. Seventeen men were employed during the latter part of the year.



Horsefly.

This group of claims has been located by Andrew Jensen, of Tulameen, and covers a mineralized zone that extends across the divide between the Tulameen river and Dewdney creek. This zone appears to represent an extension of the mineral area of Summit camp.

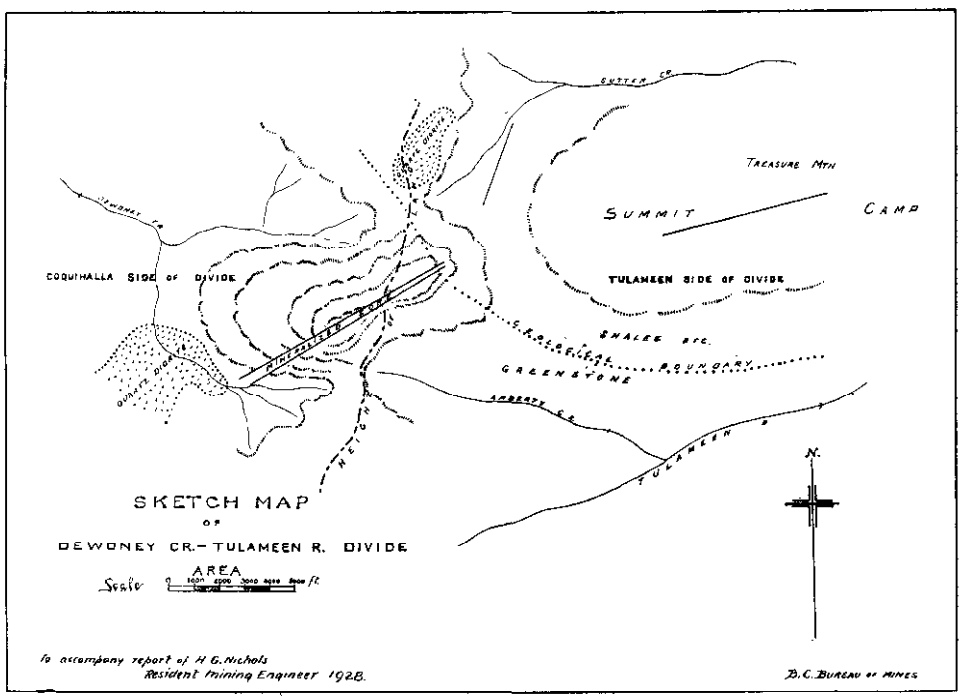
On both topographical and geological grounds this mining camp is to be subdivided into two sections. The mineral occurrences are found on both sides of the divide between the Tulameen and Coquihalla watersheds, and in two different formations, the contact between which passes through the centre of the camp. The significance of the latter condition appears to be of greater importance than is to be deducted from previous reports upon the camp.

Two different formations are respectively composed of argillites, etc., of Cretaceous age and greenstone, etc., belonging to the Dewdney series of rocks. The general trend of the mineral occurrences lies in an approximately north-east, south-west direction and cuts through the contact between the two aforesaid formations.

On the north side of this contact, in the Cretaceous rocks, the mineralization is chiefly confined to a system of fissuring, and ore occurs in concentrated form as lenses in the fissures. On the south side of the contact mineralization appears to be identified with zones of fracturing in the greenstone.

The greater amount of attention has been devoted in the past to the ore-deposits on the north side of the contact, and while this development has resulted in the proof of bodies of ore of shipping grade that might lend themselves to profitable leasing operations, no considerable bodies of ore of milling grade have been uncovered.

The character of the mineralization in the fracture-zones on the south side of the contact is more favourable to the development of larger bodies of milling-ore. A group of claims known



as the *Queen Bess* covers a fracture-zone in the greenstone, which is traceable from the aforementioned contact across the divide and down into a basin at the head of Dewdney creek, a distance of about 1½ miles.

At the north-east end of this zone, which appears to be in direct continuation of the series of fissuring in the Cretaceous rocks, it has a width of approximately 9 feet, including some seams of high-grade lead-silver mineral. Farther towards the south-west, and more particularly on the Yale side of the divide, this zone widens out to over 100 feet and is characterized by considerably greater amounts of pyrite and arsenopyrite than are found farther to the north-east.

The zone is heavily oxidized and contains a large amount of quartz. No development-work has been done in this section at depth, but the general appearance of the mineralization in the surface exposures encourages the view that ore on a commercial scale may be found at depth, although samples taken from the shallow surface cuts do not yield precious-metal content on assay. In this connection it is to be noted that exposures of the quartz-diorite intrusive, to which the mineralization of this area is understood to be related, are prominent features of this western section of the field.

It is believed that this wide silicified, mineralized, and oxidized fracture-zone in the greenstone, which is closely related to the quartz-diorite intrusions and is traceable over the divide into the Yale Division, offers attractive possibilities of response to development and may prove to be of greater economic importance than the more limited shoots of high-grade ore with which this camp has been identified in the past.

At the present time it is understood that a crosscut tunnel is to be driven to intersect the fracture-zone of the *Queen Bess* at a depth of about 150 feet below one of the most prominent outcrops towards the north-eastern end.

Should further work have satisfactory results in proving the existence of ore towards the south-west extremity of the fracture-zone on the *Horsefly*, the development of this occurrence would naturally be carried out from the Dewdney Creek side. For the present, however, it is believed that the most satisfactory method of attack would be by diamond-drilling near the apex of the divide and at points on the south-westerly slopes that could be reached from the Tulameen side by trail.

SOUTHERN MINERAL SURVEY DISTRICT (No. 4).

By Philip B. Freeland, Resident Mining Engineer.

INTRODUCTORY.

The Southern Mineral Survey District (No. 4), comprising four Mining Divisions—Grand Forks, Greenwood, Osoyoos, and Similkameen—is situated in the extreme south centre of the Province, and is bounded on the south by the International boundary-line, on the east by the height of land controlling western-flowing streams, on the north by the watershed of southern-flowing streams, and on the west by waters flowing east from the Coquihalla range of mountains.

Tonnage production figures again show an increase over the preceding year, due chiefly to the operations of the Granby Consolidated Mining, Smelting, and Power Company, Limited, at Copper mountain. The increase in the price of copper has stimulated prospecting for that metal and encouraged larger output from producing mines. The steady price of silver, lead, and zinc has helped the producing mines at Beaverdell, and the recent elimination of the zinc penalty by the Consolidated Mining and Smelting Company will have a livening effect on all producing mines containing that metal, because the cost of sorting will be reduced, if not entirely done away with, where the ore is mined carefully.

Prospecting was confined mainly to the older mineralized areas, with the result that many groups of Crown-granted claims were leased from the Government and an attempt made to clean out the workings and discover the reason why former owners closed down. With improved power, transportation, and metallurgical facilities in this district, this policy may be recommended and further production ensue.

It seems possible that most of the ore-bodies that outcropped and were accessible have been exploited to a great extent, but it must be remembered that the present ground-level is not necessarily the ore horizon, and consequently there may be plenty of profitable mineral-zones buried, especially near the older properties that have produced ore. The use of electrical prospecting methods may assist this situation where the Tertiary lavas, so extensive in this district, cover the ground and form a protective blanket over many older mineralized rocks. It is financially impossible for a prospector to develop regions that are covered either by lavas or deep soil without some means of determining first the approximate locality of mineral concentration.

The areas adjacent to Grand Forks, Greenwood, Camp McKinney, and Fairview have suffered from former mining booms and the depletion of some of the larger mining properties, with the result that very few mining companies or financial houses can be persuaded that there are still opportunities of finding mines in these regions. The outcrops of mineral are not generally attractive in value, and therefore in many instances have been condemned by examining engineers. A closer study of geological conditions, especially adjacent to the old mining areas and where the older rocks are covered, in conjunction with excellent transportation and power facilities, may be recommended.

The Hercules Consolidated Mining, Smelting, and Power Corporation has announced its intention of surveying by the Radiore process certain areas near Greenwood that appear to be favourable.

Grand Forks Mining Division.

The continued development of the *Union* at Franklin camp by the Hecla Mining Company was the outstanding feature in this Division. A permanent camp has been established and a thorough investigation of the property is taking place. Insufficient information has been obtained up to the present to warrant the installation of a concentrator, and nothing definite can be decided before, probably, the spring of 1929. There have been numerous fictitious reports regarding ore found in the lowest (No. 4) level, which are unfounded and only lead to dissatisfaction to all concerned.

The developments on different prospects by the owners all along the Granby river are beginning to show promise, and it seems likely that some attractive mineral-zones may be uncovered. Owing to the high tariff on fluorspar no shipments have been made from the *Rock Candy*.

The optioning of the old Granby smelter-site by the Hercules Mining, Smelting, and Power Corporation has excited a good deal of comment in the press and elsewhere, especially when the assay results of samples taken from the slag-pile were given to the public. The samples of slag assayed were apparently mostly from the old furnace-floor, where there was every chance of some values being spilled from either the converters or furnaces.

The samples taken near the surface, or of converter-slag or flue-dust, generally assayed high in precious metals as well as copper; the samples taken some distance away from the old furnace-site were comparatively low. The great mass of slag, granulated or solid, has not been thoroughly sampled and analysed, and until it is no reliable estimate can be made regarding its value. The main bulk of ore treated at the smelter was mined at Phoenix, and the mineral contents of the ore shipped varied from about 75 cents to $2 a ton in gold and 0.90 to 2 per cent. in copper. The Granby Company also paid dividends and financed the development and purchase of the *Hidden Creek* mine at Anyox, so that it can be readily seen that it is very unlikely that a large tonnage of slag will be found containing workable values. There is probably about 2,000 tons of flue-dust.

Greenwood Mining Division.

The continuous shipments of ore from the older operating mines on Wallace mountain and discoveries of high-grade silver ore on other properties has greatly encouraged those financing development-work in that section. The reopening of the *Providence* and, according to reports, the possible construction of a small mill to treat the dump-ore as well as mine-run has had a livening effect in mining circles at Greenwood.

Beyond cleaning out and sampling several of the older properties under the superintendence of R. Hedley, nothing has been done at Greenwood by the Hercules Mining, Smelting, and Power Corporation.

Osoyoos Mining Division.

In this Division the operation of the Hedley Gold Mining Company was the chief feature, coupled with the fact that the company has found sufficient ore to enable operations to be continued for some time.

Similkameen Mining Division.

This Division was by far the most active during the year and promises to continue in that position for some time to come. Princeton, Coalmont, and Tulameen hold enviable positions on the Kettle Valley Railway at the mouth of the upper Similkameen, Granite creek, and Tulameen River valleys respectively, and any of the many mine developments in those valleys will naturally create industry at the railway terminals. The distribution of wages from the Granby Company's mines and the coal-mines at Princeton and Coalmont materially assist the prospector, and there are several companies exploring the placer-ground of the Tulameen that help in a smaller way.

It is practically impossible to calculate the amount of platinum and gold taken from the placers, because it passes out of the country in so many different ways. It seems probable that the platinum from this district will continue to command the highest price on account of its iridium content.

Transportation Features.

The main trunk motor-road passes through Cascade, Grand Forks, Greenwood, Midway, Rock Creek, Bridesville, Osoyoos, Keremeos, Hedley, Princeton, Tulameen, and Merritt. Main branch roads fork from Cascade and traverse Christina lake and up McRae creek to Paulson and to the old *Inland Empire*, 4 miles beyond. A road from Grand Forks traversing the Granby river to Franklin camp, a distance of 48 miles, has been improved. Another road follows the Kettle river from Rock Creek to Christian valley, with a branch up the Westkettle river to Beaverdell and Carmi. The Camp McKinney road leaves the main thoroughfare between the Rock Creek crossings and goes direct to Oliver. From 2 miles beyond Osoyoos a road follows Osoyoos lake to Oliver and Penticton, with a branch from Fairview, which joins the Penticton road at Dog lake. There is another road from Penticton to Keremeos, with a branch running up to the *Nickel Plate* mine and another branch to White lake. Four roads branch from Princeton; one follows the Similkameen river for 12 miles, another goes up 1-Mile creek to Merritt, another up 5-Mile creek to Osprey lake, and the fourth follows Summers creek to Missoula lake. From Tulameen a new road has been built up the Tulameen river to Summit camp, a distance

of 21 miles, with trails in many directions. A narrow road follows the Hope trail for 13 miles beyond 9-Mile bridge.

The main trails traverse the country between the Edgewood–Vernon road, Lightning Peak camp, and Rendell creek. Another trail leaves Carmi and crosses the Kettle River divide into Penticton. Commencing at a point about 8 miles above Keremeos, an old wagon-road and trail follows the Ashnola river to the International boundary-line. The Dewdney trail leaves the wagon-road 9 miles south of Princeton and crosses the summit to Hope. Numerous trails branch from the wagon-roads and main trails and give access to nearly every part of the district. The West Kootenay Power and Light Company's line passes through the district from Cascade to Princeton and affords cheap power for mine operation.

In addition, the Kettle Valley Railway traverses the district between Farron, Grand Forks, Penticton, Summerland, Princeton, and Brookmere, with branch lines running from Grand Forks to Archibald, about 20 miles up the Granby river, and from Penticton to Oliver, about 22 miles down the Okanagan river. The old trails traversing the Pasayten river from its junction with the Similkameen river (Roche) to the International boundary-line and the trail up Chuwanten creek from its confluence with the Similkameen have been cut out by the Forestry Department. It is possible to take horses over the trail cut out this year between Cambie Creek bridge, at the junction of the Little Muddy creek and the Similkameen river (Cambie), and the Hope trail via the Nicomen Ridge trail. The trail is rough and there is a good deal of dead timber and it is necessary to pack a good axe. Another old trail between the South fork of Granite creek and the Hope trail was cut out. Another trail has been started up Thynne creek from the Otter Creek road near Tulameen by the Forestry Department. The trail running from the Lawless Creek road to the *Independence* on the Coquihalla has been cut out.

Special saddle- and pack-horse outfits can be obtained from Geo. Allison & Co. at Princeton. This syndicate caters to this class of work and knows the country thoroughly.

List of Reports on District.

In the following table a list of reports on parts of this district is given:—

Name of Author.	Publication.	Description.	Year.	Page.
R. W. Brock	Geological Survey of Canada	Boundary District	1901	49A
R. W. Brock	Geological Survey of Canada	Boundary District	1902–3	92A
R. A. A. Johnston	Geological Survey of Canada	Aspen Grove	1904	74A
Chas. Camsell	Geological Survey of Canada	Princeton	1907	.....
Chas. Camsell	Geological Survey of Canada	Hedley	1910	.....
Chas. Camsell	Geological Survey of Canada	Summary Report	1912	211
O. E. LeRoy	Geological Survey of Canada	Phoenix	1912	.....
R. A. Daly	Geological Survey of Canada	49th Parallel	1912	2 vols.
O. E. LeRoy	Geological Survey of Canada	Mother Lode	1913	.....
J. D. Galloway	Minister of Mines' Report	.....	1913	140–171
J. D. Galloway	Minister of Mines' Report	.....	1914	336–357
Leopold Reinecke	Geological Survey of Canada	Beaverdell	1915	.....
D. B. Dowling	Geological Survey of Canada	Coal	1915	255–261
C. W. Drysdale	Geological Survey of Canada	Franklin Camp	1915	.....
J. D. Galloway	Minister of Mines' Report	.....	1915	182–202
W. M. Brewer	Minister of Mines' Report	.....	1915	205
W. M. Brewer	Minister of Mines' Report	.....	1915	235
Munition Resources Com., Mines Branch, Ottawa	.....	Platinum	1920	134, 147
C. E. Cairnes	Geological Survey of Canada	Summary Report, Part A	1922	88
Eugene Poitevin	Geological Survey of Canada	Summary Report, Part A	1923	84
C. E. Cairnes	Geological Survey of Canada	Summary Report, Part A	1923	46
Philip B. Freeland	Minister of Mines' Report	Annual Reports	1917–28	.....

Topographical maps covering part of the district can be obtained from the Surveyor-General, Parliament Buildings, Victoria, B.C. A list of these follows: Nos. 8 T 277, 3 T 277, 3 T 220, 7 T 263, 25 L 21, and Princeton-Tulameen area not numbered, all by G. J. Jackson; Nos. 21 L 21, 7 L 1, 2 T 128, 1 T 241, 22 L 21, and Brookmere-Summers Creek area not numbered, all by R. D. McCaw. These maps will be found very useful to any one prospecting the areas included.

PROSPECTING.

A repetition of the likely country for prospecting which was incorporated in the 1927 Annual Report is appended.

Grand Forks Mining Division.—In the Paulson section gold, silver, and lead are found with occurrences of platinum associated with pyrite in the Burnt basin. This is an old mining district, but is worthy of more intense prospecting and perhaps closer examination of some of the semi-developed mines.

In the Cascade area the dunite rocks contain chromite which has been only partially developed.

In the vicinity of the Granby river (North fork of Kettle river) there are several prospects of silver, lead, zinc, and copper, whilst at Franklin camp the gold and copper ores command attention, especially in the pyroxenite rocks, which contain a good percentage of platinum where the copper sulphides are massive.

At the headwaters of the Granby river, named Lightning Peak camp, the silver-lead deposits are worthy of development.

A belt of serpentinized dunite rocks occurs at intervals between Grand Forks and Phoenix, and a certain amount of platinum is associated with the copper ores found near the contact of these rocks and the sedimentaries.

Greenwood Mining Division.—Further intensive prospecting and development of some of the old silver-lead mines near Greenwood is warranted, as well as a closer study of the copper occurrences at Copper camp beyond Deadwood and to the north.

Between Rock creek and Bridesville there are silver-lead deposits which have merit, and if the market price justifies it the chromite prospects in the same belt might be developed successfully.

The silver-lead deposits on Wallace mountain at Beaverdell need no advertising.

The country north and east, lying between the Kettle river and Westkettle river, is worthy of closer study, especially along the contacts of the quartz monzonite and in the quartz diorite; also the gold-bearing arsenopyrite on Horseshoe mountain, which is now being developed.

Osoyoos Mining Division.—The belt of schistose rocks predominating north of Osoyoos lake and between the Okanagan and Similkameen rivers contains many gold-bearing quartz veins which might be prospected.

The whole section of country lying within the curve of the Similkameen river between Princeton and Similkameen Station and north of the International boundary has not been thoroughly prospected. The geology of the part of the country reported upon by R. A. Daly in his 49th parallel survey is sufficiently interesting to be followed up by closer inspection, especially on the contacts of the sedimentaries and igneous rocks. Native arsenic, tungsten, and strontianite have been found in the vicinity of the Ashnola river, which drains this part of the country to the north.

Similkameen Mining Division.—A continuation of the last-named area extends west as far as the Coquihalla and has been reported upon in sections by C. E. Cairnes, of the Geological Survey of Canada, Summary Report, 1922, Part A. Prospects of coal, silver-lead, and zinc have been found east and south of the Similkameen and Pasayten rivers. The belt of pyroxenite and peridotite rocks extends from Olivine mountain on the Tulameen river in a south-easterly direction to the International boundary, and along the contact of these rocks in the weathered zones good prospects of platinum have been panned. Transportation facilities throughout the district are good and a great assistance to prospecting.

In addition to this, the demand for chromite is greater and the dunite rocks mentioned are especially attractive for finding this mineral. Undeveloped prospects of chromite occur about 3 miles north of Rock Creek village on the Westbridge road. Prices of this mineral are quoted at $22.50 a long ton for 45 to 50 per cent. Cr_2O_3. In the area adjacent to the Similkameen river, Whipsaw creek, and especially near the junction of the Similkameen and Pasayten rivers, the schistose rocks are worth investigating for their copper, lead, zinc, and gold contents. On the falls of Coldwater creek, flowing into the Similkameen (Cambie) river from the south about 6 miles from its source, the pyroxenite rocks invade the sedimentaries and are worth exploring.

Road and Trail Construction.

Much assistance was given towards roads and trails by the Department of Mines to operating companies, syndicates, and prospectors, providing the prospect of future development warranted it. Further requests were received from operating mines and others to keep the snow ploughed off the roads, and this request has been fulfilled to a great extent.

Many thanks are due to all mine operators and prospectors whose claims were visited, for their kindness and hospitality.

Production.

The following table shows the production of No. 4 District:—

Division.	Ore.	Gold.	Silver.	Copper.	Lead.
	Tons.	Oz.	Oz.	Lb.	Lb.
Grand Forks	15	.....	1,059	.....	5,206
Greenwood	2,711	134	386,957	5,000	175,898
Osoyoos	45,437	11,843	3,148	528	1,645
Similkameen	889,020	5,265	150,757	21,384,228	.....
Totals, 1928	937,183	17,242	541,921	21,389,756	182,749
Totals, 1927	805,724	16,997	659,387	17,726,201	297,659

Division.	Zinc.	Arsenic.	Coal.	Limestone.	Brick.
	Lb.	Tons.	Tons.	Tons.	$
Grand Forks	.....	.....	.....	25,329	14,000*
Greenwood	6,366	.....	.....	.....	.....
Osoyoos	.....	659	.....	462	.....
Similkameen	.....	.....	201,332	.....	.....
Totals, 1928	6,366	659	201,332	25,791	14,000
Totals, 1927	79,128	666	170,347	34,829	13,693

* Estimated.

GRAND FORKS MINING DIVISION.

Paulson Section.

No work, other than assessment, was done on the east side of Paulson during the year. Several years ago the quartz veins in syenite on the *Berlin* and *Alice L.* and also on the *Inland Empire* attracted a good deal of attention. The *Alice L.* was mentioned in the 1923 Annual Report and a section map of the main workings included. Since that time practically nothing has been done, owing chiefly to a lack of money and the inability of the owners to agree on the terms of a bond.

Some attractive silver-lead ore carrying gold was shipped from the *Berlin-Alice L.* workings. A close study of the faulting system and the advisability of driving a lower tunnel to tap and drain the shaft sunk in the main tunnel is worth consideration. These veins undoubtedly go to depth. A good wagon-road has been built from Paulson Station on the Canadian Pacific Railway to the mine and there is accommodation for about twelve men in the old *Inland Empire* buildings.

Molly Gibson. This group, situated about 4 miles south-west of Paulson, consists of the *Irish Nellie*, *Grey Eagle*, *Manchuria*, *Molly Gibson Fraction*, *Elvago*, and *Golden West* claims, and is owned by the Molly Gibson Burnt Basin Mining Company, of Rossland, with a capitalization of 1,000,000 shares, par value $1, of which 520,000 shares have been issued. Practically all the work has been done on the *Molly Gibson Fraction*, near the top of the hill on the east and west slopes, and consists of numerous open-cuts over a distance of about 1,500 feet, an inclined shaft 40 feet deep, an open-cut and tunnel about 75 feet long, and a crosscut tunnel 200 feet long and 80 feet below the collar of the shaft. The older rocks in this area are limestones, argillites, and greenstones, the latter having the greatest areal distribution. In the vicinity of the workings the limestone is intruded by porphyry dykes and generally replaced by silica carrying pyrite and pyrrhotite containing values in gold and silver.

In the shaft the ore-zone is about 8 feet wide and assays from 0.10 to 0.70 oz. in gold to the ton, with traces of silver. From 1908 to 1911 some ore mined from the surface was rawhided to Coryell Station on the Canadian Pacific Railway and shipped to the Trail smelter. The shipment averaged $17.50 in gold to the ton. The width of the ore-zone, apparently extending through the mountain, has not been ascertained, but open-cuts and trenching on mineral-outcrops prove its continuity for about 1,500 feet in length and about 25 feet in width. Owing to the hardness of the siliceous limestone and the lack of machinery, development naturally has been slow.

Halifax. This group of claims, reported upon in the 1927 Annual Report, was worked by George and Henry Jackson, of Paulson, and a crosscut tunnel driven 110 feet in length and 40 feet below the upper open-cuts. A highly siliceous downward extension of part of the ore-zone found in the main crosscut was discovered, but the values were low in silver, lead, and zinc. It is probable that the continuation of this crosscut will definitely ascertain the value of this deposit at that point. Exploration in the limestone farther away from the diorite-contact seems to be advisable, in hopes that a higher ore horizon may be discovered.

Lost Mine. This claim, owned by Fred O. Frisk, of Cascade, is situated on the East fork of Sanders creek, north of Christina lake, and about 8 miles west of Farron Station on the Canadian Pacific Railway. Some very well-mineralized rock was brought in by the owner, some of which was pyroxenite impregnated with pyrite, and the rest a highly altered siliceous limestone containing about 14 per cent. zinc. There was no platinum in the pyroxenite. Many years ago some very high-grade copper ore was found in this area but the exact location, since the discoverer died, has not been found. The country-rocks of the area consist mainly of greenstone and highly altered limestones intruded by porphyry dykes and should prove attractive to prospectors.

Hercules Consolidated Mining, Smelting, and Power Corporation, Ltd.

This company has taken an option on the Granby Company's old smelter-site at Grand Forks for one year, with the option of renewal, providing certain developments are carried out. The lease is for twenty years, renewable by the company for a further twenty years and an additional ten years. The lease includes the old smelter-site, all office buildings, the slag-dump, water and water-power available from Smelter lake and that part of the Granby river over which the city of Grand Forks possesses rights. It also includes easements for certain property on the opposite side of the river from the smelter, within the city limits, and 435 unoccupied lots in Columbia townsite at $1 a lot, subject to taxation.

According to R. Crowe-Swords, director, the old slag-dump will be thoroughly sampled to see if certain parts of it contain a sufficient metal content to pay for re-treatment, possibly in connection with the treatment of ores from properties acquired by the company. The plans of the company include the testing of these properties in the hope of developing tonnages of ore. Samples of slag taken recently from the furnace-floor assayed well in gold and copper, but no doubt this slag came from the converters and not the blast-furnaces.

Fife-Cascade Section.

The limestone-quarries at Fife were mined by the Consolidated Mining and Smelting Company during the year and the rock shipped to Trail for fluxing purposes. The chromite-deposits on the *Mastodon*, near Cascade, were not worked in 1928.

This section, covered by the report on the "North American Cordillera, 49th Parallel," by R. Daly, Memoir No. 38, is a very interesting one geologically and worthy of intensive prospecting, especially on account of railway transportation and electric-power facilities.

Granby River Section.

Seattle and Loyal Canadian. These claims, owned by Robert Clark, of Grand Forks, are situated about 7 miles up the Granby river on the west side. Work done recently amounted to 21 feet of drifting on the ore-zone in the lower tunnel. A sample of this ore assayed: Gold, trace; silver, 0.20 oz. to the ton; copper, 0.3 per cent. In the older workings above and to the north better-grade ore was found. The country-rocks on these claims are chiefly greenstones and limestones intruded by porphyry dykes. About 1 mile to the north the granodiorite batholith outcrops. Segregations of copper carbonates occur in the

fractures of the limestone between the old workings and the Canadian Pacific Railway above. Further prospecting and development along the limestone-contact seems to be warranted.

Clara Charlotte Mining Co., Ltd. This company, formed in Washington, U.S.A., has been developing the *Black Tail*, situated about 12 miles north of Grand Forks, on the Canadian Pacific Railway. In 1903 this claim was prospected by George W. House, of Eholt, the owner, and a Crown grant taken out. Numerous open-cuts, stripping, and a 40-foot tunnel driven along the contact of a porphyry dyke and the greenstone uncovered segregations of pyrite, pyrrhotite, and sphalerite in a gangue of quartz and siliceous country-rock. A picked sample of the massive ore from the upper tunnel assayed: Gold, *nil;* silver, *nil;* copper, *nil;* zinc, 2 per cent.

At the present time a tunnel is being driven about 300 feet in elevation (barometric) below the upper workings and had reached a point about 130 feet from the portal on October 15th. The contact of what appears to be an offshoot from the main porphyry dyke and the greenstone was struck 15 feet from the face of this tunnel. Both the porphyry and the greenstone were mineralized, chiefly with pyrite, along the contact. A general sample of this mineralized zone *from the porphyry-contact to the face of the tunnel in the greenstone assayed: Gold, trace;* silver, 0.20 oz. to the ton; copper, *nil.* A picked sample of the more highly mineralized rock assayed a trace in gold and silver and no copper. It is possible that higher-grade ore may be found on the other contact of the porphyry and greenstone and it is the intention of the company to extend the tunnel with that object in view. The mouth of the lower tunnel is about 100 feet from the railway-track, so that if any ore is found it can be easily transported to the smelter. The old cabins have been reconstructed and winter quarters built for the employees, as well as a new blacksmith-shop at the mine.

Standard No. 2 and Nevada. These claims, owned by F. Ogle and Dean Moore, of Eholt, are situated about 2 miles directly south of the *Black Tail*, close to the Canadian Pacific Railway. This claim was developed many years ago by open-cuts, short tunnels, and a shaft. In the lower tunnel, 20 feet long on the *Nevada*, there are copper carbonates and pyrite in a rock-fracture about 14 inches wide, associated with specks and segregations, about 2 inches in diameter, of chalcopyrite.

Higher up the hill on the *Standard No. 2* a tunnel 25 feet long was driven and a winze of unknown depth sunk from the face of the tunnel. Owing to the depth of water in the winze it was impossible to examine this work, but some high-grade copper ore was piled near the mouth of the tunnel and probably came from the winze. Since the examination of the work in October the owners have unwatered the winze and found the continuation of the ore. It is probable that a new tunnel will be driven to tap the bottom of the winze and explore the continuation of the ore-zone. These claims are well situated for transportation.

Bonanza Fraction.—This group, situated about 10 miles north of Grand Forks, has been bonded by R. Crowe-Swords, of Vancouver. A description appears in the 1925 Annual Report.

Volcano and Fantentine. These Crown-granted claims, situated about 8 miles north of Grand Forks, on the east side of the Granby river, are owned by R. A. Brown. Practically all the development was done many years ago, and with the exception of one large open-cut on top of the bluff the property has lain idle. At the time of examination many of the open-cuts were found to be caved and rock in place could not be seen. Diamond-drill cores and logs were not available, so that a great deal of valuable information, which would have materially assisted in forming an opinion of the prospects of the property, has been lost.

Most of the development-work was done on the south and south-west slopes of the mountain and consists of numerous open-cuts, stripping, and a tunnel about 800 feet long near the base of the hill. On the south slope the ground is covered with a dark-red loam and gravel, which is evidently the result of oxidation of the pyrite and pyrrhotite. Diamond-drill holes were bored on this side, but the results, according to the owner, were disappointing, although the cores contained some copper sulphides.

At about the same elevation on the bluff to the south-west, erosion has exposed large masses of pyrite and pyrrhotite associated with garnetite, epidote, and silica. Remnants of limestone occur as a thin shell covering parts of the mineralized zone and containing segregations of chalcopyrite and pyrite. Apophyses from a porphyry dyke cut through the mineral-zone. Near the bottom of the bluff, at an elevation of 2,150 feet (aneroid), a tunnel has been driven for 800

feet in a north-easterly direction. From this tunnel flat diamond-drill holes were put in, one in a south-easterly direction 400 feet long, and another in a north-easterly direction 100 feet long, from the end of the tunnel. According to the owner, no values were found in these holes, but a soft talcose gouge was struck at the end of the holes. Whether this gouge was fault or vein material has not been recorded.

The greater part of the lower tunnel was driven in porphyry, but near the face a highly siliceous rock containing specks of pyrite was struck, which had the appearance of being the lower horizon of the ore-body. On top of the bluff an open-cut had been excavated, at an elevation of 3,240 feet (aneroid), in the massive pyrrhotite, the outer edges of which showed intense metamorphism and gave a burnt appearance to the cover-rocks. In the gravel subsoil the owner found a nodule of chalcopyrite, evidently displaced, that assayed well in gold and copper. No trace of copper was found in the pyrrhotite, although copper carbonates were seen in small quantities in the cover-rocks.

During the major development of this property a great many assays were made, and according to the owner values in gold and silver varied from a few cents up to $14 a ton; the average being too low for commercial purposes. The theory held by the owner that the chalcopyrite is deep-seated, and consequently will be found at greater depth because it has a greater specific gravity than either the pyrite or the pyrrhotite, cannot be entertained, because it is a well-known fact that both the latter minerals are heavier than chalcopyrite, and in any case this factor would have little to do with mineral-deposition. Again, in every instance the chalcopyrite occurs in a higher ore horizon on this property, as can be distinctly seen in the limestone remnants on the bluff. On the north slope there has been less erosion and, although the limestone has been tilted at a high angle, it appears to be of considerable thickness. On this side further development may be recommended.

About a quarter of a mile to the south-east the granodiorite batholith outcrops and the volcanic tuffs on its contact have been mineralized with pyrite, chalcopyrite, and pyrrhotite. The mineralization on this side is identical with that found on the *Volcano* claim and it seems probable that the granodiorite is responsible for both ore-depositions. The low-grade copper ore said to have been found in some of the drill-holes is worth checking up, because metallurgical treatment has advanced to such an extent that this ore may now be commercial. The high relief of the mountain on which these claims are located and railway transportation at the foot of the hill are added attractions to any one contemplating further development.

Superior. This claim adjoins the *Volcano* on the north and is owned by S. Evans *et al.*, of Grand Forks. Several open-cuts and shallow shafts have been sunk on this property. In one of the shafts near the *Volcano* line a lead of massive pyrrhotite and pyrite was struck. A sample of this ore assayed: Gold, 1.02 oz. to the ton; silver, 0.60 oz. to the ton. Another sample taken from 16 inches of pyrite and pyrrhotite assayed: Gold, 0.90 oz. to the ton; silver, 0.50 oz. to the ton; copper, 0.50 per cent. This ore-zone appears to be the continuation of the *Volcano* mineral-deposit and warrants more work.

Pathfinder Consolidated Mining Co. This company owns the *Pathfinder*, *Iron Bell*, *Little Bertha*, and *Derby* claims, situated on Pathfinder mountain, on the Granby river, about 14 miles north of Grand Forks. Two men have been employed during the year, extending the crosscut tunnel in a northerly direction about 46 feet from a point 750 feet from the portal. A small compressor, engine, and stoper are being used for this work. Up to the present no ore has been struck in this tunnel, but the management hopes to find the downward extension of the vein mined in the *Little Bertha* above.

The *Pathfinder* claim lies about 1 mile east of the portal of this crosscut tunnel and was mined many years ago for copper. William Wilson is president of the company and W. Swain, of Pullman, Wash., secretary.

Exchange. This group, owned by R. Simpson *et al.*, of Grand Forks, is situated about 14 miles up the Granby river on the west side. Work done this year consists of deepening an old shaft to 45 feet and unwatering another about 500 feet to the west. Massive pyrite-pyrrhotite zones have been uncovered in both shafts, but up to the present only low values in gold, silver, and copper have been found. Several years ago, according to the owners, a shipment was made from one of these shafts to the Granby smelter at Grand Forks that carried values in gold. A thorough sampling will be done to ascertain the size of the ore-bearing zone.

Bluejoint Nos. 1 to 4. These claims, owned by Ab. Fee, A. and F. Scott, and P. A. Petersen, of Grand Forks, are situated about 37 miles up the Granby river and three-quarters of a mile east of Bluejoint camp. A series of open-cuts over a distance of about 1,000 feet has uncovered a mineralized fissure in the greenstone, varying in width from 5 to 8 feet, and containing sphalerite and pyrite. Assays of surface samples show low values in gold, silver, and zinc. This year a crosscut tunnel was commenced which will cut the ledge at about 25 feet in depth and a better idea of values may be obtained. An aerial cage is being used to transport men and material across the Granby river.

Copper Cliff. This claim, owned by Elmer Rice *et al.*, is situated about 38 miles north of Grand Forks, on the west side of the Granby river. The crosscut tunnel mentioned in former Annual Reports was extended during the year and is now over 300 feet in length.

Copper No. 2. This property, owned by Pete Santure and Joe Gelinas, of Grand Forks, is situated on the east side of the Granby river, nearly opposite the old Franklin townsite. The crosscut tunnel has been driven about 100 feet, including a branch to the east, in the altered tuffs and limestone. Finely disseminated pyrite has been found throughout the tunnel containing low values in gold and silver. To the south of the *Copper No. 2* numerous open-cuts, shallow shafts, and short tunnels have been driven in limestone pods containing small lenses and stringers of pyrite, chalcopyrite, and bornite. The limestone-beds in this area are only small remnants and could not be mined profitably. Close to the cabin on the *Copper No. 2* a shaft was sunk about 80 feet, many years ago, in the granodiorite. The rock on the dump taken from this shaft contains minute quantities of chalcopyrite in the fractures. Intensive prospecting along the diorite-contact, especially in the low-lying covered ground between the cabin and the present working-tunnel, is to be recommended. A trail branches east from the road at old Franklin camp, crosses the river on a pack-horse bridge, and thence to the camp.

Franklin Camp.

Since substantial developments are taking place in this camp, the following copy of part of the economic geology written by C. W. Drysdale, of the Geological Survey of Canada, in his Memoir No. 56, may be of interest:—

"*Economic Geology.*

"*Types of Ore-deposits.*—The ores of the Franklin district present a diversity of types of considerable interest to economic geologists. The metalliferous ores of the district, as will be later shown, are the result of four distinct periods of mineralization—two in the Mesozoic and two in the Tertiary. As a basis for dividing the ores formed during these several periods of mineralization, the genetic types, which are very distinct, have been employed. In this way the following classification of the ores of the district has been compiled and will be used in the report for purposes of description:—

"I. Mesozoic deposits.

1. Contact-metamorphic type. Sub-types:
   - (*a.*) Pyrite-chalcopyrite.
   - (*b.*) Galena-blende.
   - (*c.*) Magnetite-pyrite.

   } Dependent upon intrusion of Jurassic granodiorite batholith.

2. Fissure-veins.
3. (*a.*) Contact-zones.
   (*b.*) Shear-zones in granodiorite.

   } Dependent upon both intrusion of Jurassic granodiorite batholith and crustal movements during the Laramide revolution.

"II. Tertiary deposits (Miocene).

1. Segregation type—'Black Lead.'
2. Contact-metamorphic type.
3. Replacement along shear-zones.

"From the above it may be noted that there are contact-metamorphic deposits of two ages, the one in the Mesozoic and the other in the Tertiary.

"*Summary Description of Types.*—The *Mesozoic type* is characterized by the presence of such lime-silicate gangue-minerals as garnet, epidote, diopside, tremolite, and the ore-minerals, including sulphides and oxides of iron, with some chalcopyrite. The mineralized zone extends

in widths varying from 0 to 100 feet, about rudely lenticular-shaped masses of marble. The marble, which belongs to the Gloucester formation of Carboniferous age, has a closely compressed synclinal structure, with a general steep dip to the west. The basal formation is an altered tuff and greenstone of the Franklin group, which is heavily pyritized in the vicinity of the mineralized zone. The ore lies within the mineralized zone and forms rudely tabular-shaped masses or shoots, chiefly at the immediate border of the barren marble. The contact between the marble and the mineralized zone is usually very sharp. The contact, on the other hand, between the altered tuff and the mineralized zone is very gradual, and it is difficult to tell where the ore ends and the country-rock begins. The ores are divided into three sub-types, one characterized by predominant pyrite-chalcopyrite, a second by galena-blende, and the third by magnetite-pyrite. The galena-blende type follows the limy portions of the mineralized zone, where contact metamorphism has not been so powerful, while the pyrite-chalcopyrite and magnetite types, on the other hand, follow dominantly the siliceous portions. The deep-seated parent igneous rock which has produced the metamorphism is granodiorite, which cuts the ore and marble in several places.

"The *Tertiary contact-metamorphic ores* stand in strong contrast to the Mesozoic type in their exceedingly small development and different mineralogic characters. The ore is chalcopyrite, pyrite, sphalerite, galena, malachite, and azurite, in a gangue of impure quartzite and greenstone, with considerable secondary hornblende, alkalic feldspar, and epidote. The sulphides are intimately intergrown, indicating deposition simultaneous with rock alteration. The igneous rock in this case is an augite syenite and shonkinite-pyroxenite.

"The *fissure-veins* are very few in number. They vary in width from a few inches to a couple of feet, and are traceable on the surface for only short distances. They are the simple filling type and show crustification. No definite fissure system was noted. They are considered to be of the same age as the Mesozoic contact-metamorphic deposits.

"*Contact-zones.*—Another type of ore occurrence is confined to the contact of the Jurassic granodiorite and the Franklin group metamorphics, and is present in both, although chiefly in the latter. No marble is present and the lime-silicate gangue-minerals are not as abundant as in the typical contact-metamorphic deposits. The mineralization is referred to both the time of intrusion of the granodiorite batholith and to crustal movements during the Laramide revolution.

"*Shear-zones in Granodiorite.*—Certain zones in the Jurassic granodiorite have yielded to crustal stresses of mountain-making periods through shearing or slipping movements along definite planes (planes of scission or simple shear), which are inclined to the greatest pressure. Mashing, on the other hand, takes place in planes normal to the greatest pressure.

"The shear-zones have been favourable places for mineralization. The ore is disseminated chalcopyrite and pyrite, with some molybdenite in a quartz and calcite gangue. The molybdenite is in small flakes; the chalcopyrite generally with calcite in cleavage-planes. The country-rock is sheared, calcified, and silicified granodiorite. The shearing and mineralization are referred to that accompanying the mountain-making at the close of the Mesozoic.

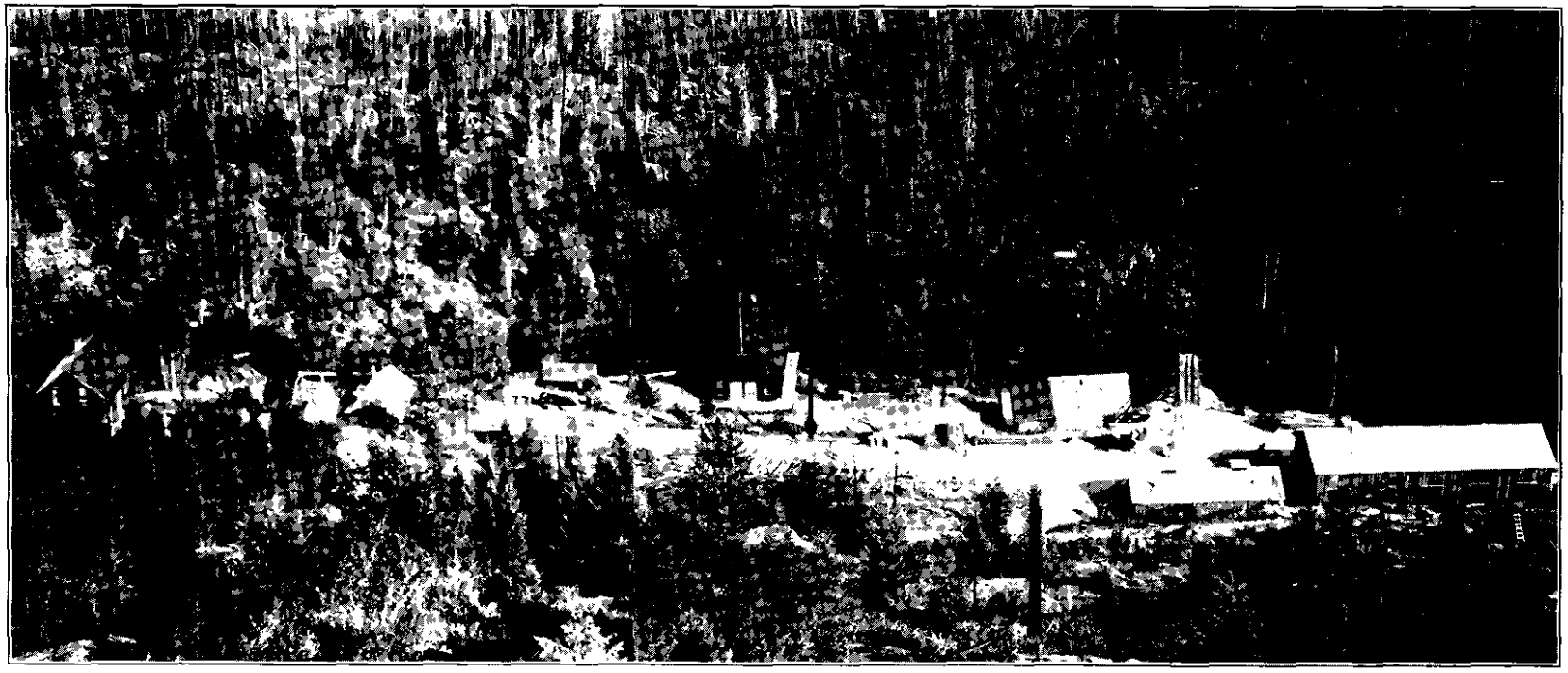
"*Segregation Type.*—The ores belonging to this type are locally known as the 'Black Lead' ores. The ore-minerals are chalcopyrite, pyrite, and some bornite in a gangue of shonkinite-pyroxenite. This formation is a basic marginal phase of the augite syenite. It is thought that they have both been derived from a common parent magma through a process of differentiation prior to intrusion. The chalcopyrite and bornite are often found surrounded by orthoclase feldspar, or in small masses closely associated with it. The pyrite, on the other hand, is generally disseminated in small grains through the ferro-magnesian constituents.

"*Replacement along Shear-zones.*—Magnetite and pyrite occur sparingly along certain shear-zones in the Tertiary monzonite as replacements. The hydrothermal metasomatism is correlated with the intrusion of the younger alkalic rocks."

Since C. W. Drysdale's report a good deal of work has been done, especially on the *Union*, *Maple Leaf*, *Glouster*, and the segregations of mineral in the pyroxenite. Up to the present the *Union* has shown the most promise and may be producing in 1929. On the *Maple Leaf*, along the contact of the syenite and pyroxenite and the greenstones near the top of the hill, lenses of pyrite and chalcopyrite carrying platinum have been found. In the pyroxenite segregations of magnetite, pyrite, chalcopyrite, and bornite have been exploited, and where the copper sulphides occur platinum is generally found. Practically nothing has been done on the *McKinley* in recent years, but history relates that diamond-drill holes bored found good values in copper ore.

Carnes Creek, Revelstoke M.D.

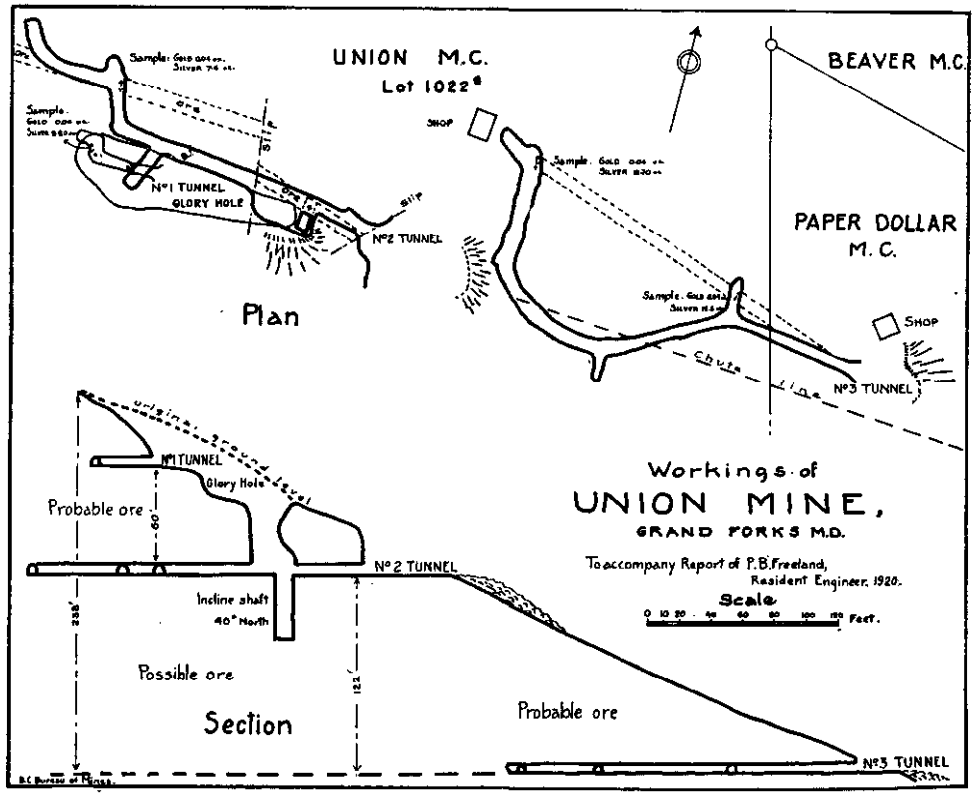
Aerial Ferry across Granby River at Bluejoint Creek.



Union Mining and Milling Co., Ltd., Grand Forks M.D.

The whole camp is an interesting one geologically and warrants closer investigation by those well enough financed to prospect thoroughly. The *Union* was closed down for many years on account of lack of capital to develop it. Transportation consists of a motor-road from Grand Forks to Franklin camp, a distance of 45 miles, or by rail to Archibald, a distance of 20 miles, and then by road 25 miles. There is plenty of water for all purposes in the Granby river, but timber is generally scarce.

Union. This group, consisting of the *Union*, *Idaho*, *Union Fraction*, and *Paper Dollar* claims, was bonded by the Hecla Mining Company, of Wallace, Idaho, late in the autumn of 1927. During the winter of that year and the whole of 1928 development on a varied scale was carried on under the superintendence of Paul Schultz. In No. 1 tunnel (upper) no work was done and the drift remains as shown on the map in the Annual Report for 1920. No. 2 tunnel was extended 300 feet in ore. In No. 3 tunnel a drift was commenced on the ore on the north side near the mouth and extended 1,400 feet, 300 feet of which was barren of values. Crosscuts are now being driven to ascertain the width of the ore-body.



No. 4 tunnel was started about 200 feet in elevation below No. 3 and to date has been driven 1,500 feet in a westerly direction, including two crosscuts to the north. According to the management, no continuous vein has been found in No. 4 tunnel, but fairly good values have been obtained in brecciated fragments evidently detached from the ore-body. This ore does not constitute a minable ore-zone. Practically the whole of No. 4 tunnel has been driven in a much-disturbed area, which has been caused either by a porphyry-dyke intrusion about 60 feet wide struck in this tunnel, or by the batholith, of which there is evidence beside the road below.

C. W. Drysdale classes the *Union* vein as a fissure and places it as the same age as the Mesozoic contact-metamorphic deposits. During the time of his examination practically nothing had been done on the *Union*. The smelter returns show that 3,535 tons of ore, having a gross value of $121,677.09, was shipped prior to 1927 from a comparatively small section of the mine.

The width of the vein in the old workings varied from 6 to 12 feet, without commercial walls, and is consequently difficult to mine.

Construction since the Hecla Mining Company commenced operations is as follows: A combination dining-room, kitchen, store-room, and sleeping-quarters for the cooking-staff, size 24 by 70 feet, with a seating capacity for fifty men; blacksmith-shop, size 16 by 40 feet, with 2 forges; engine-room, 24 by 68 feet, including a dry, 14 by 24 feet; a 33,000-gallon water-tank, for main supply and pump-house, on Glouster creek. A Bessimer 150-horse-power fuel-oil engine is used to drive an Ingersoll-Rand 8-inch by 12-inch by 15-inch compressor; a Waugh drill-sharpener and a 220-volt motor for driving a Triplex high-pressure pump. A 15-horse-power Fairbanks-Morse fuel-oil engine is used to drive one Sturgeon No. 5 and one Buffalo No. 5 ventilation-blower and 230-volt generator for the electric plant, which lights the entire camp.

Two-inch pipes are used for domestic water-supply and 4-inch for use in case of fire. A 12-inch Ventube Rubberoid ventilation-pipe tapering to 8 inches is used in the mine and has proved very satisfactory. An average number of twenty-six men has been working, including superintendents. A 2,500-imperial-gallon crude-oil tank has been erected at the mine and at Lynch Creek Station on the railway a 10,000-imperial-gallon crude-oil tank and a pump have been installed. Supplies are transported from Lynch Creek Station to the mine by motor-truck.

Until the ore-bodies between Nos. 1, 2, 3, and 4 tunnels are connected and some idea of their size and value is obtained, no steps will be taken in regard to mill-construction. The ore found in the old workings is chiefly pyrite carrying gold and silver in a gangue of silica and presents no serious metallurgical difficulties.

Wellington Camp.

Butte.

This claim is owned and has been prospected for several years by Robert Denzler, of Greenwood. On the east slope of the mountain several open-cuts, trenches, tunnels, and shafts have been excavated on quartz veins impregnated with pyrite and arsenopyrite. Owing to the intense shearing and warping of the serpentine rock in which these veins occur, great difficulty has been experienced in following the ore for more than a few feet at a time. The veins taper from 2 to 12 inches in width and appear to conform to the strike of the serpentine. Samples of the ore from the different workings vary considerably in value, from 0.20 oz. to 1.20 oz. in gold to the ton; the higher precious metal contents always being associated with the predominance of the arsenopyrite. A short distance below the workings the granodiorite batholith outcrops. On top of the hill, about 60 feet higher than the main developments, a large open-cut has exposed lenses of chromite, also in the serpentine. Insufficient work has been done to prove the extent of this deposit, but a general sample assayed 52 per cent. Cr_2O_3, which is a high-grade ore.

Keno.—This claim, owned by E. A. Wanke and associates, of Greenwood, was not developed this year.

Lightning Peak Section.

This section was not visited in 1928, but reports from the owners of the *Waterloo, Killarney, Lightning Peak* group and other claims are encouraging. A full report upon this area appears in the Annual Report for 1927. A new cut-off rawhide trail was constructed by the Government over more solid ground in the neighbourhood of the summit. This new work cuts off about 3 miles of the original distance to the camp and should be helpful to the operators.

GREENWOOD MINING DIVISION.

Phoenix Section.

Owing to a revival of interest in this area, a part of the Economic Geology, Memoir No. 21, written by O. E. LeRoy, of the Geological Survey of Canada, in 1912, may be of use to those who have not had the opportunity of reading this memoir and who contemplate mining operations:—

"*Economic Geology—Phoenix Mineral-zone.*

"The extensive deposits of low-grade copper ore, which have given rise to the important mining industry at Phoenix, occur in a mineralized area of the Brooklyn limestone which has all the characteristics of a zone of contact metamorphism. This zone is composed essentially of epidote and garnet, together with calcite, quartz, and chlorite. Actinolite, tremolite, zoisite, sericite, and apatite have been noted microscopically and, with the exception of the first-named

mineral, occur in very trifling amounts. The type of gangue rock most in evidence is one in which epidote is the predominant mineral. The rock is dark green or dirty yellowish-green in colour and is usually massive, though occasionally banded. It contains small irregular cavities filled with calcite which has weathered out on surface exposures, leaving the cavities lined with minute crystals of epidote. Bands and masses of reddish-brown and pale-brown garnet are less common on the surface than underground. In the aggregate garnet occurs in large amount and is nearly always associated with epidote in those portions of the zone where the latter is the predominant constituent. Lenses and masses of calcite with or without quartz occur generally throughout the whole zone. Little surface decomposition has been effected since the zone was glaciated, though here and there, owing to the sulphide content, the gangue rock has disintegrated into a reddish-brown sand.

"The metallic minerals are chalcopyrite, pyrite, hæmatite (specularite), and magnetite, and these have been deposited in certain favourable areas in this zone so as to form extensive bodies of workable ore.

"*Geological Relations.*

"The mineralized zone lies in relatively wide and shallow troughs flooded by jasperoids, in steep narrow troughs in limestone as shown by the form of the Brooklyn 'glory-hole,' or along the contact between jasperoid and limestone, and between jasperoid and the quartzose rocks of the Knob Hill group. The zone is considered to have been originally in great part limestone, which has been replaced metasomatically by lime silicates, chiefly epidote and garnet.

"In part the zone is overlain unconformably by the Kettle River formation and in part covered by the lava of the Midway Volcanic group. Both the zone and the included ore-bodies are cut by dykes, sills, and stocks of augite porphyrite and pulaskite porphyry, which intrusive bodies increase in number with depth, as noted in the mine-workings. Certain older dykes of basic porphyrites occur in apparently fragmentary masses, but so great has been their alteration that their origin could only be determined microscopically. In the ore-bodies they represent barren areas and were evidently not favourable localities for ore-deposition.

"*Distribution.*

"This mineralized zone, probably once continuous over an area greater than that now exposed, has been separated by erosion into a number of detached areas, which for convenience have been termed the Granby, Brooklyn, Stemwinder, and Montezuma respectively.

"*The Granby Zone.*—The principal mines with one exception are situated on the Granby zone, which surficially is semi-elliptical or horseshoe-shaped in form. The west limb is 3,200 feet long and 1,000 feet wide; while the east limb is 2,250 feet long and from 350 to 1,000 feet wide. The curved connection to the south is 2,000 feet long and from 200 to 700 feet wide. The actual horizontal dimensions, however, are much greater, as a very considerable area is overlain by the sedimentary and igneous rocks of Tertiary age. The thickness of the west limb along an east-and-west axis varies from 160 to 350 feet, with a gradual thinning-out to the east. Along the north and south axis of the same limb the maximum thickness in the central portion is about 350 feet, and from that point the zone gradually thins out in both directions. The jasperoid floor of the zone is broadly rolling (with local sharp high rolls) and has the form of a double trough or basin with half of the eastern basin lacking. The contact between the mineralized and jasperoid zones is sharp and usually marked by a fissure from a fraction of an inch to 7 feet wide, filled with a gouge of disintegrated jasperoid.

"*The Brooklyn Zone.*—This zone, on which is situated the *Brooklyn-Idaho* mine, lies to the west of the Granby zone and extends across the valley of Twin creek, crossing the lower town of Phoenix. In its central portion, which coincides with the lowest points in the valley of Twin creek, the zone has suffered considerably from erosion, with the consequent removal of an important part of the original ore-body. Along the central portion of the valley it is covered by sands and gravels, and the surface limits have therefore been projected from the underground workings.

"The zone has an elongated pear-shaped form, broad and shallow to the south, narrowing and becoming steeper to the north until it is enclosed by almost vertical walls of limestone, as shown by those of the Brooklyn 'glory-hole,' or of jasperoid to the east and limestone to the west. The floor is mainly limestone with some jasperoid in the southern part. The length is

about 1,850 feet and the width varies from about 400 feet in the south to less than 50 feet in the extreme north.

"*Stemwinder Zone.*—The Stemwinder zone is a small lenticular body, about 600 feet long and from 8 to 60 feet wide. Its attitude is about vertical, with brecciated limestone forming the east and jasperoid the west wall. In its southern extension it is known to be underlain by jasperoids. One mine only, the *Stemwinder*, is situated on this zone.

"*The Montezuma Zone.*—This zone occurs on the *Montezuma* claim and lies on the southern slope of the ridge of the same name. It is cut off to the north by a mass of augite porphyrite. Its south and east boundaries are rather indefinite, as the whole area is very shallow and gradually thins out towards the bordering and underlying jasperoid. It is of no commercial importance.

"*Character of the Ore-bodies.*

"The ore-bodies are broadly lenticular in form and lie in basin-shaped troughs in the jasperoid zone and crystalline limestone of the Brooklyn formation. The irregular lenses are either simple or compound, the latter type occurring in the Knob Hill-Ironsides body, which is the largest deposit in the camp. The size of the bodies varies from about 100 feet in length and from 20 to 50 feet wide to a body like the west lens of the *Knob Hill-Ironsides* mine, which has a length of nearly half a mile, a maximum thickness of 125 feet, and a known maximum width of 900 feet. All the larger bodies bear a distinct relation to the topography and their dip or pitch approximately coincides with the local slopes of the ridges.

"Jasperoid, with occasionally crystalline limestone, forms the structural foot-wall, which is, as a rule, the commercial foot also, though in limited areas bands of barren gangue from a few inches to 100 or more feet in thickness separate the pay-ore from the structural foot-wall. In some bodies the dip is flat, not exceeding 20°; but generally the dip is high along the outcrop, ranging from 45° to 80°, with a pronounced flattening with depth. The hanging-wall is usually a purely commercial one, except in the case of small bodies and the narrow terminal portions of the main ones. The ore-body either gradually becomes of lower and lower grade or the pay-ore terminates suddenly against a gouge-filled fissure.

"*Fissure System.*—The ore-bodies are traversed by a system of fisures locally termed 'slips.' They run in all directions and at all attitudes from vertical to horizontal. They vary in length from several hundred feet down to almost microscopic dimensions. The latter again pass into still finer fractures, in and between individual grains of the gangue-minerals. The main fissures are approximately parallel to the foot-wall of the ore-body in which they occur, and vary from a few inches to 7 feet in width and are usually filled with gouge. Many pass into the country-rock below the foot-wall, as well as upwards and outwards into the zones of barren gangue rock adjacent to the ore-bodies.

"The fissures are not all of the same age, but belong to three or more generations. They are tension fractures in the main and have probably been caused by unequal stresses set up in the zone of mineralization during the period of replacement of the limestone. It is possible that the more important were formed during a period of fissuring in the country-rocks at the time of the intrusion of the granodiorite batholith.

"The fissures have undoubtedly been the important factor in the deposition of the ore, forming as they did channels for the ore-bearing solutions, the movement of which may be compared to the movement of the sap in a tree passing from roots to trunk, then through the many subdivisions of the branches until the leaves are finally reached. In the case of the ore-bodies the main fissures are the trunk channels which connect with the smaller fissures, terminating in the microscopic fractures of the individual mineral grains. The ore solutions following these courses were, therefore, able to deposit their metallic contents in a very uniform and widespread manner. Many of the fissures, however, either wholly or in part filled with gouge and rendered more or less impervious, played an important part by guiding and deflecting the ore solutions, and thus promoting a better concentration of their metallic contents. In the closing periods of ore-deposition a large number of the fissures were filled with calcite, quartz, and chlorite, with or without the metallic minerals. Portions of some of the larger fissures remained open and permitted free development of large druses of calcite.

"The fissuring may have been accompanied by extensive faulting, but the actual displacements, if any, in most cases have been concealed by the homogeneous character of the gangue rock and ore-bodies. Evidences of late movement are furnished by numerous slickensided

surfaces occurring along many of the smaller fissures, and in two cases prominent faults occur in the ore-bodies, one in the *Knob Hill-Ironsides* and one in the *Snowshoe*. This faulting occurred subsequent to the formation of the ore-bodies and is probably of the same age as the fault system of the Midway Volcanic group.

"Irregular wedge-shaped masses or ribs of almost barren gangue rock occur in all the ore-bodies and are of varying importance as obstacles in mining. Along parts of the main ore-bodies, and in some of the smaller bodies, the continuity is broken and the ore occurs in wedges or ribs, separated from one another by complementary ribs or barren gangue or 'waste.'

"The boundaries are fissure-planes of varying width, filled with quartz and calcite or simply with gouge. Depending on the relative amount of ore and barren gangue, these bodies are stoped out or left standing; as the ore is so uniformly low grade, much admixture of barren gangue would bring it below the shipping grade.

"*Character of the Ore.*

"The average ore is almost self-fluxing in character and of such a grade that the average copper content ranges from 1.2 to 1.6 per cent. The metallic minerals are chalcopyrite, pyrite, and specular hæmatite which are uniformly though sparsely distributed through the gangue-minerals, *along fractures and cleavage-planes, and interstitially between individual grains. It is* generally found that the ore adjacent to the fissures is of slightly higher grade than the average, but gradually fades out into normal ore. Magnetite occurs in large and small isolated bodies generally at or near the border of the mineralized zone, or at different horizons in the ore-bodies, and rarely occurs as a disseminated ore. Azurite, malachite, and in one instance native copper are found in the zone of oxidation which is so shallow as to be merely superficial. They are of comparatively rare occurrence and are quite unimportant as ore-minerals. The leaching of a shallow surface zone by oxygen-bearing waters was not followed by any secondary enrichment at lower levels. The copper in solution was evidently carried beyond the limits of the ore-bodies and thus lost.

"The gangue-minerals are epidote, garnet, actinolite, quartz, calcite, and chlorite. Tremolite, sericite, zoisite, and apatite are quite rare and were only noted in thin sections. In the main mass of the ore-bodies the predominant minerals are the first-named group with the exception of actinolite. Along the borders, where the walls are limestone, the gangue is composed essentially of quartz and calcite which directly replaces the limestone, accompanied by the *deposition of the chalcopyrite and other metallic minerals.*

"Banded ores occur adjacent to the limestone as in the north end of the *Brooklyn* mine, and also where no limestone now exists, as on the surface along the northern portion of the *Knob Hill-Ironsides* body. Underground the banding varies in distinctness and is somewhat indefinite. It may represent structural planes in the original rock prior to its replacement. The banding, however, is only of local occurrence, the massive type of ore predominating throughout.

"*Origin of the Deposits.*

"The copper-gold-silver deposits at Phoenix occur in that portion of a zone of contact metamorphism characterized chiefly in its mineral composition by the abundant development of epidote and garnet. In a genetic classification of ore-deposits by Weed, those of the Boundary district, British Columbia, have been referred to the Cananea type owing to the importance of the ore-mineral chalcopyrite.

"The original limestone, which appears in fragmentary exposures adjacent to and in contact with the ore-bodies, and as residual masses included in them, is comparatively pure and *contains with the exception of silica only minute quantities of iron and alumina. The meta*somatic replacement of the limestone by epidote and garnet with minor amounts of actinolite, tremolite, and zoisite has evidently been brought about by the introduction of ferric iron, alumina, and additional silica. The contact between the replaced and original limestone is usually sharp, but thin sections show the development of epidote and garnet at considerable distances from the actual contact, in the main bodies of the limestone. Calcite and quartz are invariably associated with the lime silicates, usually filling interspaces between the grains of the latter.

"The solutions carrying the ferric iron, alumina, and silica were probably above the critical point (365° temperature and 200 atmospheres pressure for water) and consisted mainly of water-gas strongly ionized. A certain quantity of the limestone passing into solution combined

with corresponding quantities of the ions of the material already in solution, which resulted in the formation of lime-iron and lime-iron-aluminium silicates according to physico-chemical laws. This general molecular replacement in large masses of limestone would also result in the liberation of large quantities of carbonic gas and carbonated waters, which would pass out and beyond the zone of mineralization.

"The formation of magnetite was probably contemporaneous with that of the epidote, garnet, etc. It occurs in isolated masses (some of which are important as distinct ore-bodies) at various horizons, particularly at or near the edge of the mineralized zone. When the formation of the epidote, etc., had been well advanced the general character of the solutions changed somewhat and chalcopyrite, pyrite, and hæmatite were introduced and deposited in and along the numerous minute cavities and fractures, the general circulation of the solutions being guided primarily by the system of fissures developed through the whole zone.

"This zone of contact metamorphism, which includes the crystalline limestone and the mineralized zone, is characterized by the absence of closely associated igneous intrusive bodies of sufficient importance to cause the extensive metamorphism which has taken place in the original limestone. The nearest outcrops of granodiorite lie from 1 to 2 miles away, and exploratory drilling, extending to a depth of at least 1,200 feet below the base of the contact-zone, has encountered no important masses of igneous rocks.

"It has been assumed, without, however, any direct evidence, that certain intrusions of the granodiorite batholith occurring in the district have been the cause of the metamorphism of the limestone, and the source of the mineral solutions which have metasomatically replaced so large an area of the limestone by lime silicates, followed by the deposition of the metallic minerals.

"If such is the source, the mineral-bearing solutions given off by the igneous masses sought out the more favourable beds of limestone which at that time would be deeply buried under an unestimated thickness of overlying rocks, but still situated in the zone of fracture. The solutions would traverse the limestone in lateral directions, and in cases lateral descending directions, replacing the limestone by the lime silicates, and later on depositing the ore. This view appears to be confirmed by the ore which terminates gradually or sharply with depth, finally giving place to limestone or jasperoid.

"The granodiorite, as noted by Brock, and also by the writer on the *Lavey* claim near Phoenix, has locally been replaced by garnet, epidote, and actinolite. This condition may be due to an early solidification of the magma in certain areas, which were later attacked by solutions given off by more recent intrusions.

"Granite and quartz porphyries occurred at levels relatively higher than Phoenix during early Tertiary, and a great portion of the sediments of the Kettle River formation overlying part of the zone of contact metamorphism is composed largely of disintegrated rocks of the above types, none of which is found outcropping in the vicinity of Phoenix at present. These may possibly represent the hypothetical intrusives.

"With regard to the origin of such a zone of contact metamorphism in limestone formations there is considerable diversity of opinion among many of the more eminent authorities. On the one side it is maintained that the results are brought about by the metamorphism of impure limestone at and adjacent to the contact of igneous intrusive rocks, with little or no addition of material from the latter, while, on the other side, the view is advanced that foreign material from igneous sources has been introduced into the limestone which has caused the metasomatic replacement of the rock.

"From the great diversity of and variation in deposits in contact-zones of this character, it would appear that broad generalizations cannot be made from a few or even from a great number of isolated examples. In certain instances pure limestone-bands only are replaced, while in other cases the impure bands alone have the lime silicates developed. Besides the character of the replaced rock, the composition of the magma of the intrusive rock is probably an important factor, as well as the size and attitude of the igneous mass.

"As far as the ore-deposits and zone of contact metamorphism at Phoenix are concerned, the foreign material believed to have been derived in great part, if not all, from igneous sources played the most important part in the replacement of the limestone, as well as in the formation of the ore-bodies.

"The evidence derived from a number of similar zones in other districts shows that the deposits do not occur at the actual contact between igneous and sedimentary rocks, but may be

hundreds or even thousands of feet away from such contacts. At Phoenix, however, evidence of this character is entirely wanting, erosion has removed all traces of igneous rocks, if they originally existed in association with the mineralized zone, and even the latter and the ore-bodies themselves have suffered considerably from the same agencies.

"*Age of the Deposits.*

"The age of the deposits cannot be definitely placed with reference to the geological time-scale. If the hypothetical assumption regarding the origin of the ore discussed in the foregoing paragraphs be the correct solution, the formation of the ore-bodies occurred in some period subsequent to the initial invasion of the granodiorite batholith of the district and prior to the intrusion of the final phases of the batholith, as indicated by the dykes of syenite porphyry which cut the mineralized zone. The provisional age of the ore-bodies would therefore be placed as Jurassic (?)."

This memoir deals only with the type of ore-deposits found in the immediate vicinity of Phoenix and does not cover the system of fissure-veins found in the batholith at lower elevations.

To the north-east of Phoenix there is a large area covered by clay, sand, gravel, and volcanic rocks that has not been prospected at depth and offers possibilities to any one financially able to carry on the work.

The geological section map accompanying this report shows that the mineralized zone underlies the volcanic rocks and therefore presents a reasonable chance for the finding of ore below. Two 1,500-foot holes diamond-drilled on the dip of the ore-bodies in the vicinity of the Granby Company's workings failed to find any downward extension of the ore-mineral zones or igneous rocks which might be responsible for ore-deposition. The area between the *Gold Drop* and the *Ironsides* mine was very thoroughly diamond-drilled and several small ore-bodies found and mined that did not outcrop.

Pacific Tidewater Mines, Ltd.

This company, with headquarters at 418 Pemberton Building, Victoria, has optioned and leased the following claims in Phoenix: *Brooklyn, Stemwinder, Standard, New York, Montezuma, Rawhide, Bullion, Timer*, and *Bank of England*. During the summer development was carried on beside the main road on the *Stemwinder* and some interesting mineralized zones in the limestone and brecciated volcanics, containing pyrite and chalcopyrite, were discovered. In the winter two men were employed driving a tunnel on these outcrops to ascertain the potentialities of the ore-bodies. About twenty years ago the *Stemwinder* was worked and several thousand tons of copper ore mined from a glory-hole 110 feet long, 60 feet wide, and 30 to 40 feet deep, situated about 400 feet north of the present workings.

Brooklyn.

This mine was also worked about the same time as the *Stemwinder* on a much larger scale, a shaft being sunk about 425 feet deep. The ore-body on the *Brooklyn* is stated to have been about 1,000 feet long, from 20 to 90 feet wide, and 250 feet deep. Several thousand tons of ore was shipped from this property years ago. During 1928 an option was taken and a shipment of copper ore was made to the Trail smelter.

Summit.

This group, consisting of the *Summit, Balsam Fraction*, and *Mayflower*, is situated about 2 miles north-east of Phoenix and is owned by R. Foreshaw, of Greenwood. A bond was taken on the group by Vancouver interests late in the season, but no work done. A considerable amount of development was done many years ago, especially on the *Balsam Fraction*, consisting of a vertical shaft about 25 feet deep, a tunnel 25 feet lower connected with the bottom of the shaft, and another tunnel 35 feet lower and 175 feet long. The upper workings are caved and could not be properly examined, but there appeared to be an extensive fractured zone mineralized with pyrite and chalcopyrite in a gangue of quartz, epidote, and garnetite. In the lower tunnel an ore-body about 6 feet wide has been developed by an L-shaped crosscut. Three diamond-drill holes of unknown length have been bored, the results of which are unknown. One of these holes was driven in the hanging-wall, another in the foot-wall, and the third diagonally across the vein. More drilling from the surface on the dip of the vein appears to be justified. A sample of ore from the lower tunnel vein assayed: Gold, 0.02 oz. to the ton; silver, 1.4 oz. to the ton; copper, 1.9 per cent. A grab sample from the shaft-dump assayed: Gold, trace; silver, 0.60 oz. to the ton; copper, 0.60 per cent. Other open-cuts away from this zone are mineralized chiefly with pyrite. The ore occurs in a highly altered silicified limestone, which is overlain and in contact with the volcanics.

This is one of the interesting sections in the Phoenix area and can be reached either by road from Phoenix or by road from Denoro, the latter route being the shortest to the railway.

Hercules C.M.S. & P. Corporation, Ltd.

The British North Western Development Company, Limited, was incorporated on May 6th, 1897, and on October 8th, 1928, the name was changed to the Hercules Consolidated Mining, Smelting, and Power Corporation, Limited, with a capitalization of $10,000,000. The company's head office is located at 6507 Northwest Building, Vancouver. As far as can be ascertained, the directors of the company are: W. P. Morgan, London and Lancaster Deep Mines, South Africa; A. B. Jerome, Consulting Engineer, London and De Beers Mines, South Africa; J. C. Fitzgerald, London and Witwatersrand Deep Mines, South Africa; R. Fletcher, Winnipeg; Dr. F. Allen, University of Manitoba, Winnipeg, Man.; J. A. Bushel, M.E., 50 Broadway, New York; N. M. Hall, C.E., Winnipeg, Man.; and R. Crowe-Swords, Western director and representative, 1033 Balfour Avenue, Vancouver.

The holdings of the above company include the following: *War Eagle, Missing Link Fraction, American Eagle, Four Ace, Tamarack, Dandy, Pinkock, Battle Axe, Apex Fraction, Denver, Lucky Shot, Flag of all Nations, Clipper, Mamont, Starve Out, Empress, Barbara,* and *E.P.U.* Applications have been made for several more claims in the Greenwood Division. At the present time R. Hedley, of Vancouver, is examining some of these claims for the company and the results of his inspection will be a guiding factor in their future operations. According to R. Crowe-Swords, certain favourable areas will be selected and Radiore reconnaissance surveys made, followed by preliminary and detailed surveys and, if warranted, diamond-drilling. No deep crosscut tunnels will be driven unless diamond-drilling indicates sufficiently large ore-bodies.

Many statements have appeared in the press regarding the extension of the 3,000-foot tunnel to be driven by the Hercules Consolidated Mining, Smelting, and Power Corporation, Limited, from Greenwood to Phoenix, 3 miles, with the idea of tapping the downward extension of the ore-bodies in Phoenix. The elevation of the bottom of the lowest ore-body found in Phoenix is about 4,250 feet and the elevation of the mouth of the long tunnel at Greenwood is about 2,550 feet, leaving a vertical distance of 1,700 feet between the lowest ore horizon and the tunnel. Until deeper ore-bodies have been found, this plan will, according to R. Crowe-Swords, managing director, stand in abeyance.

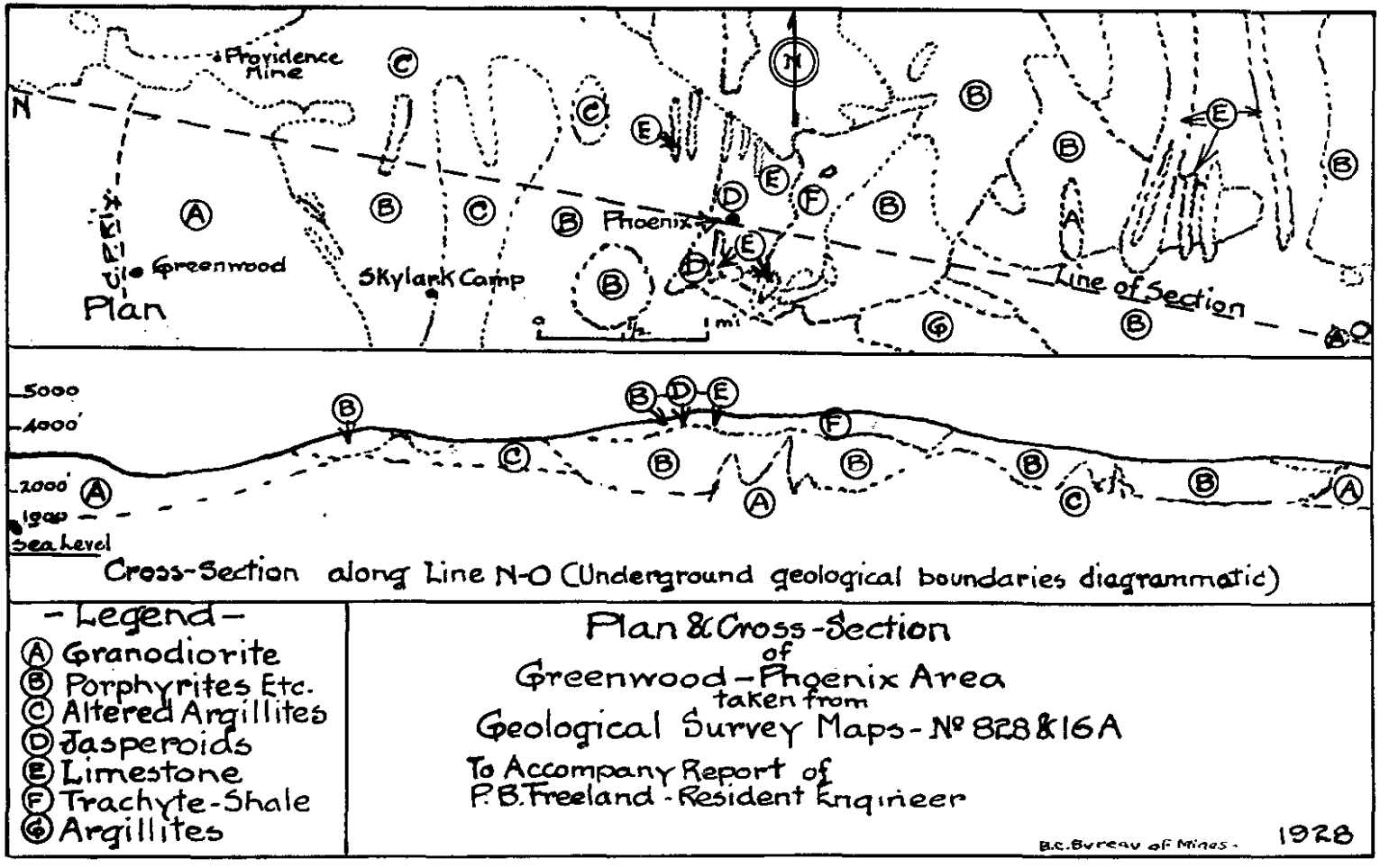
An article appearing in the *Financial Post* of Toronto, December 21st, 1928, entitled "Old Greenwood Section is now Being Revived," refers to recent development-work having proved that the ore in the district does go to depth instead of being a comparatively shallow deposition, also that recent diamond-drilling has proved this; and that driving has been resumed on the big bore, etc. These statements are entirely without foundation and nothing had been done up to December 31st, 1928, except the driving of a short tunnel at Phoenix, having a maximum depth of 25 feet at the face, and the cleaning-out of the old *Argo* tunnel at Greenwood.

The whole area adjacent to Greenwood and Phoenix is an interesting one and warrants careful study, especially of those sections covered by volcanics and subsoil, and under which there appears to be a reasonable chance of finding ore. In this section may be mentioned Deadwood, Copper camp, Central camp, Skylark camp, Wellington camp, and Summit camp, all of which have produced ore in the past. Except that from the *Providence* and *Elkhorn* at Greenwood, a comparatively small amount of ore has been shipped from the fissure-veins lying to the east of the town. Taken as a whole, under one operating system, a considerable tonnage may be available; but a great deal of work must be done before any estimates can be made.

Greenwood Section.

Providence.

This mine was worked during the earlier part of the year by a syndicate of men from Idaho and the old shaft was sunk to a depth of 200 feet. From the bottom of the shaft a drift was driven south on stringers of quartz that were considered to be the vein proper. After drifting for some distance without finding commercial ore, a survey was made and a crosscut driven west which tapped the main vein between 60 and 70 feet. A drift was driven south on the vein and several tons of ore shipped to the smelter. During the summer the work closed down and nothing more was done until the autumn, when operations commenced and are being pursued under the management of Otto Kron. The syndicate installed an electric motor connected by a direct drive to a Denver Gardner vertical com-


Providence Mine
N
Greenwood
Skylark Camp
Phoenix
Line of Section
Plan
5000
4000'
2000'
1000
Sea Level
Cross-Section along Line N-O (Underground geological boundaries diagrammatic)
- Legend -
Ⓐ Granodiorite
Ⓑ Porphyrites Etc.
Ⓒ Altered Argillites
Ⓓ Jasperoids
Ⓔ Limestone
Ⓕ Trachyte-Shale
Ⓖ Argillites
Plan & Cross-Section
of
Greenwood - Phoenix Area
taken from
Geological Survey Maps - Nº 828 & 16A
To Accompany Report of
P. B. Freeland - Resident Engineer
B.C. Bureau of Mines - 1928

pressor and a single-drum hoist. Ore-bins with a capacity of 40 tons were also built. Seven men are working on the property.

D.A. These claims, reported upon and the workings mapped in the 1927 Annual Report, were developed by driving the old *Gold Bug* tunnel ahead about 80 feet under the open-cut where the vein was discovered during the previous year. An upraise 20 feet high was driven from this level to connect with the open-cut, but did not reach its objective when the mine closed down. From the appearance of the ore, 8 inches wide, containing galena, sphalerite, pyrite, and free silver, in the bottom of the cut, this upraise is worth finishing.

Elkhorn. This mine, owned by George White, of Greenwood, is situated to the west and close to the *Providence*. During 1928, 20 feet of drifting was done in the upper shaft and 21 tons of gold-silver-lead ore was shipped to the Trail smelter. Further work was done on an old shaft beside the road and indications of displaced vein-matter discovered.

Vendella. A crosscut tunnel has been driven, about 408 feet in length, by J. Wichser, of Greenwood, to tap the downward extension of segregations of pyrite and chalcopyrite developed by open-cuts and shallow shafts in former years near the top of the hill. Recent advice from J. Wichser states that 5 feet of quartz containing galena, pyrite, and sphalerite has been struck in the face of the tunnel, which assays 1.25 oz. in gold to the ton. This ore occurs, apparently, on the contact of the serpentinized greenstone and the granite and seems to be an entirely different character of ore from that found above. Future developments will be looked forward to with interest.

Texas. This claim, owned by George Swanlund, of Boundary Falls, is situated about half a mile north of the *Providence*. A great deal of work, including a shaft 65 feet deep, was done in former years on a massive pyrrhotite outcrop near the top of the hill without finding commercial ore. At the present time the owner is driving a tunnel 450 feet lower in elevation on narrow lenses and stringers of quartz in the argillites. A new blacksmith-shop and frame cabin have been erected near the mouth of this tunnel. The claim is an interesting one, inasmuch as it lies on the strike of the *Providence* vein.

Sappho. This claim, situated 2½ miles east of midway and owned by Alex. Bravard, of Boundary Falls, was mentioned in the 1927 Annual Report. Owing to the fact that the claim has been surveyed and numbered, a mistake was made in stating that it was Crown-granted. Apparently A. Bravard is the owner and assessment-work has been done each year. According to the owner, the tunnel started last year has been extended as far as the old workings and about 10 tons of shipping ore extracted, as well as some lower-grade material that will probably pay to mill.

Jewel Lake Camp.

No major operations were carried on in this camp, 10 miles from Greenwood, during 1928, although options were taken on the *Jewel;* it is understood the old workings were unwatered, but nothing further was done. Prior to 1916 the *Jewel* produced a large tonnage of gold and silver ore, which was cyanided at the property by the Jewel-Denero Mines Company, Limited. This company owned a half-interest in the adjoining *Denero*, but apparently was unable to arrange suitable terms for the operation of this property. The *Jewel* vein extends into the *Denero* and it is believed that there are workable ore-shoots in it; this could be ascertained by thorough sampling. The vein system can be traced for several hundred feet in a northerly direction from the *Jewel*.

Gold Drop. This claim, lying to the north-east of the *Jewel* and owned by Louis Bosshart, of Greenwood, was mentioned in the 1925 Annual Report. This year a short section of road was built to connect with the main *Jewel* road and the lower tunnel driven ahead towards the downward extension of the vein found in the shaft. This tunnel has been driven a distance of about 150 feet, at an elevation 55 feet below the second tunnel, and should reach its objective 25 feet ahead, according to the owner. High-grade telluride ore has been found on this claim, especially in the region of the faults.

West Copper Camp.

This camp is situated about 7 miles in a direct line north-west of Kettle Valley Station on the Canadian Pacific Railway, near the headwaters of Lee creek. Just why the camp was named

"Copper" remains a mystery, because very little of that metal has been found. The whole section has grown up with jack-pine timber since development-work was done about twenty-five years ago and great difficulty was experienced in finding the old workings; consequently some of the development may not have been seen.

Prince of Wales and Princess Louise. These two Crown-granted claims, Lots Nos. 3681 and 3680, are located on the trail running between Nicholson Creek road and Big Copper Camp road, at a distance of approximately 3½ miles from the latter camp. Development-work done on the *Prince of Wale* consists of a vertical shaft supposed to be 30 feet deep (filled with water), with numerous open-cuts within a radius of 150 feet of the shaft, close to the west boundary-line of the claim. Owing to the caved condition of the workings the exact size of the mineral-zone could not be determined, but it appeared to be about 20 feet wide, with an easterly and westerly (mag.) strike and a dip of 40° to the north. The dump from the shaft and open-cut 15 feet north contained massive pieces of pyrite, shot through with arsenopyrite in a gangue of silica. In a 150-foot trench east of the shaft the zone was slightly mineralized with pyrite. Samples taken from the shaft-dump and open-cuts only assayed a trace in gold and silver and no copper. The country-rocks of the area, where exposed, are probably basalt, without columnar structure. In the vicinity of the workings these rocks have been pierced by plugs of pulaskite porphyry.

On the *Princess Louise*, 100 feet to the west, a shaft 10 feet deep and several small open-cuts on the contact of the porphyry have been excavated. The mineral-zone was chiefly pyrite in a siliceous gangue. No values were obtained from these workings.

About half a mile west of the West Copper cabin some development-work has been done on a quartz vein impregnated with pyrite, varying from 2 to 12 inches in width. A picked sample of this ore assayed 2.02 oz. in gold to the ton.

Rock Creek Section.

Imperial. This claim, reported upon in the 1926 and 1927 Annual Reports, was not worked this year. An error has been made in the 1927 report in quoting the contents of a shipment made to the smelter. Instead of "Gold, 11 oz. to the ton; silver, 2,102 oz. to the ton," it should have been: Gold, 11 oz.; silver, 2,102 oz. The ore-body is generally low grade, but on account of its size and situation it appears to be worthy of further development.

Chromite.

On the west side of the main Kettle river, about 4 miles north of Rock Creek village, high-grade segregations of chromite have been found in the serpentine rocks. Very little work has been done to prove the extent of these deposits.

Westkettle River.

Jo Dandy.—Only assessment-work was done on this claim, near Rhone Station on the Kettle Valley Railway, by A. Mellor, the owner. A detailed report on the property appears in the 1927 Annual Report.

Maryland. This claim, situated on the north side of the river, is owned and being worked by J. F. Worthington and associates, of Westbridge. A tunnel is being driven near the contact of the granite and greenstones in a quartz-zone mineralized with pyrite. No assays of this rock have been received to date.

Cranberry Ridge Section.

Laurion. This claim, situated about 4 miles below Beaverdell, on the opposite side of the river, was developed by Washington interests under the management of W. E. Johnston and R. C. Draggo, of Yakima. The lower crosscut tunnel has been driven under the shaft, but no ore encountered at the time of examination (August 16th). The management believes that the vein found in the shaft has been faulted and the section below the fault will be found farther in the hill.

Nipper. This group, reported on in 1925, was bonded to the management of the *Laurion* and a camp built and some open-cut work done to the south-west of the main workings. Shear-zones about 2 feet wide containing galena, sphalerite, and pyrite have been uncovered in the schist near its contact with the quartz diorite.

Owing to the extreme shearing and faulting of the rocks in this area, more development will have to be done before any idea of possible tonnage can be obtained. It is probable that the schist is part of the Wallace formation and originally covered the quartz diorite in which most of the work has been done.

Inyo and Ackworth. These claims, mentioned in the 1925 Annual Report, are owned by Vancouver interests under the management of H. Fry, 411 Pender Street West, Vancouver. During the year the lower tunnel was driven straight ahead under the open-cut in which ore had been discovered. At the time of examination some likely-looking vein material had been found in a slip on the right-hand side of the tunnel. Further work was done on this, but the results are not to hand.

Titanic. This claim, situated on the east slope of Cranberry ridge, is owned by W. Phillips *et al.*, of Cascade. During the autumn a new strike was reported as made above the old workings and some samples of ore from this find assayed high in gold. In the old tunnel and shaft high-grade silver-lead ore was found in small segregations, but owing to the extremely broken nature of the ground its continuity has been difficult to follow.

Wallace Mountain Section.

Mining on Wallace mountain on the more important properties was active during the year, and in spite of temporary "shut-downs" in some of the mines an average tonnage will probably be maintained. Mining the high-grade silver-lead veins in the quartz diorite on this mountain is difficult and costly on account of the extremely faulted nature of the ground. Up to the present no set rules apply to the intermediate faults or those lying between the main breaks, and every round blasted must be examined and the dip and strike of the faults plotted, if success is to attend the venture. Developing ore ahead is practically impossible, because it is necessary to remove "ore in sight" before the direction of the next segment of the vein can be located. It is necessary at times to drive crosscuts under the ore-zone, but this is not practised, as a rule, unless a winze has been sunk for a considerable distance on the ore first and the direction of the throw of the faults ascertained. Great credit is due those in charge of the operations on this mountain for the steady production maintained in the face of adverse conditions.

Bell. This mine, under management of Duncan McIntosh and Henry Lee, produced a total of 1,207 tons of silver-lead-zinc ore during 1928. This is the highest total for many years, if not for all time, and speaks well for the future outlook of the mine. Four machine-drills are constantly in use, with an average of three working in ore. In the summer a truck is used and in the winter a sleigh to haul the ore to Beaverdell Station.

Highland Lass. This mine adjoins the *Bell* on the north-east and is being operated by the Highland Lass Syndicate, of Kelowna and Penticton, under the management of A. J. Finch, of Kelowna. An option was taken on this property in the spring from Bell & Hallet, owners, and since that time an average of five men has been working. This mine has been worked spasmodically by lessees and the owners for many years and pockets of high-grade silver-lead-zinc ore mined and shipped, but no regular development programme followed until this year, chiefly on account of lack of funds to install machinery. The Highland Lass Syndicate mined by hand until August, when a 1-drill engine and compressor were installed and the upper tunnel extended through the fault to the lower segment of the vein. During the year 500 feet of drifting and 70 feet of upraising was done and 33 tons of high-grade ore shipped to the smelter. The management advises that approximately 40 tons of ore remains in the bin at the present time and another 40 tons is stripped in the stopes.

The ore struck in the upper tunnel appears to have the same strike as one of the *Bell* ore-zones and contains similar minerals. The same faulted condition exists and the main faults have thrown the top of the ore-bodies down the hill to the west. Lower workings struck the upper segment of the shear-zone near the surface, and if the tunnels are extended they should develop the lower part of the ore under the fault. A wagon-road was built from the summit to the upper workings.

Revenge. The owner of this property, George Barrett, of Beaverdell, drove a short crosscut in No. 2 tunnel during the year. The claim adjoins the *Bell* on the west and is fully equipped with machinery ready for development. The long crosscut tunnel has been driven below and under the ore-bodies found in the upper workings,

and an upraise connecting the work may be recommended in an endeavour to locate the lower part of the shear-zones.

Bounty. Under the management of Alec McPhee, this mine was worked in a small way during the year. A small section of the ore was found and mined in the east end of the main stope and an upraise driven about 30 feet. On the west end of the stope a crosscut was driven 40 feet and an upraise 40 feet in an endeavour to find the ore. The old workings, about 100 feet higher in elevation, were cleaned out and retimbered. There is a section of ore in between the bottom of the old workings and the stope above the lower tunnel that has not been found. A new section of road was built, cutting down the steep gradient to the mine, which will enable supplies to be hauled in during the spring and autumn.

Tiger. This claim adjoins the *Beaver* and *Black Pine Fraction* on the south-west and the *Kokomo Fraction* on the south-east. No work was done on this claim this year. In former years Naramata capital exploited the shear-zone outcrops and did a considerable amount of work without finding any persistent shoots of silver-lead ore. A close study of the faulted ore-zones on the *Rob Roy*, *Kokomo Fraction*, and *Beaver* may be usefully applied to future development-work on this claim at depth. The quartz-diorite rocks and ore occurrences are similar to those found on the *Bell* and *Sally*.

Nepanee. This group, consisting of the *Nepanee*, *Cobalt*, and *Alaska* claims, adjoins the *Buster* on Wallace mountain and is owned by E. G. Cummings, of Beaverdell. Most of the work has been done of recent years on the *Cobalt*, close to the *Alaska* line, and consists of two crosscuts, elevation 5,025 feet—one driven about 100 feet N. 70° E. (mag.) and the other, 30 feet away, driven 113 feet in a north-westerly direction. The reason for driving these tunnels was the discovery of a large piece of displaced silver-lead ore in the gravel overburden which left no clue as to its original location. No trace of this ore was found in these crosscuts. A third tunnel was driven 60 feet north-west (mag.), at an elevation of 5,007 feet, for a distance of 122 feet. At a point 43 feet from the mouth of this tunnel a shear-zone varying from 6 inches to 2 feet wide was struck on a fault. This vein was drifted on for 30 feet and a winze sunk 10 feet on the vein at the end of the drift. In the winze the vein narrowed considerably and was slightly step-faulted in a westerly direction. Picked ore taken from this vein assayed: Gold, trace; silver, 134 oz. to the ton; lead, 34 per cent.; zinc, 14 per cent.

Beaver Silver Mines, Ltd. The *Beaver*, bonded and worked by this company, was reported on and a map of the underground workings published in the 1926 Annual Report. During 1927 the ground to the north-west and south-west was exploited and the east shaft sunk 25 feet to permit development under the old workings. The amount of ore found in these workings proved to be disappointing.

In 1928 the main or east shaft was extended to a point 95 feet from the collar, and a crosscut, called the No. 3 level, driven 237 feet in a northerly direction to a point 4 feet from the *Bell* line. An upraise was put in 35 feet south-east of the face of this tunnel and ore was struck in the first round of holes. This ore was lying on a flat fault and the crosscut missed it by about 1 foot. According to a report from the management, the shear-zone, where struck, was 40 inches wide, 30 inches of which was high grade. On continuing the raise along the strike of the ore the zone widened to 7 feet and contained four streaks of pay-ore, two of which measured 1 foot and two about 6 inches in width. An average of 6 feet of this material assayed 90 oz. in silver to the ton. The length of the ore-shoot, with faces still in ore, is 36 feet, at an elevation of 8 feet above the level. The high-grade ore pinches to 5 inches in the centre of the stope, but widens again, and is 20 inches in the north-east end. The strike of the ore-body is N. 55° E. (true), which is the course of the *Bell* vein, and varies in dips from vertical to slightly east or west.

A chute and manway have been built and probably two stopers on two shifts will be in action in the near future. Machinery installed is as follows: A 30-horse-power Ruston-Hornsby oil-engine which runs the old 9 by 8 Ingersoll Rand compressor; a Diesel-type 2-cylinder, 18-horse-power horizontal Brantford oil-engine which runs a Beatty 12- by 30-inch long drum-hoist. The compressor and engine have been housed in a 14- by 30-foot frame building and the old 18- by 32-foot engine-house has been transformed into a blacksmith-shop. A 14- by 18-foot building has been built for the hoist. The hoist is driven by a roller-chain drive from the engine and has a starting device consisting of a 4-horse-power air-motor which is connected to the engine roller-chain and is operated by a jaw-clutch. The hoist is operating at 200 feet a

minute at present, but is designed to pull a 1-ton skip on rails at 70° slope at 220 feet a minute. An air-receiver 8 by 3 feet has been installed in addition to the old 6- by 3-foot one. Water from the mine, pumped by a 2 by 3 by 4 duplex, supplies more than sufficient cooling-water for the plant. The overflow from the engine and compressor is stored in the Sutherland tunnel and returned to the main storage-tank by a small gasoline-pump. An average of twelve men is being employed under the superintendence of R. L. Clothier.

Wellington. This mine, situated on Wallace mountain and about 3,000 feet south-west of the *Bell*, was bonded by the Wellington Sydicate a few years ago. From about 1925 until the beginning of 1928 development was carried on and about 932 tons of silver-lead-zinc ore shipped to the smelter. Owing to the badly crushed ground beyond a main vertical fault, extreme difficulty was experienced in following the shear-zones and a considerable amount of money was spent in an endeavour to find the ore in this area.

During the summer the syndicate decided that further financing for development was necessary, and the Wellington Syndicate, Limited, was formed with a capitalization of 50,000 shares at $1 par value. Sufficient money was raised from this issue to drive a tunnel 158 feet lower in elevation, so that known ore-bodies in the less-disturbed ground could be mined more economically. At the present time this tunnel, No. 4, has been driven 605 feet and has reached the main vertical fault. According to the management, pieces of high-grade ore were encountered in one of the minor faults whilst driving the tunnel, and assurance is felt that shipments to the smelter will be resumed in the near future.

During 1928 one car-load of high-grade ore and a small tonnage of milling-grade ore was shipped to Trail. Total development in No. 3 tunnel amounted to 271 feet of drifting, and in the 350-foot, or sub-level, 145 feet of drifting and 50 feet of upraising. New bunkers having a capacity of 100 tons were constructed below No. 4 tunnel adjoining the road. Word has just been received from the management that ore has been struck in the mine again.

Sally Mines, Ltd. This group of claims, including the *Sally*, *Pueblo Fraction*, and *Rob Roy*, was operated under the supervision of Ed. Nordman and about nineteen car-loads of ore shipped to the smelter. Development consisted of 2,139 feet of drifting, 1,334 feet of crosscutting, 272 feet of upraising, and 155 feet of sinking. According to the management, new ore-bodies were discovered on two different levels, on what is called the No. 6 vein, at the end of the year, which looks promising for 1929.

Little Joe. The lower tunnel on this claim, owned by W. R. Lawerence, of Penticton, was driven 41 feet and the downward extension of the shaft-vein discovered. Numerous faults and minor slips have displaced the vein and caused some enrichment. A sample of the vein, which varies in width from 2 to 6 inches in the tunnel, assayed: Gold, trace; silver, 2.6 oz. to the ton; lead, 8 per cent.; zinc, 4 per cent. The trail leading from the main Beaver Creek route was cut out and regraded this year.

Main Kettle River Section.

A revival of interest in the mineral-deposits situated on Horseshoe mountain, which skirts the Kettle river about 24 miles north of Westbridge on the west side, has resulted in cleaning up some of the tunnels and shafts driven about thirty years ago and a continuation of the work where values justify it. The geology of this section resembles to some extent that of Wallace mountain, Beaverdell, with the exception of a large mass of augite-syenite porphyry which lies north and east of Horseshoe mountain. The ores found up to the present occur generally as stocks and veins in the metamorphosed igneous rocks, mostly tuffs and lavas, and consist of pyrite, pyrrhotite, and arsenopyrite. Where the arsenopyrite occurs gold values are generally present.

The deepest development to date in the area is only about 50 feet on the *Mogul*, and according to the management the ore is in the diorite on a porphyry contact. The owners of other groups of claims may be well advised to clean out the old shafts and open-cuts, especially on the *Barnato* and *Hackla* claims, and endeavour to find some connection between the ore-bodies.

Mogul. This group of claims, consisting of the *Mogul*, *Silver Dollar*, *Utopia*, *Mame*, *Coin Fraction*, *Anchor*, and *Highland Mary*, situated about 2 miles in a straight line directly west of the junction of Dear creek and the main road from Westbridge to Christian valley, at a distance of approximately 25 miles north of the Kettle Valley Railway, is being developed by H. E. Hunnings & Company, Limited, of Victoria, under the supervision of A. F. Thomas.

In September the old trail traversing Stewartson creek was cut and regraded as far as the old cabins on the *Utopia* claim by the Provincial Government. These cabins were reconditioned and supplies were packed in by the company.

The old 6- by 9-foot shaft on the *Mogul* was cleaned out, new ladders put in, and sunk to 50 feet depth. From the shaft a diagonal crosscut 5 by 7 feet was driven, for 25 feet through the lead and a drift on a 3-foot vein, 12 feet in length. Numerous old open-cuts and stripping show the continuation of the vein system for 150 feet in a south-westerly direction. Beyond that point the diorite is intruded by offshoots from the porphyry and the vein has been displaced. The values found on the surface are generally low and do not compare with those found in the shaft. Samples taken from the shaft-vein prior to this exploration assayed between 1 and 2 oz. in gold to the ton.

To the north-east, on the *Monitor*, the tuffs and diorite are again intruded by apophyses from the porphyry. On the *Utopia* several old open-cuts and shallow shafts have developed displaced segregations of pyrite and pyrrhottte in the tuffs. On the *Silver Dollar* two large open-cuts have been excavated in similar mineral-zones, but nothing done to ascertain the continuity of the mineralization between the workings. Owing to caving no reliable samples could be taken. Recent work done by Hunnings & Company on this claim consists of cleaning out the main shaft and 30-foot tunnel and continuing to sink. The total depth is now 57 feet and, it is reported, a lead 14 feet wide, dipping out of the shaft, was observed at the junction of the tunnel and the shaft, 27 feet from the collar. A continuous flow of water hinders these operations to some extent, and if developments warrant it a tunnel will be driven in the spring.

Barnato. The *Barnato*, *Barnato Fraction*, and *Hackla* claims, lying to the south-east of *Mogul* group, have been leased by unknown persons from the Government, but no work was done this year up to September 15th. Most of the old workings, consisting of open-cuts, shafts, and tunnels, were in a caved condition and could not be examined, so that very little can be said regarding the possibilities. Samples of ore taken from the dumps varied in value from a few cents to $80 in gold, which is sufficiently encouraging to warrant at least the expense of cleaning out the workings and connecting the mineral-outcrops by surface trenches. The ore appears to occur in veins and segregations in the tuffs and is made up of pyrite, pyrrhotite, and arsenopyrite in a gangue of quartz.

Yorkshire Lass. This claim cuts the north-west corner of the *Barnato* and has been developed by open-cuts from 50 to 100 feet apart over a distance of about 500 feet on shear-zones varying in size from 10 inches to 5 feet in the tuffs. The mineralization is pyrite, pyrrhotite, and arsenopyrite in a gangue of quartz and silica and strikes N. 54° W. (mag.). A sample of ore from the highest open-cut assayed: Gold, 0.50 oz. to the ton; silver, 0.10 oz. to the ton. To the north and east tongues of syenite porphyry invade the tuffs.

Camp McKinney.

The history of this camp, situated about 6 miles north of Bridesville, at an elevation of 4,600 feet above sea-level, begins in 1884, when the *Victoria* vein on Rock creek was discovered a short distance above the placer-diggings of 1866. Very little was done until 1887, when the *Cariboo* vein was found impregnated with free gold.

In the Annual Report for 1897 a description of work being done is described and, as access to the underground workings was possible then, a short description follows. The rocks in the Camp McKinney area are mainly metamorphic and may be classed as a granite gneiss, enclosing highly altered stratified rocks, including quartzites and limestone. Numerous dense dark-coloured diabase dykes cut the formation. The veins apparently do not conform to the strike or dip of the formation, but cut across the stratification with an east-and-west trend and a southerly dip varying between 75° and 90°. Along a series of flat-dipping faults the veins have been thrown below the faults to the south for distances of 5 to 60 feet, and there are evidences of one throw 140 feet long. There are minor slips in other directions, but the direction of the throw is nearly always indicated by the bending of the vein or by a tail of quartz towards the other part of the deposit in the gouge.

The main vein, running through the *Cariboo*, *Amelia*, *Alice*, *Emma*, *Maple Leaf*, *Eureka*, and *Mammoth*, varies from 1 to 10 feet wide, with an average width of 4 feet in the *Cariboo* and *Amelia*. The first locators, believing that the veins conformed to the strike of the gneiss, located their claims accordingly. Consequently the above claims were staked 1,500 feet across the vein

and 600 feet along it. While the main *Cariboo* vein strikes east and west, the other quartz veins vary, as on the *Sailor*, N. 45° E.; on the *Fontenoy*, N. 45° W.; on the *Dolphin*, N. 70° W.; and on the *Victoria*, N. 10° E. Most of the quartz is milky white and compact, weathering white on the outcrops but rusty red on the dumps from iron oxide. Other sulphides noticed are marcasite, galena, sphalerite, and chalcopyrite.

The quartz in the *Cariboo-Amelia* ore-shoot is bluish-white and contains from 3 to 3½ per cent. of sulphides, the gold values being in direct proportion to the sulphide content and the size of the vein. The ore apparently was low grade where the vein pinched. Free gold was found near the surface and in places to a depth of 160 feet in the *Cariboo* and *Amelia*. In this mine the values are stated to have increased with the sulphide ratio in depth from $11 on the surface to $15 or $16 in gold and silver at a depth of 175 feet. The free gold was recovered on plates and the sulphides concentrated and shipped to the smelters.

Costs at that time were: Freighting supplies from Penticton, $30 to $35 a ton; concentrates to Penticton, $11 a ton; to the smelter, $5.50 a ton. Cordwood for power, $1.75 a cord. Cost of smelting, $3.50; mining, $4; and milling, $2 a ton. The concentrates contained 35 per cent. iron, 9 per cent. silica, and less than 10 per cent. zinc. The bullion graded: Gold, 635; and silver, 340 fine. Over 21,000 tons had been mined and milled to June, 1897, and $188,965 paid in dividends. The tailings loss is said to have been from $1.50 to $2.50 a ton.

On the *Cariboo* and *Amelia* in 1897 the vein was opened up for about 600 feet along a continuous but faulted vein varying in width from 1 to 8 feet to a depth of 175 feet. Three shafts were sunk and a crosscut tunnel 250 feet long taps the workings about 70 feet from the surface. Since these claims were worked the Great Northern Railway has been built into Bridesville and the West Kootenay high-power electric line passes through the camp, so that mining and other costs will be considerably lower for any operations contemplated in future.

Le Roi and War Eagle.

These claims are situated about 3½ miles south-east of Camp McKinney and were reported upon in the 1926 Annual Report. Since that time the Consolidated Mining and Smelting Company bonded the claims from James Copeland *et al.*, of Rock Creek, and some diamond-drilling was done, mostly on the *War Eagle*. Due to some difficulty arising about terms, the bond was dropped by the company. The *Le Roi*, owned outright by Copeland, is an especially good copper prospect.

OSOYOOS MINING DIVISION.

This Mining Division embraces one of the most interesting geological sections in the district and in recent years has had less prospecting and development done upon it than any of the others. On the west side of Osoyoos lake, from the International boundary-line to Osoyoos Custom-house, there is an interesting section of quartzites, slates, greenstones, and limestone in contact with granodiorite and gneiss, well mineralized with pyrite and chalcopyrite. A good deal of prospecting and development was done in this area many years ago and some shipments made to the smelter from the *Lake View*, *Dividend*, and *Gipsy Fraction*. These rocks continue north and west intermittently (*see* R. A. Daly's "North American Cordillera, 49th Parallel." 1912) and there are remnants of many millions of tons of rock not mapped because the geology was general.

At Fairview camp, situated east of Osoyoos lake, the richer surface gold-quartz ores were mined thirty years ago. Deeper development, down to 600 feet in the *Stemwinder* mine and 350 feet in the *Morning Star*, proved the continuance of the mineral-zone, but the grade of ore apparently became lower at depth—from $5 to $12 in gold—which at that time could not be handled at a profit. The vein system varies from 4 to 20 feet in width and can be traced intermittently in the schistose rocks for 5 miles. At the present time the West Kootenay high-power electric line passes through the camp and a branch of the Kettle Valley Railway serves Oliver, about 2 miles distant from Fairview.

This belt of schist continues north and east to Keremeos and White lake and is worthy of intensive prospecting. Along the Okanagan river north to Dog lake there are large remnants of limestone covered in part with recent volcanics.

At White lake the tuffaceous sandstones, shales, and conglomerates cover an area of about 6 square miles. The thickness of the beds on the north side of the basin has been given by Chas. Camsell as 2,000 feet, with a suggestion that on account of slipping along the bedding-planes there may have been some duplication. Work done periodically in the basin has uncovered

Road up Granby River, Grand Forks M.D.

Wellington Mine, Greenwood,

Similkameen River—Placer-mining, Similkameen M.D.

Providence Mine, Greenwood M.D.

several likely-looking coal-seams varying from 3 to 6 feet in width. No deep development, other than diamond-drilling, has been done and until shafts are sunk the commercial value of the field remains obscure.

In the Olalla district there are many interesting prospects and the recent find of nickel associated with the pyroxenite rocks is an added attraction. The copper-molybdenum ore-bodies on the *Golconda* warrant development. Between Hedley and Olalla there are numerous outcrops of arsenopyrite carrying gold in the limestone-beds and fragmentary volcanics. H. Bostock has made a geological survey between Hedley and Dog lake and his report should prove interesting to prospectors.

Hedley Gold Mining Co., Ltd.

This company again operated throughout the year, with the exception of three or four months during the severest part of the winter, when the ice in the rivers and creeks prevented the generation of power in the company's plant. A systematic programme of diamond-drilling was carried on in the mine in an endeavour to locate new ore-bodies, and it is understood some success was obtained. A total of 45,410 tons of arsenical-gold ore was mined and milled, from which 1,884 tons of concentrates and 1,318,000 lb. of arsenic were recovered. The gold is extracted by cyanide at the mill and the concentrates shipped to the Tacoma smelter. G. P. Jones is general superintendent; R. Wheeler, mill superintendent; and Wallace Knowles, mine superintendent.

Nelson.

This group, owned by J. McNulty, of Hedley, and situated in the Apex basin, about 4 miles south-east of the *Nickel Plate*, was reported on in 1923, 1924, 1925, and 1927. This year a crosscut tunnel was commenced about 50 feet below the collar of the shaft and driven for some distance towards the bottom of the shaft, when a heavy snowfall closed down the work. Vancouver interests took an option on this group and financed the work done.

Oregon.

This group of Crown-granted claims, including the *Oregon*, *St. Bernard*, *Savage*, *Winchester*, and *Two Sisters*, lies on the north-east side of the Similkameen river, about 4 miles south-east of Hedley and 4,000 feet from the Great Northern Railway. Very little work has been done on this group since 1917. Prior to that time development consisted of an upper tunnel 35 feet long, mostly in ore, and an 8-foot crosscut from this tunnel all in ore.

About 70 feet down the hill two tunnels have been driven which failed to discover the downward extension of the ore-body in that direction. An open-cut above the upper tunnel exposed plenty of low-grade mineralization. The lowest-grade sample cut along the side of the upper tunnel assayed: Gold, 0.06 oz. to the ton; silver, 0.90 oz. to the ton; copper, 1 per cent. Another sample assayed: Gold, 0.12 oz. to the ton; silver, 3.40 oz. to the ton; copper, 3.90 per cent. The lower tunnels do not prove conclusively that the ore does not extend in depth and there still appears to be a chance of its continuance at a low angle into the hill. The country-rocks are limestone intruded by diorite and gabbro. The ore-minerals are bornite, chalcopyrite, arsenopyrite, and pyrrhotite in a gangue of silica, garnetite, and epidote. This property, close to transportation and power, appears to be worth more development.

Patsy.

This group, situated about 4 miles east of the *Oregon* and owned by Dan McKinnon, of Hedley, and mentioned in the 1927 Annual Report, consists of the *Patsy*, *Grand View*, and *Diamond* claims. For a number of years development has been done in a zone of argillites near the contact of the diorite at an elevation of 350 feet above the Similkameen river, near its confluence with Stirling creek. An open-cut about 25 feet long has uncovered a quartz vein in the argillites, varying from 2 to 4 inches in width for its entire length, striking north and south (mag.) and dipping 38° west. Beyond and higher up the hill the vein can be traced in the diorite, but it does not contain any appreciable values. Twenty feet below the bottom of the open-cut, where the vein dips at 44°, a tunnel has been driven for 25 feet. In this drift the vein widens and pinches from 1 to 8 inches. Twenty-five feet lower in elevation a second tunnel has been driven for 80 feet on the vein, which varies from 2 to 4 inches in width, in a much-displaced zone of argillites intruded by apophyses from the diorite. Another tunnel, 72 feet long, has been driven 30 feet lower on shattered and pinched parts of the vein. The diorite-contact was struck in the face. A crosscut 12 feet long and 30 feet from the face has been driven west and an offset tunnel 60 feet long, commencing 18 feet from the mouth of the lower tunnel, has been driven in a south-westerly direction and at an incline of 10° up. It is evident that as the contact of the diorite is reached, as is the case in

the lower workings, the vein is too severely shattered to warrant further exploration. About 100 feet west of the lower workings several open-cuts uncovered lenses and stringers of quartz impregnated with pyrite and arsenopyrite. A sample taken from 6 inches of vein-matter in the upper tunnel assayed: Gold, 2 oz. to the ton; silver 0.40 oz. to the ton. A sample of sacked ore from the middle and lower tunnel assayed: Gold, 2 oz. to the ton; silver, 0.40 oz. to the ton. A sample from open-cuts 100 feet west of the workings assayed: Gold, 0.34 oz. to the ton; silver, 0.10 oz. to the ton. The ore-minerals are arsenopyrite, pyrite, and occasionally pyrrhotite and sphalerite. The crushed zone encountered in the lower workings is highly oxidized and replaced by calcite.

Peggy. This group, consisting of the *Peggy, Hobo, Jumbo, Tipperary, War Eagle, Whirlwind,* and *Cyclone* claims, was reported upon in 1923 and 1926. It is situated on the divide between Hedley creek and the Similkameen river, about 1½ miles north-west of Hedley. This year the owners, Dan McKinnon and R. E. Baxter, of Hedley, prospected the limestones lying on the Similkameen slope, and according to reports some arsenopyrite carrying commercial values in gold was uncovered in several new locations.

Pollock.—This group, consisting of the *Pine Knot, Daisy,* and other claims and situated about 1½ miles west of Hedley, on the south side of the Similkameen river, was reported upon in 1927. Since that time the claims have not been examined.

Big Horn Mines, Ltd. This company is a reorganization of the Horn Silver Mining Corporation, Limited (N.P.L.), and has a Dominion charter. Stobie, Forlong & Company, of Toronto, has financed developments and maintained an office in Nelson, with James O'Shea as secretary-treasurer; B. W. W. McDougall, consulting engineer; and A. T. Miller, mine manager. Later in the summer A. T. Miller succeeded B. W. W. McDougall.

Reports upon this property have appeared yearly and in the Annual Report for 1926 there is a flow-sheet of the mill. From January 1st until September 30th, 1928, when the mine closed down, an average of nine men was employed, including superintendence, engineer, and cook. Most of the development-work was done on the east side of the mine, as follows: No. 1 tunnel east, drifting 270 feet; No. 2 intermediate level south, 59 feet; sub-level, 44 feet; No. 3 east on east side of top level, 21 feet; upraising, 62 feet; and sinking, 14 feet. On the west side No. 2 level was extended 104 feet and an upraise from this level driven 49 feet. In addition to this work, assessment was done on the un-Crown-granted claims belonging to the company. A shipment was made to the smelter on September 14th, consisting of one high-grade lot which assayed: Gold, 0.814 oz. to the ton; silver, 140.26 oz. to the ton; and another lot of milling-ore assaying: Gold, 0.20 oz. to the ton; silver, 37.77 oz. to the ton. Analyses of the ore included 80 per cent. silica, 3 per cent. lead, and 1 per cent. zinc.

In August the following geological report made by Alfred R. Whitman throws some light upon the difficulties to be encountered in development:—

"*Geological Report, Big Horn Mines, Ltd.*

"*Geology.*—The group of claims known as the Big Horn Mines, 3 miles south of Similkameen, B.C., lies on a steep mountain-side on the eastern slope of the Similkameen valley, within an area of granodiorite. This formation varies in character from place to place, due to processes operative during the period of its solidification from the molten state at the time of its injection from below, long before the present topography was carved by erosion. One of the phases of its variation is a light-coloured rock called monzonite, the complementary phase being a dark-coloured rock of about the composition of diorite. The best ore occurs in the diorite and the poorer ore in the monzonite.

"Prior to mineralization the mountain has suffered considerable fracturing in the form of joints, faults, and shear-zones. These grade into one another here and there. The joints are mere cracks occurring in systems of parallel planes, upon which there has frequently been slight slippage. The faults are fractures more distantly spaced and perhaps less systematic; upon these has been pronounced dislocation. The shear-zones are fracture groups, in which the planes are closely spaced and somewhat interlaced, upon which in the aggregate there has been more or less pronounced dislocation.

"The ore, which consists of native silver, silver sulphide, silver sulpho-arsenide, lead sulphide, and iron sulphide with gold, and sometimes a little copper sulphide, in a gangue of quartz

and calcite, occurs in the shear-zones chiefly, but also to some extent in joint groups and faults. In the shear-zones the ore occurs as tabular lenses and vein-like bodies, here and there attaining spectacular richness. The aggregate ore-bodies thus made by grouping of a number of these narrow rich veins in a shear-zone, and the general impregnation of the country-rock within the shear-zone, may be said to have an average width of 3 or 4 feet and lateral dimensions varying in various ways from 10 to 200 feet. As a broad generalization, it may be said that these indeterminate ore-bodies favour the more flatly inclined shear-zones in the more dark-coloured country-rock, the dips varying from flatness to about 45°.

"These ore-bodies frequently pass from one shear-zone or set of joints to another at a different angle, making it necessary in mining to be always prepared to follow the simple rule of 'follow the ore.' In hunting new ore-bodies, however, the rule should be to drift or raise on the stronger shear-zones. The work thus far has been inadequate to reveal consistent rules for the occurrence of mineralized shear-zones; but in the course of time further careful graphical methods may succeed in discovering such rules, which will greatly reduce exploration costs.

"The ore-bodies already found in the mine occur on a number of separate shear-zones and cannot be reported as being enrichments on any single structure; and the various outcrops on the property undoubtedly are equally separate and unrelated. It is quite possible that the outcrops now visible and known may lead to a number of ore-bodies as rich and productive as those already mined and now being mined; but, in order to make the greatest profit from them, it will be necessary to follow the above rules and to study untiringly the significant structures and the graphical data relating to them in the form of maps, cross-sections, and perhaps ultimately a model.

"*Summary.*—The ore-body now being opened up on the second and third levels of the new workings and those already excavated may be duplicated in the future and perhaps exceeded if the above rules are followed and the operations prosecuted with efficiency. It is important here also to emphasize the fact that the ore-bodies have not suffered materially from faulting as has been supposed, the faults not being of any material importance."

Having had access to the workings during operations under the Condit Bros. from 1917 on, it may be stated that the vein on the west side of the mine was different in structure to that being found on the east side, inasmuch that, although there were many minor step-faults on the dip of the vein, there was no apparent lateral shearing except on the hanging-wall, which showed intense metamorphism and schistosity for upwards of 2 feet. It seems probable that the vein on the east side has been under a far greater stress, and even after enrichment the vein has been subjected to intense shearing and possibly further mineral migration, giving it the appearance of a fractured shear-zone rather than a vein proper.

The chief difficulty, and consequent high cost, experienced in the 1928 operations was due to the attempt to follow the ore in intermediate levels where the enriched zones were not large enough to warrant it. It seems advisable in future to explore the area on broader lines by driving the main levels ahead and upraising at frequent intervals, and if the ore-zone tapped by the raises is not sufficiently large the whole project may be abandoned as unprofitable. If new machine-drills are purchased two shifts can be profitably employed in the mine for practically the same overhead expense.

Woodrow and Silver Glance.

These claims, owned or optioned by the Big Horn Mines, Limited, adjoin the *Horn Silver* to the east and north. The workings on the *Woodrow* consist of numerous open-cuts and a tunnel 10 feet long, which have exposed a quartz vein 500 feet in length, from 6 to 20 inches in width, strikingly northerly and southerly and dipping nearly flat. This vein has the same fractured and oxidized appearance, in a lesser degree, as the vein in the west workings of the *Horn Silver*, but is not so well mineralized.

A sample from one of the south cuts over 2 feet assayed: Gold, 0.02 oz. to the ton; silver, 2.6 oz. to the ton. Another sample from another south cut assayed: Gold, trace; silver, 2.6 oz. to the ton. A general sample taken by A. T. Miller from the 10-foot tunnel assayed: Gold, 0.10 oz. to the ton; silver, 8.8 oz. to the ton. Another sample from sacked ore from the tunnel, taken by Miller, assayed: Gold, 0.04 oz. to the ton; silver, 40.4 oz. to the ton. There was some enrichment of the vein in the tunnel. Open-cuts have been excavated intermittently for 500 feet north, and the vein exposed appears to be about the same width and has similar mineral content as that found on the south side of the tunnel.

On the *Silver Glance*, which adjoins the *Woodrow* on the north, several open-cuts exposed a probable extension of a similar type of quartz vein. A sample from one of the better-mineralized cuts assayed: Gold, trace; silver, 2 oz. to the ton.

Tiger Gold Group Syndicate.

(Eclipse Mining and Milling Company.) This group, consisting of the *Kruger*, *Iowa*, *Strathcona*, *Kitchener*, *Eclipse Fraction*, *Ellen*, *Otter*, *Bobs*, *Buller*, *Crown*, *French*, and *Apex* claims, is situated about 3½ miles south of Similkameen Station on the Great Northern Railway. The syndicate was formed with a capital of $50,000, divided into 500 share units of nominal value of $100, of which the claim-owners receive 300 units in escrow, under the direction of A. T. Miller, late manager of the Big Horn Mines, Limited, and part of the old workings were cleaned out on the *Buller* and *Kitchener* (October 21st). A camp was established in an old cabin on top of the hill, near the end of the road which branches north from the main road at the upper Richter ranch, and traverses the hill-tops skirting the east side of the Similkameen river. From this camp a trail was built 2 miles in length to the workings on the *Buller*. At the time of examination practically nothing had been done underground and certain parts of the mine were caved.

Although no official returns are available, the part owner of the *Buller*, W. Maneres, of Penticton, states that a 10-ton shipment of ore was made many years ago and satisfactory returns obtained. This ore is supposed to have been taken from the shaft which has been sunk underground and which was still partly filled (October 21st). In the back of the tunnel above the shaft-collar (elevation 4,100 feet) the vein widened to 5 feet and was mineralized with pyrite. A sample of this ore taken in 1927 assayed: Gold, trace; silver, trace. A sample from a 1-inch streak of disintegrated schist lying between the quartz and the foot-wall in the highest open-cut on the *Buller* assayed: Gold, 4.62 oz. to the ton; silver, 2 oz. to the ton. The lowest tunnel driven on the *Kitchener*, elevation 3,675 feet, was blocked at the mouth and could not be examined.

When all the workings are cleaned out and channel-sampled some idea of the value of the property may be obtained. Specimen samples taken by A. T. Miller assayed well in gold, but no average samples representing possible tonnage had been taken by him. There is no water in the vicinity of the *Buller* and *Kitchener* workings, hence the necessity of building a camp 2 miles away. According to A. T. Miller, there are other developments on claims in the group lying to the north and east of the *Buller* that may have merit and will be examined later. The country-rock is schist.

Summit, Blue Bird, Eureka, and Mountain Lion.

These claims, situated about 4 miles south-east of Twin lakes, on Oro Fino mountain, are owned by Al. Piper *et al.*, of Oliver. A Seattle, Wash., company under the management of R. C. McKay and A. B. Couper has bonded the group. A report from Al. Piper states that a shaft has been sunk and a tunnel driven 100 feet on the property and a 15-ton mill erected. This group probably covers the *Juniper*, *Juniper No. 2*, and *Huntsman* claims, which were reported upon in the 1924 Annual Report, or lies in that vicinity. The type of mill built is not stated, but as the ore is generally gold-quartz in that area, a cyanide or amalgamation plant will probably be used.

Olalla Section.

Golconda.

This claim was reported upon in the 1927 Annual Report and since that time very little work has been done on it owing to the illness of the owner, Dan McEachern, of Olalla. Tests were made and are still being made by the Department of Mines, Ottawa, for the separation of the molybdenum and copper contents of the ore.

Banshee and Big Banshee.

These claims lie about 1 mile north-east of Olalla and were prospected by numerous open-cuts, shallow shafts, and short tunnels many years ago when the district was booming. This year, shortly after the discovery of nickel in the camp, these claims were taken up by Penticton interests and the old workings thoroughly examined, sampled, and assayed for nickel, without finding a sufficiently high percentage to warrant further work. The mineralization, consisting of pyrite and pyrrhotite, occurs in segregations and stringers in a metamorphosed limestone and greenstones near an augite-porphyry contact. Beyond and to the east of the porphyry, columnar basaltic rocks occur, striking north and south for several miles. Samples of ore taken from several of the cuts and shafts carried only traces of gold and silver.

Bullion. This group, consisting of the *Bullion No. 1, Yellow Jacket Fraction,* and *Nellie* claims, lies at a lower elevation than the *Banshee* and about half a mile east of Olalla. A great deal of development-work has been done on these claims in the past, consisting of numerous open-cuts, shafts, and long crosscut tunnels. A shipment of copper ore is said to have been made a few years ago, but the official results are not forthcoming.

There has been a heavy mineralization of pyrite, pyrrhotite, magnetite, and occasionally chalcopyrite in lenses in the altered limestone and quartzite remnants which overlie the basic rocks forming the core of the mountain. After the discovery of these deposits and a certain amount of shallow development, long crosscut tunnels were driven from 200 to 500 feet below, with negative results, in an entirely different formation to that in which the ore occurred. In some of the fractures in the limestone an emerald-green nickel carbonate, probably zaratite, was observed. Samples containing this carbonate carried less than 1 per cent. nickel. Several other samples of sulphides were taken from the workings in close proximity to the nickel-carbonate occurrences, but no nickel was found. It seems quite possible that there is an ore-shoot containing nickel somewhere in this vicinity, and further exploration is advisable, especially near the top of the ridge above the present upper workings.

Elkhorn, Rearguard Fraction, and Homestead Fraction. These claims lie to the west of the *Bullion* group, across Keremeos creek, and are owned by W. C. McDougall *et al.*, of Olalla. In a short tunnel, 25 feet long, segregations and stringers of pentlandite were found associated with pyrite and pyrrhotite in the pyroxenite rocks. Due to extreme faulting and fracturing of the rock in the tunnel, it was impossible at the time of examination to make any statements regarding future possibilities. More work will have to be done, and unless the mineralized area containing nickel is very much larger than indicated it will not pay to work.

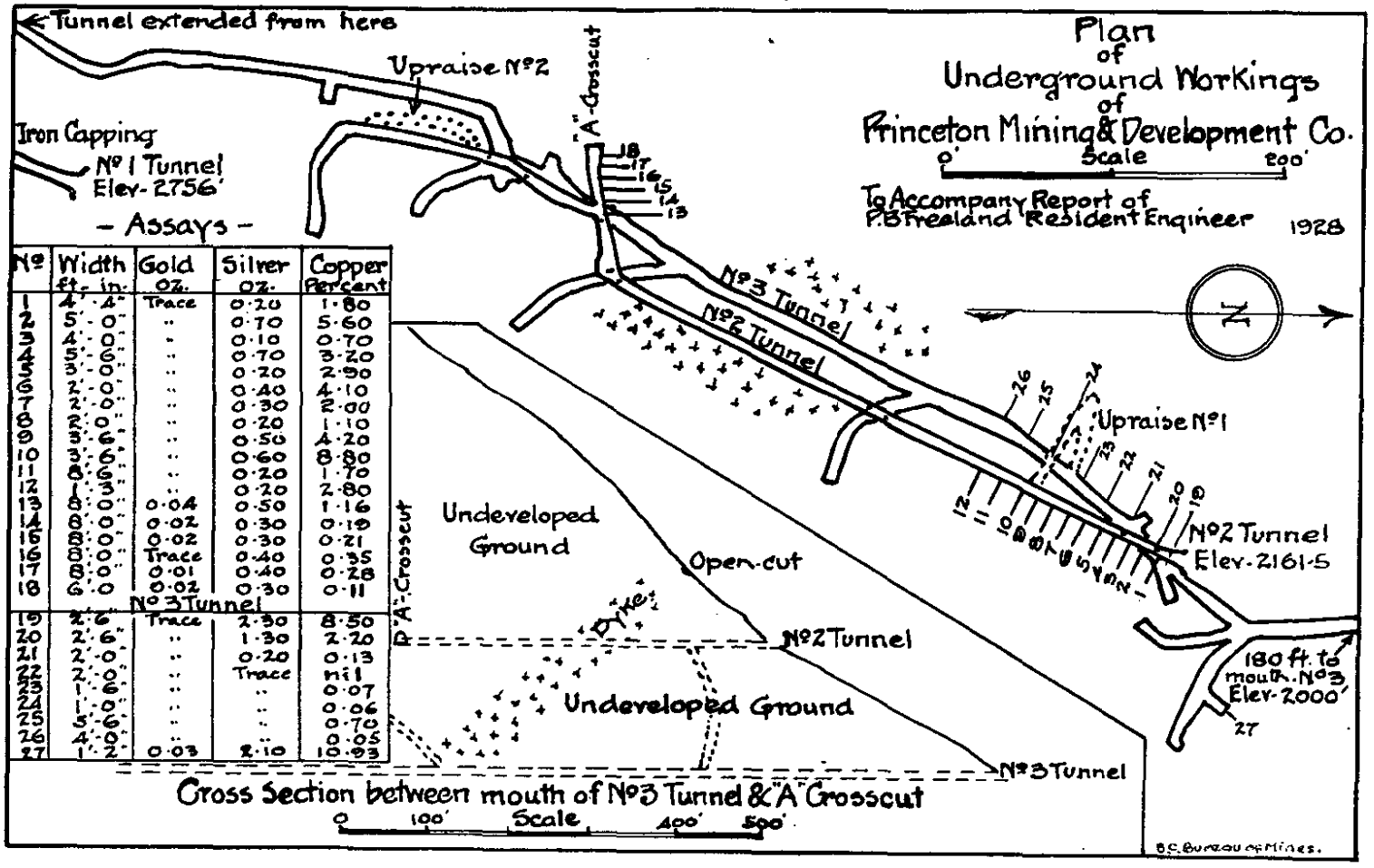
The *Elkhorn* lies on a steep bluff to the north-west of Olalla, which is highly coloured by iron oxides. The rocks outcropping are mainly quartzites intruded by basic varieties, including pyroxenite, gabbro, and augite porphyry. There are lenticular bedded segregations of pyrite, pyrrhotite, magnetite, and occasionally chalcopyrite from 2 to 4 feet wide formed in the fracture-zones in the quartzites, and quartz fissure-veins stained with copper carbonates varying from 2 inches to 18 inches in width, striking at right angles to the quartzite-beds near the contact of the gabbro. Insufficient work has been done to prove the value of these deposits, which are low grade on the present surface. The whole area adjacent to Olalla appears to be an interesting one geologically, and although very little ore has been shipped from the locality, a close study of the mineral-deposits is well worth while.

Dolly and others. This group, consisting of the *Dolly, Red Chief No. 2 Fraction, Mint Fraction, Lemon, Bush Rat, Red Chief No. 3, Silver Bell,* and *Gem Myrtle* claims, situated about 3½ miles west of Hedley and approximately 1½ miles north of and near the headwaters of Rattler creek, are owned by J. W. Gallagher, Princeton, and A. Tree, of Hedley. Development-work has been done on the mineralized banding of the limestone, from 3 to 6 feet wide, which has been tilted at a high angle on each side of the creek. The ore-minerals are galena, pyrite, sphalerite, and arsenopyrite, containing values in gold and silver. About a quarter of a mile west of the workings, which consist of open-cuts and short tunnels, the diorite batholith outcrops. Samples taken at different times by the owners assay from $5 to $35 to the ton, including gold, silver, and lead.

On the north-east side of the creek the mineralization becomes more extensive and further exploration may be recommended. The hillsides rise very abruptly on each side of the creek, and as the limestone-beds strike across it development by tunnels can be undertaken. About half a mile up the creek a quartz vein about 15 feet wide has been uncovered by open-cuts. Owing to the workings being caved no samples could be taken, but the owner states that an average of $5 to the ton was obtained.

SIMILKAMEEN MINING DIVISION.

Princeton Mining and Development Co., Ltd. The operations of this company on its property about 4 miles east of Princeton were mentioned in the 1927 Annual Report and a copy of J. C. Haas's report and maps incorporated. Check samples and ore-widths quoted in this report could not be substantiated in every case. The ore beyond the porphyry dyke occurs in narrow stringers and lenses, with several feet of waste rock



– Assays –

N°	Width ft.	Width in.	Gold oz.	Silver oz.	Copper Percent
1	4	4	Trace	0·20	1·80
2	5	0	"	0·70	5·60
3	4	0	"	0·10	0·70
4	5	6	"	0·70	3·20
5	3	0	"	0·20	2·90
6	2	0	"	0·40	4·10
7	2	0	"	0·30	2·00
8	2	0	"	0·20	1·10
9	3	6	"	0·50	4·20
10	3	6	"	0·60	8·80
11	8	6	"	0·20	1·70
12	1	3	"	0·20	2·80
13	8	0	0·04	0·50	1·16
14	8	0	0·02	0·30	0·19
15	8	0	0·02	0·30	0·21
16	8	0	Trace	0·40	0·35
17	8	0	0·01	0·40	0·28
18	6	0	0·02	0·30	0·11
			N° 3 Tunnel		
19	2	6	Trace	2·30	8·50
20	2	6	"	1·30	2·20
21	2	0	"	0·20	0·13
22	2	0	"	Trace	nil
23	1	6	"	"	0·07
24	1	0	"	"	0·06
25	5	6	"	"	0·70
26	4	0	"	"	0·05
27	1	2	0·03	2·10	10·93

between, and cannot be profitably mined. There are no upraises on the ore between No. 3 and No. 2 tunnels on the north side of the dyke, and therefore no correct estimate of ore can be made. The upraise in No. 3 tunnel shown on the map commences and finishes in ore, but does not follow the vein between for any distance.

On the surface over the top of the hill the showing of grey copper (Haas sample No. 41) measures 6 inches at the widest part and averages about 2 inches. There is a considerable amount of low-grade oxidized matter on each side of the walls of this vein which cannot be termed valuable in any way. When No. 2 upraise driven beyond the dyke was up 70 feet, the ore discovered at 65 feet was examined and found to be about 8 inches wide against a fault and tapering to 2 inches within a distance of 6 feet. Other parallel stringers were noticed in this raise, with solid bands of unmineralized waste rock between. As the width of No. 3 tunnel averages about 6 feet, it is difficult to comprehend how J. C. Haas arrived at the conclusion that the ore-body on this level would have a width of 10 to 30 feet or a value of $20.80 a ton. There are two crosscuts in No. 3, driven east and about 250 feet apart, that show a slight mineralization. The crosscut nearest the mouth of the tunnel follows the throw of a fault and exposes disintegrated stringers of pyrite and chalcopyrite which cannot be included in ore-widths.

In this report a map is included which gives the results of sampling over part of the mineralized area. A great many of these assay returns and sample-widths were kindly supplied by W. G. Norrie, mining engineer, Vancouver, who examined the property, and as the widths were checked and samples taken over the same vein from time to time over a period of years, and found to correspond, they are incorporated. Samples taken by W. G. Norrie number from 1 to 12 and 19 to 26. Sample No. 27 was taken below a flat fault which has displaced the vein found in No. 3 tunnel, approximately 50 feet to the east. Samples in sections from 13 to 18 in No. 2 tunnel were taken to check J. C. Haas sample No. 81, and to find out, if possible, if the ore was wide enough to warrant further exploration at higher levels. All the ore found on the south side of the dyke in No. 3 tunnel occurs in stringers and short narrow lenses, with bands of waste rock between, varying from 6 inches to 4 feet in width, and cannot be mined profitably.

The vein found on the north side varies from 1 to 5½ feet in width and contains minable ore 2½ feet wide for about 25 feet in length. This ore lies directly under the mouth of No. 2 tunnel, where the vein measures about 5 feet in width. It is apparent that the minable ore-body rakes north and south in the vein striking north and south, and therefore should be explored, between where No. 1 sample was taken in No. 3 tunnel and where No. 26 sample was taken in No. 2 tunnel, by an upraise on the ore-body. Another upraise should be driven from where No. 26 sample was taken to the surface and the ground above No. 13 sample explored before the mine is abandoned.

There are many commendable features about the property that warrant mention; i.e., excellent railway transportation, plenty of timber and water for all purposes, a steep hillside that permits cheap mining by tunnel and gravity methods, and an ore that contains profitable copper contents when found in minable widths. Development in 1928 consisted of driving No. 3 tunnel ahead and crosscutting west. On the surface at the south end of the property a considerable amount of trenching and open-cut work was done in the neighbourhood of the vein containing tetrahedrite, without encouraging results.

Lucky Strike Nos. 1, 2, 3, etc. This group, owned by G. Broderick & Sons, Princeton, and situated about 5 miles north-east of Princeton, adjoining the Kettle Valley Railway, was reported upon in the 1927 Annual Report. Since that time the owners report encouraging results from development done in the volcanic rocks near the granitic batholith contact.

Hematite. This claim, owned by W. G. Wilkins *et al.*, of Penticton and Princeton, is situated about 1 mile up Finnigan creek, which flows into Hayes creek about 6 miles from Jellicoe Siding on the Kettle Valley. On the west side of the creek an outcrop of granite composed of coarsely crystalline feldspars has been impregnated with hæmatite over an area roughly 30 by 40 feet. In the more highly mineralized fractures close to the creek several samples have been taken, and assay returns contained gold, silver, lead, and zinc in sufficient amounts that seemed to justify deeper exploration. Recent advice from the owners states that better ore has been found. The location of the claim, about a mile from the road and 2 miles from the railway, is ideal, and if a quantity of low-grade ore is found there is plenty of water in Hayes creek for use in a mill.

Jesse. This claim, situated near Thirsk, on the Kettle Valley Railway, is owned by E. H. Hales and Dan McDonald, of Coalmont. In an open-cut 20 feet and a tunnel 10 feet long beside the railway-track a displaced quartz vein about 6 inches wide was found and followed for 30 feet. In the cut the vein is stained with copper carbonates and iron oxides, and in the tunnel segregations of galena were found carrying good values in silver. Owing to the flat-lying country beyond the upper workings the owners decided to commence another tunnel 75 feet lower in elevation on the strike and dip of the vein. This tunnel at the time of examination had been driven about 80 feet, and the vein, varying from 2 to 8 inches in width, followed to the end of the drift, where it had been displaced by a fault. The ore-minerals in the lower workings are chiefly sphalerite with isolated segregations of pyrite and chalcopyrite. A sample of high-grade ore from the lower tunnel vein assayed: Gold, 0.56 oz. to the ton; silver, 0.70 oz. to the ton; copper, 0.30 per cent.; zinc, 54 per cent. A general sample of this ore assayed: Gold, trace; silver, 1.20 oz. to the ton; copper, 1.8 per cent. The zinc content was not calculated in the last sample, but there was about 10 per cent. present.

Snowstorm. This group, consisting of the *E.J.A.*, *B.H.*, *H.J.B.*, and other claims, owned by Frank Barbee *et al.*, of Princeton, and situated about 10 miles up Siwash creek, was reported upon in the 1927 Annual Report. In 1928 the tunnel was extended about 70 feet on the vein and an extension uncovered up the hill in an open-cut. About 300 feet down-stream another vein was discovered and, according to the owners who developed it since the examination was made, it was widening out and becoming more highly mineralized. The ore-minerals are galena, sphalerite, and pyrite carrying gold and silver.

Pacific Slope Mines, Ltd. This property, consisting of the *S. & M.* and *Marion* groups and situated about 21 miles south of Princeton, on Whipsaw creek, was reported upon in the 1927 Annual Report. Until May 18th a considerable amount of development had been done, including the extension of the main crosscut tunnel to 560 feet on the *S. & M.* and various offset tunnels from this crosscut. The face of the main tunnel was roughly 125 feet beyond and to the north-west of the highest workings, and therefore had been driven far enough to tap any downward extension of the vein system discovered in the old workings and mentioned as having developed likely-looking mineral-zones.

It was the intention of the management at that time to swing the main tunnel north and drive the first crosscut south-west ahead to prove the ground in both directions. There has been no advice received as to whether this has been done or not. Near the face of the tunnel on May 18th a fault was struck, striking diagonally across the face and dipping 37° north-west.

On this fault a disintegrated mineral-zone was found, extending the width of the tunnel and about 9 feet in length, containing galena, pyrite, sphalerite, and specks of chalcopyrite in a gangue of quartz and metamorphosed schist. A 3-foot sample of this ore containing the highest mineral content assayed: Gold, 0.01 oz. to the ton; silver, 1.40 oz. to the ton; copper, 0.2 per cent.; lead, 2.10 per cent.; zinc, 1.9 per cent. A sample of quartz taken from the first offset tunnel north assayed: Gold, 0.01 oz. to the ton; silver, 0.3 oz. to the ton. Another sample from a strong quartz vein in the main tunnel assayed: Gold, trace; silver, *nil.* The occurrence of ore, although low grade, was considered sufficiently encouraging to warrant further limited development. Later advice during the summer suggested that more ore was struck, but this has not been corroborated.

On the *Marion* the old main shaft was unwatered and sampled, with the following results: First 14 inches of oxidized vein-matter on south-east side of shaft assayed: Gold, 0.01 oz. to the ton; silver, 2.8 oz. to the ton; zinc, 10 per cent. Second 14 inches on the same side assayed: Gold, 0.01 oz. to the ton; silver, *nil;* zinc, trace. A general sample of the picked dump ore assayed: Gold, 0.04 oz. to the ton; silver, 2.6 oz. to the ton; zinc, 14.9 per cent. This shaft was unwatered and sampled by E. J. Conway, the company's engineer, because the former owner, Sam Spencer, declared that he had found good gold values in the vein. A narrow wagon-road has been constructed over the Hope Trail route from Lamont (9-Mile) Creek bridge, a distance of approximately 13 miles, to camp. P. H. Fraser was director of the mine development.

Day and Night.—These claims are situated across Whipsaw creek, opposite the *S. & M.*, and are owned by Chas. Day, Princeton. In the 1920 Annual Report a short description of the work done was incorporated. Since that time yearly assessments have been done by the owner.

Virginia. This group, owned by W. S. Wilson and P. W. Gregory, of Princeton, is situated on Whipsaw creek, about 1½ miles south of Lamont (9-Mile) Creek bridge. At an elevation of 25 feet above the creek several open-cuts and shallow shafts have uncovered a highly oxidized mineral-zone about 150 feet wide. In the largest cut, which measures about 25 by 30 feet, there are veins and stringers of quartz and chert impregnated with pyrite and arsenopyrite which are gold-bearing. No reliable widths can be given because the whole mass is displaced to such an extent that the veins do not appear to be continuous or persistent for more than a few feet at a time. A sample taken of the ore containing arsenopyrite assayed: Gold, 0.54 oz. to the ton; silver, 0.06 oz. to the ton. The oxidized pyrite did not carry any values. The rock in which the veins occur is a highly altered siliceous volcanic. Across the creek similar oxidation occurs, and as the formations appear to be in place more work may be recommended there. The location of the claims close to transportation and the large mineralized area are attractive.

Upper Similkameen Section.

Red Star and Anaconda. A report and compass traverse-map of some of the underground workings on this group were incorporated in the 1927 Annual Report. Since that time, according to reliable reports, the property has been bonded by interests resident in the Coast cities and H. E. Wilmot has been mentioned as representative. At the time of examination the main ore-bodies developed above and to the south-west had not been struck in the lowest crosscut tunnel, and according to necessarily rough calculations on account of caving, they should lie a short distance ahead, providing no further faulting has occurred.

The area in which these claims are located, about 22 miles in a direct line south of Princeton, is an interesting one and worthy of intensive prospecting, especially across the Similkameen river to the south-east. At the present time transportation facilities consist of a trail commencing near the end of the old Trans-Provincial road, about 12 miles from Princeton. The line surveyed for the road from Princeton to Hope passes along the flats about 100 feet from the lower workings, and if built will be very advantageous to any mining operations which may be carried on in the future.

Sparkler. This group was also reported upon in the 1927 Annual Report, and although the claims were not examined again this year, reliable information has been received reporting the discovery of other ore-bodies in the vicinity. Up to the present general samples gave comparatively low assays in gold, silver, lead, zinc, and copper, but the widespread mineralization in the sedimentary rocks warrants further exploration. The trail between Cambie Creek bridge and the claims was cut out and regraded this year.

Kennedy Mountain.

Red Buck. This claim, mentioned in the 1927 Annual Report, was optioned for a short time by Fred Foster *et al.*, of Vancouver, and the old workings cleaned out. The main tunnel is roughly 190 feet long, of which 96 feet from the mouth is mineralized with stringers and narrow lenticular segregations of chalcopyrite and bornite. The rock-fractures are generally mineralized with malachite and azurite, which extends over an area of 50 feet square outside the tunnel and for a distance of 100 feet in the tunnel. In and near the face the rock is more solid and is distinctly pegmatitic. Pink feldspathic pegmatite is also noticeable associated with the ore near the mouth of the tunnel.

About 500 feet south-east of these workings, in a narrow ravine, another tunnel has been driven for 63 feet. From the face to a point about 18 feet distant numerous stringers and isolated specks of pyrite and chalcopyrite occur. Practically all the development-work has been done in and above these workings, which lie approximately 150 feet above the Similkameen river. Further development, especially below the main tunnel where extensive mineralization occurs, is warranted.

Summit Camp, Tulameen.

In the Annual Report for 1926 an extract from the "Geology of the Summit Camp," by C. E. Cairnes, was included. The two prevailing different series of rocks, the Dewdney and Cretaceous, are mentioned by C. E. Cairnes and a suggestion made that they had been faulted against each other, but owing to the absence of fossils some difficulty was found in correctly

subdividing the two series. The Dewdney series is regarded as either Jurassic or Cretaceous in age, but more probably Jurassic. The Cretaceous rocks may be either late or post Cretaceous. The line of contact, which is deeply buried to a great extent, stretches in a north-westerly and south-easterly direction. In the Cretaceous rocks the following mines and prospects occur: Cascade Consolidated Silver Mining Company's group, *Eureka*, and all claims on Treasure mountain. In the Dewdney rocks are the following: *Morning Star*, *Sutter*, *Queen Bess*, *Old Indiana*, *Blue Bell*, and several others.

On the Cascade Consolidated property the vein system has been developed at the north-east end to a depth of about 1,000 feet; on the *Eureka*, which adjoins the Cascade on the west, developments have reached about 850 feet in depth. All workings on other claims are comparatively shallow. On the *Morning Star* the vein system has been traced several hundred feet on the surface and has a zone of mineralization several feet wide on the east and containing pyrite, zinc, and minute fractures filled with galena. A tunnel, about 25 feet below at the west end, where the vein is about 8 inches wide, containing high-grade galena, developed a narrow downward extension of the ore-body and a crosscut north struck an oxidized quartz vein that did not outcrop.

Comparatively deep developments on the *Indiana* and *Blue Bell* claims were disappointing. On the *Queen Bess* developments at about 200 feet depth have, according to the owner, A. Jensen, struck the downward extension of the mineral-zone, containing quartz on the foot-wall and 12 feet of ledge-matter carrying 8 inches of galena, sphalerite, pyrite, and chalcopyrite, and looks very encouraging. The results obtained at depth in the Cretaceous rocks have been disappointing up to the present and the ore found is chiefly zinc containing low precious-metal values. In the upper workings there are shoots of galena that carry high values in silver. Further development down to 500 feet below the crest of the hill may uncover ore-bodies that can be closely sorted and profitably shipped, and this may be recommended. In the Dewdney series of rocks, lying to the south-west close to the contact, developments to 200 feet in depth on the *Blue Bell* and *Indiana* have also proved unprofitable, although there appears to be a wider mineralized zone that may have potentialities at a greater depth and prove high enough grade to mine and mill to advantage. Apparently the fracture-zones continue to widen to the south-west and away from the contact of the Cretaceous rocks, and it is in this direction that development may uncover minable ore-bodies at depth.

Cascade Consolidated Silver Mining Co.

No work was done upon this company's property on Treasure mountain during 1928 and the camp was in charge of a caretaker. Since this property was reported upon (July 9th, 1927) drifts were extended both ways on the vein from the lowest crosscut tunnel. The east drift was driven 126 feet, with a 15-foot offset to the south, and the west drift, 135 feet, with a crosscut 27 feet to the north-west. Owing to caved ground the tunnel beyond this point could not be examined. The vein in both drifts was intensely sheared and disintegrated, leaving a well-grooved slickensided foot-wall. The porphyry hanging-wall has caved in both drifts.

The widest mineral-zone measured about 3 feet and contained mostly sphalerite, with pyrite in a lesser degree and occasional veinlets of galena. A general sample of this ore assayed: Gold, trace; silver, 4.6 oz. to the ton; zinc, 34 per cent. If the 3-foot vein-widths were persistent this ore-body might be mined profitably in conjunction with the ore found in the upper levels, but the average measures about 6 inches across.

In No. 2 tunnel the east drift has been driven roughly 770 feet, with a crosscut from it south 51 feet long and about 210 feet from the face. An upraise has also been put in about 150 feet high on the north side and 25 feet from the main crosscut tunnel. The ore in this drift is generally zinc and occurs in disintegrated masses, stringers, and lenses varying from 2 inches to 2 feet in width. On the west side the tunnel could not be measured because of caved ground and dammed-up water. About 66 feet from where the main crosscut joins the west drift an upraise 15 feet high has been driven on a lens of galena-sphalerite ore measuring about 14 inches wide in the drift and 8 inches at the top of the raise. Beyond this and to the south a crosscut 40 feet long has been driven and an upraise about 40 feet high at the mouth of the tunnel. Two ore-veins, 6 and 12 inches wide, containing lead and zinc, have been cut by this tunnel on either side of the porphyry dyke, which measures 18 feet from wall to wall at this point. These veins taper at the top of the raise and in the back of the tunnel.

The west drift has been driven to a great extent in the foot-wall, and holes have been drilled to the ore at various intervals and blasted, so that a rough estimate could be made by the company of widths and values. As far as could be seen, the galena and sphalerite, varying from 2 to 18 inches in width, are generally intimately mixed, but there are occasional lenses of nearly pure galena measuring from 4 to 12 inches in width and 10 feet long. The sorted galena ore assays generally about 100 oz. in silver to the ton and 40 to 50 per cent. lead.

The upper (or No. 1) tunnel has been driven 198 feet and a 1-foot vein containing mostly galena stoped out for about 30 feet in length above the level. A grab sample of this ore, of which there is about 30 tons in a bin, assayed: Gold, 0.02 oz. to the ton; silver, 96 oz. to the ton; lead, 30 per cent.; zinc, 26 per cent. The porphyry dyke has been faulted to the south-west at the junction of the drift and crosscut on this level, and the extension of the second vein found in the lower levels has not been discovered up to the present. The best ore was found on the foot-wall of the dyke in the No. 2 tunnel, and as there appears to be a higher percentage of galena in the upper levels of the mine the No. 1 crosscut should be driven ahead to the vein intersection.

Eureka. This group, owned by A. Jensen *et al.*, of Tulameen, covers the extension of the main vein system developed in the Cascade Consolidated Company's property. Developments at an elevation of 4,960 feet (aneroid) consist of a winding crosscut tunnel 124 feet long, 63 feet of which followed a fault-plane containing drag-ore. At a point 63 feet from the mouth 3 feet of mixed galena-sphalerite ore was struck and drifted on N. 50° E. (mag.) for 36 feet. At the end of the crosscut another vein 18 inches wide was struck, in contact with a 6-foot porphyry dyke, and drifted on for 21 feet N. 53° E. (mag.). Similar ore-minerals occurred in this vein. On the strike of the vein system north-east numerous open-cuts along the dyke have uncovered encouraging surface outcroppings containing oxidized matter which generally lead to ore in this camp. The pure galena, where found, carries about 100 oz. in silver and 40 to 50 per cent. lead.

Summit Camp Mines, Ltd. This company, formed by Andy Jensen and associates to operate the *Queen Bess*, commenced operations late in the autumn, and according to Jensen a crosscut tunnel 150 feet long has been driven, about 200 feet in elevation below the vein-outcrop, that intersected the ledge, 12 feet wide, containing galena, sphalerite, pyrite, and chalcopyrite. The galena was 8 inches wide where cut and a few shots blasted beside the ore to the east showed promising results and a possible widening of the vein. Deeper developments are evidently contemplated by this company.

Numerous open-cuts along the strike in a south-westerly direction uncovered the continuance of this vein system. Beyond the dividing line between the Similkameen and Yale Mining Divisions much wider mineral areas are reported. A sample of galena, sphalerite, and pyrite from the cut above the crosscut assayed: Gold, 0.02 oz. to the ton; silver, 55 oz. to the ton; lead, 19 per cent.; zinc, 6 per cent. A narrow road about 21 miles long follows the river from Tulameen to Summit camp and adds materially to transportation facilities.

Rio Grande and Lucky Strike. This group, situated about 7 miles up the South fork of the Tulameen river, was staked during the winter of 1927 by R. Jameson and T. Smitheram, of Princeton, and bonded to Chas. F. Law, of Vancouver. Considerable excitement was created at the time by this find owing to the belief that it was an old Hudson's Bay mine which many years ago had shipped lead ore. An examination of the claims proved that nothing had ever been done and that the find was a new one.

Development-work done on the south-west side of the river by the stakers consisted of shallow open-cuts and stripping over a distance of about 100 feet. The vein-matter, 5 feet wide, is composed of kaolin, sericite, crushed quartz, and partly disintegrated oxidized pyrite, through which narrow stringers of galena and sphalerite, varying from 1 to 4 inches wide, occur. A sample across the vein assayed: Gold, trace; silver, 0.40 oz. to the ton; lead, *nil;* zinc, 1.2 per cent. A picked sample of galena assayed: Gold, 0.02 oz. to the ton; silver, 13.5 oz. to the ton; lead, 28 per cent.; zinc, 2 per cent.

About three-quarters of a mile west of the main workings, beside a small creek, another outcrop has been discovered which is undoubtedly the same mineral-zone, although no work has been done or galena ore found. The prospect warrants more work to ascertain the size of the vein and values at slightly deeper elevations. A rough trail has been built, branching from the Tulameen–Summit Camp road about half a mile north of Sutter Creek bridge, which crosses the

main river above the canyon and from thence over the ridge to the South fork. There are eleven crossings of the South fork before the claims are reached, which would probably be dangerous for horses in high water.

Tulameen Nos. 1, 2, 3, etc.

These claims, staked about 4 miles by trail up the Tulameen river from Amberty creek, are owned by A. Chisholm and Joe Diotte, of Tulameen. The formations cut by the creek are chiefly slates striking S. 70° E. (mag.) and dipping about 70° north-east. Numerous apophyses from the main porphyry dyke outcropping to the north-west have intruded the slate and caused a widespread pyritic mineralization in the rock-fractures. Occasionally some of these stringers contain galena and sphalerite, but in insufficient quantity up to the present to be profitably mined. More interesting mineral-outcrops have been discovered by the owners higher up the mountain, but unfortunately owing to dense fog these could not be examined. This is an interesting belt and warrants close prospecting.

TULAMEEN RIVER SECTION.

Lion.

This claim, owned by Dan Vuich, of Tulameen and Merritt, lies close to the road beside Railroad creek, which flows into the Tulameen about 8 miles from Summit camp. Two tunnels have been driven, one 33 feet long on the north side and the other about 10 feet long on the south side, on a shear-zone in the quartz diorite. The vein-matter, consisting of quartz and country-rock, measures from 2 to 8 inches in width and contains finely disseminated pyrite and chalcopyrite. A sample of the vein assayed: Gold, trace; silver, 0.8 oz. to the ton; copper, 0.3 per cent.

Great West Mines, Ltd.

This company is a holding company that has issued shares privately to acquire mining properties of merit and sell them to other companies which will actually operate and develop the same. The directors of the company are: Wesley H. Hughes, mining-broker, 418 Standard Bank Building; Chas. N. Maywood, broker, 1260 Melville Street; H. H. Dawson, salesman, 1023 Haro Street; E. D. G. Fuller, salesman, 1075 Gilford Street; and Mrs. M. Wilson, Glencoe Lodge, all of Vancouver. The company has acquired the following mineral claims from Frank Bailey, of Tulameen: *Hortonolite, Iridium, Ren Furley, Platinoid, Miss Forget-me-not, Rhodium, Palladium, Osmi-Iridium,* and *Red Craig,* situated on Grasshopper mountain, about 8 miles up, and on the north-west side of, the Tulameen river.

The country-rocks of the area, consisting of peridotite, pyroxenite, limestone, and argillites, stretching for a long distance north and south, are eroded between 2,000 and 3,000 feet in depth by the Tulameen river, which has left a clear cross-section. Intensive searching by prospectors, by J. Kemp and later by C. Camsell and E. Poitevin, of Ottawa, failed to reveal any workable deposits of platinum. It is generally conceded that the peridotite and pyroxenite rocks are responsible for the platinum metals found in the river and creek beds of this area, but whether or not there are any buried deposits large enough to be profitably worked remains to be proved.

According to F. Bailey, the chief object of the company is to find and mine ore-bodies containing platinum, and with this in view prospecting for chromite, with which platinum is generally associated, was carried on. At the time of examination numerous open-cuts, short tunnels, and shallow shafts had been excavated, but no minable platinum ore-bodies found, although samples assayed traces of platinum. Without definitely outlined bodies containing profitable precious- or base-metal contents and unlimited capital any attempt of this kind is at a serious disadvantage. Three men were at work on the property and a cabin was being built.

Bonanza.

This group adjoins the Great West Mines, Limited, property on the east and is owned by Frank Bailey, Tulameen. An oxidized-pyrite zone about 200 feet wide has been extensively explored by open-cuts near the contact of the schist and argillites and the peridotite rocks. In the cuts to the west, nearest the contact, the fractured zone contained pyrite, chalcopyrite, and calcite. A tunnel has been started to crosscut the main mineral-zone at considerable depth.

Motherlode, Spokane, and Red Bird.

These groups of claims, owned by J. McMahon, J. Speck, and J. Osborne, of Tulameen, were mentioned in the 1924 Annual Report. Situated on Rabbitt mountain, about 4 miles north-west of Tulameen, on the Kettle Valley Railway, the claims can be reached by road and trail. The general rock formations, classed by Chas. Camsell as the Tulameen group, include andesite,

breccia, limestone, and argillite. In the immediate vicinity of the claims the rocks are mainly schistose intruded in places by granite-porphyry dykes.

On the east of Rabbitt mountain the main granite batholith is exposed for several miles and includes the Otter granite, which is Tertiary, and the Boulder granite, which is Mesozoic. On the west side of the mountain there are several outcrops of augite syenite and one large mass of Otter granite. According to the geological arrangement, the Boulder granite was the primary disturbing factor which tilted and sheared the argillites, and was probably responsible for the mineralization found along the eastern contact, which embraces the above groups of claims. Later, the Boulder granite was invaded by the Otter granite and caused further disturbances along the eastern contact. At the present time most of the ore-deposits are found in the argillites, but further search for ores along the contact of the two granites may be recommended on account of the possibility of mineralized shear-zones occurring in the Boulder granite.

On the *Motherlode*, *Spokane*, and *Red Bird* claims there are numerous mineralized zones filled with pyrite and chalcopyrite in a gangue of quartz, conforming to the strike of the schist and extending from 200 to 300 feet in length in various localities. A certain amount of cross-fracture filling also occurs, but is generally low grade. The widest zone on the *Spokane* measures about 20 feet on a fault and is exposed in the bottom of a 25-foot open-cut. The general average mineralized width is about 2 feet. The schist strikes about east and west (mag.) and dips from 30° to 40° south.

Development-work done on the *Spokane* consists of a series of open-cuts and shallow shafts on the vein system over a distance of about 700 feet. A sample of sorted ore from the second cut assayed: Gold, trace; silver, 0.60 oz. to the ton; copper, 2.46 per cent. Another sample from the most easterly cut assayed: Gold, 0.02 oz. to the ton; silver, 0.40 oz. to the ton; copper, 2.24 per cent. No recent work has been done on the *Red Bird*, except the unwatering of the old inclined shaft in the upper tunnel. A sample of ore from the 3-foot vein in this shaft assayed: Gold, 0.02 oz. to the ton; silver, 1.1 oz. to the ton; copper, 3.38 per cent.

On the *Motherlode* trenching, tunnels, open-cuts, and shallow shafts have exposed extensive crushed and displaced shear-zones in the schist carrying variable low values in gold, silver, and copper, but too broken to be mined profitably at present. History relates that high-grade gold ore has been found on this property and a considerable amount of copper.

For several miles north of Rabbitt mountain the same formations exist and in several areas similar mineralized conditions exist. No deep work has been done anywhere on the ore and there seems to be a possibility of parallel surface veins either widening out or amalgamating at depth. The Kettle Valley Railway runs parallel about 3 miles distant from this area and there is an unlimited water-supply in Otter lake or the Tulameen river for operative purposes.

Hope Range Copper Co. This company, incorporated in 1927, is mentioned in the 1927 Annual Report. No work is reported to have been done in 1928. The claims owned by this company are situated close to the contact of the granodiorite and the schist and work has been done on similar mineralized zones as those mentioned on the *Spokane* and *Red Bird*. An increase of values in copper in the shaft is attractive and warrants deeper development.

Granby C.M.S. & P. Co., Ltd. During 1928 this company's mine at Copper mountain was operated steadily and the ore shipped to the mill at Allenby for concentration. New construction consisted of a two-story, 48-room, wood-frame bunk-house, completely lined with Gyproc, a semi-fireproof material, to replace the one burnt down. Each room is heated by a separate steam-radiator and accommodates two men. The sorting plant is working satisfactorily and a high percentage of the waste porphyry dyke, which is pink in colour, is being eliminated in addition to a small amount of other waste rock, which makes it possible to mine ore-bodies that are intermixed with porphyry.

The total length of drifting done was 9,580 feet; upraising, 4,675 feet; and sinking, 17 feet. Ore is being mined from the glory-holes and between the sixth level (3,175-foot) and the second level. One small ore-body is being mined by the shrinkage system. No mining will be done below the sixth level until more information is acquired regarding size and depth of the mineral-zone developed by the extension of the sixth level. The unofficial size of the lowest ore-body found in the mine is given at 2,700 feet long, from 50 to 75 feet wide, and of unknown height and depth, containing values of about 3 per cent. copper. This body is a comparatively new discovery and adds greatly to the assets of the mine. Bulldozing is being done in the stopes and in

bulldozing chambers above the chutes. Owing to the fact that the ore is generally broken down to a size that is easily handled a complete system of grizzlies has not been installed. The number of men working in the mine averaged about 380. A baseball-ground is being levelled and a new curling-rink has been built. Other improvements include painting the bunk-houses, boarding-house, first-aid and post-office buildings, garage, staff-house, store building, and several of the dwellings.

At the Mill (Allenby).—Several minor improvements were made in the mill, but no new machinery installed or any additions made to the building. No changes have been made in the mill flow-sheet. A new community garage to accommodate eight cars was built at Allenby townsite. All the dwellings have been reroofed with cedar shingles and given a coat of stain. The dust-control system in the mill is working satisfactorily. The new tailings-pond is working efficiently and each summer the company continues to build up the old tailings-pond dams with coarse-tailings residue to provide storage in case of emergency.

The average daily tonnage was about 2,500 tons, which is an increase of approximately 500 tons a day over 1927. The total tonnage milled was 889,020. Total concentrates shipped to Trail and Tacoma smelters, 33,252 tons. The number of men employed at the mill was 108.

Coal.

One of the outstanding features in this Division has been the development of the coal-seams in the Princeton district. This area, covering about 50 square miles, has been known for many years, but owing to competition from the bituminous fields has not been extensively operated until this year. The following figures will give an idea of the output during the past ten years:—

	Total Production. Long Tons.		Total Production. Long Tons.
1919	32,382	1924	160,017
1920	29,700	1925	131,807
1921	77,310	1926	135,496
1922	142,806	1927	169,771
1923	147,477	1928	201,332

A much higher figure is expected during 1929, when the Pleasant Valley Coal Company, Limited, commences operations at full capacity under the ownership and direction of W. R. Wilson, of Fernie. The lignite-coal seams found in this basin vary generally from 4 to 12 feet in width and are strikingly clean for this variety of coal. The Kettle Valley and the Great Northern Railways both serve the Princeton area and consequently enlarge the field for marketing production. Further details regarding operations appear under "Inspection of Coal-mines" in this Annual Report.

Placer.

Keen disappointment was felt when the management of the Tulameen Gold and Platinum Recovery Company, Limited, decided to stop preliminary testing operations on its leases on the Similkameen river. Surface prospecting was encouraging in several pits dug and attractive values were found in different places, which appeared to justify further expenditure. Due to the presence of water, bed-rock could not be reached by ordinary shaft-sinking methods and it was necessary to churn-drill the area. The results obtained proved that much money could have been saved if drilling had been resorted to in the early stages of investigation. The theory that values are often lost when drilling has proved to be true at times, but there is no other comparatively cheap way to ascertain values under water. Other ventures on the Similkameen and Tulameen rivers would do well to follow the lead made by this company and drill their holdings before installing machinery or resorting to hand methods of prospecting when water has to be dealt with.

Tulameen Gold and Platinum Recovery Co., Ltd.

This company, reported upon in the 1926 and 1927 Annual Reports, continued operations on the Similkameen River leases under the management of Geo. V. Tupper. An attempt was made to work the gas-electric shovel and several hundred yards of gravel were handled, but the returns apparently were not high enough to warrant the operation of this type of machine. Undoubtedly a percentage of the values were lost because, it is understood, bed-rock was

not cleaned and an open bucket was used, so that this operation could not be considered as a practical test for recovery of values.

Later, a Star power-drill was brought in and a hole drilled on a low flat on Lot 398. This hole was put down 118 feet and soft granitic bed-rock was struck. The conditions of this hole showed a thin stratum of river-wash on top and a thick body of glacial material to bed-rock. Water was struck between 4 and 5 feet down from surface; between 5 and 7 feet larger stones were struck, and beyond that different textures of clay intermingled with stones. No values were found, except one flake of gold, between 88 and 90 feet. No. 2 drill-hole was put down 20 feet, a little over a quarter of a mile up-stream from No. 1, and as similar conditions were found to exist to that depth the work was stopped and the whole operation abandoned.

Reconnaissance up-stream on the left bank of the river, underneath the surface gravel, confirmed the idea that clay was present. Similar conditions were found to exist on the right bank of the river. On the high benches three shafts have been sunk—No. 1, 130 feet; No. 2, 230 feet; and No. 3, about 40 feet—by the former management, with the idea that an old high channel might have flowed from the Tulameen into the Similkameen river at Bromley creek. Surface pannings showed some values, and as high rim-rock outcropped on the Tulameen side of the area a certain amount of exploration was justified. As pointed out by Chas. Camsell, of the Geological Survey, there have been some striking changes in drainage in that area, the most marked instance being Wolf Creek valley, which is now occupied by a stream inconsistent with the size of the valley. The rounded outline and regularity of form, whilst probably due mainly to erosion, is also in part the result of the filling-in of the old irregularities of the surface by Tertiary flows and also by Glacial debris. There are many instances of topographical development caused by recent regional uplifts. At the upper end of this area there is evidence of channel-blocking by volcanic flows. It seems possible, therefore, that a regional uplift may have accounted for the glacial filling found and underneath there was a chance of discovering an old channel. Proof of these occurrences can be seen higher up the Tulameen river.

Slate Creek Consolidated, Ltd.

This company has a Dominion charter and is a consolidation of the Similkameen Placers, Limited, and the Slate Creek Platinum Company. Throughout the greater part of the year this syndicate operated its leases on Slate creek under the management of Norman McCormick. At the time of examination (June 12th) the main tunnel under Slate creek had been driven 232 feet in rock and 370 feet in clay and gravel. The face of this drift struck a toe of disintegrated schistose rock protruding into the stream-bed from the south-east. A recent letter from the manager states that the tunnel has been driven 80 feet farther south up-stream, and then 90 feet towards the centre of the old channel. At this point a shaft, 33 inches by 4 feet 10 inches inside timbers, was sunk for 40 feet and the top of the stream-gravel was struck. In this gravel a stratum of silt and mud, 20 inches wide and heavily saturated with water, was struck, which overtaxed the capacity of the pump to such an extent that the directors decided to abandon sinking and push the drift ahead so that the water would flow by gravity through the tunnel.

According to the manager, the gravel struck in the shaft panned in gold and platinum, and he was satisfied that the old channel had been reached. Small boulders taken from the bottom of the shaft were pyroxenite, peridotite, and olivine. The power plant consists of an 8-horse-power Cushman 2-cylinder gas-engine coupled to a 110-volt, 50-watt generator. The pump is a 10-inch centrifugal, directly connected with a 3-horse-power motor, 1,800 r.p.m. The suction is 2½ inches in diameter and the discharge 2 inches. Capacity, 150 gallons at 30 feet in depth.

On what is known as the *Bluff* leases, or former Slate Creek Platinum Company property, a total of 775 feet of drifting was accomplished, and the management believes that the old channel has been located and that the gravels below the Slate Creek workings can be mined from this tunnel extension. Work ceased on the *Bluff* owing to lack of funds.

Big Bend Platinum Gold Mining Co., Ltd.—This company, under the management of John Marks, of Tulameen, operated for about eighteen days during high water on leases situated about 6½ miles up the Tulameen river from Tulameen village, and cleaned up, according to the management, about 9 oz. of gold and 30 oz. of platinum. Machinery installed consists of a monitor and derrick, besides 2,500 feet of flume, 472 feet of 10-inch pipe, and 150 feet of 4-inch pipe.

Sootheran Leases.—Several ounces of gold and platinum were washed from these leases, situated about half a mile below Eagle creek, by Garnet Sootheran during the season.

Granite Creek Dredging Co.

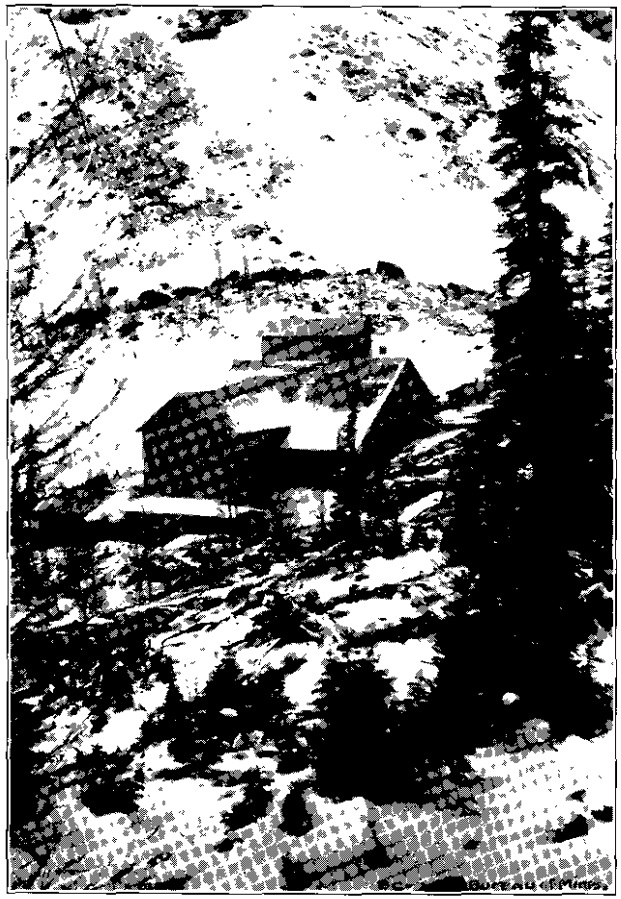
This company, under the management of J. F. Jones, with headquarters at 310 Hyde Building, Spokane, and leases on the Tulameen river at the mouth of Granite creek, constructed a light bridge over Granite creek and built dwelling-houses preparatory to installing dredging machinery in the spring. The company has been reincorporated and the 500,000 shares of no par value have been reduced to 290,000 at $1 par value.

General.

Work has been done on the *Flynn* lease at Coalmont and on the *Howard* and *Ruby* leases on the Tulameen below Granite creek, with encouraging results. Several other prospects have also been worked in a small way and values in gold and platinum found. Nothing was done on the John Guest leases, but hopes are held out that two gravel-ejectors will be installed by March, 1929.

McCulloch Creek Placers, Revelstoke M.D.

Berengaria Mining Co., Ltd.—Portal at Kootenay Lake, Ainsworth M.D.



Paradise Mill, Windermere M.D.

Toby Creek, Windermere M.D.

EASTERN MINERAL SURVEY DISTRICT (No. 5).

By A. G. Langley, Resident Engineer, and B. T. O'Grady, Assistant.
(Reports marked * are by B. T. O'Grady.)

INTRODUCTORY.

The district comprises the Revelstoke, Lardeau, Trout Lake, Slocan, Ainsworth, Slocan City, Arrow Lake, Nelson, Trail Creek, Golden, Windermere, and Fort Steele Mining Divisions.

Progress during the Year.

The year witnessed a decided increase in mining activities, notably in the Slocan and Nelson Mining Divisions, while numerous properties were examined by scouting engineers. The shipping-list contains between fifty and sixty names of properties and the tonnage produced shows a substantial increase over that of last year. Owing to the ready market for mining securities, many new companies were incorporated and a number of promising properties which had previously been lying idle are now well capitalized and being aggressively developed.

A striking feature of the year was the success attained in the underground development of a number of mines, which has placed large reserves available for extraction, so that the present indicated tonnage of the independently owned properties is greater than that of any previous year in the last ten years. This is a very satisfactory state of affairs and should be reflected in a greater production during the coming year.

The Consolidated Mining and Smelting Company started construction on an addition to the *Sullivan* concentrator, which will increase its present capacity of 4,000 tons to 6,000 tons a day. New concentrators were put into commission at the *Lucky Jim*, *Whitewater*, and *Paradise*, while those at the *Ruth-Hope*, *Hewitt*, *Galena Farm*, *Noble Five*, and *Cork-Province* were remodelled in accordance with the latest flotation practice.

Hydro-electric Power Development.

Significant of the progress of the industry and of the faith that those who are well informed have in its future is the enormous outlay of capital expended in power plants.

This year marks the completion of the new plant of the West Kootenay Power and Light Company at South Slocan, which is capable of developing about 70,000 horse-power, making the total developed by this company on Kootenay river about 160,000 horse-power. It is understood that this company is investigating power-sites on the Pend d'Oreille river with a view to possibly constructing another plant there, which would have an output of 80,000 horse-power. The bulk of the power generated is used at the Trail reduction-works, the rapid extension of which during recent years has called for an ever-increasing supply, and judging by the present programme of power-development a future increase in production is anticipated. Other important hydro-electric developments are in the East Kootenay, where power is supplied by the East Kootenay Power Company to the *Sullivan* mine and collieries in the Crowsnest area.

The extension of power-lines to the *Florence* at Ainsworth by the city of Nelson and to the *Yankee Girl* by the West Kootenay Power and Light Company, followed by an announcement that the latter company intends to build a power-line into the Slocan, marks a new chapter in the history of mining in the district, and no doubt will create additional interest in the possibilities of many properties in the surrounding areas, as well as being highly beneficial to producing mines. It has always been felt in the past that the lack of cheap and continuous power has been a great handicap to large-scale operations.

Electrical Prospecting.

This method of locating ore-bodies was employed more extensively this year than in the past and from indications it has come to stay. The Radiore Company had a party in the field at Sandon, where a surface survey was made at the *Ruth-Hope* during the early part of the year. The results were evidently considered satisfactory as the company was given a contract for further work late in the fall. The Schlumberger Company had a party at work on the *Silver Cup*, in the Trout Lake Mining Division, and also at the *Wigwam*, in the Revelstoke Division.

Geological Survey Work.

The Geological Survey of Canada had three parties in the field—one under C. E. Cairnes in the Slocan and Arrow Lake Divisions, one under J. F. Walker in the Nelson area, and another under H. C. Gunning in the Big Bend area north of Revelstoke.

Changes in Smelter Schedules.

At the end of the year the Consolidated Mining and Smelting Company gave notice that in future no penalty would be charged for the zinc contained in lead ores. Previously to this the company made a few changes in their zinc schedule in favour of the shipper.

Future Prospects.

The great and ever-increasing development of hydro-electric power, the rapid expansion of the Consolidated Mining and Smelting Company, together with many new and important mining developments throughout the district, forecast its entry into an era of greatly increased prosperity.

In the East Kootenay, which comprises the Golden, Windermere, and Fort Steele Divisions, there was no pronounced increase in prospecting and minor activities, but, on the other hand, important developments are taking place which may mean a great deal to the future of this section of the district and be the means of reviving interest in numerous prospects on which little work has been accomplished.

GOLDEN MINING DIVISION.

Monarch.

The outstanding development in this Division was that at the *Monarch* at Field, to which frequent references may be seen in the Annual Reports for previous years. It is one of the oldest properties in the district, its early history dating back to the days of construction of the Canadian Pacific Railway. Since then it has been operated intermittently with varying success, but has never been placed on a permanent producing basis. This is not to be wondered at, for the ore mined was of milling grade, low in silver and containing a fair percentage of zinc, which latter was a detriment. Now, however, modern metallurgical practice and better marketing facilities have entirely changed the aspect of things and the same character of ore can be mined and treated at a substantial profit.

Engineers employed by A. B. Trites recognized the possibilities both at the *Monarch* and adjoining *Kicking Horse* properties, which were acquired by him in 1926. The first thing to be determined was whether sufficient ore could be developed to warrant the erection of a concentrator and the equipment of the properties for large-scale production. Subsequent development accomplished under the direction of A. W. Davis proved highly satisfactory and placed a considerable tonnage in sight. At this stage of the proceedings F. R. Eichelberger and associates, of San Francisco, acquired the property under option and during 1928 continued development.

The ore occurs as replacement deposits in a brecciated limestone to form large tabular ore-bodies. The limestone belongs to the Cathedral formation, which forms the base of the Middle Cambrian. At first it was thought that fissuring was responsible for the location of the ore-bodies, but in view of recent work this now seems indefinite. In any event, the ore so far discovered may be said to lie in two zones, one in which the old *Monarch* workings are located, now called the *East Monarch*, and the other lying at about 700 feet distant, known as the *West Monarch*. From this latter ore-body shipments have been made in more recent years.

During the season a new Sullivan compound compressor having a capacity of 285 cubic feet of free air a minute was installed and about 1,300 feet of underground work accomplished.

By continuing a drift in a southerly direction from the old *East Monarch* stope a new body of high-grade ore was encountered. At the time of examination its limits had not been defined, but the indicated dimensions were as follows: Length, 125 feet, with ore still in the face; width, about 65 feet; and thickness, 25 feet. The average of numerous samples indicated the following values: Lead, 35 per cent.; zinc, 10 per cent.; silver, 2.5 oz. to the ton. The ore appears to be remarkably uniform in grade and occurrence for this type of deposit. The galena is coarsely crystalline, while the zinc, occurring as sphalerite, is of a light-amber colour and somewhat difficult to detect. It should be an ideal ore for treatment by oil-flotation as only a very small percentage of iron sulphides is noticeable.

At the *West Monarch* the length of the ore-body as determined by drifting southerly into the mountain is about 600 feet, with ore still in the face, and apparent width and thickness,

130 and 23 feet respectively. The ore is similar in character and occurrence to that in the *East Monarch*, but the values are not so high. Numerous samples gave indicated values of about as follows: Lead, 15 per cent.; zinc, 10 per cent.; silver 1.9 oz. to the ton.

The old stopes which formerly represented immense pillared caves are now filled with ore and waste, so that no further development can be done until a means is provided for getting rid of this material, as anything dumped from the adit-levels would fall on to the railway-line, 1,000 feet below. The obvious solution to this problem is the erection of a concentrator, which it is understood will be proceeded with early in the spring of 1929, as it is considered that sufficient ore is developed to warrant this expenditure. The plant will probably have an initial capacity of 300 tons a day, power being supplied by Diesel engines.

Kicking Horse. This property is situated high up in the bluffs on the north side of the Kicking Horse river; development consists of about 1,000 feet of underground work. The ore-bodies lie in the same formation and are similar in character to those of the *Monarch*, except that the zinc content and iron contents are rather higher. The combined lead and zinc averages about 20 per cent. and silver about 2.5 oz. to the ton.

There is a considerable tonnage developed, estimated roughly at 50,000 tons, which makes the total ore available at the two properties (*Kicking Horse* and *Monarch*) about 200,000 tons. This is a remarkably good showing considering the amount of development-work done to date. The ore can be mined and transported to the concentrator by aerial tramway at small cost and the concentrates cheaply loaded on the railway. As the ore-bearing formation covers an immense area and as the mineralization does not appear to be controlled by local conditions, it is safe to assume that the potentialities are decidedly attractive. The average number of men employed during the season was twenty-five.

Giant. This property is situated on the Spillimacheen river at a distance of about 6 miles by road from the railway. This property, which was acquired under option by A. B. Trites in 1926, was partially developed by diamond-drilling and underground work under the direction of A. W. Davis. It was optioned in 1928 by F. R. Eichelberger, who had a small crew employed during the summer months. When visited in June work was being confined to prospecting from an intermediate level driven from a point 65 feet up the raise connecting the lowest level with the No. 3, and while ore had been exposed in these workings, not enough work had been done to allow an opinion to be formed as to its possible economic importance.

In the lowest level a crosscut driven from the surface for a distance of 640 feet intersected the vein at a point where ore had been struck with the diamond-drill. Although the ore shows a good strong width at this point, subsequent drifting was disappointing. The strongest showing of ore was confined to a short length of drift driven in a westerly direction from the crosscut, but here structural conditions became complex and apparently the foot and hanging walls of slate came together, but whether this phenomenon was due to local contortions of the strata or not could only be determined by more work in this section of the mine, which seemed to offer the best possibilities for further exploration. *See also* 1927 Annual Report.

Witwatersrand Syndicate. The Witwatersrand Syndicate, Limited, had a crew of ten men busily engaged at development and exploration of a group of claims situated near the head of McMurdo creek at a distance by trail of about 35 miles from the Columbia river at Parson's. The season's work included extensive trail repairs and a certain amount of surface and underground work, which latter will be carried on during the winter. Unfortunately time did not allow an examination of this property being made during the season, but Captain G. W. Edwards, who is directing the work, informed the writer that he was well satisfied with results so far obtained. The ore is silver-lead and a small trial shipment will be made to Trail during the winter.

Talc.—A deposit of talc is being mined in the Rocky mountains by the National Talc Company, of Calgary. It is situated at a distance of about 17 miles south of the main line of the Canadian Pacific Railway, the nearest station being Massif. The talc is said to be of a grade for which there is a good demand.

WINDERMERE MINING DIVISION.

Paradise. This property is now being operated by the Mond Nickel Company under the direction of H. H. Yuill. During the earlier part of the year the new concentrator was put into commission and exhaustive experiments were made

with various reagents in order to obtain the best possible recovery from a low-grade mixture of lead and zinc sulphides, with which was associated a large percentage of iron sulphides. Satisfactory results were finally obtained and shipments of lead and zinc concentrates were made during the latter part of the summer. Upon arriving at a satisfactory solution of the metallurgical problem, attention was directed to the further development of the known ore-bodies and the possibilities for exploration in other parts of the mine.

In the 1927 Annual Report a map of the mine-workings and a short description may be seen, but in order to make this report intelligible a brief review of conditions is necessary. The lowest level, known as the 7,800-foot, is opened by a long adit driven in the general strike of the ore-zone. In 1927 the advancement of this level picked up the downward extension of an important sulphide ore-body developed in an intermediate level, and subsequent work gave promise of sufficient ore, in the opinion of the management, to warrant the erection of the mill. At the end of the 7,800-foot level the mineralization shows decided strength, but owing to intense folding movements the ore occurrence here is irregular and the continuity indefinite. In this section of the mine the ore-deposition had apparently been controlled by narrow bands of slate which had impounded the solutions, and as these structural conditions persisted beyond the ore so far exposed, further exploration along the general strike of the ore-zone appeared to offer attractive possibilities. When visited encouraging results were being obtained from the development of a body of good-grade zinc ore near the portal of the 7,800-foot level, which gave promise of producing a substantial tonnage.

From the mine-bin the ore is conveyed by a short length of aerial tramway to the concentrator, which is situated some 400 feet lower down. The rated milling capacity is from 50 to 75 tons. After passing through a jaw-crusher the ore goes to the mill-bin, from which it is automatically fed to a conveyor-belt and then direct to a Hardinge ball-mill in closed circuit with a Dorr classifier, the overflow from which supplies sixteen sub-aerated Mineral Separation cells. The concentrates after passing through a four-disk American filter drop into the bins for shipment. As the mill is below the wagon-road it is necessary to hoist the concentrates by a short length of aerial tram to a loading-bin.

Power is supplied for operating the plant by a 3-cylinder Petters oil-engine of 187.5 b.h.p. at 275 revolutions a minute. A 2-cylinder Petters engine of 84/90 b.h.p. is belted to a 19 by 19 by 12 compound Ingersoll-Rand compressor. The installation also includes a 50-k.v.a. General Electric generator and exciter.

When the property was visited the mill-feed was running about 4.5 per cent. lead, 12 per cent. zinc, and 4.5 oz. to the ton in silver. It is understood that the management is seriously contemplating the removal of the concentrator to the foot of the mountain on Toby creek, which would also necessitate the building of about 4 miles of aerial tramway.

Among other activities in this Division, the following have been reported: At the *Lead Queen* on Frances creek work was confined to driving a lower tunnel under contract, which will give an additional depth of 500 feet below the upper workings. It is understood that this work will be continued during the winter. The property is being operated by New York interests under the supervision of H. E. Forster, of Wilmer.

The *White Cat* on Slade creek was operated by J. C. Pitts and associates, R. Morland being in charge of the work. A small crew of men was employed and a shipment of 15 tons of silver-lead ore made to Trail. Recent exploration and development is stated to have met with satisfactory results.

The *Pretty Girl*, situated on the summit of the ridge between Slade and Law creeks, was operated by the North Kootenay Mines, Limited, of which J. A. Lundy is president. The property, which has been lying idle for a number of years, is described in the Annual Report for 1903, at which time an examination was made by W. Fleet Robertson. It was also visited in 1915 by John D. Galloway, but at this latter date the caved condition of the workings did not allow the results of development being examined. From information available there apparently exists a mineralized zone in which occur a series of narrow veins of grey copper. A fairly representative sample of the ore is said to have given the following values: Silver, 55.5 oz. to the ton; copper, 26.58 per cent.

On the North fork of Toby creek a small amount of work was done at the *Outcrop* and *Outlet* group, which is referred to in the Annual Report for 1924. It is understood that this property was acquired by the Kootenay Metals Corporation, Limited, of which C. V. Sommerville is president.

In order to exploit the *Grotto* and other claims on Horsethief creek, a company called the Kootenay Giant Mining Company, with a capitalization of $1,000,000, was incorporated. The extent of this company's operations during the season is not known at the time of writing.

Among other properties at which minor activities have been reported, the following may be mentioned: The *Nip & Tuck* at the head of McDonald creek, the *Mineral King* and *Nettie M.* on Toby creek, and the *Silver Spray* on Copper creek.

Lead. This group, consisting of five claims and owned by Blake Bros., of Fort Steele, is situated near the southern boundary of the Windermere Division at an elevation of 6,100 feet (aneroid). It is reached by a trail of about 12 miles in length, which leaves the railway at a point near Torrent Station, although the best route to this property would be by way of Findlay creek.

The area is underlain by granite, which apparently occurred in the form of sills with intervening beds of highly metamorphosed sediments. Prospecting had disclosed a series of small veins or cracks in the granite, into which mineral-bearing solutions had been injected to form narrow stringers containing lead, zinc, and iron sulphides. While the containing walls showed alteration, there did not appear to be any appreciable replacement. Although no ore-body of commercial importance had been developed, the presence of these stringers suggested the possible existence of a main fissure, which remains to be proven by further work at increased depth.

The work done consisted of a tunnel driven into the face of the bluff for 71 feet in a southwesterly direction. At the end of this tunnel a shallow winze had been sunk. A sample from a small pile of sorted ore gave the following returns: Gold, 0.04 oz. to the ton; silver, 12.9 oz. to the ton; lead, 23.8 per cent.; zinc, 3.5 per cent. The property is also referred to in the Annual Report for 1926.

FORT STEELE MINING DIVISION.

At Kimberley the end of the year saw preparations well under way for the enlargement of the *Sullivan* concentrator to a capacity of 6,000 tons a day, which means an increase of 50 per cent. in the tonnage treated. This substantial increase does not necessarily mean that the metal-output of the concentrator will be increased in the immediate future, but that at least the same output may be maintained by the mining of a lower grade of ore which may be more advantageous to mine during the present stage of operations than at a later date.

The improvements and additions will include increased fine-ore bin capacity to the unit of mill capacity, the remodelling of the secondary crushing plant, in which the ore from the primary plant at the mine will first pass through a 7-foot Symons cone crusher; the product will then pass over Hummer screens and through two sets of 72- by 20-inch rolls in parallel, the resulting product, being of ⅜-inch size, passing into the fine-ore bins to be fed to the ball-mills.

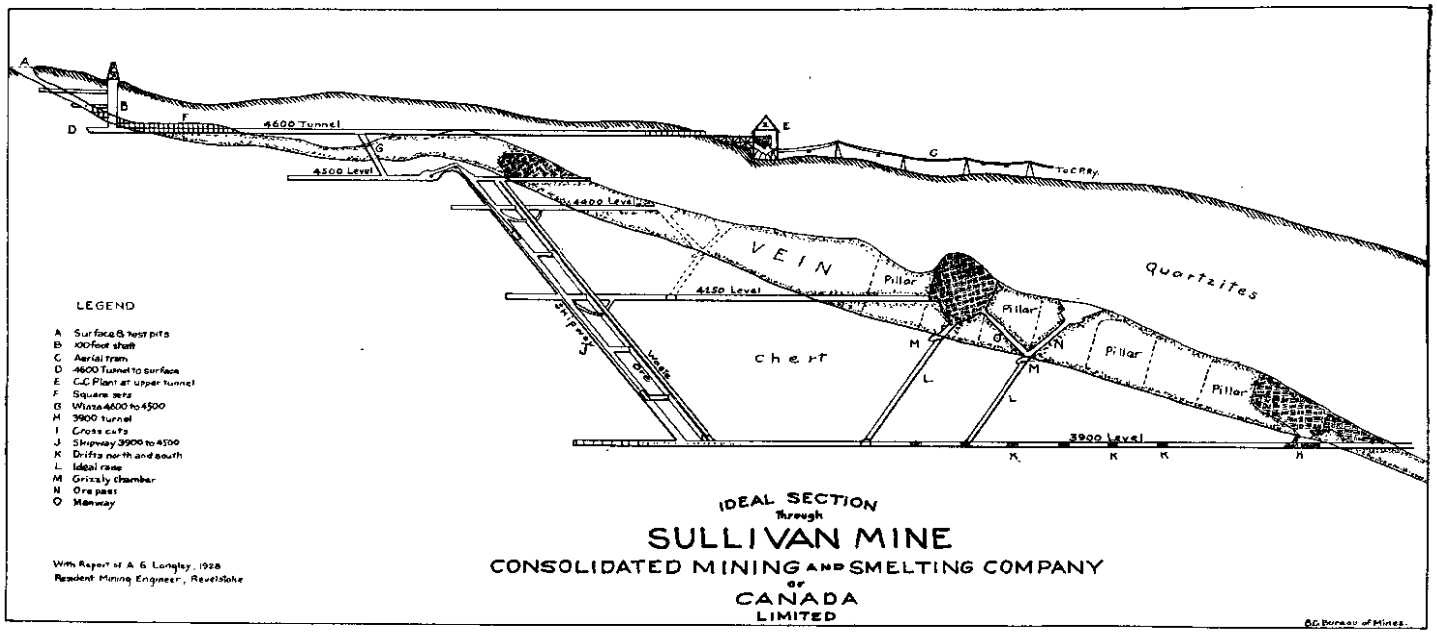
The additions to the fine-grinding equipment will consist of two primary and four secondary 10-foot by 48-inch Hardinge ball-mills. Aikens classifiers will be used instead of Dorr classifiers. Gentry thickeners will be installed between the classifiers and flotation-machines to permit control of desirable densities.

The new flotation equipment will consist of 24-inch Mineral Separation sub-aerated cells with texrope-driven spindles.

Power for the concentrator is transmitted over duplicate lines at 66,000 volts from the Bull River and Elko plants of the East Kootenay Power Company. This is stepped down to 550 volts and distributed to the various motors in the plant. As an auxiliary to this source of power a turbo-generator plant has been installed, which is capable of running the mill in the case of an emergency, as well as generating power for the Moyie plant, 40 miles distant.

The turbines and generators are housed in a spacious building of reinforced concrete, steel, and brick. The plant consists of three Westinghouse turbo-generators and three 1,875-k.v.a. Westinghouse a.c. generators. Steam is supplied by a battery of seven Babcock & Wilcox water-tube boilers, cooling-water from the condensers being utilized for heating solutions in the milling process. When sufficient heat is not available from this source, due to closing-down or reduction of load of the turbines, the steam-pressure is reduced and by-passed through low-pressure lines to the mill.

Sullivan. Development is being kept well apace with production and more ore is being continually added to the already immense reserves. Recent work has been largely confined to the north-westerly end of the workings, where from an intermediate level a crosscut tunnel of about 350 feet in length is in ore for the entire distance; this of course does not represent the true width of the vein, which has a dip of about 23°.


A
B
C
D
E
F
G
4600 Tunnel
4500 Level
4400 Level
4150 Level
3900 Level
C.P.R.
VEIN
Pillar
Quartzites
chert
Shipway
Winze
Ore
LEGEND
A Surface & test pits
B 100 foot shaft
C Aerial tram
D 4600 Tunnel to surface
E C.C. Plant at upper tunnel
F Square sets
G Winze 4600 to 4500
H 3900 tunnel
I Cross cuts
J Shipway 3900 to 4500
K Drifts north and south
L Ideal raise
M Grizzly chamber
N Ore pass
O Manway
With Report of A. G. Langley, 1928
Resident Mining Engineer, Revelstoke
IDEAL SECTION
Through
SULLIVAN MINE
CONSOLIDATED MINING AND SMELTING COMPANY
OF
CANADA
LIMITED
B.C. Bureau of Mines.

In this section of the vein the ore is of lower grade along the foot-wall side, the predominant mineralization being iron sulphides with which is associated a combined lead and zinc content of about 15 per cent. It is in order to mine this grade of ore and at the same time maintain a metal-output at least equivalent to that being obtained on the present basis of production of 4,000 tons a day, that the output of the mine will shortly be increased to 6,000 tons a day. This necessitates an increase to the capacity of the compressor plant by the addition of a 3,000-cubic-foot Belliss & Morcom air-compressor.

This year construction was completed of a large brick building near the portal of the 3,900-foot level, which provides office accommodation for the mine staff and large storage-space for various supplies, such as are in continual demand for the mine and surface plant. Methodical and convenient arrangements have been made underground for the storage of drill-steel, machine and parts, which can be distributed to various parts of the workings with as little delay as possible, while ample precautions have been taken to protect the safety of the men.

In view of the great importance of this mine to the industry at large, and of the outstanding success of its operation, the following information relative to its gradual development, methods employed, and equipment used is quoted from a paper presented by L. D. Thompson, of the engineering staff at the mine, before the Annual Western Meeting of the Canadian Institute of Mining and Metallurgy at Vancouver in November. The first part of this paper deals with the history of the property from the time of its discovery and goes on to describe conditions during the period that mining was confined to the upper horizon of the ore-zone, but as these matters have already been referred to in previous Annual Reports, only information contained in that part of the paper which deals with more recent history is given. It may be mentioned that the success met with in the development of the ore-zone from the 3,900-foot level and the solution of the metallurgical problem presented by the complex mixture of lead, zinc, and iron sulphides marked the dawn of a new era for the *Sullivan* mine.

"*3,900-foot Tunnel.*—In 1915, diamond-drilling having proven the continuation of the ore-body to a considerable depth, it was decided to drive a tunnel from Mark creek at an elevation of 3,900 feet, This 10 by 12 tunnel was successfully driven and a raise 7,100 feet from the portal struck the foot-wall of the south ore-zone 62 feet above the back of the tunnel.

"Since 1919 development-work has proceeded rapidly on the 3,900-foot level. Two crosscuts were driven west under the main ore-zones for a distance of 1,100 feet and from the end of these raises were driven to the 4,500-foot level. One of these raises is of five compartments—two skipways, manway, ore-pass, and waste-chute. The waste and ore chutes are separated by a 2-foot concrete partition with 20 feet of rock between these and the hoisting-shaft. Two other ore-chutes connect the 3,900- with 4,500-foot level. With the completion of these four raises all hoisting ceased and the tramway operation was discontinued, all ore being hauled to the surface through the 3,900-foot tunnel.

"*Advent of Flotation.*—In 1919 the selective mining methods were discarded owing to the successful results obtained in the experimental concentrator at Trail. Satisfactory savings of both lead and zinc sulphides were being made by a selective flotation process and the grade of ore possible to treat was such that the minable portions of the ore-body began to embrace the greater part of the south and north ore-zones. Shipments of zinc ore were gradually increased until the production became 1,100 tons a day, and continued at this rate until the completion of the *Sullivan* concentrator in 1923.

"*Exploration of Ore-body between Lower and Upper Levels.*—Meanwhile a definite plan for the exploration of the ore-body between the lower and upper levels was gradually being formulated. It was finally decided to divide the ore-body into alternate stoping and pillar areas, size and shape of areas to depend on thickness of ore. From a minimum of 30-foot squares the size ranges to a maximum rectangular area of 100 by 200 feet. The ultimate size is determined when stoping operations have revealed the character of the hanging-wall and the nature of the folds in that area.

"Drifts were driven north and south off the crosscuts and raises are driven to the foot-wall at not less than 55°. At this point the grizzly-chamber is cut, and from here finger raises at plus or minus 40° are driven to the hanging-wall. These raises are later opened up to 16 by 16 feet before being used as ore-passes. A manway is maintained from drift to the grizzly-chamber by means of a 2-foot concrete partition.

"The grizzly consists of three bars 16½ feet long, each bar being composed of three 100-lb. British standard section-rails bolted together at each end. The centre rail of each bar is slightly

raised to allow the balls of the rails to overlap. By the use of short pieces of angle-iron the ends of grizzy-bars are bolted to 12 by 12 coast-fir cross-members, which are in turn usually supported by concrete. The grizzly openings are 20 inches.

"Four upright 12 by 12 coast-fir timbers, two on each side placed 5 feet 2 inches apart, hold the chutes, which are made of ½-inch plates with 3-inch wood filler riveted and bolted together. A slot in the bottom and angle-iron guides up the insides allow the loading-door, made of ¾-inch plate reinforced with 45-lb. rails, to move up and down. A 12-inch air-cylinder with 4-way valve operates the loading-doors. Eight 1-inch bolts hold the chute to the 12 by 12 uprights, which facilitates removal or replacement.

"*Stoping.*—By inclining finger raises towards one another stopes are started at or about the point where two of such meet the hanging-wall. One finger raise is used as an ore-pass and the other as a manway, which affords a safe means of access for men, supplies, and pipe-lines, and also ensures natural ventilation for each stope.

"The first part of the operation is side-swiping along the hanging-wall, great care being taken not only to clean off all the ore, but to leave the back of the stope in a safe condition. This is followed by benching from the raise; thus a stope assumes a funnel-shape, with the raise as its spout. In this manner a considerable portion of the ore will run by gravity to the mine-cars. When the foot-wall is reached in the raise a drag-line scraper operated by a double-drum hoist is installed to draw the remaining ore into the chute.

"Using this method, the hanging-wall is gradually exposed; each successive bench allows a larger ring to be cleaned until the outline of the stope reaches its required dimensions. From then on the bench is terminated by the sides of pillars.

"The muck from a stope all going into one chute, the system is readily adapted to contracting, and 70 per cent. of the ore is broken on a per-ton basis. The contractors buy their own powder, fuse, and caps and the company supplies all necessary tools and equipment. Contracts are all verbal and may be broken at any time by either party. The company adjusts prices only at month ends and guarantees current day's wages. A contractor with a machine-shift production of 65 or 70 tons will make about $7 a day. The average production for the whole mine is about 54 tons per machine shift; the total number of shifts used in this last calculation includes scrapermen as well as miners.

"The contract comprises two men on morning and afternoon shifts; the morning crew bar down, plug, and bulldoze all oversize and set up two machines on upright bars for side-swiping or one machine on a tripod for benching. The pair on afternoon shift complete drilling the rounds and load the holes. The fuse is spit at 10.20 p.m. on a signal given by means of compressed air; 9- and 12-foot fuses are used and with the air signal ensure safety where stopes are closely connected.

"*Drifting and Raising.*—Drifting crews consist of four men. The two on day shift, supplied with a mucking-machine and a switching-motor, muck out the round. If there is time they set up on horizontal bar and start drilling. Afternoon shift completes the round and blasts. The ordinary V-cut 18-hole round is used in a 9 by 9 drift in chert or quartzite, while the same cut with a round of 24 holes is used in a 9 by 10 drift in ore. Blasting, as in the stopes, is done on the compressed-air signal. Contract prices vary from $9 to $12 a foot.

"In raising two upright bars are used with machines set on arms, and the raise round consists of 18 to 24 holes, the pyrrhotite requiring the most holes. The operation requires two shifts and the blasting is done at the same time as in stopes and drifts. Contract prices vary from $14 to $16 a foot and include necessary timbering. In finger raises in ore without timbering the price varies from $11 to $12.

"*Transportation.*—Three crews per shift, each consisting of two motormen and two chutemen, using 12-ton tandem locomotives, are used for loading and gathering purposes. Two 24-ton tandem locomotives haul trains of 30 Granby-type mine-cars, with a capacity of 82 cubic feet each, a distance of 1½ miles to the receiving-bin at the coarse-crushing plant. A dispatcher situated at the main crosscut in the south end controls all train movements on the main line by telephone. The surface automatic telephone system is extended underground and an auxiliary magneto-type telephone-line is also maintained.

"*Coarse-crushing Plant.*—The 600 live-ton receiving-bin for the coarse-crushing plant is situated about 650 feet from the 3,900-foot tunnel portal. From the above bin the muck is fed to a 36- by 42-inch Buchanan jaw-crusher set to 6 inches. The discharge passes over a bar

grizzly with 1¾-inch openings. Oversize passes over a picking-belt, where waste rock and clean lead ore are sorted. The former goes to the dump and the latter is shipped direct to the smelter.

"Three Traylor No. 10 gyratories complete the reduction to minus 2 inches, and the discharge from these, plus the undersize from the grizzly, is elevated to a shuttle conveyor on top of a 3,300 live-ton storage-bin.

"A C.P.R. train of ten 70-ton cars transports the ore a distance of 2½ miles to the fine-crushing plant at the *Sullivan* concentrator.

"*Power.*—Power is obtained from the East Kootenay Power Company and is brought into Kimberley on a 66,000-volt transmission-line. Outside type transformers reduce the voltage to 2,200.

"Three electric and one water-driven compressors have a capacity of 15,000 cubic feet a minute and a pressure of plus 85 lb. a square inch is maintained underground.

"Three armoured cables through 3-inch diamond-drill hole from the surface deliver power at 2,200 volts at various places underground. Two motor-generator sets in the power-house and four underground furnish the 250-d.c. current for trolley locomotives. Power-consumption at the mine is about 3,000 horse-power.

"*Safety First.*—General provisions for the safety and welfare of all employees has received considerable attention from the management. To this end safety-first and co-operative committees meet the officials of the company at regular intervals and practical suggestions meet with hearty approval. First-aid classes are held during the winter months and stretchers and first-aid equipment are located at central points throughout the mine and plant. Recreation-halls, bunk-houses, and cook-houses are provided for single men; numerous cottages have been built for married men, and a loan system established to aid those who build their own. Present conditions are such that our labour turnover is practically *nil*.

"*Sampling.*—A special effort has been made to keep the grade of the mill-feed as even as possible as an aid to flotation. By expediting the collection and passage of samples from the mine to the assay office and return of reports a grade-sheet covering the working-places is kept up to date. Tonnages in stopes and raises are estimated, as is the amount of ore broken in each round. Thus a run of mine for each shift is calculated and a forecast of amounts to be pulled from the various working-places during the next shift is made. This forecast is not rigid or it would interfere with the operation, but the idea of mixing a train of high with a train of low to make an even grade is established and variations of over 1 per cent. in either lead or zinc have been practically eliminated.

"This mixing of ore is also aided by horizontal bedding in the main storage-bin at the concentrator and more or less vertical bedding in the mine storage-bins.

"*Conclusion.*—The *Sullivan* mine produced 783,403 tons during the first half of 1928 in 155 working-days, which gives an average daily production of 4,946 tons. The operation was carried on for sixteen hours per day, six days a week, with one extra holiday on May 24th. The concentrator treated 4,000 tons every twenty-four hours.

"In conclusion, it might be interesting to note that the total development now only amounts to 17.7 miles and total shipments of all classes of ore to June 30th, 1928, were 7,714,699 tons."

At Moyie operations were continued on the recovery and re-treatment of the old *St. Eugene* mill tailings by the Consolidated Mining and Smelting Company. The plant, which has a capacity of 500 tons a day, is also equipped with coarse-crushing machinery for the purpose of milling dump material from the *Sullivan* mine or to be used as the occasion may arise as an auxiliary to the Kimberley concentrator.

Kootenay King. This property is situated on Wildhorse creek at a distance of approximately 6 miles by road and 6 miles by trail from Fort Steele. A considerable amount of work had been accomplished by the original owner, W. Meyers, when in 1925 the property was acquired by W. B. Dornberg, W. A. Anstie, and associates. In the same year it was examined by the writer and a description of the workings may be seen in the Annual Report for that year. In 1928 it was acquired by the Kootenay King Mining Company, which placed a diamond-drill on the ground, and after a summer's campaign of exploration the property was acquired under option by the Britannia Mining and Smelting Company, Limited, in the fall of the year.

A cabin to accommodate ten men was constructed and a crew put to work under W. E. Selnes. Diamond-drilling was continued and a little underground work was done. Regarding

the results of the work, the following has been supplied by the Britannia Mining and Smelting Company:—

"This underground development consisted of driving the No. 1 tunnel ahead another 10 feet to determine if a second ore-body existed, as appeared possible from the surface outcrops. However, the tunnel continued in massive quartzites with no mineralization. In No. 2 tunnel the north drift was extended 15 more feet along the fault, which cuts across the tunnel with a strike of N. 15° W. Some low-grade ore was encountered. A second drift was collared 197 feet from the portal and driven in a south-easterly direction through slightly mineralized ground. In all, some 4,000 feet of diamond-drilling was done in 1928 by the Kootenay King Mining Company. Several holes were drilled from a set-up in the gulch, above No. 2 tunnel, at an elevation of 7,600 feet. Others were drilled at the mouth of No. 1 tunnel and also on the trail below No. 2 tunnel. Fair ore was encountered in some of the holes, but in others the results were not so encouraging. Due to the rugged nature of the country at the level of the tunnels, snowslides frequently occur and it was necessary to withdraw the crew in the middle of December. It is anticipated that Britannia Mining and Smelting Company will renew diamond-drilling operations in the spring."

Among numerous activities, the following have been reported: The *Copper King*, owned by W. S. Santos, of Cranbrook, was operated during the year and a small shipment made to Trail; the *Payroll* on Nigger creek was further developed by Maurice Quain; further prospecting was done by the Evans Bros. on the *Evans* group on Whitefish creek, by J. Angus on his claims on Hellroaring creek, on the *B. & V.* group by B. Frisinia, and on the *Guindon* group by Frank Guindon.

Placer-mining.

The principal placer-mining activities were on Wildhorse creek, where W. A. Drayton had a small crew of men employed at hydraulicking. Minor activities were also reported near Lumberton.

Gypsum.

Mining operations were continued by the Canada Cement Company on its property near Mayook Siding.

Phosphate.

A shipment of phosphate rock was made by the Consolidated Mining and Smelting Company from its property near Fernie to Trail, where it was converted into superphosphate and shipped to Government agricultural farms on the Prairies for experimental purposes. There are indications that this may develop into a very important industry.

SLOCAN MINING DIVISION.

Mining in the Slocan Division has been very active this year and many important developments have taken place which should be reflected in a substantial increase in tonnage. It is strictly a high-grade silver-lead-zinc camp and is capable of producing pleasant surprises at any time for those who have the capital and possess sufficient faith to prospect favourable localities. During recent years most of the tonnage has been produced by old-time properties, which at one time or another have either been very low in ore reserves or abandoned as being worked out. There are many striking examples of how these properties have been brought back to life by intelligent and systematic development, to be placed on a profitable producing basis. The trouble seems to have been in the old days that the owners were too anxious to pay dividends and did not direct sufficient attention to the accumulation of reserves for development. Strikes made at the *Noble Five* and *Galena Farm* this year bear evidence of the potentialities of old properties, which attracted little attention while dormant in recent years.

Besides silver and lead, zinc is an increasingly important factor in the production since the gradual improvement in the treatment of the ores by the oil-flotation process and the more favourable marketing facilities. During the year the removal of the penalty for zinc in lead ores from the smelter schedule, together with slight alterations to treatment charges for zinc ores, will be of decided benefit to the shippers of ores and concentrates.

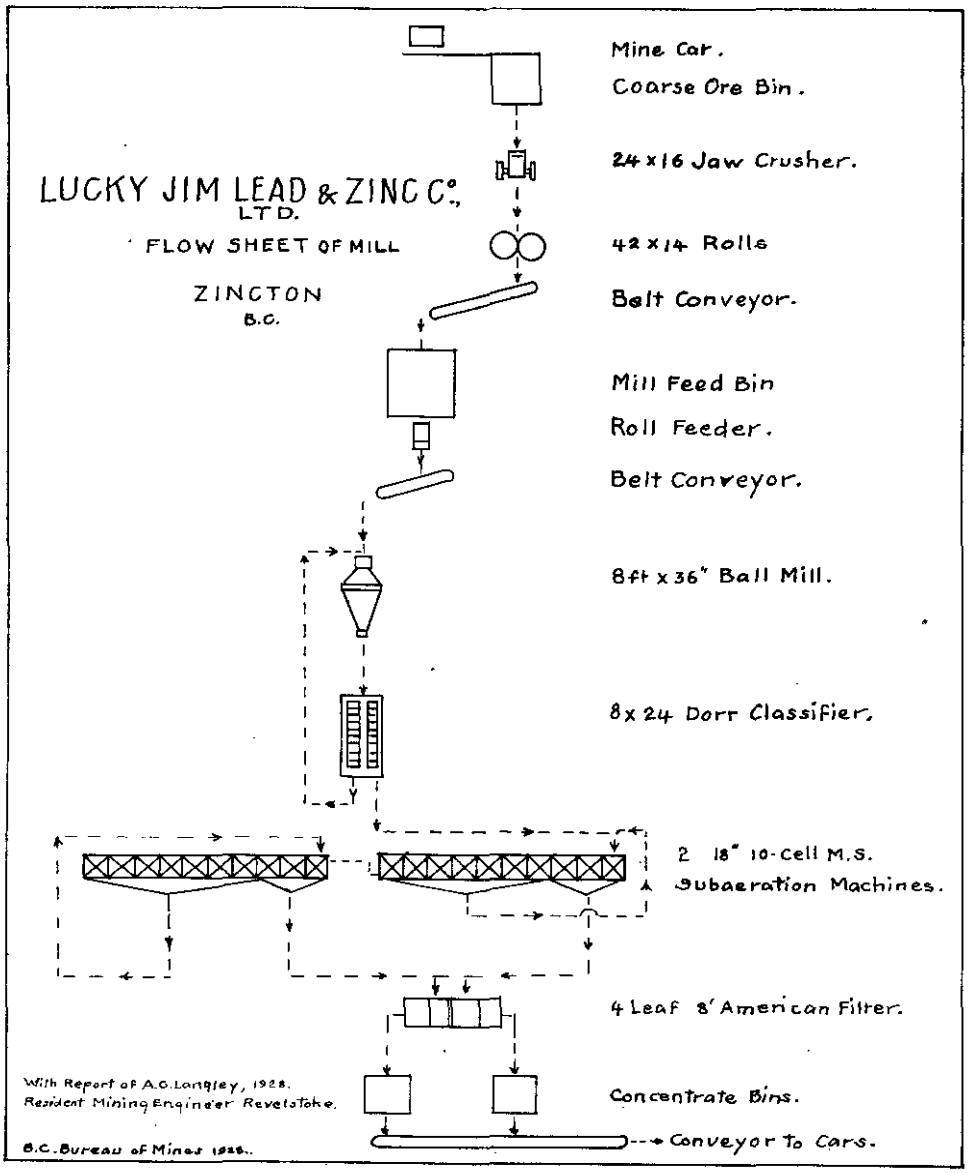
At the end of the year announcement was made by Lorne A. Campbell, general manager of the West Kootenay Power and Light Company, that a transmission-line would be constructed to the Slocan in the near future. This will fill a long-felt want and will not only be of great

benefit to large-scale operations, but should add materially to the attractions of the Slocan for capital investment for the purposes of exploration and development work. The year witnessed the completion of the road from Slocan City to Silverton, also that of the connecting-link between Bear lake and Kaslo. The last Geological Survey Report published on the Slocan is C. E. Cairnes's Preliminary Report in the Summary Report for 1925, Part A. This report contains the description of a number of properties and gives valuable information relative to this area.

ZINCTON.

Lucky Jim.

This mine is situated at Zincton, on the Kaslo–Nakusp Railway. The new concentrator, which has a rated capacity of 200 tons, was kept running at capacity during the year; in fact, towards the end of the season it is reported to have treated 225 tons a day. Mining and milling costs were reduced to a minimum and in all probability reached about the lowest point that has yet been attained in the Slocan. The mill-feed is reported to have averaged about 10 per cent. zinc, 1½ per cent. lead, and 1½ oz. of silver



to the ton. Although low metal prices will no doubt seriously affect the earnings, the operation of this property stands out as a technical success.

The mill flow-sheet follows the general practice that has been adopted throughout the Slocan and may be seen on the accompanying diagram. All the machines are electrically driven, power being supplied by two 4-cylinder Petter oil-engines of 250 horse-power each and direct-connected to Westinghouse 200-k.v.a. alternators, 440-volt, 60-cycle, 3-phase. In addition, there is a 120-horse-power Fairbanks-Morse engine belted to an air-compressor and to a 90-k.v.a. Westinghouse alternator. The last reference to the property may be seen in the Annual Report for 1927.

SANDON CAMP.

Ruth-Hope. This mine, operated by the Ruth-Hope Mining Company and situated at Sandon, is described in previous Annual Reports, so that only a brief review is submitted. The mine was first acquired by this company in 1923 and the history of its subsequent development unfolds a story of an interesting mining achievement, for when work was first started there was nothing much but its past history and attractive geological features to commend it. R. H. Stewart, who was principally responsible for the incorporation of the company, recognized the possibilities of the property and eventually succeeded in placing it on a profitable producing basis, until it now ranks among the most important of the independent shippers of the district.

Work was first confined to determining the possibilities offered by the upper horizon of the *Ruth* ore-zone, from which a large tonnage had been extracted during the earlier history of the mine. This was successful in opening up a new ore-body in what was then known as the Stewart vein, while further underground prospecting revealed possibilities for a considerable tonnage of milling-grade ore being won from certain sections of the old workings. However, it was soon recognized that the future of the mine rested largely with the potentialities of the area covering the westerly extension of the *Silversmith* ore-zone.

To explore this area a 2,700-foot crosscut tunnel was driven from the old No. 5 level, making the total distance to the surface 3,700 feet. This resulted in the development of an important high-grade ore-shoot at a depth of 1,000 feet below the outcrop, and after a long struggle expectations were realized. Besides stoping this ore-shoot on the No. 5 and No. 6 levels, a good grade of milling-ore was being mined from an ore-shoot which was developed last year above the No. 2 level. In addition to actual mining of ore, development was proceeded with in other parts of the mine and preparations were being made to tap a body of milling-ore between the Nos. 4 and 5 levels.

The grade of ore being fed to the mill in October and results being obtained are represented by the following, which was considered to be about the average:—Mill-feed: Silver, 20.5 oz. to the ton; lead, 7 per cent.; zinc, 7.4 per cent. Lead concentrates produced: Silver, 122.5 oz. to the ton; lead, 64.8 per cent.; zinc, 4.5 per cent. Zinc concentrates: Silver, 49.5 oz. to the ton; lead, 1.5 per cent.; zinc, 49.7 per cent. Tails: Silver, 2.4 oz. to the ton; lead, 0.03 per cent.; zinc, 1.1 per cent.

The concentrates are loaded into the railway-cars by automatic dumping-skips, which are lowered down a short incline from the mill-floor. In the mill the Mineral Separation machines are run by an endless-rope drive, which is a unique feature, but has given good results. Sampling is done throughout by water-balanced automatic samplers.

The property covers a large area, and in order to test portions on which little exploration had been done Radiore surveys were made and it is understood favourable indications were obtained.

Noble Five. This mine is owned and operated by the Noble Five Mines, Limited, with a capitalization of $3,000,000, divided into 6,000,000 shares of 50 cents each par value. Paul Lincoln is president and general manager and J. G. Shepherd is superintendent. The property acquired this year by the above company consists of the *Noble Five* group of eight claims and the *Surprise* group of three claims.

The history of the *Noble Five* dates back to the early days of the Slocan. For many years it was a pet hobby of the late Hon. James Dunsmuir, who spent much money in its development and equipment with the object of placing it on a permanent producing basis. The work, which was carried on under the direction of Paul Lincoln, included the driving of a 2,700-foot crosscut from the surface to the *Noble Five* vein, which was intersected at a depth of 1,000 feet below

the old upper workings. This was followed by drifting on the vein and driving a vertical 4-compartment raise to connect with the upper workings. Upon the completion of this latter work a concentrator with a rated capacity of 100 tons was constructed and ready for operation in 1920. Shortly after this, the death of Mr. Dunsmuir caused the closing-down of the mine, which lay dormant until 1927, when Paul Lincoln resumed operations in a small way under a lease and shipped 1,246 tons of milling-grade ore to Trail.

During 1928 the above company was incorporated and sufficient capital was provided to pay for the property and to carry out an extensive development and exploration campaign as planned by Arthur Lakes, the consulting engineer. The company commenced operations under favourable auspices, having a mine on which large sums had been spent in development-work, which gives access to the vein system at great depth, as well as buildings and camp equipment which would take thousands of dollars to replace. While further underground exploration-work was being proceeded with, the remodelling of the mill and the rehabilitation of the tramway and other surface plant was rushed to completion, with the result that the property was in shape for production by the end of the year.

The underground work met with results that surpassed all expectations, that is to say, with reference to the development of the *Deadman* vein, where a strike was made which is quite remarkable, even in the history of the Slocan, as there was but little evidence to signify that the conditions encountered might be expected. This vein was cut by the long crosscut of the low adit-level, known as No. 18. It had been previously explored by a short length of drift and abandoned, as the mineralization, principally consisting of iron sulphides, was too low grade to be of economic importance. The recent continuation of this drift through a strong porphyry dyke encountered a sheared fissure with a well-defined hanging-wall of slate and porphyry on the foot-wall side.

In driving along this hanging-wall the foot-wall soon disappeared and the whole width of the drift was in ore of milling grade, the width of which latter had not been determined. The structure, apparently consisting of bands of ore with narrow intervening bands of slate, crossed the drift at an oblique angle towards the foot-wall. When examined in October the drift was in ore for about 60 feet, with a strong showing in the face. A sample taken across a width of 3 feet at the face gave the following returns: Gold, 0.06 oz. to the ton; silver, 67.9 oz. to the ton; lead, 27.3 per cent.; zinc, 7.15 per cent. Another sample taken across an ore-band 22 inches wide at a distance of 55 feet from the face assayed: Gold, 0.04 oz. to the ton; silver, 47.7 oz. to the ton; lead, 31.3 per cent.; zinc, 9.7 per cent. The material in the bins indicated that the muck from this drift constituted a good grade of milling ore, in which there was a fair percentage of clean galena.

While the true dimensions and character of this deposit had not been determined, there is every reason to anticipate that it will prove to be a very important ore-body, especially when it is considered that it lies well within the heart of the mountain in virgin ground at a depth of 1,100 feet below the old workings on this vein. The fact that the shear is strong, well defined, and has drained the main raise and upper portions of the mine, indicates that it is persistent in a vertical direction and gives rise to optimistic hopes that development from the upper horizons of the mine-workings will meet with satisfactory results.

The *Noble Five* vein as developed on the No. 18 level is tight and carries a narrow but persistent streak of clean galena. It is quite possible that at this horizon it has been subjected to squeezing and will make a stronger width of ore where the structural conditions are more favourable. It is understood that contemplated mining and development, apart from the continuation of that of the *Deadman* vein from the eighteenth level, will include the stoping of the *Noble Five* vein from the eighth and eighteenth levels and exploring it on the tenth, twelfth, fourteenth, and sixteenth levels. Further reference to this property may be seen in the Annual Report for 1925.

The *Surprise*, which was formerly operated by the Rosebery-Surprise Mining Company, has a splendid record of production, given at 48,360 tons with average values of about 47 oz. of silver to the ton, 18 per cent. lead, and 13 per cent. zinc. This ore was mined and shipped from an ore-shoot developed to a depth of 900 feet below the apex of the vein during the years 1914 to 1925, since when the mine has been closed down, except for leasing operations. The possibilities for picking up the downward continuation of this important ore-shoot at depth, together with the fact that the *Noble Five* workings offered the only logical point from which this could be undertaken to the best advantage, were the principal reasons for the acquisition of this

property. In order to explore the potential area at a depth 750 feet below the old *Surprise* workings, the No. 8 *Noble Five* level will be extended in an easterly direction for about 700 feet, from which point a crosscut of about 450 feet will intersect the downward projection of the *Surprise* vein.

The concentrator erected to treat *Noble Five* ore, which is situated on the wagon-road at Cody, within a distance of 1½ miles from the railway at Sandon, has been remodelled for straight flotation. Its equipment consists of a jaw-crusher, rolls, ball-mill classifier, and McIntosh flotation-cells. It is understood that its present capacity is about 50 to 60 tons a day, which it is proposed to gradually increase until 100 tons a day is attained some time during the summer.

Silversmith. At this property, which in recent years enjoyed a splendid record of production, yielding handsome returns in dividends, work was confined to exploration with a view to developing sufficient tonnage to ensure continuous production and warrant the remodelling of the concentrator.

Important work of this character was being done on the downward continuation of the *Slocan* ore-shoot, which during the early history of the camp yielded a large tonnage of high-grade silver-lead ore from above the 1,000-foot level. From this level a shaft had been sunk to the 1,200-foot level, where a station had been cut and the vein crosscut. Here the vein consists of a strong sheared zone of about 50 feet in width, in which the appearance of small inclusions of ore and gangue-matter give rise to expectations that important ore-bodies may not be far distant. It is intended to continue sinking the shaft to the 1,500-foot level and then thoroughly explore the ore-zone by drifting and crosscutting. Lead and zinc concentrates which had been in storage at the mill were shipped to Trail. References may be seen in previous Annual Reports.

At the *Slocan King* a considerable amount of exploration-work had been accomplished, both from the 1,000-foot level and the 500-foot level. On this latter level sinking is contemplated on a short shoot of high-grade ore exposed in the bottom of the drift. For further reference *see* the Annual Report for 1927.

Further work is also being proceeded with at the *Leadsmith*, but the results obtained are not known at the time of writing. Refer to the Annual Report for 1927.

Victor. This property, owned by George Petty, of Sandon, is situated on the Carpenter Creek slope of Queen Bess mountain at a distance of about 3 miles from Sandon. The formation is slate which has been intruded by porphyry dykes. The vein cuts the formation, striking north-easterly and dipping at a steep angle.

The discovery of the outcrop was first made by digging trenches to a depth of from 15 to 20 feet through the heavy covering of gravel-wash. This work was facilitated by the use of water for sluicing the loose gravel down the hillside. The outcrop showed a narrow and fairly short length of clean galena which carried high values in silver. To prospect this a tunnel was driven 50 feet below and a considerable tonnage of high-grade ore was mined and shipped from this level. The No. 2 tunnel, driven 100 feet below No. 1, was disappointing as the main ore-shoot, as developed above, was not encountered.

The No. 3 level, driven 70 feet below No. 2, however, develops ore of varying width for almost its entire length of 300 feet, making in places nice lenses of clean galena. In the last 60 feet of the drift the ground is soft and loose, in which the ore is continuous, showing in one place a maximum width of 5 feet. Unfortunately, on account of timbering, only glimpses of the ore could be seen through the lagging. At the face a crushed zone had been encountered which contained a considerable percentage of ground-up galena and zinc-blende. A sample of this material assayed as follows: Gold, 0.04 oz. to the ton; silver, 47.9 oz. to the ton; lead, 17.5 per cent.; zinc, 20.3 per cent. A sample of the massive galena exposed in the drift assayed: Gold, 0.12 oz. to the ton; silver, 122.2 oz. to the ton; lead, 61.4 per cent.; zinc, 4.8 per cent. A raise to the surface from this level unexpectedly missed the No. 2 level, which would indicate that the latter level is not on the same vein.

The No. 4 level has been driven at 170 feet below the No. 3 and was started on a nice showing of ore which was cut off by a strong porphyry dyke, through which the tunnel has not been continued. Recent work has been confined to the advancement of No. 3 and surface prospecting.

Since its discovery in 1921 Geo. Petty with a crew of two or three men has shipped ore yielding net smelter returns of over $54,000. The property is referred to in previous Annual Reports.

Bluebird. This group, consisting of the *Bluebird*, *Rawdon*, *Stranger*, and *Idaho No. 2*, was acquired by the Bluebird Mines, Limited, of which W. H. Burgess, of Kaslo, is managing director. The vein lies in a strong sheared zone cutting the summit ridge between Jackson basin and the valley of Carpenter creek. It was prospected and mined in the early days by several tunnels, shafts, and deep trenches, but as all of these workings were either caved or filled in, nothing much could be seen when the property was visited, except an occasional glimpse of the structural conditions as exposed on the summit of the ridge. Old-timers who were familiar with the property when it was previously worked all seem to be optimistic as to possibilities.

The company built a suitable camp for a small crew on the Jackson Basin side as soon as snow conditions permitted in the spring, and work was then started on reopening the old tunnel on the *Stranger*. At the end of the year it is reported that this tunnel had been retimbered and advanced for several hundred feet, where indications appeared favourable for soon encountering ore. On the Carpenter Creek slope a new tunnel has been driven for 315 feet under contract. This tunnel is on the *Idaho No. 2* and is situated at a distance of 1,000 feet or so below the summit. A little ore is reported to have been encountered, but the objective is 100 feet ahead of the present face. Work will be proceeded with all winter.

Rambler-Cariboo. This property, comprising a group of five Crown-granted claims, was acquired during the year by the Slocan-Rambler Mining Company, Limited, with a capitalization of $500,000, divided into 2,000,000 shares at a par value of 25 cents a share. The mine was formerly operated by the Rambler-Cariboo Mines, Limited, and for many years enjoyed a steady and profitable production. During latter years, however, this company, being short of funds for an extensive development campaign, ceased operations and allowed the mine to be worked by leasers. The ore is silver-lead-zinc, carrying a high silver ratio. The total production in past years, including 1927, was 157,632 tons: Gold, 10 oz.; silver, 3,139,801 oz.; copper, 720 lb.; lead, 22,012,314 lb.; zinc, 4,304,691 lb.

The mine is opened by a long adit-tunnel to a depth of 1,400 feet, which provides good facilities for economical mining and at the same time gives access to a large area of virgin ground which has decidedly good potentialities. The equipment consists of an old-type concentrator at the railway, which is connected with the mine by a 2-mile aerial tram.

During the present year development has been confined to the low or No. 14 level. Here the drift is reported to have been extended in a southerly direction for 381 feet by the end of the year. At this time it was reported by J. M. Robertson, superintendent, that although nothing of a definite nature had yet been determined regarding the possibilities of developing tonnage of large proportions, there were indications that continuation of development would eventually lead to the discovery of new and important ore-bodies either in this drift or in the advancement of the main crosscut tunnel to test the shear in its northerly trend. This latter tunnel had been advanced 176 feet.

New cabins were constructed at the mine during the earlier part of the year. The property is referred to in the Annual Reports for 1927.

Canadian. This group comprises five claims—the *Adams*, *Brandon*, *Sarah B.*, *Katie D.*, and *Hill Top Fraction*—which are all Crown-granted, and six un-Crown-granted claims. The property adjoins the *Ivanhoe* group and extends over the summit of Silver ridge down towards Silverton creek. Joe Brandon, of Silverton, is the principal owner.

The No. 1 vein, on which most of the work has been done during recent years, strikes north and south, with a dip of 60°. It cuts the summit of the ridge and has been attacked by a tunnel known as the No. 1 level at a point 220 feet below the apex of the ridge. From this level leasers have been busily engaged for a number of years digging out and shipping high-grade ore. Some shipments are said to have averaged about: Silver, 140 oz. to the ton; lead, 68 per cent.; zinc, 2 per cent. This, of course, represents sorted ore, which means that a lot of low-grade material has been left in the stopes.

The No. 1 level has been driven into the hillside at an elevation of 7,000 feet (aneroid). Its total length is 692 feet. In this length of drifting the vein shows persistency and makes ore in two shoots, one near the portal and the other in the southerly end of the workings. The galena mostly occurs in streaks and lenses in an oxidized gangue, which in places carries good

values in carbonates. Towards the end of the level the dip becomes flatter and the vein shows a width of from 4 to 5 feet.

The No. 2 level has been driven at a point about 100 feet below No. 1 level. In this tunnel there is evidence of considerable movement, and while a body of zincky ore is exposed, the characteristic features of the upper level are not recognizable, which leads to the belief that the vein is faulted between the levels; hence further work here holds attractive possibilities, especially as the workings have not been extended far enough to get under the downward continuation of the southerly ore-shoot. Should results be satisfactory, further exploration might well be carried on from the old No. 4 and No. 8 levels, the latter being 1,100 feet below the apex.

These lower levels are extensive and the results of the work accomplished could not be intelligently interpreted without making an exhaustive examination with the aid of mine-maps. Unfortunately neither time nor facilities at the writer's disposal allowed of this being done on the occasion of his visit to the property. There are two other veins on the property which appear to be worthy of further exploration. Leasers were busy, as usual, during the summer months and a shipment was made during the latter part of the year.

Home Rule.

This property is situated at an elevation of 5,750 feet on the north side of Carpenter creek and at a distance of about 3 miles from Sandon. The property is owned by Rod Dewar, of Sandon, who has accomplished a considerable amount of prospecting single-handed. The area is underlain by quartzites, schists, and slates of the Slocan series. A small tight vein has been drifted on for 172 feet in an easterly direction. At 47 feet from the portal a 35-foot winze had been sunk on a small lens of clean galena which made in a swell of the wall. A sample taken across a width of 4 inches assayed: Gold, 0.06 oz. to the ton; silver, 68.2 oz. to the ton; lead, 48.3 per cent.; zinc, 6.3 per cent.

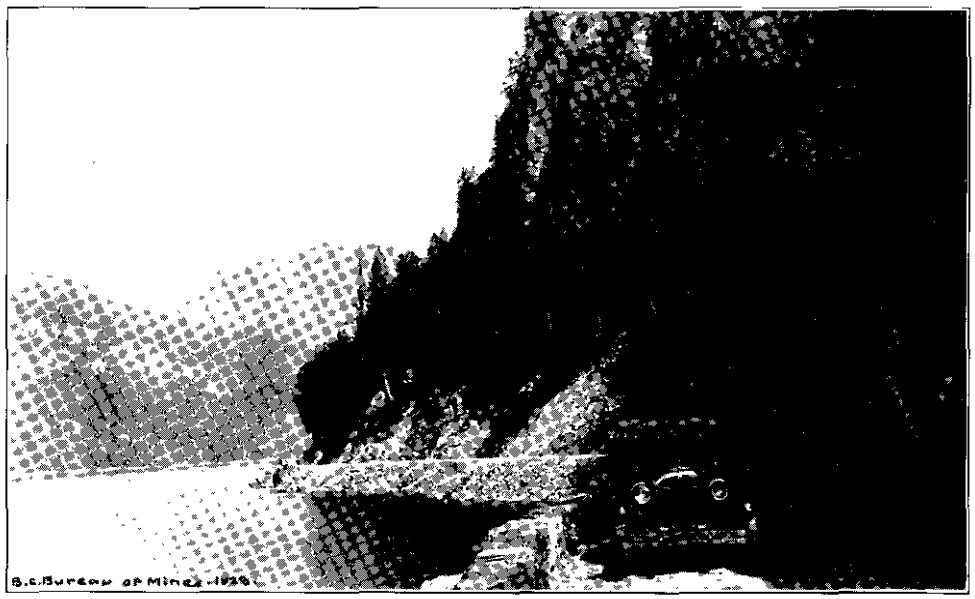
At a short distance past the winze faulting movements had interrupted the continuity of the vein, which was picked up again nearer the face and showed a streak of ore for a short distance. The ground seemed blocky and broken and it is possible that farther in the hill conditions may become more uniform. A lower prospect-tunnel had been started and was in about 20 feet on a tight fracture, in which a little ore had been encountered. A sample taken from a small pile of sorted ore assayed: Gold, 0.03 oz. to the ton; silver, 26.8 oz. to the ton; lead, 34.8 per cent.; zinc, 1 per cent.

Altoona.

This group, consisting of the *Bowknot*, *Commander*, and *Altoona*, is owned by J. A. Murphy, of Sandon, and is situated at a short distance from Sandon on the main road to Three Forks. A considerable amount of work has been done on the property in an endeavour to develop an easterly and westerly vein, and while the results so far obtained are indefinite, there is evidence of considerable mineralization, which would appear to warrant further prospecting. The workings consist of four adit-levels, of which the No. 3 was caved, and the No. 4 or lowest was said to be in the foot-wall and was not examined. The formation is composed of rocks of the Slocan series, which have been intruded by porphyry dykes and subjected to considerable movement.

In the No. 1 level a sheared fissure had been drifted on for about 350 feet, in which distance the mineralization is fairly continuous, but narrow. The most promising showing which offered possibilities for further development in this drift was at a point where a width of 8 to 10 feet of sulphide ore was exposed in the side of the drift, apparently lying at an angle with its direction. A sample taken along 90 inches gave the following returns: Gold, 0.03 oz. to the ton; silver, 10.2 oz. to the ton; lead, 1 per cent.; zinc, 13.7 per cent. On the opposite side of the drift a better grade of ore was exposed, but not much importance could be attached to it as the nature of the occurrence was indefinite. More work might be done here to determine the extent of the deposit. At the face of the drift a sample taken across 10 inches assayed: Gold, 0.04 oz. to the ton; silver, 1.2 oz. to the ton; lead, 1.9 per cent.; zinc, 9.4 per cent.

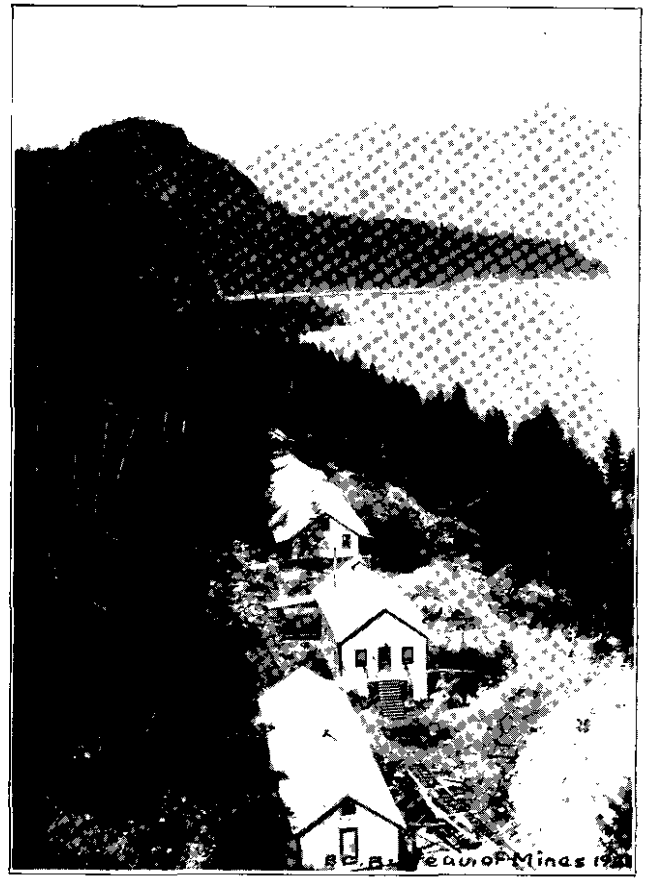
In the other end of the workings, and at a distance of about 90 feet northerly from this vein, there appeared to be a parallel vein on which a little work had been done, exposing a short length of low-grade ore, consisting of iron, zinc, and lead sulphides. Not enough work had been done here, however, to allow an opinion to be formed as to possibilities. In the No. 2 level a small streak of ore had been encountered, a sample of which gave the following returns: Gold, 0.05 oz. to the ton; silver, 7.4 oz. to the ton; lead, 11.7 per cent.; zinc, 10.5 per cent. Unfortunately the writer did not have time to make a survey of these workings, so was unable to determine their relation to those in the No. 1 level.



Slocan Lake Road, Slocan M.D.

Mammoth Mine, Slocan M.D.

Ruth Hope Mining Co., Ltd., Slocan M.D.



Kootenay-Florence Mining Co., Ltd., Ainsworth M.D.

It was understood that J. A. Murphy intended to build a cabin and proceed with further exploration. The property is conveniently situated for shipping facilities.

Three Forks.

McAllister. This property is owned and operated by the Slocan Silver Mines, Limited, in which the Standard Silver-Lead Mining Company, of Silverton, has a controlling interest. The principal values are in silver, which is associated with tetrahedrite occurring in a strong and well-defined white quartz vein. Other metallic values are negligible. The ore is conveyed by an aerial tram to bins on the wagon-road and then hauled by motor-truck for 3½ miles to the railway at Three Forks. The property was closed down in 1926, when the price of silver dropped, and reopened this year. Production started about July 1st and between then and the end of the season 5,266 tons, averaging 39 oz. silver to the ton, was shipped to Trail. Owing to the high silica content of the ore a very favourable smelting rate was obtained.

The bulk of the tonnage mined was won from between the No. 4 and No. 5 levels. It is reported that the season's work has thrown considerable light on the structural conditions and that the vein has been picked up in the lowest or No. 6 level. The results obtained during the year under the management of W. H. North have been very satisfactory as regards earnings and also, it is understood, development. For further reference *see* the Annual Report for 1925 and previous Reports.

The *Monitor* at Three Forks was worked under the terms of a lease by George Gormley, who, as usual, shipped a considerable tonnage to Trail.

Alps Alturas. This property, consisting of two Crown-granted claims and a fraction, is located among the scenic gradeur of the high peaks at the head of Martin creek, a small tributary of Kane creek, which latter is generally referred to as the North fork of Carpenter creek. It is owned by the Alps Mining Company, of which W. J. McMillan, of Cloverdale, is president. The capitalization of the company is $800,000, divided into 3,200,000 shares of 25 cents each par value.

The property lies at a distance of about 10 miles from Three Forks Station on the Kaslo–Nakusp Railway. Of this distance, about 3½ miles is covered by the *McAllister* wagon-road and the balance by trail, which becomes very steep as the mine-workings are approached. Accommodation is provided by two small cabins; one is in the basin, 1,000 feet or more below the workings, and the other on a high bench, within about a quarter of a mile of them, which was the nearest safe point.

The geology of the area, which is fully described by C. E. Cairnes in Part A, Summary Report, 1926, of the Geological Survey of Canada, might briefly be referred to as representing a series of highly metamorphosed rocks of sedimentary and igneous origin lying in close proximity to a large intrusive mass of granite, which forms the southerly slope of the mountain. Tightly squeezed and sheared between a hanging-wall of metamorphosed rocks and a foot-wall of serpentine-schist, a band of rusty weathering rock resembling an altered dolomite marked the zone in which the antimony ores were found to occur. This zone has an easterly and westerly strike and can be seen cutting the summit ridge high above the workings and again on the other side of the mountain.

The elevation and situation of the workings are such that they are only free from the snow for a short period each year, while winter operations would be endangered by snowslides. Hence it can easily be realized that under existing conditions not a great deal of work has been accomplished and prospecting has been limited.

No. 1 tunnel, at an elevation of 7,900 feet (aneroid), was first driven to explore a quartz vein for gold values, when stibnite was discovered in small lenses. Here about 240 feet of work has been done, but beyond what might be considered favourable indications no ore in important commercial quantities is at present visible. However, more prospecting might well be done here.

The No. 2 tunnel, at an elevation of 8,000 feet, has been driven for about 100 feet on a quartz vein having a strike of east and west and a dip of 40° to the north. For about the first 65 feet a good grade of antimony ore was encountered, and from this ore-shoot most of the ore shipped was mined. The bulk of the ore here has been stoped to the surface, but there still remains a nice showing from which a fair percentage of clean ore could be sorted. The vein showed a maximum width of 4 feet, tapering down to about 2½ feet at the face. The stibnite

occurred in streaks, small lenses, and as disseminations through the quartz. Some 200 feet higher up the hill a short tunnel has been driven to prospect the downward continuation of a quartz vein carrying a high percentage of stibnite, but it was stated that not enough work had been done to arrive at any definite conclusion regarding its continuity. This working could not be examined on account of snow.

Following around the mountain to the north, several similar zones can be seen, in which stibnite and quartz have been found to occur, but further prospecting is necessary to determine the importance of these showings. A little prospecting was done by W. J. McMillan during the summer on a quartz vein which carried a little galena, but work was not far enough advanced to arrive at any definite conclusion as to possibilities.

According to information available, about 105 tons of antimony ore averaging 57.20 per cent. antimony has been shipped from the property. The shipments were made to Jersey City, Chicago, and Glasgow. Unfortunately there is no local market, as it is understood that the Consolidated Mining and Smelting Company does not at the present time accept antimony ore for treatment.

The possibilities for digging out pockets of ore from scattered workings are attractive, and possibly a considerable tonnage could be mined by this method, while the information gained in the process might reveal more important bodies than have so far been developed. However, the high cost of freight rates to marketing centres, added to the costs of transportation from the mine to the railway, leave little encouragement for profitable small-scale operations at present metal prices. Hence it would seem logical to assume that the objective to be aimed at is to develop sufficient ore to warrant an aerial tramway, the building of a road, and the equipment of the property with such plant as may be deemed advisable for the handling and treatment of the ore.

Silverton.

Galena Farm.

This well-known property was acquired from the Patrick Clarke Estate during the latter part of 1927 by W. L. Sheeler and associates. The mine has occupied an important place in the history of Slocan mining for a number of years and has a healthy record of production. The tonnage was derived from a strong vein which was cut off by a flat fault at about 150 feet below the surface; beyond this fault its downward continuation had not yet been established. At the time of acquisition by the present owners the property was being operated in a small way by leasers, who had been successful in opening up ore past a vertical fault in the westerly end of the workings, which gave promise for a fair tonnage. The strength of the mineralization and the fact that it occurs in a well-mineralized zone traceable to Silverton creek, in addition to attractive indications in the underground workings, were among the factors which pointed to favourable potentialities and resulted in the present deal being consummated.

Early in the year the old mill was dismantled and converted from the water-gravity system of concentration to straight oil-flotation, embodying sub-aerated Mineral Separation cells and other modern equipment. The plant was first operated on old mill tailings, dump material, and ore from the westerly part of the mine, while exploration was energetically carried on in the easterly section of the mine in order to pick up the extension of the vein past a vertical fault, which marked the end of the old workings in this direction. This work was initiated by drilling long holes with a Waugh prospecting-drill. The ore was picked up and followed by drifting. When visited in the fall, this ore had been followed for about 200 feet past the fault and stoping operations had been started. The ore was of good grade and showed a width of from 3 to 5 feet along the drift, swelling to 8 or 10 feet in the stopes.

No difficulty was being experienced in maintaining sufficient mill-feed of excellent grade from this section of the mine, the average values running about 18 to 20 oz. to the ton in silver, 8 to 12 per cent. lead, and about 12 per cent. zinc. In a vertical direction this ore-body had been explored by two raises; one 70 feet in length followed the ore for the entire distance and the other had been advanced 30 feet in ore.

The mill, which has a capacity of from 40 to 50 tons a day, was productive of very satisfactory results, as may be seen from the following: On a feed running—silver, 18 oz. to the ton; lead, 8 per cent.; zinc, 12 per cent.—the following recoveries were being made:—Lead concen-

trates: Lead, 68–70 per cent.; silver, 125 oz. to the ton; zinc, 6–7 per cent. Zinc concentrates: Zinc, 50 per cent.; lead, 2 per cent.; silver, 28–30 oz. to the ton. Tails: Silver, 1.5 oz. to the ton; lead, 0.2 per cent.; zinc, 0.3 per cent.

The equipment of the mill is similar to that in general use, and consists of a jaw-crusher, rolls, ball-mill in closed circuit, with a Dorr classifier and a 14-cell sub-aerated Mineral Separation machine, of which seven cells are employed as roughers and two as cleaners for the zinc concentrates. The remaining five cells are used for lead concentrates, four of which are roughers and one cleaner. From the Mineral Separation cells the concentrates are fed to two cone classifiers, which in turn supply an American filter. The overflow from the classifiers passes to Dorr thickeners, the thickened product being fed to the filters, the overflow going to waste. The object of introducing the cone classifiers is to eliminate colloidal material and hence obtain a dry filter cake, which apparently was being achieved, for a very nice shipping product resulted. The moisture content of the zinc concentrates was given as about 10 per cent. and that of the lead as 8 per cent.

Future plans call for more exploration and development at depth and the installation of a Diesel engine for auxiliary power during the dry season, when there is not sufficient water for present requirements. The year has witnessed profitable operation and it is reasonable to expect this property to hold its place among the important producers of the Slocan for some time.

Hewitt. This mine is owned and operated by the Victoria Syndicate. The deep development which was undertaken soon after the acquisition of the property in 1926 has been fully justified by the results now being obtained. The development of high-grade ore in the downward extension of the easterly ore-body has established definite possibilities for the continuation of this ore to much greater depths, and a low tunnel was started during the latter part of the year to explore its downward continuation.

On the No. 9 level this ore-body has a length of 90 feet and an average width of 11.3 feet. Values in silver, lead, and zinc occur in a broken quartz gangue. The principal silver values are in the form of ruby silver, which is characteristic of the ore in this mine. Work in other parts of the mine was progressing with favourable results and a considerable tonnage of milling-grade ore had been opened up.

As an example of the results being obtained by the mill, the following is given as being representative at the time of the writer's visit to the property:—Mill-feed: Silver, 35.5 oz. to the ton; lead, 5 per cent.; zinc, 6.6 per cent. Lead concentrates: Silver, 361.25 oz. to the ton; lead, 50.3 per cent.; zinc, 8.6 per cent. Zinc concentrates: Silver, 15 oz. to the ton; lead, *nil;* zinc, 54 per cent. Tails: Silver, 1.5 oz. to the ton; lead, *nil;* zinc, 0.7 per cent. The property is referred to in the Annual Report for 1927.

At the *Van Roi* leasers were busily engaged during part of the season. The property, which belongs to Clarence Cunningham, is extensively developed and has a good record of production. The claims cover the easterly extension of the *Hewitt* vein system and the ore is similar in character. It was reported at the end of the year that the property had been acquired by the Amalgamated Mines, Limited, of Vancouver.

Mammoth. This property, consisting of five claims, covers an area to the east of the *Standard*, which latter has one of the best records of production of any property in the Slocan. The original owners, H. W. Dewis and the late S. Wetterhuus, of Silverton, bonded it to R. A. Grimes, who in turn gave an option to the Porcupine Goldfields Development and Finance Company, under the direction of which mining and development was continued until early in 1927. When the option was relinquished Mr. Grimes interested the Western Exploration Company and extensive plans have been completed to place the property on a permanent producing basis.

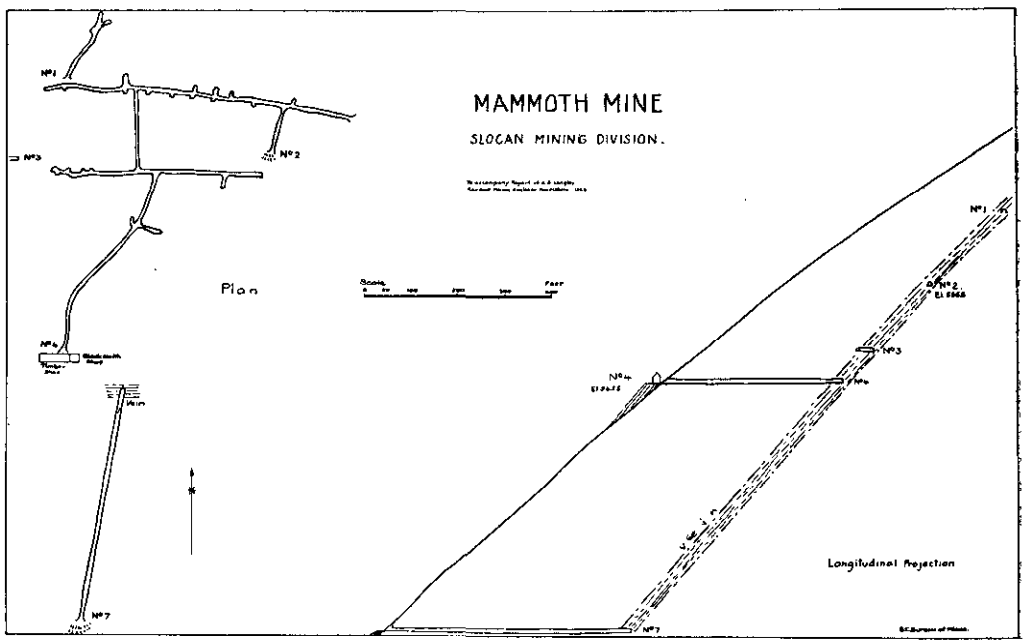
The vein, which strikes easterly and westerly, occupies a strong sheared fissure cutting the argillites and quartzites of the Slocan series. The vein-filling consists of crushed country-rock in which metallic sulphides, together with gangue-minerals of spathic iron, quartz, and calcite, occur. Post-mineral movements are in evidence which have crushed and disseminated the ore along streaks and bands in the vein-filling. The ground is loose and generally needs timbering. Structural conditions are typical of the Slocan vein systems.

The workings are situated on a steep and narrow ridge between two snowslide gulches at elevations ranging from 4,900 to 5,800 feet above sea-level. The first exploration was done on

the No. 1 level, where a little ore and promising indications are exposed, but being near the surface this level was abandoned to drive the No. 2 at an additional depth of about 165 feet.

In the No. 2 level the vein has been drifted on for about 600 feet. The ore occurs in streaks, bunches, and disseminations and is fairly continuous for about 400 feet. A considerable tonnage has been mined and shipped from these workings, representing a value of about $30,000 net smelter returns, but that left above the level is not considered to be of any great commercial importance, although the possibilities are far from exhausted for further development. The No. 3 level, driven at a depth of 140 feet below the No. 2, consists of 250 feet of drifting, along which a short length of ore is exposed, but the workings have not been advanced far enough to develop the downward continuation of the ore in the No. 2 level. The No. 4 level, which gains in a vertical depth of about 200 feet below the No. 2, consists of a crosscut 450 feet in length, from which about 500 feet of drifting has been done. The ore can be traced along this drift for almost its entire length, except in places where it is obscured by the timbering.

On account of the nature of the ore occurrences, a great many samples would have to be taken to arrive at a definite opinion as to the average width and value, but, judging by the assay



plan of samples taken in the course of development, a mill-feed of from 15 to 20 oz. in silver to the ton, 3.5 per cent. lead, and 10 per cent. zinc across a width of from 3 feet to 5 feet may be expected. In a small stope which had just been started a sample across a width of 55 inches gave the following returns: Gold, 0.03 oz. to the ton; silver, 18.1 oz. to the ton; lead, 2.8 per cent.; zinc, 15.8 per cent. A raise driven along the foot-wall of the vein connects this level with the No. 2.

The No. 7 level consists of a crosscut driven from the surface at a vertical depth of 533 feet below the No. 4 level. This intersected the downward continuation of the vein at 475 feet. When examined, the vein at the point of intersection showed a strong width and similar characteristics to those prevailing in the upper levels, except that the ore was confined to a narrow streak of massive zinc-blende and galena. Considering that this level is about 720 feet on the dip of the vein below No. 4, the possibilities are good for the development of an important ore-body. Since the property was visited it is reported that subsequent drifting on this level has opened up a strong width of ore.

The preliminary preparations to carry on extensive operations at this property included the rehabilitation of the old *Standard* power plant on Silverton creek by building 1 mile of new flume, the building of 2½ miles of new road from the *Standard* to the *Mammoth*, the installation of an air-line from the *Standard*, and the erection of a suitable camp at the mine for the accommodation of a crew of at least forty men, at which electric light, telephone, and electric heaters were installed. The erection of a concentrator on the old *Standard* mill-site is contemplated for the coming year. The ore will be conveyed by an aerial tramway which will connect with the *Standard* tram.

The *Standard* has also been acquired by the same company and attention will be directed to its further exploration as soon as development-work at the *Mammoth* has been brought to a definite conclusion. During the year a number of leasers were engaged at the *Standard*.

New Denver.

Bosun. This mine, which is situated near New Denver, on Slocan lake, was successfully operated for a number of years by the Rosebery-Surprise Mining Company under the direction of J. P. McFadden. It was bought during the early part of 1928 by Colin Campbell, of New Denver. The history of the mine dates back for many years, and after a long period of inactivity was acquired by the above company in 1917 and turned into a profitable producer.

Until 1927 the ore was won from above the lowest or main adit-level, which has been driven along the direction of the strike of the vein from a point about 30 feet above the lake-shore. In 1927 a shaft was sunk and another level, known as the No. 7, was established at an additional depth of about 100 feet. For the last two years mining operations have been confined to the No. 7 level, where the vein has been drifted on for between 200 and 300 feet. The ore occurs in a fairly wide fractured zone, making in streaks and small tight lenses along the strike and filling small lateral fractures. A characteristic feature of the structural conditions is the faulting of the vein by small porphyry sills; the displacement is not great, but is persistent in the various levels and in each case is in the same direction.

In the east end of the workings, which are furthermost into the hill, ore was exposed in the roof of the stope along a length of about 120 feet, varying in thickness from a few inches to about 1 foot. At the east end a slip cut the ore off, but conditions appeared favourable for it being picked up again by a small amount of drifting. About nine leasers were busily engaged in the old upper workings.

The ore is silver-lead-zinc, carrying high silver values. Both clean lead and a milling grade of ore were being mined for shipment to Trail. The values of the milling grade were about as follows: Silver, 66 oz. to the ton; lead, 17 per cent.; zinc, 23 per cent. The lead ore assayed about: Silver, 150 oz. to the ton; lead, 70 per cent.; zinc, 3–4 per cent. Towards the end of the year it is understood that negotiations were being made for the sale of the property to a mining company.

Molly Hughes. This property, which is situated on the shore of Slocan lake at a short distance from New Denver, is being operated by the Pinto Mines, Limited, under the superintendence of H. H. Dimock. The history of the mine dates back for many years, it having been operated intermittently by various interests.

The vein, which lies in granite, dips at a steep angle and strikes in an easterly and westerly direction. It carries a narrow but persistent streak of high-grade gold-silver ore, with which is associated small percentages of lead and zinc. No concentration is necessary, the ore going direct to the smelter, where it is treated at low cost on account of the high silica content. The mine is opened by a 329-foot crosscut from the lake-shore. From above this level the bulk of the ore has been stoped to the surface. Hence the future possibilities depend on the results of development below this main level and the development of other parallel veins by further crosscutting.

When the present company took over the property a shaft had been sunk for 100 feet below the main adit and a small amount of drifting and stoping had been accomplished, when work was discontinued owing principally to inadequate and costly power. These conditions were rectified by the installation of two 50-horse-power Ingersoll-Rand direct-connected angle-compound oil-engines, while a 2-compartment incline raise, 192 feet in length, was driven to the

surface to facilitate the shipment of ore. At the top of this raise the ore is dumped by a skip into a 75-ton bin situated in close proximity to the railway-track and the cars are loaded by means of a short incline track up which the ore is hoisted.

On the lowest level the vein has been drifted on in an easterly and westerly direction from the bottom of the shaft. In the easterly end the vein has been exposed along a length of about 270 feet and in places has been stoped to about 50 feet above the level. In the westerly end, where drifting was still being proceeded with, ore had been exposed along a length of about 80 feet. Throughout the workings the pay-streak, which showed a narrow average width, pinched and swelled from a few inches to a maximum of about 18 inches. From these workings the mine is credited with shipments to the extent of 316 tons for the year. To give an idea of the values, two of the best cars gave the following returns: Weight, 59,401 lb. Assay values: Gold, 0.39 oz. to the ton; silver, 152.8 oz. to the ton; lead, 1.25 per cent.; zinc, 2.3 per cent. Weight, 63,551 lb. Assay values: Gold, 0.60 oz. to the ton; silver, 176.25 oz. to the ton; lead, 2.25 per cent.; zinc, 2.6 per cent.

Other work consisted of driving a crosscut to intersect the projected downward extension of a parallel vein, known as the *Pinto*, which had been prospected on the surface. This crosscut was in about 200 feet, and it is understood its continuation and the sinking of the shaft to an additional depth of 100 feet form part of the development programme for the future.

Miscellaneous Notes.

Among numerous other activities, the following have been reported: At the *Black Colt*, which covers an interesting area between the *Victor* and *Queen Bess*, development was continued on the lower level by E. J. Vandergrift and associates, where it is understood some ore and encouraging results were obtained. At the *Idaho-Alamo* leasers were working during the season. The *Queen Bess*, *Idaho*, and *Alamo* were amalgamated at the end of the year to form the Consolidated Queen Bess Mines, Limited, and the public were invited to buy stock. What success was attained by this promotion is not known at the time of writing. The *Queen Bess*, particularly, enjoyed a splendid record of production over a short period in past years and is considered to offer good possibilities for further development.

In the same vicinity the *Corinth* was operated for part of the season, work being confined to exploration and development. According to Neil McMillan, of Sandon, who had charge of the work at the time the property was shut down, there are good possibilities for developing an important ore-body with a small additional amount of work. The mine is equipped with a small oil-engine and compressor. The camp buildings provide accommodation for nine men.

The *Colonial*, embracing four claims and a fraction, including the *Freddie Lee*, was acquired under option by W. G. Wasmansdorff, of Vancouver. A. L. McPhee is in charge of the work now being undertaken. A few shipments of high-grade silver-lead ore have been made during recent years. The property is situated on Cody creek at a short distance from Sandon.

Development-work was proceeded with at the *Carnation* by George Clark, who reports having encountered a nice showing of high-grade silver-lead ore.

It is reported that a compressor plant has been installed at the *Soho* by the Mary Ryan Mines, Limited, and after a period of comparative inactivity the property is being aggressively developed.

The *Rio*, situated near the summit of the divide at the head of McGuigan creek, was worked by the Helenitia Mines, Limited, of Calgary. It is reported that a nice showing of high-grade silver-lead ore was encountered. The property is reached by trail from the *Rambler* wagon-road. It is also understood that further work was done on the *Great Western*, in McGuigan basin, by Bruce Kirk.

The famous *Payne* was acquired under option by R. S. Lennie and associates and a thorough examination made; whether this will result in the resumption of mining operations is not known.

Other minor activities include the *Yakima*, *Minnesota*, *Black Grouse*, and *Milton*. Near New Denver, shipments were made from the *Mountain Chief*, which has been steadily worked during recent years by some Italian miners. Further work was reported to have been done on the *Fisher Maiden* on Silverton creek and by W. Vallentine on his claims at the head of the creek.

LIST OF SHIPPING-MINES, SHOWING TONNAGE PRODUCED, 1928.

Slocan Mining Division.

Mine.	Locality.	Tons.	Character of Ore.
Alamo	Alamo	114	Silver, zinc, lead.
Bosun	Sandon	1,149	Silver, zinc, lead.
Buffalo	Silverton	19	Silver, lead, zinc.
Canadian	Sandon	119	Silver, lead, zinc.
Carnation	Sandon	421	Silver, gold, zinc, lead.
Eagle	Three Forks	4	Silver.
Echo	Silverton	14	Silver, lead, zinc.
Elkhorn	Alamo	43	Silver, lead, zinc.
Galena Farm	Silverton	7,938	Silver, gold, zinc, lead.
Hewitt	Silverton	14,177	Silver, zinc, lead.
Ivanhoe	Sandon	70	Silver, lead, zinc.
Lucky Jim	Zincton	44,378	Silver, lead, zinc.
Lucky Thought	*Silverton*	65	*Silver, lead, zinc.*
Mammoth	Silverton	286	Silver, lead, zinc.
McAllister	Three Forks	5,266	Silver.
Molly Hughes	New Denver	326	Silver, lead, zinc.
Monitor	Three Forks	170	Silver, gold, lead, zinc.
Mt. Chief	Alamo	254	Silver, zinc, lead.
Noble Five	Cody	102	Silver, zinc, lead.
Noonday	Cody	10	
Queen Bess	Alamo	48	Silver, lead, zinc.
Ruth-Hope	Sandon	13,110	Silver, lead, zinc.
Silversmith*	Sandon	.....	Silver, lead, zinc.
Standard	Sandon	365	Silver, zinc, lead.
Van Rol	Silverton	2,016	Silver, zinc, lead.
Victor	Three Forks	72	Silver, gold, lead, zinc.
Wonderful	Sandon	34	Silver, gold, zinc, lead.
Yakima	Sandon	9	Silver, zinc, lead.

* Produced from approximately 4,400 tons of ore milled in 1927.

SLOCAN CITY MINING DIVISION.

Enterprise. *This property is one of those that were acquired by Stobie, Forlong & Company* and amalgamated to form the Yankee Girl Consolidated Mines, Limited. It was formerly operated by E. C. Wragge and P. Maguire, who shipped a considerable tonnage to Trail. For references *see* Annual Report for 1924 and subsequent Reports. A small crew of men was employed during the year at development, which was principally confined to the No. 7 or lowest level.

Altogether 620 feet of tunnelling is reported to have been accomplished on this level, most of which consisted of drifting on the vein. In this drift the ore occurrences are described as sporadic and irregular lenses, and while the pay-streak is stated to be very thin, there was an apparent widening in the bottom, which seemed to indicate the existence of an ore-shoot below the level. Further prospecting was also done on the No. 2 and No. 3 veins, but it is understood that this work has not been sufficient to determine the possibilities of these exposures.

The *Neepawa*, which adjoins the *Enterprise*, was acquired under option by R. Crowe-Swords, who had a few men employed during the season.

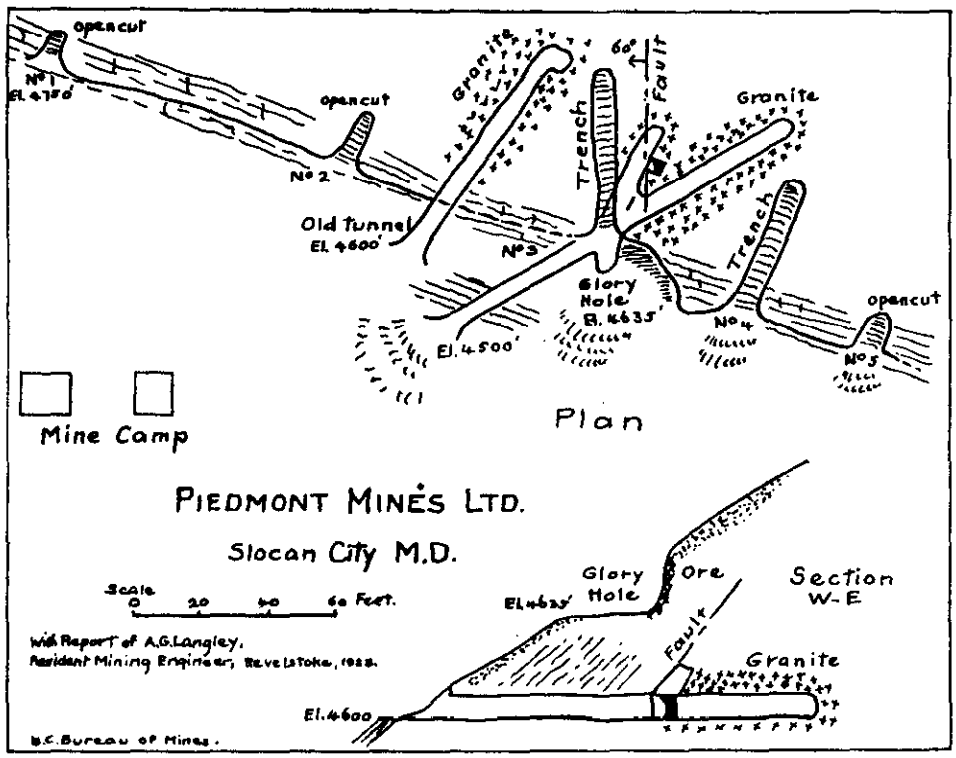
The *Westmont*, which is situated on the opposite side of the creek from the *Enterprise*, was worked under the terms of a lease by R. Ainslie and partner.

Piedmont. This property is situated on Lemon creek at an approximate distance of 5 *miles from the main road to Slocan. The property was acquired last year by* Regina interests and the Piedmont Mines, Limited, was formed to carry on development. It was formerly known as the *Hope No. 2*, under which name it is described in the Annual Report for 1927.

Soon after the company took over the property a very ambitious programme for future operation was launched. In brief, large expenditures were incurred in the erection of an aerial tramway and power plant before sufficient work had been done to determine possibilities. At this time a small amount of superficial work had uncovered a strong exposure where former prospecting had been done, and hereafter referred to as the "glory-hole." An old prospect-tunnel

driven to explore the downward continuation of this ore had met with negative results. So this year found the property equipped for production with only a small tonnage available for shipment and badly in need of further exploration.

The area in which the ore has been found to occur is underlain by granitic rocks and remnants of highly metamorphosed sediments, in which latter the mineralization has taken place. Highly silicified limestone was apparently the host of the mineral solutions, and has been replaced between narrow limits to form occurrences of low-grade ore, except at the glory-hole, where there is an exceptionally good surface showing of massive sulphide ore. A sample taken across 16 feet, the width of the face, gave the following returns: Gold, trace; silver, 7.8 oz. to the ton; lead, 8.9 per cent.; zinc, 30.5 per cent.



To further explore the downward continuation of this ore another tunnel had been run from a point about 35 feet below the floor of the glory-hole. This intersected a north-and-south fault and ended in granite without developing any ore of importance. This and an old tunnel driven from a near-by point proved conclusively that the granite in this locality lay at shallow depth below the sediments in which the ore occurred and that the mineralization did not continue in the granite. Whether this granite was simply an intrusive tongue or represented a large mass remained to be proved by further work. To the west there appeared to be a much greater depth of sediments; hence further prospecting in this direction, where favourable indications had been exposed in the open-cuts, was advised. At the time of writing the results of the season's work are not known, except that the mine is credited with shipments to the extent of 488 tons.

White Hope.* This property, consisting of six full claims and a fraction and owned by P. Strand and C. Tipping, is situated on the Slocan–Silverton road, on the eastern side of Slocan lake, about 5 miles from Slocan. The cabin on the *White Hope* is at an elevation of about 2,500 feet above sea-level or about 800 feet above the lake. The workings near the cabin, consisting of short tunnels and open-cuts, develop showings in altered silicified limestone which strikes from N. 65° W. to N. 75° W. (mag.) and dips from 26° to 30° to the north-east. The ore consists of galena, zinc-blende, and pyrite, in a gangue of silicified altered limestone. The mineralization conforms to the bedding of the limestone. Back

and easterly from the cabin there is a gulch, on the southern side of which some cuts have been made, in which are exposed attractive showings of ore in oxidized ledge-matter. In these workings the vein has evidently been displaced by the erosion which formed the gulch, the exposed sections of the vein striking and dipping at angles greatly varying from the attitude of the surrounding undisturbed strata. A short crosscut tunnel driven in below the lowest of these open-cuts, in which a section of vertically standing vein is exposed, had not cut the vein, although driven some distance beyond where it should be if the dip indicated was the true dip. This section of vein had evidently been undermined at its north-western extremity and subsided into its present attitude. Continuity of the vein on the southern side of the gulch cannot be expected, therefore, until the vein is traced beyond the area of subsidence and erosion which has taken place to a certain extent along the plane of the vein. A grab sample from a pile of ore derived from a broken section of vein, 3 to 4 feet wide, in the lowest open-cut assayed: Gold, 0.04 oz. to the ton; silver, 8.1 oz. to the ton; lead, 28.4 per cent.; zinc, 13 per cent.

On the northern side of the gulch the vein is exposed in the face of a short tunnel. Here the vein, about 3 feet wide, is in place. A sample across 8 inches, where the mineralization was concentrated, on the hanging-wall side of the vein in this working assayed: Gold, trace; silver, 2.6 oz. to the ton; lead, 33.4 per cent.; zinc, 9.5 per cent. On the foot-wall side of this pay-streak there is 28 inches of sparsely disseminated galena and zinc-blende which assayed: Gold, trace; silver, 1.1 oz. to the ton; lead, 0.5 per cent.; zinc, 0.5 per cent. The vein here is well defined, striking and dipping in correct relation to the general attitude of the limestone-beds in the vicinity.

A few hundred feet southerly from the cabin and at a slightly lower elevation there is a tunnel driven about 150 feet in limestone, which in places is considerably pyritized and silicified. A little farther south and above the tunnel there are two open-cuts, the sides of which had caved, making it impracticable to examine them to advantage. A grab sample of quartz containing pyrite on the dump of one of the cuts assayed: Gold, 0.24 oz. to the ton; silver, 24.8 oz. to the ton. The 150-foot tunnel had apparently been driven on top of the vein developed in the open-cut from which this ore was derived.

The *White Hope* is very conveniently situated for economic operation and the showings examined indicated interesting possibilities for further exploration. The appreciable gold and silver values contained in the last-mentioned sample, of rather unpromising-looking quartz, are especially interesting. Since the examination was made, on which these notes are based, an appreciable amount of development-work is reported to have been done by C. Hansen and associates, of Idaho, who have bonded the property.

Among other activities, the following have been reported: The *Meteor* on Springer creek was operated by J. Cullinane and associates, who shipped some high-grade silver ore to Trail. A reference may be seen to this property in the Annual Report for 1919.

Elk.—Above the *Meteor* a little work done by the Bruin Bros. is reported to have given satisfactory results.

On the *Arlington* a small amount of work was done and a Radiore survey made by the Bayview Mining Company, of Victoria. The *Boomerang* was leased and bonded to W. Newbury, of Wallace, Idaho. Other small activities are reported at the *L.T.* at the head of Springer creek and at the *Black Prince* and *Two Friends*, from which latter a car-load of ore was shipped by J. Tattersall.

Dayton.—A. E. Palmquist was operating the *Dayton*, near Slocan, in the early part of the year and made a shipment of about 2½ tons to Trail smelter, which assayed about $21 to the ton in gold, 120.7 oz. to the ton in silver, 1 per cent. lead, and 14 per cent. zinc.

LIST OF SHIPPING-MINES, SHOWING TONNAGE PRODUCED, 1928.

Slocan City Mining Division.

Mine.	Locality.	Tons.	Character of Ore.
Anna	Springer Creek	3	Silver, lead, zinc.
Dayton	Slocan City	2	Silver.
Hope No. 2	Lemon Creek	488	Silver, zinc, lead.
Meteor	Springer Creek	69	Silver, gold.
Two Friends and Black Prince	Slocan City	17	Silver, zinc.
Westmont	10-Mile Creek	44	Silver, zinc, lead.

AINSWORTH MINING DIVISION.

The mining activities in this district are far-flung and, as means of travel are improved, areas which heretofore have been considered inaccessible will gradually be brought within the range of transportation facilities, when more properties will undoubtedly receive the attention of the scouting engineer and the mine operator. The present year witnessed the commencement of a Government trail from Howser lake northwards up the east side of the Duncan river. This no doubt will be of great convenience to the prospector and all those having interests in the Duncan River country. The building of the Kaslo-Bear Lake road by the Government fills a long-felt want, by giving ready access from Kaslo to one of the busiest mining sections of the district, which in the past has only been served by a tri-weekly train service. Supplementing the train service between Lardeau and Gerrard by a Ford car equipped to run on the rails has been a boon to mining men and others who have business to attend in this section of the country. It is believed to have been so successful that the Canadian Pacific Railway may possibly improve it by putting a larger car on the run.

Kootenay Lake Section.

In Ainsworth camp the development of the *Kootenay-Florence* has been the centre of interest, and it is gratifying to note that after a long struggle the results accomplished at the end of the year promise to place the property on a profitable producing basis. Transmission of electrical energy to this mine by the city of Nelson should help to stimulate activity at numerous properties surrounding the famous Ainsworth camp.

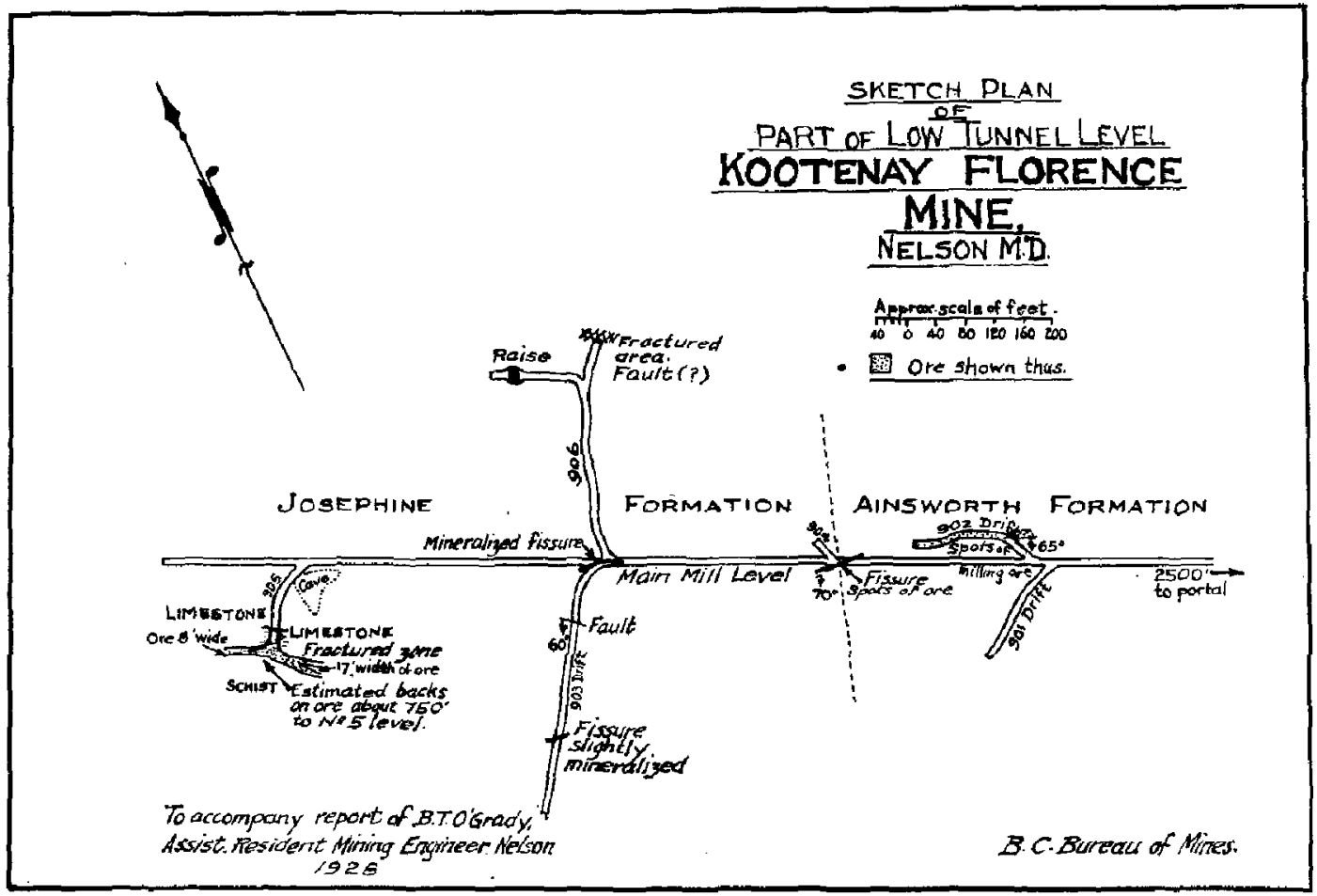
Ainsworth and Kootenay Lake.

Kootenay-Florence.*

The most important mining operation in the Kootenay Lake section during the year was that at the *Kootenay-Florence* mine, situated about 2 miles north of Ainsworth. The property now includes the *Kootenay-Florence, Lakeshore,* and *Nicolet-Snelling* groups, aggregating eighteen Crown-granted claims which extend along and westerly up the hill from the shore of Kootenay lake. The mine is operated by the Kootenay-Florence Mining Company, Limited, capitalized at 6,000,000 shares, par value 20 cents. This company, which succeeded the Florence Silver Mining Company, Limited, was formed primarily to finance the driving of a long crosscut tunnel from just above the level of the mill to explore the downward continuation of important ore-bodies mined and developed in the old upper workings. Numerous references to these workings are made in past Annual Reports and considerable information regarding the geology and character of the deposits is contained in Memoir 117, Geological Survey of Canada. It will only be necessary, therefore, to recapitulate briefly such information as will be convenient for the clear understanding of this report of operations.

The sedimentary rocks exposed around Ainsworth, including the area herein described, are referred to the Carboniferous age and in part are possibly Pre-Carboniferous. They are intruded by granites and lamprophyre dykes of Jurassic age. Granites of the Nelson batholith are exposed towards the summit of the ridge between 2 and 3 miles to the west of Kootenay lake. The rocks of the area with which this report is concerned are: The Early Bird formation, consisting of siliceous limestones, which is the lowest horizon exposed on the Kootenay-Florence property; Princess formation of mica-schists and quartzites; Ainsworth limestones; Josephine formation, including limestones, quartzites, green hornblende-schists, and andalusite-schists. The origin of the ores is attributed to ore-bearing solutions, which emanated from the granite in the pneumatolitic stage of cooling, rising in fissures and forming ore-bodies at favourable localities, either in the fissures, or in the rocks cut by the fissures, where the mineral-bearing solutions attacked and replaced favourable limestone-bands. Both types of deposits are represented at the *Kootenay-Florence.*

In the upper mine, which was developed to five levels, the two most important horizons economically were the limestone-bands and the quartzite hornblende-schist contact where they are cut by the fissure. These rocks, which are members of the Josephine formation, strike north and south and dip from 40° to 45° to the west. The fissure system developed in the upper workings has a general easterly and westerly strike and dip of 42° to the south. Complete figures of past production are not available. The period of the greatest activity was from 1916 to 1920, when a large tonnage was milled. During the same period small shipments of crude ore were


SKETCH PLAN
OF
PART OF LOW TUNNEL LEVEL
KOOTENAY FLORENCE
MINE,
NELSON M.D.
Approx. scale of feet.
40 0 40 80 120 160 200
Ore shown thus.
Raise
Fractured area. Fault(?)
906
JOSEPHINE FORMATION
AINSWORTH FORMATION
Mineralized fissure
902 Drift
Spots of ore
65°
Main Mill Level
Fissure
Spots of ore
Milling ore
2500' to portal
70°
905
Cave
LIMESTONE
Ore 8' wide
LIMESTONE
Fractured zone
17' width of ore
SCHIST
Estimated backs on ore about 750' to No 5 level.
60°
Fault
903 Drift
Fissure slightly mineralized
To accompany report of B.T.O'Grady,
Assist. Resident Mining Engineer Nelson
1926
B.C. Bureau of Mines.

made at intervals. Large ore-bodies were developed, indicating potentialities for important production with deeper development.

The ore consists of a coarsely crystalline mixture of galena and zinc-blende, with some pyrite and occasional chalcopyrite. The gangue is altered and decomposed limestone, calcite, and quartz. In the immediate vicinity of the ore the rock is often decomposed to a soft sugar-like mass of calcite and quartz and in other places it has been silicified. The galena in the quartzite hornblende-schist stopes is coarse-grained shipping-ore with minor amounts of zinc-blende, whereas that of the replacement bodies is coarse-grained and fine-grained, both varieties showing a sheared structure. An average of the mill-feed, supplied by the Florence Silver Mining Company, was: Silver, 2.5 oz. to the ton; lead, 7.4 per cent.; zinc, 7 per cent.

Towards the end of the year the big low-level tunnel, which gains a vertical depth of about 355 feet on the No. 5 level, had been extended to a point approximately 3,940 feet from the portal. This tunnel crosscuts in turn the Princess, Ainsworth, and Jospehine formations, which in this working strike north and south, with average dips of 45° to the west, and is driven approximately parallel to the fissure-vein system, which, in the upper workings of the mine, contained large bodies of ore and with which were associated north-and-south replacement ore-bodies in limestone. The Josephine formation is cut towards the inner end of the big tunnel. In several places in this main adit, and in lateral tunnels extending on each side of it, westerly striking fissures are intercepted in the Ainsworth and Josephine formations.

These fissures, which have not been developed to any extent, carry in places sulphide mineralization, indicating promising points for exploration. At about 3,650 feet in from the portal a band of limestone which proved to be 155 feet wide was cut. This is the first important width of limestone encountered in the Josephine formation. At about 3,750 feet in, a lateral tunnel driven 15 feet to the south from the main tunnel encountered a heavy flow of water from a cave in the limestone. When the water drained off and entrance was again possible, some replacement mineralization was observed in the case, which follows the bedding-planes of the limestone and which is approximately 75 feet in diameter and apparently triangular in shape.

This replacement mineralization, consisting chiefly of iron sulphides with spots of lead and zinc sulphides, in the calcareous gangue, was in the hanging-wall of the cave, but when the water was drained off most of the sulphide material collapsed and is lying in broken sections on the floor. It is inferred that the immediate origin of the replacement solutions came from the fissure-vein which lies some little distance to the south. The ore which is found in places in the cave is similar in character to the replacement ore mined in the No. 5 level above.

The mineralization in the cave apparently terminates at its northern end against a westerly striking fissure, in which there is a marked development of quartz and fluorspar crystals together with marcasite. Some exceptionally fine fluorspar crystals were extracted from vugs in this fissure. The lateral was continued southerly from the cave along the bedding of the limestone and some light mineralization, chiefly pyrite, began to show, which improved as the fissure was approached. At about 90 feet from the main tunnel the lateral intercepted the foot-wall at a wide fractured zone striking westerly and dipping about 40° to the south. The hanging-wall side of this fractured zone, which was cut at about 115 feet from the main tunnel, is marked by a band of strong sulphide mineralization in which galena predominates. When the property was visited towards the middle of December this ore on the hanging-wall side had just been broken into and the ore exposed was from 3 to 4 feet wide, following a well-defined plane of fissuring. Up to that time this constituted the strongest and most definite mineralization encountered in the big tunnel-workings. Since then this hanging-wall ore-body has been drifted on easterly and westerly and, towards the end of the year, the two drifts had attained a combined length of 150 feet, with mineralization in varying degree throughout. Of the 150 feet of drifting done, 80 feet is on the east side of the lateral tunnel and 70 feet on the west. The strongest mineralization is exposed in the western drift.

According to reliable report, the first 30 feet of the west drift has a 3-foot band of milling-ore; then there is a length of 30 feet of ore containing possibly 40 per cent. combined lead and zinc over a width of 4 feet; and the last 10 feet of the tunnel has a width of 2 feet of milling-ore. At this end some north-and-south replacement mineralization is indicated which is not uncovered. There is still about 300 feet of very promising ground ahead of the face of the west drift. Some solid galena is developed in this working which is medium to fine-grained, showing

a marked sheared structure. According to the management, this ore, which would require sorting, assays: Silver, 23 oz. to the ton; lead, 73 per cent.; zinc, 5 per cent.

In the east drift there is reported to be considerable mineral exposed in narrow veinlets which will possibly make milling-ore. The backs on the ore to No. 5 level calculated on the supposed rake of the ore-body are estimated to be over 750 feet. In the fractured zone between the hanging-wall ore-body and the foot-wall fissure there are spots of mineralization which may be connected with replacement ore along the bedding-planes. This has not yet been determined, however. Exploration, therefore, has recently entered an area of very interesting possibilities and the promising ore-body which is being developed gives some assurance that the property will reach the producing stage before very long. In this connection some small shipments of clean ore are expected to be made shortly, and the mill, built in 1916, will be remodelled as soon as ore reserves are considered sufficient to warrant it.

Approximately 11½ miles of 22,000-volt power-transmission line was constructed between the mine and Balfour, where connection was made with the Nelson City power-line. At the mine a sub-station of 450-k.v.a. capacity has been installed, with step-down for lower voltage for various uses. This plant went into operation during September.

A 1,050 Ingersoll-Rand compressor, directly connected to a General Electric synchronous motor, has been installed and adequately housed in a corrugated-iron building near the portal of the big tunnel. A new camp area has been established on a level with the portal by spreading the dump uniformly over the former irregular surface. New buildings include a boarding-house and bunk-house, with all modern improvements, to accommodate 100 men, and a new combination blacksmith and machine shop. B. W. W. McDougall is engineer in charge of operations and Howard Denis is superintendent.

Princess Creek Mining Co., Ltd.*

This company, sponsored by E. J. Edwards and H. N. Keller, of Spokane, was recently organized to develop the *R.F.G.* and *Bell* groups, consisting of seven claims adjoining the *Kootenay-Florence* to the north. The Princess Creek Mining Company, Limited, is capitalized for 2,500,000 shares, par value 10 cents. Deposits containing lead and zinc sulphides, developed in superficial workings, are said to occur in the Josephine formation under conditions resembling the *Kootenay-Florence* deposits, the character of the mineralization also being the same. The new company is reported to have acquired the *Kootenay-Florence* power plant and compressor on the South fork of Woodbury creek, and immediate plans include driving a tunnel giving a depth of 300 feet on a strong surface showing.

Albion, Banker, and Maestro.*

A considerable amount of work was done on these properties, which are situated near Ainsworth. On the *Albion* a total footage of about 407 feet of underground work was done and 400 feet of diamond-drilling. On the *Banker* underground work amounted to 1,615 feet and 55 feet on the *Maestro*. Compressor equipment used included two Ingersoll-Rand portable gas-compressors. Ventilation was given by blowers driven by a small gas-engine. The properties were subsequently allowed to revert to the owners.

No. One.—Late in the fall this mine, near Ainsworth, was leased by the Consolidated Mining and Smelting Company to McPherson & Grant, and a small amount of work is reported to have been done.

Fire Brand.*

This property is situated about 2 miles south-westerly from Ainsworth, at an elevation of about 1,500 feet above Kootenay lake. F. Bureau, backed by J. Brennand and associates, of Kaslo, have taken a lease and bond on the *Fire Brand* and *Pipe Dream* and have staked twelve other claims in the vicinity. A small amount of surface work was done, a substantial log cabin and a barn were erected, and about one-third of a mile of road slashed out to connect with the road which leads from Ainsworth to the *No. One* and numerous other properties, including the *Albion*, *Banker*, and *Maestro*, mentioned above.

A 60-foot incline shaft and some open-cuts develop a sheeted zone in coarsely crystalline limestone which contains irregular bunches of galena, zinc-blende, and siderite. Occasional wire silver occurs in cavities and seams. The ore as sorted contains high silver values. The property, which is in a very early stage of development, is located near the *Krao*, the mineralization and character of the deposits being somewhat similar. The *Krao* and many other properties in the Ainsworth camp are described in Memoir 117, Geological Survey of Canada.

Neosho.* Situated at a short distance south-westerly from the *Fire Brand*, the *Neosho* and adjoining *Norman* have been taken under lease and bond by W. S. Heffernan, of Kaslo, who organized the Neosha Mines, Limited. During the summer months work of a preliminary nature was done on the *Neosho* and *Norman*, which are among the earliest claims in the camp, having been located in 1889. The cabin near the workings is at an elevation of about 3,300 feet above sea-level or 1,550 feet above Kootenay lake. The wagon-road to Ainsworth passes within half a mile of the camp, connection having been made by a wide trail. On the *Neosho* a considerable amount of work was done as early as 1889, including two shafts and a tunnel, and some ore was shipped to smelters in the United States. The early mining records were lost and at the time the property was visited the workings were inaccessible, so that it was not possible to make a satisfactory examination of conditions underground.

The principal workings on the *Neosho* are a shaft, apparently over 100 feet deep, and a connecting tunnel about 200 feet long, according to plans seen by the writer. The elevations at the collar of the shaft and the portal of the tunnel are 3,450 and 3,400 feet respectively above sea-level. According to reliable information, these workings and another shaft, not seen, develop a vein 2½ feet wide carrying values in silver, lead, and zinc. The country-rock is limestone striking northerly and dipping to the east. From this vein, which apparently follows the bedding of the limestone, some shipments were made, but the high zinc content penalized the ore to such an extent that shipments were discontinued and the property was subsequently closed down. In the long intervening period of inactivity which elapsed the workings caved in places, making it impossible to descend the shaft or enter the tunnel. Since the property was visited the tunnel has been cleaned out. The following samples were taken from piles of ore outside the portal of the tunnel and in the old sorting-shed:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
Big pile of oxidized material (possibly 8 or 10 tons) outside portal of tunnel	Trace	30.5	3.8	7.5
Small pile of oxidized material in shed, probably rejected when ore was sorted for shipment	0.02	32.6	7.8	23.8
Small separate pile of siliceous material containing sulphides, in shed	Trace	20.9	5.1	13.4

The values in this rejected material indicate a high silver content in the ore which was shipped.

The *Norman* vein workings, which lie about 600 feet south-easterly from the portal of the above-mentioned tunnel, were not visited. This vein is reported to be parallel to the *Neosho* vein, about 260 feet away and at a slightly lower elevation. The workings on the *Norman* vein consist of a shallow shaft and open-cuts in which similar mineralization is exposed in places. Work was discontinued in the fall pending arrangements for further financing.

*Violet.**—A small amount of work is reported to have been done on the *Violet* on Woodbury creek. The ore is a "dry ore" containing high silver and some gold values. The property is owned by J. Henry, W. G. McLanders, and D. McLellan.

Berengaria.* At Deanshaven, on the east side of Kootenay lake, an interesting discovery was made in the spring by R. T. Deane. When ground-sluicing to make a fill along the lake-shore an enormous mass of ore was accidentally discovered, which consisted of heavy alternating bands and masses of pyrrhotite, galena, and zinc-blende, with small amounts of chalcopyrite, in a limestone gangue. Six claims, constituting the *Talisman* group, were then staked. In August Deane shipped about 114 tons as milling-ore to Trail, which netted approximately $4 a ton after paying freight and smelter charges. The average assay was: Silver, 3.6 oz. to the ton; lead, 8.5 per cent.; zinc, 11 per cent. Subsequently the Berengaria Mining Company, with a capitalization of $10,000, divided into 1,000,000 shares, was formed to do exploratory work. The "mine" was then leased to J. Foulds, W. Smith, and T. Hawes on a royalty basis. A 2-drill compressor and accessory equipment were installed and a tunnel was driven into the ore-mass, from which the leasers shipped an additional 240 tons of ore of rather better grade. When the property was visited by the writer, after the first shipment by Deane

had been made, there was a spectacular face of ore about 10 or 12 feet wide and 20 feet high. In the open-cut on each side of the ore boulder-clay was exposed, which probably also underlies the mass at no great depth. The impression was formed that the occurrence might be an enormous glacial erratic which had been protected from disintegration by the enveloping boulder-clay. It is considered possible, however, that the mass of ore, which lies in approximately correct relation to adjacent stratified rocks, has slid down from its original position, which may not be very far distant. In this case a discovery of importance might be made in the vicinity.

Broster.* This group of claims has been staked by D. Broster, M. Johnson, and associates, along the peninsula separating Crawford bay from Kootenay lake. A small amount of tunnelling and some deep trenching has been done on two distinct deposits. The tunnelling was done on a vein in limestone carrying silver-lead-zinc mineralization and the trenching was done on a pyritized zone in schist.

KASLO.

Properties Tributary to Kaslo–Nakusp Railway.

Whitewater. This property was operated steadily by the Whitewater Mines, Limited, of which W. H. Burgess, of Kaslo, is managing director. As a description of the ore-deposits and mine-workings has been given in recent Annual Reports, only a few brief notes will be submitted on the outstanding features of this year's operation. The mine was visited early in the year, when mining and development work was progressing satisfactorily. Recent reports from the management describe the mine as looking better for tonnage than ever before. It is reported that a good width of high-grade zinc and milling-ore was encountered in a 60-foot raise from the lowest level, known as No. 14. An important strike is also reported in the west end of No. 11 level, where the ore shows a width of 8 feet. This establishes an additional depth of 100 feet to the ore-body encountered on the Nos. 12 and 13 levels.

The mineralization is extensive and the discovery of new ore-shoots from time to time as development progresses is to be expected, especially as there still remain large areas of virgin ground which have good potentialities.

The mine is opened to great depth by No. 14 adit-level and conditions are favourable for both low mining and milling costs. Ore is hauled out of the mine to the mill by a Mancha electric locomotive.

With a view of reducing operating costs and increasing the power an important power-installation was made. The power plant originally installed to operate the mill and mine compressor consists of a Pelton wheel, the water being under a head of 500 feet, and two oil-engine-driven generators of 90 and 150 horse-power respectively. During the latter part of the year this was augmented by a new hydro-electric plant of 285-horse-power capacity. An intake was constructed on Whitewater creek at an elevation of 1,040 feet above the power-house, from which a pipe-line 7,000 feet in length carries the water to the plant. The upper section is wire-wound wood pipe 12 inches in diameter, and the lower section, from a head of 500 feet to the bottom, is of solid-drawn steel pipe of 10 inches diameter.

The plant consists of a Gilbert-Gilkes Pelton wheel directly coupled to a Crompton-Parkinson alternator having a capacity of 240 k.v.a. at 230 volts, 3-phase, 60 cycles at 1,200 revolutions a minute. This unit will carry the entire load of the mill for eight or nine months in the year and a partial load during the winter months, when the water is low. The plant was supplied and installed by Bartholomew, Montgomery & Co., of Vancouver.

Wellington. This group, comprising nine Crown-granted and three un-Crown-granted mineral claims, covers the westerly extension of the *Whitewater* ore-zone. The property was acquired during the latter part of 1927 by the Wellington Mines, Limited, with a capitalization of $500,000, divided into 2,500,000 shares of par value 20 cents. R. H. Stewart is president and W. G. Harris is superintendent at the mine. Work was first confined to exploration of the upper horizon of the *Whitewater* vein, in order to gain definite information regarding its continuity, dip, and strike, with a view of determining where the intersections of the *Whitewater* shear-zone with important limestone-beds would occur at depth. During the course of this work a little ore and favourable indications are reported to have been encountered, while sufficient information was obtained to allow a decision to be arrived at regarding the procedure for development at depth.

Following this decision, plans were made to advance the old *Hazel* tunnel, which had been driven by former operators for a distance of 250 feet. This tunnel will gain a depth of about 800 feet below the old upper workings and, according to survey, will have to be advanced for 800 feet to reach the foot-wall zone of the *Whitewater* vein. At the end of the year this tunnel was reported to have been advanced 100 feet and, at a distance of 270 feet from the portal, to have unexpectedly intersected a vein showing a width of 6 feet of commercial ore at a depth of 600 feet below the surface. It is understood that while the crosscut is being continued this vein will be explored.

It is also reported that further exploration is being undertaken on the *Wellington* vein, which lies parallel to the *Whitewater* at a distance of about 1,000 feet to the north. During the early history of the property this vein is credited with a considerable production of high-grade silver-lead-zinc ore.

The latter part of the year saw the completion of new camp buildings which provide good accommodation for a crew of thirty men, also an engine and compressor house, blacksmith-shop, dry-house, etc. The new camp and power plant are situated at a short distance from the railway, connection being provided by half a mile of good road. The plant consists of a 75-horse-power semi-Diesel Vickers-Petters oil-engine and a 520-cubic-foot Ingersoll-Rand compressor. A caterpillar tractor is used for haulage purposes.

The property is of long standing; early references to it may be seen in the Geological Survey of Canada Report for 1895 and the Annual Report for 1896.

The Keystone Charleston Mining Company, Limited, which was incorporated during the year with a capitalization of $500,000, acquired the *Keystone*, *Colorado*, *Kingston*, *Charleston*, and *Corean* claims. The property adjoins the *Whitewater* to the north. It is referred to in the Annual Report for 1923, page 210.

Jackson. This property was acquired by the Jackson Basin Mines, Limited, late in 1927. During 1928 exploration-work has been principally confined to prospecting the easterly extension of the vein across the creek. After a considerable amount of deep trenching and open-cut work the outcrop was picked up, showing a strong width of oxidized ledge-matter which carried streaks and small bunches of galena. It is understood that subsequent tunnelling has exposed a nice showing of sulphide ore. The possibilities for the discovery of important ore-shoots on this side of the creek are considered favourable on account of the presence of limestone-bands. For further reference to this property *see* the Annual Report for 1923, under the heading of *Dublin Queen*.

Further work was done at the *Corrigan*, which is located at a short distance from the *Jackson*.

Re-treatment of the large accumulation of tailings in the bottom of Kaslo creek from the old *Whitewater* mill was continued by the Metals Recovery Company, under the direction of M. S. Davys.

Utica. This mine, which during recent years has been comparatively inactive, owing, it is believed, to disagreement among the shareholders of the previous company, has been acquired by a new company, promoted by Stobie, Forlong & Company, and operations will be resumed this spring by the Utica Mines, Limited. The capitalization is $3,000,000, divided into 3,000,000 shares at a par value of $1. The mine no doubt will be placed under the efficient management which has so far marked the operations of properties in the district promoted by this firm. The mine is situated at an elevation of 6,500 feet and is reached by 5 miles of road from Adamant Station on the Kaslo–Nakusp Railway.

The total production, including 1927, from this property has been: Tons, 5,564. Gold, 3 oz.; silver, 716,189 oz.; lead, 1,660,654 lb.; zinc, 247,167 lb. This represents ore that was sorted and sacked for shipment, leaving, no doubt, a considerable quantity of milling-grade ore available. Some exceptionally rich ore has been mined from this property, while the bulk of the shipments carried good average values. The future of the mine seemingly depends on the development of the downward extension of the ore-shoot by the low tunnel, which, it is understood, still lacks about 250 feet of its objective. The property is briefly described in the Annual Report for 1922 and referred to in subsequent reports.

On Lyle creek the Consolidated Mining and Smelting Company did some exploratory work on the *Phoenix* and *Fletcher* claims. A winter camp with accommodation for eight men was established in October and a portable compressor plant installed.

George Murhard did further work on the *Vera*, near Retallack, and A. J. Curle, of Kaslo, put in a season on his property near 14-Mile point on the Kaslo–Nakusp Railway, where there is reported to be an interesting showing of low-grade ore. W. P. Kane, of Kaslo, had work done during the season on the *Dayton* group on Blue mountain, some 6 miles from Kaslo.

Keen Creek Area.

Cork-Province.

This property, comprising thirteen claims, is owned and operated by the Cork-Province Mines, Limited, with a capitalization of $1,000,000, divided into 3,000,000 common shares of par value 25 cents and 250,000 preferred shares at $1 par value. The area is underlain by rocks of the Slocan series, consisting principally of dark schists in which are interbedded limestone-bands. This formation is cut by a well-defined fissure and the occurrence of important ore-bodies at its intersection with the limestone-bands is a characteristic feature of the mine. Evidently the fissure represents the ore-channel from which the solutions formed replacement deposits in the limestone. So far development has principally been confined to one fissure, and should other similar fissures be found to exist a repetition of conditions might well be expected.

The mine is opened by a crosscut tunnel 900 feet in length, which forms the main adit, and from which there is a tramway to the mill. This is known as the No. 3 level. During the earlier history of the mine, ore was mined from above this level, but in more recent years operations have mostly been confined to the No. 4 level, access to which is gained by a shaft sunk to a depth of 100 feet below the No. 3 level.

During 1928 further work done on the No. 3 level developed milling-grade ore along a length of about 130 feet of drifting. The importance of this showing yet remained to be proven by more development.

When visited early in the year the shaft had been sunk an additional 125 feet to the No. 5 level, where a station had been cut and a nice showing of ore had just been disclosed in the face of a short drift. Later in the year it is reported that the main crosscut had been extended for 100 feet past the projected downward extension of the *Superior* vein, which lies parallel and about 900 feet south of the present workings. This vein was prospected during the early history of the property and a small shipment of high-grade ore was mined from near the surface.

According to a report received from the managing director of the company, the crosscut intersected two fissures, one 8 inches wide and the other 4 feet, each containing milling-ore. The latter was intersected at a point 90 feet from the projected intersection of the *Superior* vein. After advancing the crosscut for a short distance farther it is intended to drift on the most important of the two fissures. As this drift will be nearly 1,000 feet below the apex of the vein, favourable developments at this horizon will naturally have an important bearing on the future of the mine.

Power-shortage, which has always been a handicap to continuous operations in the past, has now been eliminated by the installation of a new plant capable of generating 435 horse-power. This is a hydro-electric automatically controlled plant and is situated on Keen creek at a distance of 1½ miles below the mine. Power is developed by a Gilbert-Gilkes Turgo impulse wheel operating under a head of 360 feet at 720 revolutions a minute. This is directly coupled to a 350-k.v.a. generator and exciter equipped with automatic controls.

Water is taken from a 20-foot dam across the creek, near the mill, and delivered to the plant by a wood-stave pipe. Transmission-lines carry the energy back to the mine and mill. The installation is unique, in that it is the only privately owned plant of its kind in the Province where operators will be dispensed with. The wheel is controlled at the mine by control-wires. The unit will automatically shut itself down in the event of hot bearings or accidents of any kind, and at the same time the cause of the trouble will be indicated. The plant was designed and installed at Bartholomew, Montgomery & Co., of Vancouver.

The old mill building has been put in shape and a new crushing-house added, preparatory to changing the flow-sheet, which will be approximately as follows: From the mine the ore first passes through a Gates crusher, then is conveyed by a belt to the mill storage-bin. The fine crushing is accomplished by two sets of rolls and a Marcy ball-mill, the latter being in closed circuit with a Dorr classifier, the overflow from which is fed to a 20-cell sub-aeration Minerals Separation machine. The concentrates are dried by an American filter. All machines will have individual electric drives.

Revenue.

This property, consisting of three Crown-granted claims and a fraction, was acquired from Lochlan MacLean and associates, of Kaslo, by the Sturgis Creek Mines, Limited. The head office of the company is at Calgary and capitalization is 2,000,000 shares of no par value. F. T. Harbour is president and manager. As the property is described in the Annual Report for 1920, only a brief review will be given. It is situated on Keen creek and reached from the railway by 10 miles of wagon-road and 2 miles of trail. The elevation of the lowest tunnel is approximately 2,300 feet above the road-grade, at the point where the trail leaves it.

The vein occupies a sheared fissure in granite and is mineralized with galena, zinc-blende, and pyrite, carrying good silver values. The workings consist of four adit-tunnels which gain a depth of approximately 260 feet below the uppermost tunnel. When examined work was being confined to stoping between the No. 1 and No. 2 levels; the stope had been advanced to within about 15 feet of No. 1, leaving a small tonnage available. This ore was being sorted and sacked for shipment and about 30 tons had been packed down to the road. Along the roof of the stope the vein showed a width of from 2 to 3 feet for a length of about 50 feet. The ore occurred as disseminations through vein-filling and occasionally made in streaks and bunches of clean galena. The amount of ore that could possibly be mined from this shoot between No. 1 and the surface was unimportant.

To get an idea of the values that might be expected from a shipment of sorted ore, the following samples were taken in the stope: A sample across a streak of galena 8 inches wide assayed: Gold, 0.03 oz. to the ton; silver, 83.6 oz. to the ton; lead, 48.1 per cent.; zinc, 9.6 per cent. A sample across a 6-inch streak on wall of the vein, of finely crystalline ore, assayed: Gold, 0.03 oz. to the ton; silver, 110.3 oz. to the ton; lead, 56.7 per cent.; zinc, 11.6 per cent. The width of the vein at this point was about 3 feet. Besides the streaks of shipping-ore sampled, the remainder of the vein is of milling grade.

It was obvious that this vein was badly in need of further exploration at depth; first by continuing the next tunnel down the hill, which had not been advanced far enough to develop the downward continuation of the ore in No. 2, and then, if results proved satisfactory, to advance the lowest level, with the objective of placing sufficient tonnage in reserve to warrant the equipment of the property with an aerial tram and possibly a mill. On account of the rocky and steep nature of the mountain-side traversed by the trail, road-construction would be very costly, while transportation by this method during winter months would not be practical on account of snowslides. For further reference *see* Annual Report for 1920.

Smuggler.*

This group of Crown-granted claims, owned by Pat Maguire and associates, is situated on the western slope of Kokanee mountain, above the glacial basin at the junction of the headwaters of Kokanee, Enterprise, and Keen creeks. In the basin there is a spacious cabin, owned by Maguire, which is used as a starting-place by mountaineers and visitors to the Kokanee glacier. Trails extend up all three creeks mentioned, but perhaps the easiest means of approach at present is by car from Kaslo to the end of the Keen Creek wagon-road and thence by trail a few miles in length. The elevation of Maguire's cabin on the *Kootenay Queen* is about 6,500 feet above sea-level. From here a rough trail extends to the cabin on the *Smuggler*, at an elevation of about 7,500 feet.

The claims are situated towards the centre of a large area of granitic rocks of the Nelson batholith. The same area contains the high-grade "dry ore" deposits of Woodbury, Springer, and Enterprise creeks, the silver-lead-zinc ores at the *Molly Gibson* on Kokanee creek, and other deposits. The *Smuggler* vein, from 3½ to 6 feet wide, strikes south-easterly or diagonally up the hill towards the *Molly Gibson*, which is over the summit on Kokanee creek, and dips steeply to the south-west.

The workings examined consist of three tunnels and several open-cuts, tracing the vein from 7,750 to 8,000 feet elevation, but the vein is also said to be exposed in the bluffs near the summit at about 8,500 feet elevation. The principal tunnel is inaccessible from caving and the vein in the open-cuts could not be seen for debris or snow. The mineralization, seen where the vein was exposed in spots, consists of galena in oxidized ledge-matter, the ore occurring in narrow pay-streaks. In the lower tunnel at 7,750 feet elevation, which is about 250 feet in length, there is a small stope from which some 14 tons of high-grade ore was extracted and shipped many years ago.

The following samples were taken from the *Smuggler* vein:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
Grab sample from small pile of ore outside portal of tunnel at 7,750 feet elevation	0.04	59.1	9.7	5.8
Grab sample from large pile, possibly 40 or 50 tons, at portal of caved tunnel at 7,850 feet elevation	0.04	17.4	1.1	0.8
Grab sample from dump of open-cut at 8,000 feet elevation	0.02	5.8	1.1	1.2

The *Smuggler* vein is believed to be the extension of one of the veins of the *Molly Gibson*. At an elevation of about 7,400 feet, and about 500 feet south-westerly from the *Smuggler* vein, a parallel vein, from 1½ to 2 feet wide, is exposed in a shallow surface working. This vein, known as the No. 2, consists of oxidized siliceous material, no sulphides being visible.

On the *Slocan Chief* some old workings develop two small veins also striking south-easterly and dipping to the south-west. At about 6,600 feet a drift-tunnel extends about 200 feet along a narrow vein without developing any appreciable amount of ore. From a deep open-cut above this tunnel some high-grade ore is reported to have been extracted. About 40 feet in the tunnel from the portal a second vein is intercepted in a short crosscut. This vein is from 4 to 6 inches wide and contains galena, zinc-blende, and possibly silver sulphides. A sample across 4 inches assayed: Gold, 0.04 oz. to the ton; silver, 173.5 oz. to the ton; lead, 5.8 per cent.; zinc, 11.6 per cent. This little vein is clean-cut, with gouge on either wall. Due to the caved condition of some of the workings the results were somewhat indefinite. The impression was formed that the extension of the two *Smuggler* veins might possibly be tested to advantage at lower altitudes if the overburden is not found to be too deep. A little more work might be done on the very narrow *Slocan Chief* vein from which the last-mentioned sample gave high silver values.

Silver Bear.—Development was continued during the season under the direction of C. Starr, who had a small crew employed. The property is referred to in the Annual Report for 1924.

Daybreak.—During the early part of the year a shipment of ore was hauled out, but, it is understood, very little work was accomplished at the mine, which was temporarily closed down pending the settlement of further litigation, which in the past has handicapped the operation of this property.

Mike Murphy, of Kaslo, and partners put in a season's prospecting at the head of Granite creek. Exploration-work at the *Bismark* was undertaken by the Consolidated Mining and Smelting Company. Work was stopped in September and the option was dropped.

Poplar Camp.

White Eagle. This group is situated at the head of Cascade creek at a distance of approximately 12 miles from the railway. The property, consisting of a group of five claims, was acquired during the latter part of the year by the Keene Mountain Gold and Silver Mines, Limited, with a capitalization of 2,500,000 shares of no par value. J. Gallo, who was largely responsible for the incorporation of this company, is in charge of the mining operations. The head office of the company is at Calgary.

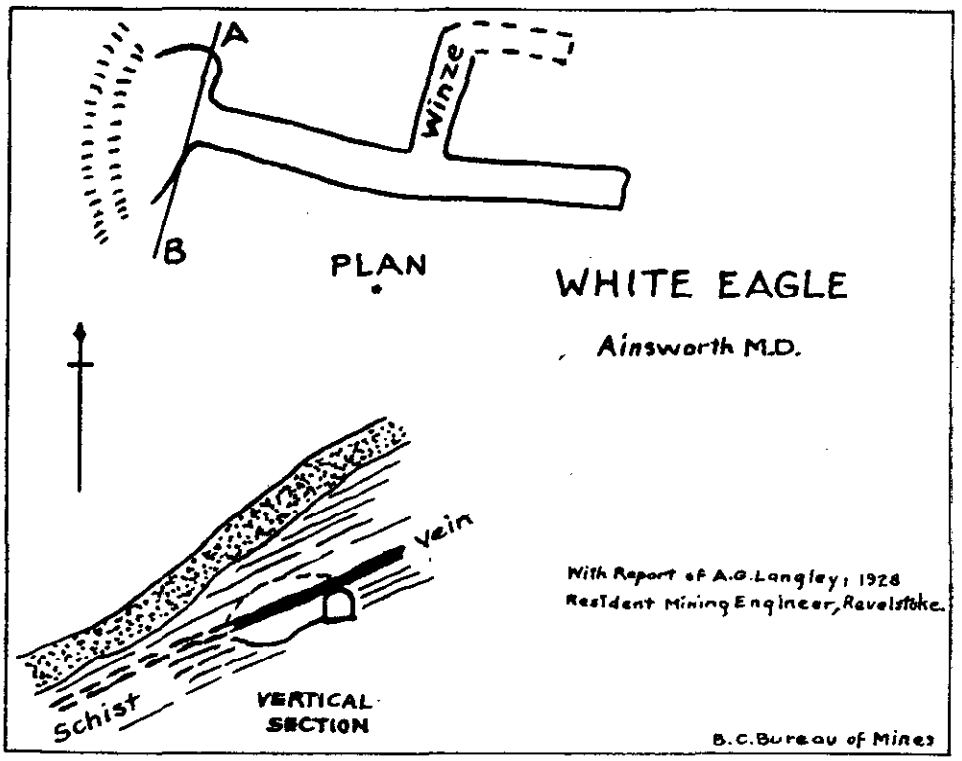
The trail closely follows the creek-bed and, crossing the fan-like form of numerous snow-slides, is only suitable for a pack-trail during certain periods of the year. These conditions could be improved by relocating the trail higher up, should developments be found to warrant the considerable expense that would be necessary. The camp consisted of two small cabins, beautifully situated on the shore of a small lake nestled among the summit peaks, at an elevation of 6,800 feet above sea-level.

The formation in the vicinity of the workings consists of slate-schists and occasional bands of limestone. The vein on which the work was being confined, consisting of a quartz-filled fissure conforming to the dip and strike of the enclosing rocks, could be traced for a considerable distance along the hillside, which it traversed at an oblique angle. A little prospecting had been

done along the strike of the vein, but not sufficient to establish the continuity of the mineralization. The strongest showing had been laid bare by erosion at the side of a shallow draw, where a width of about 2 feet of massive sulphide ore was exposed, dipping at an angle of 25°.

Here an old prospect-tunnel had been driven along the strike of the vein and was being continued at the time of examination, its total length being 69 feet. A short winze had also been sunk on the vein at a distance of 37 feet from the portal.

These workings do not disclose anything of particular importance, but further surface work near the portal had exposed the vein for about 15 feet on the dip, where massive sulphides and milling-grade ore were exposed across a width of about 2 feet. A sample taken across 21 inches of what appeared to be the best grade of ore gave the following returns: Gold, 0.61 oz. to the ton; silver, 31.6 oz. to the ton; lead, 39.8 per cent.; zinc, 23.2 per cent. A sample of about the average milling-grade ore assayed: Gold, 0.19 oz. to the ton; silver, 15.5 oz. to the ton; lead, 25.7 per cent.; zinc, 12.7 per cent. The ore showed strongly in the bottom of the cut and further work was planned to explore its downward continuation by means of a lower tunnel.



During the latter part of the year a shipment of about 9½ tons was made to the Trail smelter; returns showed this ore carried the following values: Gold, 0.27 oz. to the ton; silver, 21.1 oz. to the ton; lead, 32.6 per cent.; zinc, 21.3 per cent. The net value of the shipment after deduction of freight and smelter charges was $240.29. It is understood that a crew of eight or ten men will be employed during the winter months. The company is also interested in another group of claims in this vicinity which were not examined.

Comstock.* During the summer months a small crew was employed by P. J. Sheran on the *Comstock* and adjoining *Noonday* claim, which belong to a group of claims situated on the south-eastern side of Cascade creek. A steep switchback trail connects the cabin with the main trail at a point about 6 miles from the Lardeau-Gerrard Railway. A small amount of development has been done at intervals since the property was described in the Annual Report for 1925. The principal work done during the current year was the continuation of the lower crosscut tunnel on the *Noonday*. The vein had not been reached when the property was visited in August, apparently due to its dip into the hill being flatter

than at first supposed. The mineralization in the *Comstock* is chiefly silver-lead-zinc, but on the *Juno*, also owned by Sheran, situated farther up Cascade creek and to the west of the *Comstock*, appreciable gold values are associated with iron and lead sulphides. On the *Reco*, examined in 1925, the mineralization in open-cuts was similar to that of the *White Eagle*, also described in this report, and a sample of selected ore from an open-cut assayed: Gold, 0.32 oz. to the ton; silver, 18.6 oz. to the ton; lead, 32.2 per cent.; zinc, *nil*.

At the Bullock Gold Mines' property a long crosscut tunnel is being driven, to cut the vein system at depth, by J. J. McNamara, who installed a portable compressor and had a small crew steadily employed during the season. A description of the property may be seen in the Annual Report for 1927. There was about the usual amount of prospecting activity in this section of the district.

Howser Lake and Duncan River.

A new trunk trail is being built along the eastern side of the upper Duncan river northerly from Howser lake, 4.6 miles of which have been completed. The work is being done on a fifty-fifty basis by the Provincial and Dominion Governments to afford access to the upper river during the low-water period.

Riverside.* This property, situated on the same side of the river, near McGuire creek, has been taken over by the Omo Mines Corporation, of Spokane. The *Riverside* is described in the Annual Report for 1927. Since then a large number of claims covering the southerly extension of the vein have been acquired by the company. The vein is reported to have been opened up by trenching and crosscutting at a number of places a long distance to the south of the workings previously described. Good widths of milling-ore are reported to have been exposed in the new workings. Substantial camp buildings have been constructed and a trail, 3 feet wide, has been built for a length of 6¾ miles, making connection with the end of the completed portion of the trunk trail mentioned above. Jack Thompson, an experienced mine foreman and operator, is in charge.

*Red Elephant.**—At this gold property on Hall creek work was continued by J. Moris, of Spokane, who has operated the property continuously, except for the winter months, for several years. Results of the current season's work are reported to have been highly satisfactory.

*Gertrude.**—A small amount of preliminary work has been done by J. M. Anderson on this group of Crown-granted mineral claims situated on Lake creek. The property is at present reached by the trail up Gertrude creek, which is a tributary of the upper Duncan river, on the west side, below Hall creek.

*Fresno.**—D. D. McPhail put in a season on his *Fresno* property on Gertrude creek. The trail was cleaned out and improved in connection with this property and the *Gertrude* mentioned above.

Blue Jay.* This group, comprising the *Snowstorm*, *Blue Jay*, *Mountain View*, *Gladstone*, *Copper Glance*, *Victoria*, *Joker*, and *Jutland*, Crown-granted mineral claims, is situated at the head of McDonald creek, which is tributary of the West fork of the Duncan river (also known as Westfall river). The property is reached by trail, possibly about 12 miles in length, which crosses over the divide (elevation about 7,000 feet above sea-level) which forms the watershed between Ferguson creek and McDonald creek.

A small amount of surface work was done on the property during the summer months by a syndicate, formed in Victoria, including P. Comerford and S. H. Stanley. In the principal deposit the ore consists of argentiferous galena with some zinc-blende, occurring in streaks, bunches, and disseminations as replacement in limestone. The workings on the *Joker* and *Mountain View* consist chiefly of trenching and stripping at intervals across the strike of the ore-bearing band of limestone, which strikes north-westerly up the steep mountain-slope on the western side of McDonald creek. The dip of the strata approximates the vertical, but in places a very steep dip to the south-west was noted. The width of the limestone in which the ore is found is about 60 feet.

The mineralization, traced by numerous open-cuts for a length of 700 feet through part of the *Joker* and for a short distance into the *Mountain View*, apparently favours the south-westerly side of the limestone, which is interstratified between schists. In the eight trenches examined, some of which did not fully crosscut the ore-bearing zone, irregular mineralization

is exposed over widths up to 25 feet, as shown in an open-cut at 6,150 feet elevation. In this working the ore occurs in ribs, kidneys, and stringers, separated by horses of unaltered country-rock. A grab sample of broken ore, representing material which would have to be mined selectively, assayed: Gold, trace; silver, 0.25 oz. to the ton; lead, 12.3 per cent.; zinc, 2.8 per cent. This 25-foot width constitutes the strongest showing seen.

The mineralization is of the typical disseminated variety found in the "Lime Dyke" mineral belt of the Trout Lake and Lardeau Mining Divisions. In this type of deposit continuity of mineralization can only be expected where there are favourable structural conditions, and in this connection the limestones, which stand at uniformly steep angles, have not yet been shown to contain any important replacement deposits. Strong and wide surface showings have been found in many places, but continuity of the mineralization remains to be demonstrated. The widespread mineralization in the limestones of the district indicates favourable possibilities for finding important concentrations of ore where special geological conditions exist. The mineralized limestone-beds should be traced, if possible, into zones of folding and fracturing.

Approximately parallel to the above-described deposit, and some 300 or 400 feet to the south-west, there is a vein which has been developed by a tunnel, now caved, and some open-cuts for a total length of about 250 feet. These workings are in the north-east corner of the *Victoria* and the south-west corner of the *Joker*. This vein, which coincides with the foliation of the enclosing schist, contains some fragmental, irregular mineralization consisting chiefly of galena, with some pyrite and chalcopyrite, associated with quartz. No body of ore was seen which could be sampled to advantage.

On the *Snowstorm*, which is on the eastern side of McDonald creek, there are some old superficial workings, including a short tunnel, but these were not visited, as the writer was informed by the syndicate's representative at the property that nothing of interest had been developed in them.

Golden Rule.* Adjoining the *Joker* of the *Blue Jay* property to the south-west, the *Golden Rule* Crown-granted claim has been acquired by J. M. Ennes and G. S. McCarter. The formation consists of alternating bands of limestone, schist, and argillite. Superficial workings, including a short tunnel at about 6,800 feet elevation, develop a sheared silicified zone in limestone near the contact with argillite. The mineralization, of an irregular character, consists chiefly of stringers and disseminations of galena associated with quartz and siliceous phases in the limestone. A sample of selected ore from the tunnel assayed: Gold, 0.05 oz. to the ton; silver, 64.8 oz. to the ton; lead, 64.7 per cent.; zinc, 2.6 per cent. Some prospecting was done in the vicinity by Ennes and associates.

President.* At this property, situated on the western side of Howser lake, towards its northern end, the crosscut tunnel being driven by R. S. Gallop was over 800 feet in when the property was visited in the fall. The work is being financed by a syndicate in Victoria. There are interesting exploratory possibilities in the area. The ore carries high silver values associated with galena.

Glacier Creek.* This group is situated on Glacier creek, near the southern end of Howser lake. Exploratory work started by the Consolidated Mining and Smelting Company in 1927 was continued during the current season. In addition to some light surface-stripping, seven diamond-drill holes were put down, totalling 1,108 feet. Subsequently the option on the claims was dropped by the company.

High Grade.* J. C. Rady spent the season prospecting his *High Grade* and *Low Grade* claims on the eastern side of Howser lake, about 5 miles northerly from the settlement of Howser. Just above high-water level Rady has been driving a crosscut tunnel to cut a vein exposed farther up the hillside. Float-ore from the vein is said to have given good values in silver associated with a grey copper mineral.

A small amount of work is reported to have been done on the *St. Patrick*, on Hammill creek, by S. N. Ross, who had the property under lease and bond.

LIST OF SHIPPING-MINES, SHOWING TONNAGE PRODUCED, 1928.

Ainsworth Mining Division.

Mine.	Locality.	Tons.	Character of Ore.
Banker, Maestro	Ainsworth	127	Silver, lead, zinc.
Berengaria	Deanshaven	354	Silver, lead, zinc.
Cork-Province	Zwicky	41	Silver, lead, zinc.
Daybreak	Zwicky	200	Silver, lead, zinc.
Davys' Mill	Kaslo Creek	4,550	Gold, silver, zinc, lead.
Jackson	Retallack	40	Silver, lead.
Revenue	Sturgis Creek	40	Silver, lead, zinc.
Silver Bear	Kaslo	4	Silver, zinc, lead.
Spokane-Trinket	Ainsworth	93	Silver, lead, zinc.
Tiger	Ainsworth	22	Silver, lead, zinc.
White Eagel	Poplar	9	Silver, lead, zinc.
Whitewater	Whitewater	24,553	Silver, gold, zinc, lead.

REVELSTOKE MINING DIVISION.

Chief interest for a while was focused on the operations at the *Snowflake*. The promotion of the *Waverley-Tangier* also created quite a little interest. In order to supply the demand for information by the public a special bulletin, in which full reports are given on these two properties, was issued.

By the end of 1928 the Big Bend wagon-road had been extended as far as Carnes creek, a distance of approximately 26 miles from Revelstoke. The mere fact that this road was being built, naturally attracted attention to the mineral and timber potentialities of the vast area tributary to the Columbia river and lying to the north of Revelstoke. As yet, however, no very serious attempts at lode-mining have taken place. The most important operation in this part of the district was at French creek, some 60 miles north of Revelstoke, where the French Creek Development Company put in a busy season making extensive preparations for hydraulicking.

In the early days French creek was the scene of many placer activities and an immense amount of work was accomplished by the old-timers in drifting, shaft-sinking, and ground-sluicing. This work was nearly all confined to extracting gold from the main channel of the creek, and it is said that for a considerable distance the whole creek-bed was undermined and supported on timbers. The gold was found to lie along the bed-rock, which was covered with a considerable depth of gravel. Extraordinary difficulties had to be contended with in getting rid of the boulders and fighting against water; nevertheless, there is little doubt that a large quantity of gold was recovered from these workings. To-day little remains to bear evidence of these activities; the cabins have rotted away and only an occasional stone fireplace and other remnants may be seen which bear silent testimony of former works of man.

L. N. Remillard, who has spent many years prospecting the gravels of French creek, considers that he has an old channel on a high bench adjoining the creek and claims to have obtained results from testing-pits which justify the present undertaking. The work accomplished by the French Creek Development Company under the able direction of L. N. Remillard is remarkable, considering that all supplies have to be packed for at least 40 miles, and the shortness of the season for outside work.

Six thousand feet of 4- by 3-foot flume has been constructed, a great part of which was built around a steep and bluffy hillside. The lumber was all cut on the ground by a water-driven sawmill, which had a capacity of about 12,000 feet a day. From the end of the flume a 2,000-foot pipe-line conveys the water from the penstock to two No. 6 Hendy Giant monitors under a head of about 200 feet. At the end of the season water was turned on for testing purposes and everything is reported to be in good shape for hydraulicking next spring.

Placer-mining was also being done by ground-sluicing methods on McCulloch creek by D. Fulmore, C. Williams, and L. Maley. I. McBean put in a season prospecting on Carnes creek, where he has uncovered some interesting showings. In view of the possible extension of the wagon-road around the Big Bend, renewed interest was evidenced in the mica-deposits on Mica creek and vicinity, where a number of claims were staked by J. S. H. Munro and associates, of Revelstoke.

The Geological Survey of Canada had a party in the field under H. C. Gunning. After taking in the country around Albert Canyon and Illicillewaet they worked northwards as far as French creek, covering a vast area of rugged mountain country and accumulating a lot of valuable data.

Snowflake. This property is owned by the Snowflake Mining Company and is situated on Clabon creek, about 10 miles from Albert Canyon Station on the main line of the Canadian Pacific Railway. Much interest was manifested by the public regarding this property during the year, owing to sensational statements made by or on behalf of the company regarding proven ore tonnages and the results obtained from the No. 4 tunnel development. The property was examined by the Resident Engineer in June, and in October a special examination was made by the Provincial Mineralogist. To satisfy the public demand for exact information regarding the property, a special bulletin compiled by the Provincial Mineralogist and containing all available reports was issued in November by the Honourable the Minister of Mines. This bulletin contains the following reports on the *Snowflake*:—

(1.) Report by B. T. O'Grady, Assistant Resident Engineer, No. 5 Mineral Survey District; reprint from 1922 Annual Report of the Minister of Mines.

(2.) Report by A. G. Langley, Resident Engineer, No. 5 Mineral Survey District; reprint from 1927 Annual Report of the Minister of Mines.

(3.) Interim report by A. G. Langley, dated June 22nd, 1928.

(4.) Report by F. W. Guernsey, made in August, 1928, for the Snowflake Mining Company, Limited (N.P.L.).

(5.) Report by John D. Galloway, Provincial Mineralogist; examination made October, 1928.

(6.) Report by F. W. Guernsey; examination made October, 1928.

Of these reports, the last four had not previously appeared in print and covered developments for the year 1928 to October. The last two reports contain information regarding results of development in the No. 4 crosscut tunnel.

These reports show that while no tonnage of commercial importance had been proven, as a prospect the property has possibilities for further exploration. The work at the mine is being carried on in an efficient and economic manner. Since the intersection of the vein system by the No. 4 crosscut tunnel it is understood that further exploration-work is being proceeded with from this point. It is also reported that new cabins have been built at the mine and at a point near the railway siding.

In addition to the reports on the *Snowflake*, a special report prepared by B. T. O'Grady, Assistant Resident Engineer, on the Waverly-Tangier Mines, Limited, was included in the special bulletin issued. In this report was embodied the results of a detailed examination by Mr. O'Grady in 1921, a brief examination in October, 1928, and available information from reliable sources.

Woolsey. This property, comprising forty-two claims, extending from Clabon (the East fork of Silver) creek to Tangier (the North fork of the Illicillewaet) river, is generally referred to as the *Morton-Woolsey*, presumably on account of the interest held by the Morton-Woolsey Consolidated Mines, Limited. It is understood that the Bernier Metals Corporation, which operated the property from May, 1925, to December, 1927, was succeeded by the above company, which in turn gave an option to the Bush and McCulloch Syndicate in March of this year, since when this syndicate has been operating the property.

Under the agreement of the option, it is understood, the Bush and McCulloch Syndicate is to incorporate the Regal Silver Mines, Limited, capitalized at 5,000,000 shares of no par value. Upon registration of this latter company, 1,500,000 shares are to be given to the Morton-Woolsey Consolidated Mines, Limited, for its interest in the property.

The property, which is referred to in the 1927 Annual Report and other earlier reports, adjoins the *Snowflake* and covers the extension of the same vein system at a lower elevation. The property was not examined by the writer this year, but the following notes have been kindly supplied by R. F. Hill, consulting engineer for the syndicate:—

"From the low adit-level, known as No. 3, a crosscut has been driven to intersect the downward continuation of quartz veins exposed on the surface; of these, No. 5 vein has had the most work done on it. At 608 feet from the main tunnel a 4-foot quartz vein with heavy slate breccia was encountered, which carried a fair proportion of lead and zinc; this is probably the No. 3 vein. At 674 feet a 4-foot 6-inch quartz vein was cut; this carried a heavy iron content and may be the No. 4 vein; in view of future work this was opened up by a 15-foot drift. At 763

feet what is undoubtedly the No. 5 vein was reached, having all the characteristics of this vein where opened up on the No. 2 level. It showed heavy enrichment of galena on the hanging-wall side, with balance of quartz more heavily mineralized; the vein proved to be 16 feet wide, with a small finger of slate in the centre. A drift has been run into the hill or westerly on the hanging-wall side of this vein for a distance of 112 feet; at the 100-foot point a crosscut is being run to the hanging-wall. At 962 feet what is probably the No. 6 vein was encountered; this has proven to be 10 feet wide, having a heavy galena-streak in the centre. Total crosscutting, June 22nd to December 31st, 792 feet; total drifting, June 22nd to December 31st, 127 feet."

Woolsey Mines, Ltd.

The *Round Hill* and *Donald* claims, which are situated near Flat Creek Siding of the Canadian Pacific Railway, were acquired by the Woolsey Mines, Limited, of Victoria. The property was not examined by the writer, but is described as a promising prospect by engineers who have visited it. A small crew was employed during the season. The ore is silver-lead-zinc. There are said to be a series of quartz veins in which the ore probably occurs as lenticular shoots, but it is understood that insufficient work has been done to determine definitely the extent and true nature of the mineralization.

Wigwam.

This group is situated on Akolkolex creek at a distance of about 6 miles from the Revelstoke–Arrowhead Railway. Exploration-work which has been carried on for a number of years under the direction of W. T. Dumbleton was continued. Diamond-drilling is claimed to have proved the existence of a wide mineralized zone along a length of 5,000 feet. The objective of the work now being done is to locate in this zone ore-bodies of commercial importance, it being believed that there are good possibilities for developing a large tonnage of low-grade ore. A large sum has already been expended and further drilling is contemplated as soon as the snow leaves the surface, which fully demonstrates the faith that the parties interested have in the undertaking.

During the year the work consisted of diamond-drilling, surface-stripping, and a little underground work. It is understood that a considerable amount of underground work is projected, in order to further explore and develop the ground where favourable results were obtained with the diamond-drill. The ore so far encountered consists of a low-grade mixture of lead, zinc, and iron sulphides. For further reference *see* Annual Reports for 1921, 1923, and 1925.

Asbestos.

This group, situated near Sidmouth Station of the Revelstoke–Arrowhead Railway and owned by J. T. Lauthers, of Revelstoke, was again visited this year. A sufficient amount of open-cut work and pits has been accomplished to demonstrate that there is a large tonnage of asbestos-bearing serpentine which could be mined at small cost. The following tests were made in the Ore Dressing and Metallurgical Laboratories of the Department of Mines, Ottawa, on a 300-lb. sample forwarded by the Lardeau Mines Exploration Syndicate, Limited, of Vancouver:—

Purpose of Tests.—Tests were desired to determine the quantity and quality of the fibre and its suitability for the manufacture of asbestos boards and shingles.

Characteristics of the Rock.—The shipment consisted of greenstone, serpentine, a little calcite and foliated talc, and a large amount of asbestos fibre. The fibre is of different kinds, mostly soft white fibre, some soft brown fibre, and some hard, honey-coloured semi-fibre. There are graduations between these different fibres, but these three are the general ones. Some fibre sent with the shipment as special specimens was 6 inches long; the longest in the regular shipment was about 3 inches in length.

Experimental Tests.—A small piece of soft white fibre picked out of the shipment was heated to 1,000° C. in an electric furnace. On cooling it was found to have lost 35.8 per cent. of its weight, had become pink in colour, and very brittle, breaking very easily.

The shipment was crushed to 1-inch size in a small jaw-crusher and cut into quarters by passing through a Jones riffled sampler. One quarter, 75 lb., was screened on 2-mesh and the fibre picked out of the plus 2-mesh. The plus 2-mesh rock was crushed to pass through the 2-mesh screen and mixed with the —2-mesh material from the the first screening. The —2-mesh material was then screened on 4-mesh and the fibre removed from the +4-mesh by suction. The +4-mesh rock was crushed to pass through the 4-mesh screen and mixed with the —4-mesh from the second screening. The process was repeated at 8 and 12 mesh. The —12-mesh material was screened on 25-mesh and the fibre removed from the two sizes, —12-35 and —35 mesh, by tabling

Reeves-McDonald Mines, Ltd., Nelson M.D.

Reno Mine, Nelson M.D.

anticipated that work at these properties, which have been lying idle for many years, will be resumed in 1929.

True Fissure. This property, on which development has been carried on for a number of years, experienced an inactive season, presumably pending other arrangements being made for the resumption of operations. In past years G. F. Park, of Cincinnati, has been largely responsible for financing its development and last year built a road 2¾ miles in length to within half a mile of the low tunnel.

A shipment of 30 tons of sorted and sacked ore made to Trail during the early part of the year demonstrated that the costs of treatment and transportation, added to those of mining, haulage, etc., did not allow a satisfactory margin of profit at prevailing metal prices. This ore carried the following values, according to the smelter returns: Gold, 0.15 oz. to the ton; silver, 11.7 oz. to the ton; lead, 8.4 per cent.; zinc, 30.4 per cent. Such values are sufficient to show a good margin of profit if the ore were milled at or near the mine; hence the future of the property depends on the development of sufficient tonnage to warrant mill-construction and its equipment for more extensive operations than have been carried on in the past by hand-mining methods.

Since the property was examined and reported on last year the drift in the *Bluebell* low-level workings, which had been advanced for a total distance of 1,200 feet from the crosscut, showed the vein to be persistent and to be mineralized across a narrow width for about 200 feet. For the last 50 feet the vein-filling consisted of quartz, pyrite, and a little galena and zinc-blende, with a width of about 5 feet. A sample taken near the face across a width of 5 feet gave the following returns: Gold, 0.12 oz. to the ton; silver, 10.4 oz. to the ton; lead, 1.4 per cent.; zinc, 3.3 per cent.

A sample taken from the dump of quartz and pyrite, which represented the vein-filling for the last 50 feet of the drift, assayed: Gold, 0.06 oz. to the ton; silver, 6.7 oz. to the ton; lead, 0.7 per cent.; zinc, 1.9 per cent.

Other recent work consisted of advancing "C" tunnel for another 100 feet. This tunnel, which is driven in the hanging-wall side of the *True Fissure* vein, struck soft caving ground with a heavy flow of water and was abandoned. This was unfortunate as at the face the depth below the surface is about 300 feet and conditions appeared to warrant the continuation of this tunnel. The only practical way in which to avoid the heavy ground was to drive in the vein itself or in the foot-wall, but as both represented very hard ground, progress by hand-steel would be very slow and costly. In a short crosscut to the foot-wall, which had been driven near the end of the tunnel, the vein showed a brecciated structure to be fairly well mineralized with zinc-blende in a quartz gangue across a width of about 12 feet.

The lowest level had been advanced to a point under the *Bluebell* workings where apparently the downward continuation of the vein had been encountered in the face of the tunnel. For further reference *see* Annual Report for 1927.

White Quail. This is a group of four claims on Gainer creek at a distance by trail of about 3 miles from the end of the wagon-road on Lardeau creek. Elevation of camp and workings is 4,500 feet. The area is underlain by steeply tilted greenish schists and interbedded bands of limestone. Exploration-work, which at the time of examination was limited to a few trenches and open-cuts, indicated the presence of a mineralized zone conforming to the dip and strike of the formation, and while the importance of the exposures was still somewhat indefinite, it was apparent that further exploration was fully warranted. This zone, striking in a north-westerly direction, is probably correlated to that recognizable on the *Molly Mack*, more recently referred to as the *Lead Stack*, on the opposite side of Gainer creek. (*See* Annual Report for 1927.)

The mineralization where exposed was confined to the limestone, the ore making as replacement deposits along its contact with the schist. The surface of the hillside being covered by a considerable depth of overburden, supporting a healthy growth of timber, made surface prospecting slow and costly work, so after disclosing ore in several places it was decided to drive into the hill and then crosscut the ore-zone at a depth of from 50 to 100 feet below the surface. When visited this tunnel had been driven for about 50 feet and was in schist on the foot-wall side of the ore exposed on the surface. A sample taken across a width of 52 inches in an open-cut above this tunnel assayed: Gold, 0.01 oz. to the ton; silver, 1.4 oz. to the ton; lead, 14 per cent.; zinc, 1.1 per cent. A sample taken from the same place of the best-grade ore from a small pile which had been sorted assayed: Gold, 0.36 oz. to the ton; silver, 5.4 oz. to the ton;

lead, 36.7 per cent.; zinc, 1.6 per cent. A new cabin having accommodation for four or five men had been built. Four men were employed.

Spyglass. This property, consisting of a group of ten claims, was acquired by the Spyglass-McLeod Mining Company, Limited, with a capitalization of $500,000. The early history dates back to some twenty-five years ago and short references may be seen in the Annual Reports of 1903 and 1904. Since this time little, if any, work has been done on the property. The mine cabin is situated on Poplar creek at a distance of approximately 12 miles by trail from the railway at Poplar. The trail for the greater part of this distance traverses steep hillside country and crosses a number of snowslide tracks, which cannot be avoided. It has may adverse grades and is only suitable for a pack-trail.

The old mine-workings are situated at an elevation of 5,650 feet above sea-level (aneroid), or about 1,000 feet above the cabin. Development has been confined to a quartz vein which occurs in a band of slate-schist; the latter, having a width of about 200 feet, lies between two masses of intrusive granite. The vein conforms to the schistosity of the enclosing rock and has a strike of about N. 30° W. and a dip of between 50° and 60° to the south-west. The mineralization has apparently taken place where the quartz has been folded and fractured and is confined to a short length of the vein so far exposed. Near the surface very high values in silver have been obtained.

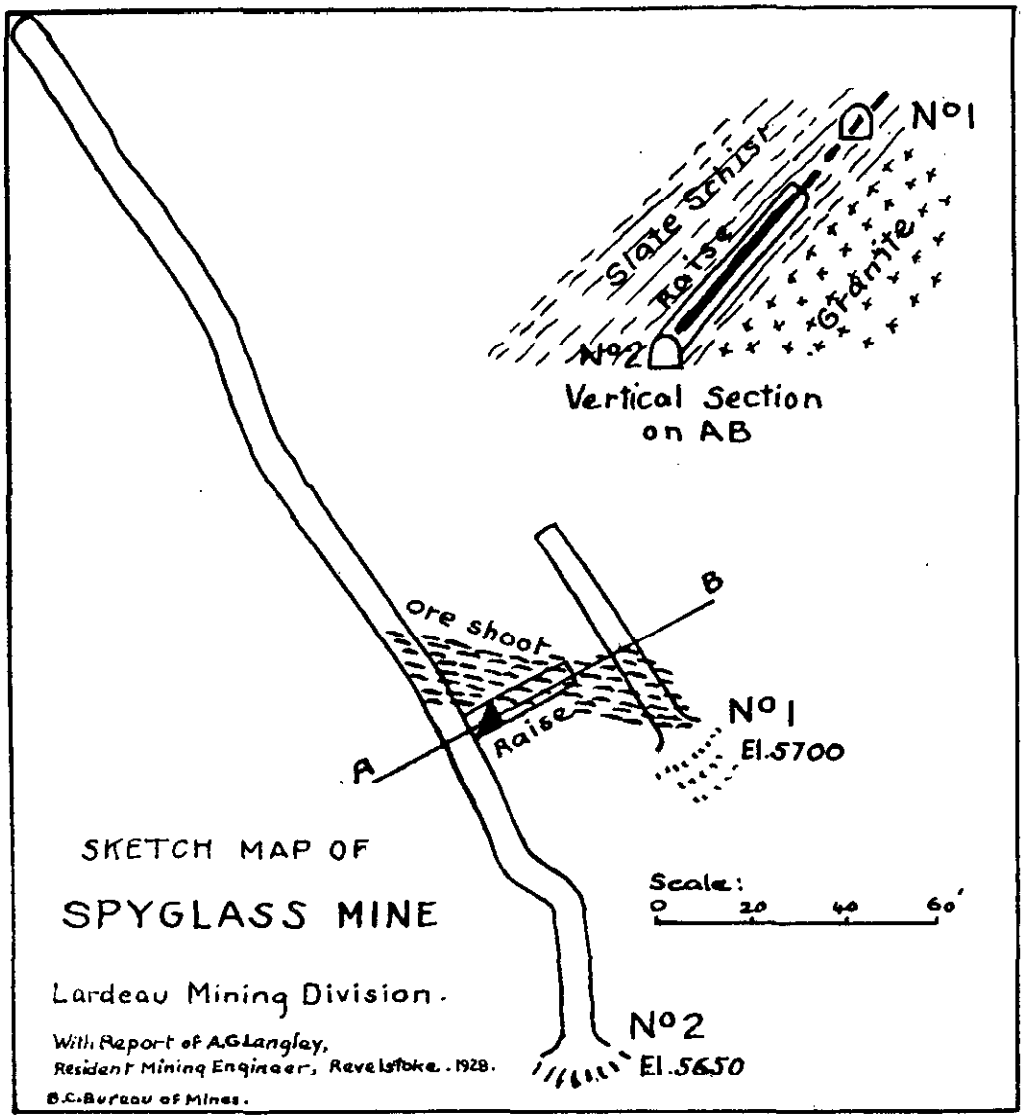
Two tunnels have been driven on this vein. The No. 1, at an elevation of 5,700 feet, has a length of about 50 feet. This no doubt was the first work undertaken to explore the attractive outcrop, which is still visible at a point near the portal. Here the vein shows a 2-foot width of quartz which is heavily mineralized on the foot-wall side with pyrite. At a short distance from the portal a lens of high-grade silver-lead ore is exposed, having a length of about 10 feet and a maximum width of 15 inches. A sample taken at this point gave the following returns: Gold, 0.03 oz. to the ton; silver 411.7 oz. to the ton; copper, 4.86 per cent.; lead, 13.6 per cent.; zinc, 6.7 per cent. As there are only a few feet of backs above this point there is no appreciable tonnage available.

A shallow winze had been sunk on the downward continuation of the ore, but this was full of water and could not be examined. Past this showing the vein does not carry commercial values. A sample taken across 14 inches at the face of the tunnel assayed: Gold, 0.02 oz. to the ton; silver, 1.9 oz. to the ton. In the high-grade ore the silver occurs as native and probably argentite, as well as being associated with grey copper.

The No. 2 level develops the vein at an additional vertical depth of approximately 50 feet. The total length of the tunnel is 244 feet. The downward continuation of the ore in this tunnel shows a width of about 18 inches along a length of 20 feet. A raise had been driven on the ore-shoot and was up about 40 feet. The quartz in the raise was mineralized in places with occasional narrow streaks and bunches of ore, which indicated that careful sorting would be necessary to obtain a shipping product. At a point near the top of the raise a small pocket of good-grade ore was exposed and a sample taken here gave the following returns: Gold, 0.04 oz. to the ton; silver, 220.9 oz. to the ton; copper, 3.68 per cent.; lead, 23.1 per cent.; zinc, 5.8 per cent. At a point in the drift 13 feet beyond the raise a sample taken across the vein gave the following returns: Gold, 0.02 oz. to the ton; silver, 172.1 oz. to the ton; copper, 1.43 per cent.; lead, 4.9 per cent. Beyond this point the vein has been followed by the tunnel, but shows little evidence of mineralization, except along a short length, where a little disseminated galena can be seen. As the ore-shoot has a tendency to strengthen with depth and as the values obtained are high, further prospecting of its downward continuation is warranted.

No work had been done at these workings during the year, the time being fully occupied in building a new cabin, making necessary trail improvements, and prospecting quartz-outcrops along the bank of the creek. Here occasional small blotches and dissemination of galena formed along fractures in the quartz offered possibilities for prospecting, which had been started and consisted of driving a short length of tunnel and stripping the surface. Not enough work had been done to allow a conclusion being drawn as to the importance of these showings, but indications appeared to warrant further prospecting.

A sample taken from a small quantity of ore that had been collected in the course of the work assayed as follows: Gold, 0.02 oz. to the ton; silver, 79.8 oz. to the ton; lead, 13.9 per cent.; zinc, 1 per cent. In the writer's opinion, there is no connection between this showing at the creek and the vein upon which the work has been done up the hill.



Marquis and Gilbert.

This property, comprising a group of seven claims and a fraction, according to the company prospectus, has been acquired under option by the Keene Mountain Gold and Silver Mines, Limited, of which J. Gallo is managing director. The property is situated at an elevation of about 600 feet above the valley of the Lardeau river at a distance by trail of about 1½ miles from the railway at Poplar. Its history dates back to the time when public attention was attracted to the Poplar camp by reports of high gold values being discovered in numberous quartz veins. In 1903 the geology of the area, character of the deposits, and descriptions of this and other properties was summarized by W. Fleet Robertson, Provincial Mineralogist, in the Annual Report for that year.

Numerous open-cuts, trenches, and some tunnelling bear evidence that this property was subjected to fairly intensive prospecting in the early days. After a long period of inactivity, operations were resumed in 1928 by J. Gallo, who excavated a deep open-cut in the ridge which marks the mineralized zone. This exposed in section a schist formation, which along lines of sheared fractures had become disintegrated and heavily stained with iron oxide.

In these fractures good gold values are associated with lenses and streaks of arsenopyrite and with soft oxidized material, across narrow widths. From this open-cut the following

samples were taken:—Across a width of 8 feet of oxidized material containing a little arsenopyrite: Gold, 0.08 oz. to the ton; silver, 0.6 oz. to the ton. Across 1 foot of oxidized material: Gold, 0.11 oz. to the ton; silver, 0.4 oz. to the ton. A grab sample from twenty sacks of ore sorted for shipment: Gold, 6.61 oz. to the ton; silver, 2.1 oz. to the ton. A grab sample from the top of a 5-ton pile of sorted ore containing arsenopyrite: Gold, 7.34 oz. to the ton; silver, 1 oz. to the ton.

With careful mining and sorting it is possible that a considerable tonnage of good-grade ore might be won, while further work may reveal larger and less pockety occurrences than have so far been encountered. At the end of 1928 a shipment of about 11 tons gave the following values: Gold, 1.343 oz. to the ton; silver, 0.5 oz. to the ton.

The *Fidelity* near Gerrard was also acquired by the Keene Mountain Gold and Silver Mines, Limited. Further work is reported to have been done under contract by Dave Morgan on the *Mohican* on Gainer creek.

LARDEAU MINING DIVISION.

The failure of those interested in the *Teddy Glacier* to undertake the extensive development as planned in 1927 was a disappointment to those interested in this section of the district, and it is hoped that satisfactory financial arrangements will soon be made to thoroughly test the attractive surface exposures on this property. It is reported that the glacial ice has receded still farther to expose more ore. Reference may be seen in the Annual Report for 1927.

The Lardeau Mines Exploration, Limited, carried on prospecting activities on a number of claims in which it is interested, notably the *Alma* on Pool creek and the *Paymaster* on Lexington creek. The former property is described in the 1927 Annual Report.

George Goldsmith did more work at the *Scout*, and John Leask, of Cranbrook, had a couple of men employed at the *Big Showing*. It is also understood that D. McIntosh had a small crew employed at the *Lead Star*. All of these properties are described in previous Annual Reports. At the *Eclipse*, on Pool creek, the Consolidated Mining and Smelting Company had a few men employed at diamond-drilling and underground work. There was little activity at the *Multiplex* on Pool creek, and beyond a survey being made of the claims and a possible location for an aerial tramway there is nothing new to report.

LIST OF SHIPPING-MINES, SHOWING TONNAGE PRODUCED, 1928.

REVELSTOKE, LARDEAU, AND TROUT LAKE MINING DIVISIONS.

Mine.	Locality.	Tons.	Character of Ore.
Snowflake (Revelstoke)	Albert Canyon	44	Silver, lead, zinc.
Marquis and Gilbert (Lardeau)	Poplar	11	Gold, silver.
True Fissure (Trout Lake)	Ferguson	54	Silver, zinc, lead.

NELSON MINING DIVISION.*

The marked increase in mining activities initiated in 1927 has been continued during the present year. Production has been restricted, but results of the large amount of development done, notably at the *Yankee Girl* near Ymir and the *Reeves-McDonald* on the Pend d'Oreille river, are expected to place this Division on an important producing basis within the next few years. Numerous other developments and minor activities are hereinafter described in the body of this report. The power-lines being extended to the mining districts by the West Kootenay Power and Light Company should greatly stimulate mining enterprises. In this connection the *Yankee Girl* is now operating on electric energy supplied by the West Kootenay Power and Light Company over a 31½-mile 20,000-volt transmission-line, which follows the valley of Cottonwood creek and the Salmo river south of Nelson to Ymir, and thence up the valley of Wildhorse creek. Authority given the same company to investigate power-sites on the Pend d'Oreille river with the objective of installing an 80,000-horse-power hydro-electric plant opens up the prospect of low-cost energy for the *Reeves-McDonald*, *Red Bird*, and other properties in that vicinity.

The Geological Survey of Canada had two parties in the field, the geological survey party under J. F. Walker and the topographical party under S. M. Steeves. A new series of geological

maps is contemplated, based on geographical boundaries, and a start has been made in this Division on a 15′ by 15′ sheet between 117° and 117° 15′ longitude and between 49° and 49° 15′ latitude. The scale will be 1 mile to 1 inch and contour interval 100 feet. This sheet embraces the area from the International boundary north to near Porcupine creek. The geological work done this season consisted of detail work about some of the properties in and adjacent to the area being mapped as the areal geology will necessarily be postponed until part of the new topographic map is available. Valuable assistance was rendered by J. F. Walker to small operators and prospectors. Other work done in the Division by this Geological Survey party consisted in mapping the geology of the east side of Kootenay lake south of Crawford creek with a view to correlating the geology of the East and West Kootenay. Detailed information concerning the various activities, large and small, are contained in the body of this report under the following sub-headings: Ymir District; Sheep Creek Camp and South of Salmo; Erie Creek (North Fork of the Salmo River); Pend d'Oreille River section; Nelson section; Kootenay Lake and Creston.

Nelson Section.

Silver Reef.* This property, described in the Annual Report for 1927, is situated in the angle between the forks of Anderson creek just east of the Fairview district of the city of Nelson. The property is owned by W. Richards, W. Symons, and R. Barron. A small amount of development was done during the last two years by the Silver Leaf Mines, Limited, which is the name of the company promoted by H. E. Morgan to acquire and operate the *Silver Reef* under lease and bond. Owing to pressure of other work the property was not visited during the year under review. A small crew has been employed part of the year. About 100 feet of drifting and crosscutting has been done on the *Silver Reef* vein and a little tunnelling on the *Rover* vein. Some samples were recently brought into Nelson which gave assays of from $26 to $30 in gold to the ton, but it is not known what widths were represented. Gold values in this vein and the *Rover* vein have hitherto been very low, the principal values having been in silver, lead, and zinc.

California.* Immediately south of Nelson, the *California* gold property has been taken under lease and bond by R. S. Whaley, of Vancouver, who is responsible for the incorporation of the Condor Gold Mines, Limited (N.P.L.), which is the company formed to develop the property. A small payment is reported to have been made, but no development-work has materialized up to the time of writing.

Queen Victoria Consolidated Mines, Ltd.* In September it was announced in the local press that the Queen Victoria Consolidated Mines, Limited, had been formed in connection with a re-grouping of copper holdings, controlled by C. M. Mohr, at Beasley, on the Kootenay river west of Nelson. The new company was stated to have been organized in Montreal by the firm of Isbell, Logan & Company. A free miner's certificate was taken out at Nelson in May, but up to the time of writing no activity has materialized. According to the Mining Recorder's books at Nelson, the following twenty-two mineral claims near Beasley are recorded in the name of the Queen Victoria Consolidated Mines, Limited: *Elk No. 2, No. 3, No. 4, No. 5, No. 6; Monarch No. 2, No. 3, No. 4, No. 5, No. 6, No. 7; Queen No. 2, No. 3, No. 3 Fraction, No. 4, No. 5, No. 6; Sunset No. 1, No. 2; Ottawa; Montreal; D. and M.* In addition, there are two Crown-granted mineral claims: *Monarch*, Lot 2082; *Elk*, Lot 2081. These two Crown-granted claims were registered in the name of the Sterling Trusts Corporation of Toronto (for whom C. M. Mohr acted as agent) until allowed to go to tax sale on November 8th, 1927, when they were purchased by M. C. Monaghan. When the twelve-month redemption period expired recently the claims were acquired by the Queen Victoria Consolidated Mines, Limited, in whose name they are now registered.

Practically all the workings on the old *Monarch* group are on these two Crown-granted claims, which have been the nucleus of several successive promotions in which C. M. Mohr has taken a leading part. Among these promotions are the Spokane Mining and Development Corporation, of Nelson, operating the property in 1917; the Falls Creek Mining Company, operating the same holdings in 1919; and the present new company. The ownership from 1917 until the claims went to tax sale seems to have been vested in the Sterling Trusts Corporation, of Toronto. In mechanics' liens filed in 1924 and 1925 against the *Monarch* and *Elk* Crown-granted claims the defendants specified were the Spokane Mining and Development Corporation, Sterling Trusts

Corporation, Middle States Holding Company, and some of the officers of the several companies mentioned.

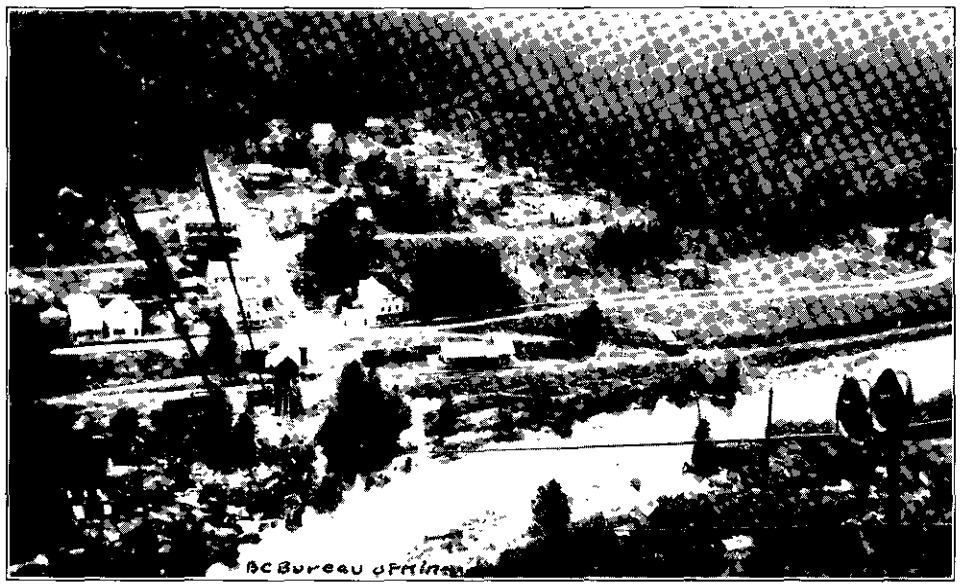
Throughout the period during which the above companies were connected with the *Monarch* property only a very small amount of development was done at long intervals. The *Monarch* is described by A. G. Langley in the Annual Reports for 1917 and 1922. The latest regrouping, in addition to the *Monarch*, includes the *Queen Victoria* Crown-granted claim, Lot 368, which was transferred early in the year to the Queen Victoria Consolidated Mines, Limited, by Mrs. Lucia Leaf, who acquired the claim at a tax sale. Information concerning the *Queen Victoria* is contained in the Summary Report of the Geological Survey for 1911, page 154. Up to the time this 1911 Report was published the production amounted to 6,189 tons of copper-silver-gold ore of a total gross value of $49,771. In 1914, 7,920 tons is reported to have been shipped to the Greenwood smelter of the British Columbia Copper Company, Limited, then operating the *Queen Victoria*. During the same year this company discontinued work at the property and removed the compressor and other equipment. Subsequently and in the same year 775 tons was shipped by leasers, supposedly from old dumps which were resorted. In 1916, F. Philips and J. Williams leased the property and shipped about 1,500 tons of low-grade copper ore, principally derived from cleaning up the old workings. Profitable production by the leasers was made possible by the prevailing high price of copper. Since then there have only been occasional small leasing activities.

Catherine.* This Crown-granted claim, at an elevation of 4,200 feet, is situated on the eastern side of Cottonwood creek, about half a mile northerly from the *Perrier*, and is connected by trail with the Great Northern Railway and the Nelson–Spokane highway. The claim is owned by Mike Egan, who has leased it to N. Bystrom. When the property was visited in June some stripping had been done by Bystrom and associates on a vein, 4 to 6 feet wide, cutting the granite in a south-easterly direction and dipping from 30° to 35° to the north-east, or into the hill. The vein, which is strong and well defined, had been stripped for a length of from 90 to 100 feet. The gangue-filling is quartz and the ore-minerals are pyrite and galena, with free gold. In places the vein is considerably leached and decomposed with a red, rusty appearance from the amount of iron oxide present. The vein has apparently been formed largely by replacement. Horses of granite separate the pay-streaks, which are up to 12 inches wide, and bands of granite occur in all stages of alteration and replacement. Stringers of ore separate and come together in the vein in irregular fashion. The following samples were taken, which represent a section of the showing where it was 3½ feet wide:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
18 inches of unoxidized quartz containing galena, on hanging-wall side	0.14	1.2	1.2	0.4
12 inches of red oxidized material and galena, next to the last sample	2.52	20.1	37.3	0.7
6-inch oxidized pay-streak on foot-wall, separated from last sample by a 6-inch granite-parting	0.97	1.4	1.4	0.5

The high gold content of the samples of decomposed ore can probably be attributed to local concentration of the metal from oxidizing agencies, but the gold content of the hanging-wall sample, which was unoxidized quartz very sparingly mineralized with sulphides, suggests that good milling values will persist in the vein below the zone of oxidation, which will probably not be very deep. Two shipments were made by the lessees, which are as follows: 23 tons shipped in July assayed: Gold, 2.58 oz. to the ton; silver, 5.3 oz. to the ton; lead, 5.3 per cent.; zinc, 0.5 per cent.; and 23 tons shipped in September assayed: Gold, 1.63 oz. to the ton; silver, 3 oz. to the ton; lead, 3.2 per cent.; zinc, 0.8 per cent.

Granite-Poorman.* The Granite-Poorman Gold Mines, Limited, with a capitalization of 3,000,000 shares of no par value, has been incorporated to take over and operate the old *Granite-Poorman* property west of Nelson. The company is to acquire title to the property in return for 1,500,000 shares of stock and it is proposed



Ymir Town, Nelson M.D.

Yankee Girl Mine—New Camp, Nelson M.D.

Reeves-McDonald Mines, Ltd., Nelson M.D.

Reno Mine, Nelson M.D.

to issue 500,000 shares of stock to the public at 30 cents a share. The *Granite-Poorman*, referred to at length in the Report of the Geological Survey of Canada for 1911 and the Annual Report for 1915, has been inactive for some years.

The property has had a somewhat chequered career, having passed through many hands and been repeatedly worked by leasers. Past production, which is estimated at over $1,000,000, was mostly made prior to 1912. Up to this time about 83,175 tons of ore was produced, the gold content of which was recovered in the proportion of 80 per cent. on the plates and 10 per cent. in the concentrates. The milling-ore ranged in gold values (recovered) from $6.50 to $12 a ton, with a very low silver content. Concentrates averaged about 1½ oz. of gold to the ton and 1½ per cent. of copper. Total values recovered are reported to have been about 63 per cent. of the mill heads. The stoping width averaged about 2½ feet, the length of the ore-shoots, which were continuous from the surface, being from a few hundred up to 1,000 feet.

The new company proposes to drive a 4,000-foot tunnel to develop the veins at greater depth. Conflicting reports have been received in regard to the ore remaining in the lower workings, now flooded, of the *Hardscrabble* and *Poorman* veins, but it is hardly reasonable to expect that any considerable tonnage of quartz which could be profitably extracted was left in these workings or in workings on the other veins. It is hoped that deeper development may be successful in proving further ore-shoots.

The property is equipped with an old 20-stamp, 100-ton mill, the present value of which is problematical. New machinery would be required to modernize the mill, also extensive repairs and a new foundation would be necessary if the old mill building is to be utilized further. The compressor equipment, of large capacity, is in good shape. The question of mill equipment, however, can well be left until sufficient ore is developed to justify such expenditures. Up to the time of writing no activity has developed in connection with the new venture and the only work done this year was the facing-up of the rock at the site of the proposed long tunnel situated on the mill level.

Royal Canadian and Nevada.*

Situated on the upper Granite road, about 7 miles west of Nelson, this property has been acquired by the Kootenay Premier Mines, Limited, organized by A. G. Norcross and associates, of Nelson. The property comprises the following Crown-granted claims: *Royal Canadian, Nevada, Nevada Fraction, Muldoon, Roy No. 2, Mocken Bird Fraction, Colorado, Colorado Fraction, Maple Leaf, Minnie;* and the un-Crown-granted *Kathleen Fraction.* There are several veins on the property, the principal ones being the *Royal Canadian* and *Nevada* veins. The recorded history of the property dates back to the period between 1898 and 1901, when the property was slightly developed by the Duncan United Mines, Limited, an English company which acquired a number of other properties in the district. Subsequently this company went into liquidation and the late J. P. Swedberg is reported to have acquired the *Nevada* portion of the property, on which he did a small amount of development with successful results. Both properties remained idle for a considerable time until bonded by A. G. Norcross in 1925. A little work was done on the *Nevada* by him in 1926 and 1927 prior to organizing the present company.

During the present year a small amount of preliminary work was done on the *Royal Canadian* vein by the Kootenay Premier Mines, Limited, with a view to resumption of operations in the near future. The old workings on the *Royal Canadian* vein consist of three short drift-tunnels giving a vertical depth of about 150 feet. The examination on which these notes are based was confined to the upper two tunnels, as the lowest tunnel was not accessible owing to caving near the portal, which condition, however, has since been remedied.

This vein, with an average width of about 20 inches, occurs in a grey granodiorite formation, which it cuts in a southerly direction, with dip from 60° to 70° to the north-east. The ore consists of pyrite, chalcopyrite, and bornite, with occasional free gold in a quartz gangue, the values being in gold (which predominates), silver, and copper. The elevation of the three tunnels is, respectively, 2,475, 2,400, and 2,325 feet above sea-level. Raises connect the three tunnels, from which three winzes have been sunk, one on each level. A small amount of stoping has been done above and below the levels.

The upper (or No. 1) tunnel is a drift along the vein for a distance of about 137 feet to where the vein is displaced by a fault striking north-easterly at an acute angle to it. Throughout the part of the tunnel described the vein is well defined and contains milling-ore. The slope of the hillside above the vein developed in this tunnel is about 26°. Beyond the fault the

tunnel follows what appears to be the same vein, which, however, is not so well defined, for a distance of 145 feet to the end of this working. The No. 2 tunnel strikes the vein 37 feet in from the portal, from where it is followed for some 234 feet to the same fault as in the upper tunnel. Beyond the fault on No. 2 level the tunnel continues on a vein similar to the corresponding vein in the upper tunnel beyond the fault, but better defined and containing higher values.

The No. 3 tunnel is reported to have encountered a flat-lying wide lamprophyre dyke which occupies the greater part of this level, although a winze and two raises develop the vein below and above the dyke, which is gradually being left in the roof towards the inner face of the tunnel. Good values are reported to have been obtained in the vein above and below the dyke. Values of past production, made from the very limited amount of shallow workings on this vein, are reported to have amounted to about $36,000. The greater part of the ore extracted in former years was put through the *Granite-Poorman* mill during the time that the Duncan United Mines, Limited, was simultaneously operating the *Royal Canadian* and the *Granite-Poorman*. The *Nevada* vein, at an elevation of 3,000 feet approximately, lies to the south of the *Royal Canadian* workings and higher up the hill. This vein follows a fractured contact-zone between the grey granodiorite and a "blue" granite composed of a coarse-grained quartz hornblende diorite which in the adjoining *Granite-Poorman* property was the country-rock to the best ore-shoots. A crosscut tunnel intersects the *Nevada* vein 70 feet from the portal, and from that point short drifts extend both ways along the vein, which, varying in width from 8 inches to 3 feet, strikes N. 78° E. and dips steeply to the south, or into the hill. The strike of the *Nevada* vein is therefore nearly at right angles to the strike of the *Royal Canadian* vein and drift-tunnels extended along the latter vein will crosscut the *Nevada* vein at vertical depths of several hundred feet, with the advantage that ore-shoots may be encountered on the way. In the east drift on the *Nevada* vein a winze is reported to have been sunk 65 feet on the vein which contained a 12-inch pay-streak of high-grade ore. On the surface a short distance beyond the eastern end of this drift there are two shafts, 55 feet apart, sunk about 70 and 27 feet on the vein respectively; 100 tons extracted from a stope in the east drift and milled at the *Granite-Poorman* mill is said to have averaged between $35 and $40 to the ton. The vein is continuous throughout the west drift, which is about 60 feet long, and in this working good assays are obtainable. The extension of the *Royal Canadian* vein would intersect the *Nevada* vein at a point about 300 feet easterly from the last-mentioned group of workings on the *Nevada*, described above. In conclusion, it may be said that the limited workings on the *Royal Canadian* and *Nevada* show that the veins are persistent in a horizontal sense and are likely to be so vertically. The work is not advanced sufficiently to determine the extent of the ore-shoots. The *Nevada* vein contains the highest values and the small amount of work done on it has given very encouraging results. Cheap electric power is available and a connection is now under construction from the Nelson City power-line in the vicinity. The property is favourably situated for economic operation.

At the end of 1928 negotiations with English interests were completed for the introduction of adequate working capital for developing and equipping the mine.

Good Hope.* J. B. Baxter, Jr., put in a season prospecting this group of claims on Bird creek, about 10 miles by road in a south-westerly direction from Nelson. The workings on the *Good Hope*, at about 3,100 feet elevation, are near the creek, which runs through the claim, and the *Little Bobbie*, *Ruth-Ida*, and *Lucky Jack* are staked easterly up the hill. The formation of the area is composed of rocks of the Rossland Volcanic group.

On the *Good Hope* the work done includes a large amount of ground-sluicing and open-cutting, several tunnels aggregating about 400 feet of work, and a shallow incline shaft. These workings develop easterly-striking fissures in quartz-mica and chlorite schists. The fissures, which apparently coincide with the schists in strike and dip, contain bands and lenses of quartz interbanded with pyritic and siliceous schist, the width of individual quartz and schist aggregates being up to 3 feet. Pyrite, and chalcopyrite to lesser extent, were the only ore-minerals noted in the quartz, but free gold occurs in pockets of rusty decomposed material. A sample of this latter material, representing a width of from 2 to 10 inches, taken from the "foot-wall lead" in the No. 3 or lowest tunnel, assayed: Gold, 1.80 oz. to the ton; silver, 2.62 oz. to the ton; copper, 1 per cent. Westerly from these workings, the *King George V.* and *Acme* claims, owned by the

late J. Smallwood, are apparently located on the extensions of the same veins. In the showings developed in superficial workings on these claims, however, there is little oxidation in evidence and no appreciable values were obtained from samples of quartz.

On the *Ruth-Ida*, at about 4,000 feet elevation, there is an old vertical shaft, said to be 62 feet deep and to contain a short crosscut at the bottom of it, and some open-cuts, which develop a northerly-striking quartz vein which contains some irregular mineralization with iron and copper sulphides.

Other claims visited in the area tributary to the old Bird Creek road include the *Emerald*. On this claim, at an elevation of about 5,000 feet, there are some short tunnels. These workings, which were inaccessible from caving, and some open-cuts, develop a lead possibly 4 or 5 feet wide, apparently conforming to the planes of foliation of the enclosing schists, which strike easterly and westerly. The mineralization, as seen on the dump of one of the caved tunnels, consists of iron and copper sulphides, and copper carbonates, in a gangue composed of quartz and altered country-rock. Selected ore from a small pile assayed: Gold, 0.06 oz. to the ton; silver, 1.98 oz. to the ton; copper, 9.15 per cent. Some other old claims in the vicinity were visited by the writer, accompanied by Baxter, but nothing of interest was seen on them owing possibly to the neglected condition of the old superficial workings.

Northern Light.*

Owned by T. P. Moran and the late Ralph Young, the *Northern Light* is situated near a small creek tributary to Forty-nine creek from the south and is reached by a trail, about 1½ miles in length, from the Forty-nine Creek road a little below the *Gold Hill*. The group includes the *Northern Light*, *Copper Scroll*, and *Copper Bell* claims.

The old workings examined consist of a crosscut tunnel at an elevation of 5,250 feet above sea-level and some open-cuts and a shallow shaft at about 5,000 feet elevation. The upper group of superficial workings develop a quartz vein, from 2 to 4 feet wide, in schists of the Rossland Volcanic series. The vein is mineralized in places with iron-oxide and copper-carbonate stains. The work done has been insufficient to indicate a definite ore-shoot. Selected ore from the shaft dump assayed: Gold, 0.89 oz. to the ton; silver, 1 oz. to the ton; copper, 0.16 per cent. The crosscut tunnel, driven about 120 feet, has not reached the vein, which should be traced down the hill to find its relative position to the tunnel before the latter working is continued. A small amount of work of a preliminary nature was done by the owners with a view to further development during the coming year.

Gold Coin and Gold Bond.*

A small amount of work is reported to have been done by G. Birtsch on a group which includes the *Gold Coin* and *Gold Bond* claims, situated near the head of Whitewater creek, which is a tributary of Rover creek. The property, which has not yet been visited by the writer, is reached by trail about 7 or 8 miles in length from the end of the Rover Creek road south-west of Nelson. The ore is reported to carry good values in gold and silver, associated with galena, zinc-blende, and pyrite, in a quartz gangue. The veins are said to occur in granite near the contact with rocks of the Rossland Volcanic series. The property is reported to have been bonded recently and some activity is expected to develop during the coming season. In connection with this deal the interested parties have acquired the adjoining *Stillwater* and *Stillwater Fraction* Crown-granted claims.

Placer.

Forty-nine Creek Placers, Ltd.*

This is the name of a recently incorporated company which has been organized to develop placer leases, owned by H. W. Robertson and M. C. Monaghan, on Forty-nine creek west of Nelson. In 1915, when some preliminary work was done, the ground was under bond to F. Keffer and H. Johns, mining engineers, of Spokane. They drove a tunnel, about 226 feet in length, into an old channel. Progress was greatly hampered by the presence of fine glacial mud, which necessitated the use of face-boards and great care in lagging. Subsequently H. Johns died and work was suspended. During the years intervening between then and the recent resumption of work, infiltration of fine glacial mud gradually filled up the inner part of the tunnel, which, fortunately, was very substantially timbered throughout.

Placer-mining has not heretofore been very important in the Nelson Division. Forty-nine and Wildhorse creeks were among the principal streams worked in the old days when placer gold first drew the attention of prospectors to the district, Forty-nine creek in particular having

yielded fairly good "pay" in places where the bed-rock was found to be shallow. In the case of the present venture interesting speculative possibilities of making a clean-up are presented by this old channel, the existence of which is well established. This filled-in portion of the old original channel is probably about 1,700 feet in length and parallels a more recent channel, carrying the present creek, which has been thoroughly worked in past years.

The present operators have very carefully and painstakingly recovered the inner portion of the tunnel, where great caution had to be exercised to prevent a run of the fine mud, and have advanced the face of the tunnel a short distance. The character of the material is changing and wash-gravel and boulders are gradually replacing the slide material. Good progress should now be made and when bed-rock is reached the width and richness of the channel will be thoroughly explored. The property is very conveniently situated, the tunnel being only a very short distance from the motor-road which leads to the Nelson City power plant. If a block of ground is proved up for hydraulicking there is plenty of water available and the grade of the creek ensures ample dumping-room. F. Phillips, an experienced mine foreman and operator, is in charge of the work.

Golden Age.* This property is situated on the western side of the Salmo river on the Nelson–Spokane highway and the Great Northern Railway. It is owned by the Golden Age Mining Company, Limited, capitalized at $500,000, in which E. and S. Terzian, the original locators, are understood to hold a controlling interest. The last reference to the property is contained in the Annual Report for 1922, since when an appreciable amount of work has been done at intervals, including some tunnelling in 1928. A small stamp-mill, built some years ago, is located across the road from the portal of the lower tunnel. It has been but little used as no appreciable quantity of ore was available at the time it was erected and none has since been developed. Between the railway and the road there is a good camp, consisting of a boarding-house, manager's residence, and three smaller buildings used for men's sleeping-quarters.

Since operations were started last year at the *Euphrates*, across the valley, the mill has occasionally been operated for very short periods on small lots of ore from that property. The compressor installed by the Golden Age Mining Company in 1927 is located directly below the property of the Euphrates Mining Company, which was also promoted by the Terzian Bros., and was used for driving the tunnel on the *Ell-Tee* claim of the *Euphrates* group. The compressor is operated by a water-power supply-line under a head of 300 feet, the water being utilized through a 5-foot Impulse wheel designed and built by the Nelson Iron Works. The flume-line was not built, as at first proposed, to Clearwater creek, which is a strong stream about 7,000 feet away, but derives its water from an unimportant creek reached by a comparatively short length of flume. In July this source of supply was found to be inadequate and the compressor has since been idle.

The geology of the area in which the *Golden Age* is situated has not yet been mapped, but the rocks can with some certainty be correlated with the Rossland Volcanic group, which is shown on the map of the Ymir Mining Camp (Geological Survey, Memoir 94) to occupy large areas a few miles south of the property. These rocks are considered to be of Triassic age. Though no intrusive igneous rocks are exposed in the vicinity, large areas of granitic rocks related to the Nelson batholith of Jurassic age are shown on the Ymir and Nelson map-areas, and it is quite probable that rocks of this character underlie the *Golden Age* deposits and that in them originated the solutions which are responsible for the mineralization. Surrounding the *Golden Age* workings the country is occupied by a series of chlorite-schists in which can be recognized metamorphosed andesite, banded tuffs, and coarse augite porphyrite which was probably injected as sills between the tuffs and flows. The whole series is intensely schistose, the foliation striking N. 40° W. and dipping 60° to 80° to the south-west.

The *Golden Age* workings, consisting of two tunnels and a number of open-cuts, develop a series of small lenses and stringers of quartz scattered along a narrow shear-zone which coincides with the foliation of the enclosing schists. The shear-zone has been traced by stripping and tunnelling from a point near the mill for several hundred feet up the western side of the valley. The quartz-lenses are small and scattered, the largest one being exposed in an open-cut below the road and being about 13 inches wide. The lower tunnel, at an elevation of about 2,800 feet above sea-level and on a level with the road, has been driven about 500 feet (estimated) along the shear-zone. A few very small stringers of quartz were seen in a small stope 350 feet

in from the portal, from which a few tons of rock were extracted and milled. At about 400 feet in from the portal a short crosscut has been driven to the south-west, but nothing of interest could be seen in it.

The upper tunnel, about 100 feet above the road, is approximately 130 feet long. In this tunnel the vein is continuous for a considerable distance, but is less than 8 inches wide on an average. Judging from the small amounts of quartz and pyrite present in the deposit and from the fact that the material which was put through the mill yielded no appreciable amount of gold, it seems evident that the gold content of the deposit is below the limit of economic extraction. From an inspection of the *Golden Age* and *Euphrates* properties it would seem that the deposits coinciding with the foliation of the enclosing schists are lensy and that the veins cutting the schistosity offer more promise of continuity and contain higher values.

Euphrates.* This property, which was staked by the Terzian Bros. some years ago, is situated on the north-east side of the Salmo river, nearly opposite the *Golden Age* mine camp. Both properties are under the same management and the camp facilities are used jointly. Descriptions of the surface showings are contained in the Annual Reports for 1926 and 1927. Owing to pressure of work the property was not visited during 1928. The Euphrates Mining Company, Limited, capitalized for 4,000,000 shares of the par value of $1, has been incorporated.

The principal work is reported to have been done during 1928 on the *Ell-Tee*, where a tunnel was driven about 175 feet on a vein, 4 to 12 inches wide, which contains shoots of high-grade gold ore. This vein, the surface showings of which were described in the Annual Report for 1927, is a well-defined quartz-filled fracture coinciding in strike with the enclosing schists of the Rossland Volcanic series, but dipping steeply to the north-east, cutting across the schistosity of the rocks. There are, in addition, a number of widely separated showings of milling-grade ore, up to 5 feet wide, exposed in open-cuts on other parts of the property, which comprises sixteen claims. The *Euphrates* is therefore a promising prospect in a very early stage of development. The veins can be developed to considerable depth by tunnelling, transportation conditions are of the best, and cheap power is available.

Bluebird.* This property, consisting of the *Bluebird*, *Crown Point*, *Apex*, *Tamarac*, and *Endora* claims, owned by E. and S. Terzian, is situated on the summit of the mountain ridge north-east of Apex Siding on the Great Northern Railway south of Nelson. To get to the workings, which are at an elevation of about 5,750 feet above sea-level, a steep logging-road is followed for a short distance from the Nelson–Spokane highway, and from there on it is necessary to climb the steep side-hill, there being no trail. On top of the ridge some shallow stripping has been done along the outcrop of a quartz vein in granite. The strike of the vein, which averages about 10 inches in width, is N. 40° W. and its apparent dip is 53° to the north-east. The shallow cuts trace the vein for possibly about 200 yards. The mineralization consists of occasional disseminations of pyrite and galena is a gangue of rusty quartz. The following samples were taken at the most likely looking places:—

Width.	Gold. Oz. to Ton.	Silver. Oz. to Ton.
12 inches	0.08	0.4
9 inches	0.47	1.4
9 inches	0.09	0.2
8 inches	0.91	0.9
12 inches	0.03	1.5

The results of the sampling indicate that in the present workings the vein is too narrow and the values in it are not sufficiently high to permit of profitable working. The overburden is light, however, and at other points along the outcrop more favourable conditions may be found.

Perrier.* Work was recently resumed at the *Perrier* after a number of years during which the property has been idle through lack of capital. The property is very conveniently located, being on the Great Northern Railway, 4 miles south of Nelson, and connected by a short piece of road with the Nelson–Spokane highway. A comprehensive description of the property is contained in the Annual Report for 1920 and other references will be found in the Annual Report for 1915 and in the Geological Survey Report for 1911. Work is now being done by the Perrier Development Syndicate, financed by eastern

interests. The local personnel of the syndicate includes R. W. Hinton, C. E. Crossley, and A. W. Crossley, of Nelson. New construction at the collar of the shaft includes bunk-house, blacksmith-shop, and a gallows-frame with ore bins and chute. New hoisting and compressor equipment were recently installed preparatory to sinking the shaft to greater depth and further development of the promising ore-body referred to in the above-mentioned Government reports.

Kootenay Lake.

Merry Hope.* A small amount of work is reported to have been done on the *Merry Hope* on Procter creek, about 7 miles from Kootenay lake. The group consists of the *Merry Hope, Ethelbert, Lottie B.*, and *T. and A.* claims, owned by A. E. Jerome, T. H. Lane, and J. Bicker. The property was not visited owing to pressure of work in other parts of the district. The deposits are reported to consist of stringers of fairly clean galena in quartz veins. An assay of ore from the *Merry Hope* claim made for the owners gave: Silver, 48.1 oz. to the ton; lead, 70.3 per cent.; and a sample from the *Lottie B.* claim assayed: Silver, 12.8 oz. to the ton; lead, 36.1 per cent. It is not known what amounts of ore these samples represented. The property was reported to have been taken under option by the American-Canadian Engineering Company, of Spokane, but up to the time of writing this option has not been exercised.

Wisconsin.* On Midge creek, 14 miles from Kootenay lake, the old *Wisconsin* property has been taken under lease and bond by the Interior Mine Development Company, Limited, formed by O. D. Frith, J. P. Coates, and associates, of Nelson. The firm of Stewart & Batten, mining engineers, recently became interested in the undertaking. A Radiore survey was made in November, which will probably be followed by diamond-drilling during the coming season. According to reports of well-known mining engineers, the property has exceptionally favourable possibilities for the development of an important tonnage of low-grade gold-silver ore.

*Gold Medal and Cariboo.**—A small amount of work is reported to have been done by J. L. Irving, M. Anderson, and associates on the *Gold Medal* and *Cariboo* claims, situated on the West fork of Kokanee creek, 5 or 6 miles from the *Molly Gibson* road. Ore containing values in gold and copper is reported to occur in a granite formation.

Sanca Mines, Ltd.* Near Ginol's Landing and Sanca creek, on the east side of Kootenay lake, the properties of the Associated Mining and Milling Company, Limited, and United Lode Mining Company, Limited, were transferred to the Sanca Mines, Limited. Work has been concentrated on the zinc-lead and copper showings on the *Iolanthe*, on the shore of the lake, where a new camp has been established and a small compressor installed. New work here includes about 100 feet of crosscut tunnel. Other work done includes the reconditioning of old workings and assessment-work on the numerous claims constituting the properties.

Ebor.* A small amount of surface work is reported to have been done by J. H. Smith on the *Ebor* claim on the east side of Kootenay lake, about 1½ miles north of Boswell. Some open-cuts were made near the lake-shore on a small well-defined fissure-vein cutting quartzose schists which strike northerly and southerly and dip to the west. The strike of the vein is easterly and it dips steeply to the north. The mineralization consists of stringers and small masses of galena and pyrite, with small amounts of zinc-blende, in a quartz gangue. Samples representing small amounts of this ore give good assays in silver and lead.

Spokane.* A small amount of work is reported to have been done by the Laib Bros. on the *Spokane*, situated at the head of the South fork of Canyon creek, 18 miles by trail from Kootenay lake. Chief efforts, however, were concentrated on widening and improving the Cultus–Canyon Creek trail, which serves the *Spokane* and numerous other prospects in the surrounding area. Through the assistance of the Department of Mines this trunk trail is being gradually improved and access is being afforded to a number of mining properties which have been handicapped through lack of transportation facilities. The *Spokane* has been very intelligently developed and a considerable quantity of ore has been put in sight. A full description of the workings is contained in the Annual Report for 1927.

*North Wind.**—This property, situated about 2 miles easterly from the *Spokane*, on the opposite side of the creek, has recently been bonded by W. H. Tyrrell, representing San Francisco interests. The *North Wind* is described in the Annual Report for 1927.

Kootenay Landing-Creston Area.

Only minor activities are reported to have occurred in this area. These include the *Wynndel*, near Creston, from which a small shipment was made early in the year by J. W. Rutledge and associates, of Cranbrook; and the *Alfred* and *Josephine*, near Duck creek, worked in a small way by the Desireaus.

Ymir District.

The camp has recently taken on a new air of prosperity, largely due to the substantial operations of the Yankee Girl Consolidated Mines, Limited. Besides the operations at the *Yankee Girl, Goodenough, Hunter V.*, and *Howard*, there were a number of minor activities in the vicinity of the larger operations, including *Morning Star* and *Evening Star, Old Timer, Golden Crown, Mayblossom, Iowna, Dewey, Rainy Day, Blue Bell, Canadian Cariboo*, and *Big Horn*. A large number of reverted Crown-granted claims have been acquired in the Wildhorse Creek area.

The following extract from Memoir 94, Geological Survey of Canada, is of interest in connection with the possible value of old abandoned properties in the Ymir mining camp, many of which have only been slightly explored: "Without doubt many undiscovered veins and ore-shoots are still hidden under the thick cover of wash and drift in certain promising belts. Much of this territory, however, is held by Crown grant and there is little encouragement to the prospector. Veins parallel to those of the main producers of the past should be sought after and many of the abandoned barren veins should be tested further for the occurrence of ore-shoots at geologically favourable localities." As many of the Crown-granted claims referred to have now changed hands, some further development can be expected along the lines suggested in the above quoted extract from C. W. Drysdale's report.

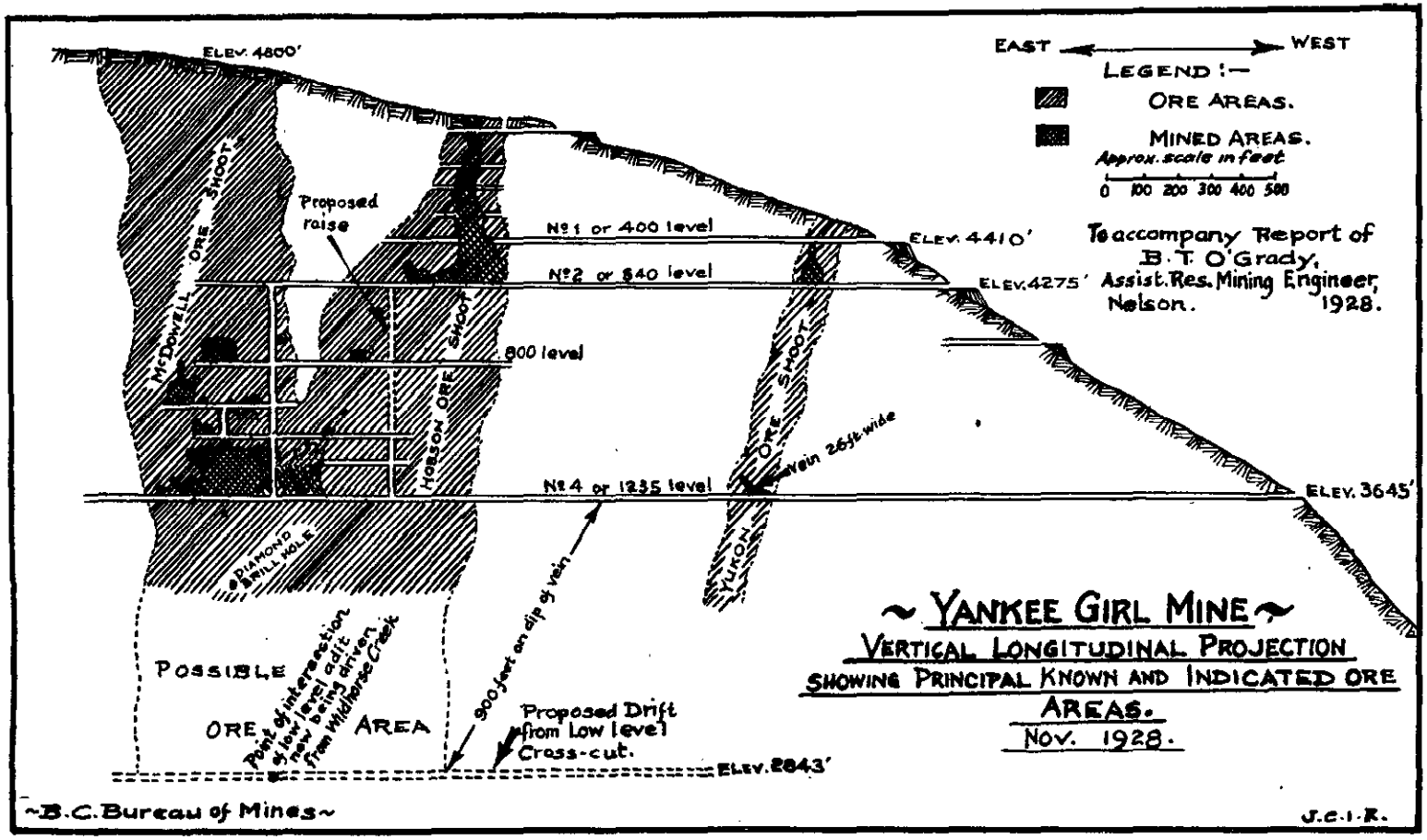
Yankee Girl.* This mine is situated about 2 miles by road from Ymir, on the eastern side of the Salmo River valley. A general description of the property is contained in the Annual Report for 1927, which includes a summary of the geological conditions, vein system, character, grade, and occurrence of the ore. The operation of the mine was taken over in March by the Enterprise Consolidated Mining Company, Limited, now known as the Yankee Girl Consolidated Mines, Limited. Immediately preceding the time of transfer of ownership to the present operators efforts were largely being directed to the mining and shipping of ore. The present company at once ceased all ore shipments, excepting only such as were necessary to operate the aerial tramway in bringing supplies up to the mine from the railway at Ymir.

In February some 1,600 tons of ore, selectively mined, was shipped to the Trail smelter by the former operators. Shipments of crude ore by the present company were curtailed in order to eventually obtain the greater profit which will be possible by milling all mine production in the company's mill, later to be built.

Until the end of August all efforts were concentrated on development in what may now be described as the upper mine and which was developed from the Salmo River slope. The accompanying illustration gives an idea of the extent of this group of workings, which in the aggregate now amount to about 18,000 feet. The illustration is confined to the workings on the *Yankee Girl* vein, as the spur vein, which has recently become of importance, cannot be shown in combined vertical longitudinal projection since it lies on the foot-wall side of the vein shown.

The total footage of development-work done in the upper mine-workings by the present company amounts to about 2,350 feet. The chief development was done on the 800- and 1,035-foot levels in the principal known ore-bearing area comprising the Hobson and McDowell ore-bodies, which is about 1,000 feet long. Results of the work done in the levels above the 1,235-foot indicate a good possibility that the McDowell ore-body will extend upward to the surface and that the Robson shoot will extend downward to the 1,235-foot level; also it is possible that in places these two ore-bodies will lose their separate identities and become merged. The probable extension of this ore area to at least 250 feet lower than the 1,235-foot is indicated by diamond-drilling done before the present company took over.

Very promising ore-bodies were opened up on the spur vein on the 800- and 1,035-foot levels. The possibilities of this spur vein are important, since it shows ore from 300 to 400 feet long, over a good stoping width, on the 800- and 1,035-foot levels and has not yet been sought in the ground above and below these levels, with this exception: that during past operations ore was


EAST
WEST
LEGEND :—
ORE AREAS.
MINED AREAS.
Approx. scale in feet
0 100 200 300 400 500
ELEV. 4800'
McDOWELL ORE SHOOT
Proposed raise
No 1 or 400 level
ELEV. 4410'
No 2 or 840 level
ELEV. 4275'
800 level
HOBSON ORE SHOOT
YUKON ORE SHOOT
Vein 26ft. wide
No 4 or 1235 level
ELEV. 3645'
DIAMOND DRILL HOLE
POSSIBLE ORE AREA
Point of intersection of low level adit now being driven from Wildhorse Creek
900 feet on dip of vein
Proposed Drift from Low level Cross-cut.
ELEV. 2843'
To accompany Report of B. T. O'Grady, Assist. Res. Mining Engineer, Nelson. 1928.
~ YANKEE GIRL MINE ~
VERTICAL LONGITUDINAL PROJECTION
SHOWING PRINCIPAL KNOWN AND INDICATED ORE AREAS.
Nov. 1928.
~B.C. Bureau of Mines~
J.C.I.R.

shipped from a spur vein on the 400-foot level, probably the same vein, in which the ore-shoot is reported to have been 120 feet in length. No work, therefore, has been done on the spur vein between the 400- and 800-foot levels or below the 1,035-foot level. On the 800-foot level drifting on this spur vein discloses the ore-shoot to be about 400 feet long and of considerably better grade than the general character of the ore in the *Yankee Girl* vein.

On the 800-level the drift on the *Yankee Girl* vein, which was continued westerly 103 feet through the Hobson ore-shoot, opened up an additional length of 70 feet of ore, making the total length of the ore-shoot over 900 feet on this level. The western limits of this shoot at this horizon are considered to have been definitely passed.

For the purpose of preparing the mine for mill production a new vertical main raise, having two hoisting-compartments and a manway, has been put up from the 1,235-foot level to a short distance above the 1,035-foot level, at which point it is connected by a crosscut to the spur vein drift. It is intended later to continue this main raise to the 540-foot level, which will permit economical and rapid transit of men and supplies.

The above items comprise the most important features of the new work. There are promising points of attack in other parts of the mine, but work was restricted by the limited capacity of the compressor equipment available at the time.

The Yukon ore-shoot in particular deserves extensive exploration. A little stoping was done on this ore-body on the 540- and 1,235-foot levels during past operations, but no development has been done on it between these levels. On the 1,235-foot level this ore-shoot shows a width of 26 feet.

Reserves of developed and probable ore in the *Yankee Girl* vein above the 1,235-foot level have been greatly increased and further possibilities for important tonnage extensions are indicated by the results of development on the spur vein, the potentialities of which have only recently been demonstrated. In regard to tonnage, gold values fluctuate considerably and estimates will vary widely according to the grade of material which it will be found possible to mill at a profit. The mine has recently been completely resampled and metallurgical tests are now being made. No precise tonnage figures will be available until complete data are assembled and calculations completed. Tentative estimates by the management, based on incomplete assay plans, indicated 125,000 tons of ore, in addition to several hundred thousand tons of probable ore, all of which is above the 1,235-foot level. Extensive additions and improvements were made to the buildings and equipment at the old camp near the above workings.

Due to the fact that all the property is devoid of timber, a timber limit was acquired, situated at the headwaters of Bear creek. A road some 1½ miles in length was built to it and a portable sawmill installed. This mill has been turning out mine and square timbers for the new construction on Wildhorse creek. It is driven by a 30-horse-power caterpillar tractor. Towards the end of August, operations from the Bear Creek side were discontinued and work subsequent to that has been entirely on the Wildhorse Creek side. A tunnel-site was chosen, the best possible camp-site convenient to it was selected, and a large clearing made preparatory to construction-work. The site selected for the Wildhorse low-level tunnel is about 2,000 feet below the collar of the Hobson shaft, or 765 feet below the 1,235-foot level. The estimated depth on the dip of the vein is about 900 feet.

This tunnel should intersect the *Yankee Girl* vein system about 4,800 feet, more or less, from the portal. The first objective on reaching a point below the McDowell-Hobson ore-area will be to put up a raise to the upper workings for ventilation. Due to the fact that the mountain-side, at the base of which the portal-site is situated, is subject to snowslides, it was deemed inadvisable to erect the plant and camp buildings on the southerly side of Wildhorse creek.

This new camp comprises thirteen buildings. The principal buildings are: Two-story bunkhouse with twenty-eight outside rooms, each to accommodate two men, with two wash-rooms and two reading-rooms; two-story boarding-house with dining-room to seat 115 men and with rooms overhead to accommodate twenty men; a large office building; a compressor building, 33 by 74, in which is also located the power-line sub-station; blacksmith-shop; warehouse; stable; change-house; heating-plant building. On Wildhorse creek a blower-house for mine-ventilation equipment and an auxiliary warehouse have been built. There is also a log and stone powder-magazine with a capacity of one and a half car-loads of powder. The boarding-house, bunk-

house, and change-house are steam-heated from a central plant of sufficient capacity to permit later the inclusion in the heating-circuit of the mill buildings.

About 1½ miles of new road have been built at the new camp, including a bridge of 30 tons capacity across Wildhorse creek. The camp and proposed mill-site being on the northern side of the creek, connection is made with the portal of the new low-level tunnel by a trestle 830 feet long and up to 90 feet high, built to withstand a train-load of 40 tons; 35-lb. rail tracks are in place on this trestle.

An 1,840-cubic-foot Sullivan angle-compound compressor driven by a 300-horse-power synchronous motor has been installed in the compressor building and is in operation. The blacksmith-shop equipment includes two drill-steel sharpeners, one oil and one coal forge. Concrete foundations for the ventilating-exhauster for the big tunnel and for the 75-horse-power motor driving it are in place in the building constructed for them at the portal. A 6-inch compressed-air line is installed, crossing the creek on the trestle from the compressor building to the tunnel.

Additional equipment to be received in connection with the big bore include a 40-horse-power electrical trolley-type locomotive generator-set, a mechanical shovelling-machine operated by compressed air, and the ventilator-exhauster.

The tunnel has been commenced and will be carried through in 9 by 8 section on a 0.5-per-cent. grade, but towards the end of the year solid rock had not yet been reached at 110 feet from the portal, the tunnel having been driven for this distance through sand, clay, gravel, and boulders, requiring spiling and heavy timbering.

Electric power from the West Kootenay Power and Light Company over a 31½-mile transmission-line at 20,000 volts is transformed in the sub-station to 2,200, 440, and 110 volts for various uses.

To the end of the year about 550,000 feet B.M. of lumber, over two car-loads of cement, and proportionate quantities of other materials had been used in construction on the Wildhorse Creek side. Water is brought to the camp in three sub-surface pipe-lines totalling 4,600 feet in length.

The efficiency and economy displayed in the planning of the camp and its equipment reflect credit on the management. G. L. Thompson is superintendent and B. W. W. McDougall is engineer in charge of operations of this company and other British Columbia companies sponsored by Stobie, Forlong & Company.

*Morning and Evening Star.**—Above the *Yankee Girl* and along the trend of the same vein system these claims, owned by E. C. Wragge, have been taken under option by J. L. Parker, of Vancouver, who unwatered the shaft preparatory to further exploratory work. The Two Stars Mining Company is reported to have been formed to develop the property.

Goodenough.* This property, which is situated on the north-western side of Wildhorse creek, about 4½ miles by road from Ymir, is referred to at some length in the Annual Report for 1927. Several hundred feet of tunnelling, chiefly on the No. 3 or lowest level, was done during the early part of 1928 by the Enterprise Consolidated Mining Company, Limited, which at the time also held an option on the adjoining *Ymir*. Subsequently both properties were relinquished by this company, which concentrated efforts on the *Yankee Girl*.

Subsequently the owners, H. Jackson, A. MacDonald, and associates, went to work and opened up some promising showings of ore on the No. 1 and No. 2 levels. Six car-loads were shipped by them to the Trail smelter during the last three months of the year. The following information was extracted from the smelter returns for these shipments:—

Dry Weight.	Gold.	Silver.	Lead.	Zinc.	Net Value, less Freight and Treatment.
Lb.	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.	
77,204	1.00	7.1	6.15	8.6	$806.66
83,884	0.83	5.9	5.55	8.4	686.05
83,381	1.21	8.9	7.55	11.3	1,050.52
113,995	1.20	9.0	7.65	10.7	1,448.44
81,076	1.14	9.5	7.55	10.3	992.36
82,582	1.395	11.0	7.55	9.3	1,247.15

The shipments were made as smelting-ore, payment being made for gold, silver, and lead only. The ore commands a very favourable smelting rate on account of its high silica content, which in these shipments ranged between 50 and 60 per cent. This more than made up for the loss of and penalty on the zinc content (20 cents a unit in excess of 5 per cent.). Under the new schedule of the Consolidated Mining and Smelting Company, however, the zinc penalty will be entirely removed. Shipments made in 1928 by the several operators aggregated about 1,608 tons.

Work done on the *Goodenough* has not been brought to full conclusions, although in the Nos. 1 and 2 levels the work done has shown the character of the deposits to be somewhat irregular, and that the ore does not lend itself to the usual regular blocking-out methods owing to numerous small faults and dykes and the lenticular shape of the ore-bodies. Ore can be seen at numerous points in these workings and the strength of the mineralization in the No. 2 tunnel is promising for the downward continuation below that level. It is possible that at increased depth the lensy character of the ore-bodies will change as at the *Ymir*, where similar conditions are reported to have been encountered in the upper part of the ore-body. The No. 3 tunnel, which, on the dip of the vein, gains a depth of about 220 feet on the No. 2 tunnel, has been extended to about 550 feet (estimated) from the portal, but work was discontinued before the ore-zone was reached. Diamond-drill holes put down in 1927 cut the veins 80 feet below the No. 2 level. According to the plans seen, the No. 3 tunnel would only have to be continued easterly a short distance to develop the downward continuation of the most westerly ore worked on the No. 2 level. It is reported that the owners intend to do some development this winter on the No. 3 level. Results of this work will be watched with interest.

Ymir.* Situated on Wildhorse creek, about 5 miles from the town of Ymir, this mine was formerly a large producer, the active period of operations having been between 1896 and 1908. Discoveries and production made at the adjoining *Goodenough* during the last few years have revived interest in the old *Ymir* property, the possibilities of which are not believed to be by any means exhausted. During 1928 the No. 10 level has been reconditioned, and timbered where necessary, in view of negotiations pending for resumption of exploratory work.

A very comprehensive report on the property is contained in Memoir 94, Geological Survey of Canada. The following report by R. W. Brock, then Director of the Geological Survey (made since operations ceased), from the Summary Report of the Survey for 1908, indicates interesting possibilities for further exploratory work at the *Ymir* mine: "From Nelson a trip was made to Ymir, where the *Ymir* mine was visited. This, with its extensive equipment, including an 80-stamp mill, was formerly a large producer, but at present work is confined to development. The main workings are on a large lens-shaped ore-shoot about 500 feet long and 30 feet wide, which was continuous downward for 500 feet. There gangue began to become prominent, but rich pockets continued for several hundred feet, the gangue, however, gradually increasing. At 1,000 feet in depth the ore was confined to streaks. At the east end of this ore-shoot it seems to gradually peter out, but the west end may be cut off by a fault, although I undersand that what is thought to be the same fissure has been traced on the surface for several thousand feet without finding another body of ore. The second level has been drifted on for 250 feet west of the dyke and then a crosscut 800 feet long has been made into the hill. At this point broken ground is encountered and a drift run along it with a raise on a bunch of ore.

"On the surface above the outcrop of the producing vein a large amount of rich float has been found, which must have originated in a second vein; but extensive prospecting has failed to discover this lead. The float would appear to indicate a point of origin near the edge of the main ore-shoot block, about in line with the ore at present being worked at the end of the long crosscut in the second level.

"Although a good deal of prospecting has been done on the property, it has been chiefly to test the ore-shoot at depth, and a considerable amount of very promising territory still awaits exploration. The ground west of the ore-shoot, beyond the probable fault, has been tested only by the drift on the second level and the long crosscut. No crosscut in the opposite direction has yet been made and no crosscuts have been run from the main shoot to test for parallel ore-bodies. The rich float up the hill, and the frequency with which parallel veins and ore-shoots occur in southern British Columbia, renders such exploratory work a promising venture.

This ground should be tested, for the *Ymir* mine has been one of the prominent dividend-payers of the West Kootenay district."

Hunter V.* This property, owned by the Consolidated Mining and Smelting Company, has been operated steadily throughout 1928 and a considerable tonnage of low-grade fluxing-ore has been produced. The *Hunter V.*, which is on the divide between Porcupine and Hidden creeks at an elevation of from 5,000 to 5,700 feet above sea-level, is connected by aerial tram, 18,000 feet in length, with ore-bins on the Great Northern Railway about 2 miles south of Ymir. The geology of the deposits is described in Memoir 94, Geological Survey of Canada.

The ore consists of irregular bands, streaks, and disseminations of fine-grained sulphides, in which can be recognized pyrite, galena, zinc-blende, occasional native silver, pyrargyrite, and possibly other silver sulphides. The gangue consists of limestone, impure and highly silicified. The mineralization is irregular and there are no visible structural boundaries to the deposits. Mining is done in a large glory-hole connected with two adit-tunnels, through which the output is withdrawn. Ore-areas are mined in bulk with a view to fluxing requirements, and at the same time an approximately even standard of values, these being chiefly in silver with a little gold, is maintained sufficient to cover the charges of delivering the low-grade material to the company's smelter. In this connection the costs of mining, mucking, and tramming the output are very low and indicate a very efficient small-scale operation. D. Matheson is in charge at the mine, a small crew being employed.

Blackcock.* This claim, situated on the steep mountain-side south-westerly from the *Wilcox* and on the northern side of Wildhorse creek, is connected by wagon-road some 5 miles in length with the Great Northern Railway at Ymir. The elevation of the lowest workings is about 3,675 feet above sea-level, or about 500 feet higher than the road which follows the flats on the northern side of Wildhorse creek. The geology of the area, including the *Blackcock*, is shown on Map 175A, Geological Survey of Canada. The country-rock of the vein examined is a fine- to coarse-grained granite rock belonging to the Nelson batholith. Narrow lamprophyre dykes traverse the granitic rocks in the vicinity of the vein in places. The vein, which is of the fissure type with mineralized walls, strikes approximately east and west (mag.) and dips from 65° to 75° to the north, or into the hill. The ore consists of altered silicified country-rock and quartz containing irregular masses and disseminations of iron pyrites, galena, and occasional zinc-blende.

The principal values are in gold. Silver occurs in minor quantity, fluctuating with the amount of galena present. The pyrite is auriferous and the presence of galena here, as elsewhere in the Ymir camp, is invariably an indicator of good gold values. The presence of zinc-blende also seems to be accompanied by good gold values. The ore occurs in the form of tabular bodies or shoots in the vein, the high-grade ore occurring in bands and pay-streaks.

The old workings are distributed along a length of about 800 feet of outcrop. Commencing at the western end of the section of vein examined, the workings are briefly as follows: A shaft, reported to have been sunk 55 feet. This shaft, which contains some water, could not be examined. Just below the collar of the shaft there is exposed a width of 8 feet of iron-stained ledge-matter, containing masses of pyrite and some disseminated galena and zinc-blende. This ore could not be reached to sample. A grab sample of ore on the dump of this shaft assayed: Gold, 0.48 oz. to the ton; silver, 1.3 oz. to the ton; lead, 2.3 per cent.; zinc, 3.1 per cent.

About 50 feet easterly from this shaft and at a slightly lower elevation there is a tunnel driven about 25 feet in a direction N. 65° W. (mag.), or diagonally across the vein, which in this working is very wide and well mineralized, especially towards the foot-wall side. Samples along the western wall of this tunnel assayed as follows:—

Description.	Gold.	Silver.	Lead.	Zinc.
Across 5 feet on foot-wall side of vein	0.77	2.6	7.9	4.9
Across 30 inches next to last sample	0.51	0.5	1.4	0.9
Across 24 inches next to the last sample	0.26	0.7	1.1	0.6
Silicified granite on hanging-wall side, 6 feet wide	0.27	0.5	*	*

* Not assayed.

Together these samples represent a width of 15½ feet exposed along the side of the tunnel, but, as the vein is crosscut diagonally, the true width of the ore-body would be considerably less. In this showing the mineralization is very strong and uniformly distributed. Just east of the portal of this tunnel a lamprophyre dyke, 2½ to 3 feet wide and standing about vertical, strikes about N. 45° W. across the vein, which is apparently not disturbed by it.

The next working going easterly is a tunnel, about 75 or 100 feet distant from the last working, which starts as a crosscut for about 40 feet and continues as a drift on the vein for about 50 feet to the west. In this westerly drift the material developed is pyritized and silicified granite, but the full width of the vein is not exposed. No samples were taken in the drift owing to the hardness of the rock and the limited time available for the examination. At the intersection of the vein in the crosscut a raise connects with the surface. Here some stoping has been done, leaving a large chamber which at present is not easily accessible. A sample of selected ore on the dump of this working assayed: Gold, 1.78 oz. to the ton; silver, 5.2 oz. to the ton; lead, 13.8 per cent.; zinc, 7.6 per cent. The westerly drift would only have to be extended a short distance to get under the strong mineralization exposed in the 25-foot tunnel mentioned above.

About 100 feet farther to the east there is the main shaft, which is inaccessible without a rope. This shaft is reported to have been sunk 110 feet and to contain short drifts on the 25-, 50-, and 100-foot levels. Some stoping was apparently done in the shaft-workings, which is understood to have been responsible for most of the past production. A sample across a 12-inch pay-streak just east of the collar of the main shaft assayed: Gold, 0.91 oz. to the ton; silver, 6.8 oz. to the ton; lead, 18 per cent.; zinc, 4.8 per cent.

About 200 feet farther east along the outcrop there is an open-cut exposing some pyritized siliceous ledge-matter containing sparsely disseminated galena. Some 50 feet easterly from this open-cut there is a shallow shaft full of water where the vein could not be inspected. The next working is a tunnel situated about 300 feet easterly from the last shaft. This tunnel, which starts as a crosscut, is completely blocked by slide material at the portal but could be opened up at small cost.

Past production is reported to have amounted to several hundred tons of ore, most of which was shipped to the old Hall Mines smelter at Nelson, and for which no figures are available. In the Annual Report for 1899 it is recorded that A. Julian shipped between 35 or 40 tons which contained about $25 a ton in gold and silver. The last three cars shipped to the Trail smelter gave the following returns: (1.) 25 tons: Gold, 0.68 oz. to the ton; silver, 1.16 oz. to the ton. (2.) 24 tons: Gold, 0.84 oz. to the ton; silver, 2.16 oz. to the ton. (3.) 20¾ tons: Gold, 2.04 oz. to the ton; silver, 5.4 oz. to the ton.

In view of the production made in the past and the good values obtained from the above samples taken from the accessible portions of the old workings, the *Blackcock* would appear to have possibilities meriting further investigation. High-grade ore was chiefly being sought in the early days of the camp and possibilities for tonnage of milling-grade material were sometimes overlooked. Electrical energy which has now been brought to the *Yankee Girl* should permit of more efficient and economical operation of other mines in the vicinity.

Old Timer.* This property, owned by A. Burgess and associates, of Ymir, is situated on the mountain east of the pass between the North fork of Wildhorse and Clearwater creeks. The elevation of the workings is about 6,000 feet above sea-level and the property is reached by a trail, about 1½ miles in length, which connects with the end of the North Fork road 7 miles from Ymir. For many years the property has been idle except for annual assessment-work. A little activity materialized in the spring of 1928, but was discontinued for lack of funds.

The formation is composed of highly metamorphosed Pend d'Oreille schists, which strike in a general northerly direction, intruded by granitic dykes from the adjoining Nelson batholith. The main mass of the granite cuts through the *Old Timer* a short distance north-east of the workings.

The vein strikes north-easterly and dips steeply to the north-west, paralleling the main productive veins of the camp, notably the *Ymir*, *Goodenough*, and *Yankee Girl* veins, which cut similar rocks. The associated minerals are galena, zinc-blende, and pyrite, in a quartz gangue, the chief values being in gold. There is considerable oxidation near the surface and, according to Memoir 94, Geological Survey of Canada, pyromorphite or lead phosphate, which is of rare occurrence in Canada, was found in the zone of oxidation.

The old workings consist of a tunnel and a prospect-shaft. The tunnel is a drift along the vein for about 160 feet. In this working the vein could only be seen in places between the lagging and where the vein is visible it is only partially exposed. It is apparently several feet in width, possibly up to 4½ feet wide. The following sample, which was taken at the only place where an appreciable width of the vein was exposed, represents a width of 2 feet of vein partially exposed in the roof 75 feet back from the face of the tunnel: Gold, 0.93 oz. to the ton; silver, 2.6 oz. to the ton. A grab sample of rusty, decomposed material from two small piles on the tunnel dump assayed: Gold, 0.71 oz. to the ton; silver, 1.8 oz. to the ton. Another sample from a separate small pile of honeycombed quartz at the same place assayed: Gold, 0.53 oz. to the ton; silver, 1.2 oz. to the ton.

The prospect-shaft, which is caved and inaccessible, is situated along the trend of the vein about 300 feet north-easterly from the tunnel and farther up the gentle slope of the hillside. The gold values in the samples are of interest. The vein should be exposed in the tunnel for thorough sampling and its south-westerly extension should be tested further for the occurrence of ore-shoots at the geologically favourable localities indicated by outcroppings of granite dykes seen between the *Old Timer* workings and the *Summit* group referred to below. The best shoots in the Ymir camp have been localized at or near the intersections of the veins with granite tongues. On the *Pathfinder* claim of the *Old Timer* property, hurriedly visited on the return trip, which lies to the south-west of the workings described, there is an old caved tunnel which could not be examined. A grab sample from a small pile of siliceous ore from the dump of this working assayed: Gold, 0.29 oz. to the ton; silver, 1.5 oz. to the ton; and a sample of selected sulphide ore from a 3-foot vein in the creek near by assayed: Gold, 2.84 oz. to the ton; silver, 3.7 oz. to the ton.

Summit Group.* This property, owned by A. Vigneux, of Nelson, is situated south-westerly from and below the *Old Timer*, which it adjoins. The *Summit* group consists of eight Crown-granted claims, but the examination on which this report is based was limited to the workings on the *Summit* claim, which is situated in the pass between Clearwater and North fork of Wildhorse creeks at an elevation of about 5,000 feet above sea-level. The country-rock of the *Summit* vein is an argillite of the Pend d'Oreille group, striking northerly and dipping steeply to the west. Granite tongues from the Nelson batholith outcrop on the surface towards the north-east of the workings. The vein, consisting of quartz interbanded with country-rock, is from 6 to 12 feet wide and has a similar strike and dip to the *Old Timer* vein. The two veins are approximately in line, if allowance is made for the difference in elevation. A crosscut tunnel has been driven easterly for an estimated distance of about 160 feet, intersecting the vein, which is about 6 feet wide; a drift then extends along the vein to the north-east for about 145 feet. A short crosscut near the inner face of the drift shows the vein to be 12 feet wide at that point. The hanging-wall side of the vein, wherever exposed, is smooth and well defined.

A few samples showed negligible values in gold and silver and the vein has evidently been tested at an unfavourable locality. It is possible that ore-shoots may exist along the trend of the vein in the zone of granite intrusion which lies a short distance north-easterly. The following extract from Memoir 94, Geological Survey of Canada, which alludes to the system of north-easterly-striking veins in the Ymir mining camp, is applicable in this case: "Veins parallel to those of the main producers of the past should be sought after and many of the abandoned barren veins should be tested further for the occurrence of ore-shoots at geologically favourable localities."

*Alexandre and Dumas.**—A small amount of work is reported to have been done on the *Alexandre* and *Dumas* Crown-granted mineral claims, situated about a mile easterly from the *Summit*, by T. Wilkinson and J. H. Dunn. The property is referred to in Memoir 94, Geological Survey of Canada, page 93. The ore contains values in gold, silver, and lead.

Tamarac.* This property is situated at an elevation of 4,600 feet above sea-level on the eastern side of the Salmo River valley, about 2 miles due north of Ymir. During the current year a little preliminary work was done with a view to resumption of activity. The property is owned by E. W. Widdowson, of Nelson. The following notes are based on a cursory inspection in connection with an application for assistance towards repairing the trail.

Information regarding the history and development of the *Tamarac* are contained in the above-mentioned Memoir 94. The formation of the area is shown on Map 175A accompanying this publication. The country-rock is composed of spotted granite porphyry considered to be of Jurassic age. To the east of the workings there is a large area of rocks of the Rossland Volcanic group of Triassic age. The workings, consisting of open-cuts, a shaft, and a tunnel, develop a curving quartz-filled fissure-vein with a general north-easterly and south-westerly trend and dip from 30° to 50° to the north-west. The vein, varying in width from one to several feet, is heavily mineralized with iron sulphides, chiefly pyrite with some arsenopyrite in a massive quartz gangue. According to the above-mentioned publication, the ore-zones are confined to the bends in the vein and the schistose portions of the granite-porphyry country-rock. Two ore-bodies have been partially developed by raises and winzes from the tunnel and by the shaft and a small amount of stoping.

The tunnel-workings include, roughly, about 500 feet of drifting, with some winzes and raises. The two ore-bodies developed in the tunnel are less than 100 feet apart, the first one being encountered at about 200 feet in from the portal. The length of the ore-bodies would have to be determined by thorough sampling, for which time was not available. The shaft mentioned in the sampling results referred to below develops the most north-easterly or second ore-body encountered in the tunnel. This shaft is blocked by caving at about 30 or 40 feet down from the surface. Samples taken to get an idea of the values in the ore left in the workings are as follows:—

Description.	Gold. Oz. to Ton.	Silver. Oz. to Ton.
Across 2½ feet, 10 feet down shaft	0.32	0.4
Across 3 feet, 20 feet down shaft	0.96	0.6
Across 4 feet, 30 feet down shaft	1.12	0.7
Pile of ore, about 12 tons, outside tunnel	0.42	0.5
South-westerly ore-body in tunnel, across 10 inches	0.26	0.5
Raise in tunnel between two winzes; width, 24 inches	0.28	0.7
In tunnel below last sample; width, 14 inches	0.64	1.5
North-easterly ore-body in tunnel, 14 inches at bottom of stope	0.40	1.1
Across 10 inches in face of tunnel, about 200 feet beyond last sample	0.52	0.7

The first three samples in the above list consisted of oxidized ore containing masses of partially decomposed sulphides. Results of the sampling indicate blocks of ore in the incompletely developed ore-bodies. The sample near the face of the tunnel shows that ore may be opened up by driving ahead. The impression formed from the very incomplete examination made was that the vein, which has only been developed to comparatively shallow depth, might to advantage be more fully explored laterally and at depth. A change of formation might be expected at no great distance beyond the inner end of the tunnel, with possibly more favourable conditions for ore-deposition.

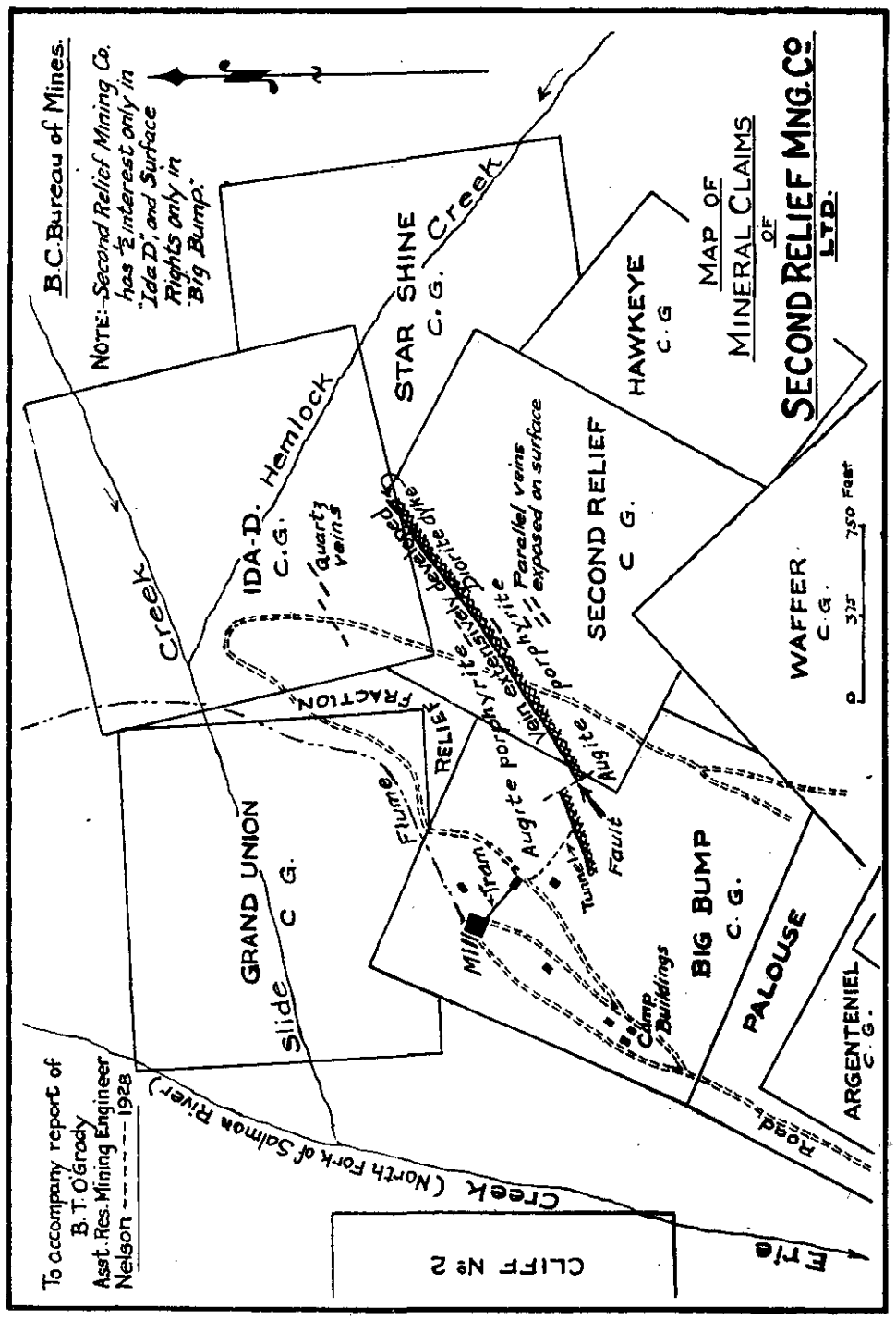
Iowna.* A small amount of work was done during the season by A. Burgess on the *Iowna* group, situated on the north side of Porcupine creek at an elevation of about 3,300 feet above sea-level and 1½ miles by road from the Great Northern Railway. The formation is Pend d'Oreille schist and Nelson granite. The ore carries gold values associated with pyrite in a gangue of quartz and altered wall-rock. The *Iowna*, which was not visited owing to pressure of work, is described by C. W. Drysdale in Memoir 94, Geological Survey of Canada, page 118 *et seq.*, since when some work has been done at intervals.

Dewey.* This property, situated on the northern side of Porcupine creek, about a mile from the Great Northern Railway, and which was formerly owned by the Chloride Mining and Milling Company, is reported to have been acquired recently by S. A. Curwen, of Ymir, in connection with a judgment obtained by him against that company. References to the property are contained in the Annual Reports for 1926 and 1927. No appreciable amount of work is reported to have been done during the year under review.

ERIE CREEK (NORTH FORK OF SALMO RIVER) AND VICINITY.

Second Relief.* This property, situated on Erie creek, 13 miles by road from Erie, was referred to at some length in the Annual Report for 1927. As the amount of mining done during the present year has been small, this report will be confined to a

general description of conditions. There are several veins on the property, but only one has been developed to any extent. Exact records of past production made from this vein are not at present available. Incomplete information derived from past Annual Reports total about 43,000 tons, but, as no tonnage figures are given for several years during which production is



known to have been made, it will be safe to assume a production of 50,000 tons between 1900 and 1919, in which latter year the mill of the Relief Mining Company was destroyed by a forest fire. The gold values are said to have averaged about $15 to the ton, but recoveries made in past milling operations left much to be desired.

At the time of the fire the mine was being operated on a contract for purchase by the Relief Mining Company, of Arizona. This company followed development too closely with mining in its attempt to meet purchase payments. When met by the severe reverse of the complete destruction of the mill and camp by the forest fire, and having but a small tonnage of immediately available ore, the property was allowed to revert to the owners, the Second Relief Mining Company, Limited.

From 1919 to 1927 the property was idle. During 1927 it was acquired by the Oscarson Mining Company under an agreement to purchase. This agreement has recently been cancelled in consideration for stock in the owning company and future operations are to be conducted under the old name of the Second Relief Mining Company, Limited, which has owned the property since 1905. The Oscarson Bros. remain in charge, R. O. Oscarson being managing director.

The *Second Relief* vein, which was responsible for the production mentioned above, has been developed by underground workings for a length of about 1,200 feet through a vertical range of about 416 feet. It strikes north-easterly, with a dip of 80° to 85° to the north-west, and follows the north-west contact of a diorite dyke which cuts the surrounding augite porphyrite. Mineralization has been found to be very continuous, except for minor displacements due to faults and dykes, for 1,500 feet along the surface and underground. Neither the north-east nor the south-west extremities of the vein are reached by the underground workings as both pass out of the *Second Relief* ground. Vein-outcrops have been found several hundred feet to the north-east on the *Ida D.* claim, but have never been explored as the operating company owns but a half-interest in that claim. The vein is persistent from the highest point on the outcrop for over 400 feet in depth to the present lowest working, No. 4 level, which bottoms in ore below the areas stoped.

The values are almost exclusively in gold, the associated minerals being pyrite, pyrrhotite, chalcopyrite, garnet, epidote, and molybdenite, in a siliceous gangue. The last three minerals named are usually found associated with massive pyrrhotite containing high gold values. This vein, therefore, though not of very important width, is remarkably continuous and contains mineralization of deep-seated character. This is of considerable interest in view of the several known parallel veins which, unlike the extensively worked *Second Relief* vein, have not been developed to any extent. On the south-east contact of the diorite dyke there is another vein that has been opened at several places on the surface, samples from which have shown good gold values. At two places on No. 2 tunnel level crosscuts were driven to this vein, but it was found too narrow at the points cut for mining and no further work was done to explore its extent.

Since the forest fire denuded the mountain-side in 1919 prospecting has been much easier. Taking advantage of this, the present management has done considerable surface geological work in the immediate vicinity of the mine, with the result that the *Second Relief* vein has been found to be one of a series of possibly six veins, apparently parallel in dip and strike, which are all within about 400 feet of the present underground workings. The existence of several parallel veins, up to 3 feet wide, has been known for some time, but the "No. 4 parallel vein," recently found, constitutes an interesting discovery in view of its somewhat larger size. This vein, only a short length of which is exposed in a shallow surface cut, is from 3 to 5 feet wide. Samples show the gold content to be of good milling grade and the character of the mineralization is the same as in the *Second Relief* vein. In view of the continuity and strength of the mineralization proved in the latter vein, the assumption that the parallel veins of similar character will be equally persistent is not unreasonable, and it is to be hoped that development will show at least one of them to be of good workable width.

Only a small amount of work was done in the mine during the year 1928. The No. 4 tunnel was advanced 75 feet to near the *Ida D.* boundary-line, opening up a length of 120 feet of good ore for stoping to the No. 3 level. Some 40 feet of work was done in a raise above No. 4 level, which completed connection with No. 3 level. The old portion of the raise had to be retimbered throughout. Several old stopes above No. 4 level have been reconditioned to give access to ore remaining in them. The mill was given a test run and, on the basis of information

gained, changes in the flow-sheet are being made preparatory to resuming operations in the spring of 1929, when arrangements for financing continuation of development are expected to be completed.

Arlington.* At the *Arlington* the 15-stamp mill installed last year was worked intermittently, only five stamps being used, and a small amount of concentrates was shipped. The operators of the property, which is shut down at present, are the Arlington Mining Company, of Illinois, promoted by A. D. Westby. The mill was apparently installed to treat the old dumps, which were supposed to contain commercially recoverable values. Incomplete figures indicate the past production of the mine, made between 1903 and 1913, to have been about 10,000 tons of sorted ore of an average gross value of between $50 and $60 a ton. The ore consists of galena, pyrite, and zinc-blende, in a quartz gangue. The vein, which is narrow, follows the bedding-planes of the country-rock, consisting of soft, black, graphitic slates. The dumps are believed to contain a considerable tonnage of very low-grade material, from which the sorted ore was derived. It is doubtful, however, if any profitable extraction can be expected from the present concentrating equipment.

*Drum Lummon.**—This property, on Erie creek, about 6 or 7 miles from Erie, was diamond-drilled by the Consolidated Mining and Smelting Company in continuation of the exploration, initiated in 1926, of the copper-gold deposits near "Green City."

Erie.* This property, consisting of four claims situated near the road at a short distance east of Erie settlement, is owned by J. E. Webber and associates, of Trail. The work done during the latter part of 1928 includes a drift-tunnel about 175 feet long, from which two winzes have been sunk 30 and 40 feet respectively. These workings develop a small vein up to 10 inches wide containing galena, sphalerite, and chalcopyrite, in a siliceous gangue. The formation in the vicinity of the workings is composed of schistose rocks of the Rossland Volcanic group. A grab sample from a pile of 6 or 7 tons of sorted ore gave the following assay: Gold, trace; silver, 6.7 oz. to the ton; lead, 21.8 per cent.; copper, 2.26 per cent.; zinc, 4.3 per cent. A sample representing a wide iron-capping exposed in an open-cut near the tunnel assayed: Gold, 0.02 oz. to the ton; silver, 0.6 oz. to the ton; lead, 0.5 per cent.; zinc, 0.6 per cent. Only a very brief visit was made to the property, which will be more carefully examined at the first opportunity.

Armstrong.* This group of Crown-granted mineral claims, situated 1½ miles westerly from Erie and about three-quarters of a mile by trail from the highway, was recently acquired by S. E. Coulter and P. Coulter. A little work was done cleaning out the old tunnels and opening up the trail to the property, which had been dormant since about 1902, when it was being developed by the Transvaal and Zambesi Mining Company.

The old cabin, a few hundred feet below the workings examined, is at an elevation of about 3,850 feet above sea-level, or 625 feet above the highway. The workings examined, apparently on the *Black Knight* claim, consist of some open-cuts and four tunnels, which develop four widely separated parallel silicified fractured zones in granite. The planes of fracturing strike about N. 55° W. to N. 58° W. (mag.) and dip at about 50° to the north-east. The associated minerals are chiefly galena, sphalerite, pyrite, and arsenopyrite, which are sparsely and irregularly disseminated through the silicified granite gangue. Occasional streaks of antimonial sulphides occur and in places copper-carbonate stains were noted.

The principal working is a crosscut tunnel at an elevation of 3,275 feet, driven N. 45° E. (mag.). Towards the centre of this working a wide fractured silicified zone is cut, which strikes N. 58° W. (mag.) and dips at 50° to the north-east. The hanging-wall of the zone is marked by a basic dyke, about 2½ feet wide, which apparently coincides in strike and dip with the vein. About 8 feet of drifting was done by the Coulters on the hanging-wall side, and samples taken in this drift at points where the mineralization was concentrated gave the following results:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
12-inch streak in floor of drift	0.02	13.4	3.7	0.5
Selected ore from same place	0.03	90.2	22.3	0.8
12-inch streak on foot-wall side of zone	0.02	5.7	2.2	4.5

Samples taken at other points between the drift and the foot-wall streak mentioned did not show any appreciable values. The hanging-wall mineralization extends irregularly back from the drift and along the roof of the crosscut tunnel. The mineralization in the other tunnels, which lie easterly from the above working and at a little lower elevation, is of similar character. A sample across 18 inches at the portal of a short tunnel, a few hundred feet easterly from the above-described working and at 3,250 feet elevation, assayed: Gold, 0.01 oz. to the ton; silver, 10.7 oz. to the ton; lead, 4.8 per cent.; zinc, 0.5 per cent. The mineralization in this tunnel and in another short tunnel farther to the east consists of widely separated streaks and bunches of similar material. Further exploratory work would be necessary to locate, if possible, areas where the mineralization is sufficiently concentrated to be worked profitably.

*Harold and Winnie.**—On Beaver creek diamond-drilling was done by the Consolidated Mining and Smelting Company on the *Harold* and *Winnie*. The deposits consist of low-grade siliceous mineralization, the values being chiefly in gold and silver.

Howard.* This property is situated on the South fork of Porcupine creek, about 7½ miles by road and trail from the Great Northern Railway south of Ymir. A general description of the *Howard*, including its history, is contained in the Annual Report for 1927. During the early part of 1928 the No. 3 tunnel was advanced several hundred feet by J. H. Pomeroy and associates.

Controlling interest in the property was acquired by J. F. Duthie, of Seattle, on March 1st, 1928. Subsequently a series of diamond-drill holes were put down, primarily to study the geology. Diamond-drilling was then discontinued and since July about 1,000 lineal feet of underground work was done, chiefly tunnelling with some raising. Substantial new camp buildings, including a cook-house and blacksmith-shop, have been erected, a second Sullivan portable compressor has been installed, and both compressors have been moved to the portal of No. 2 tunnel.

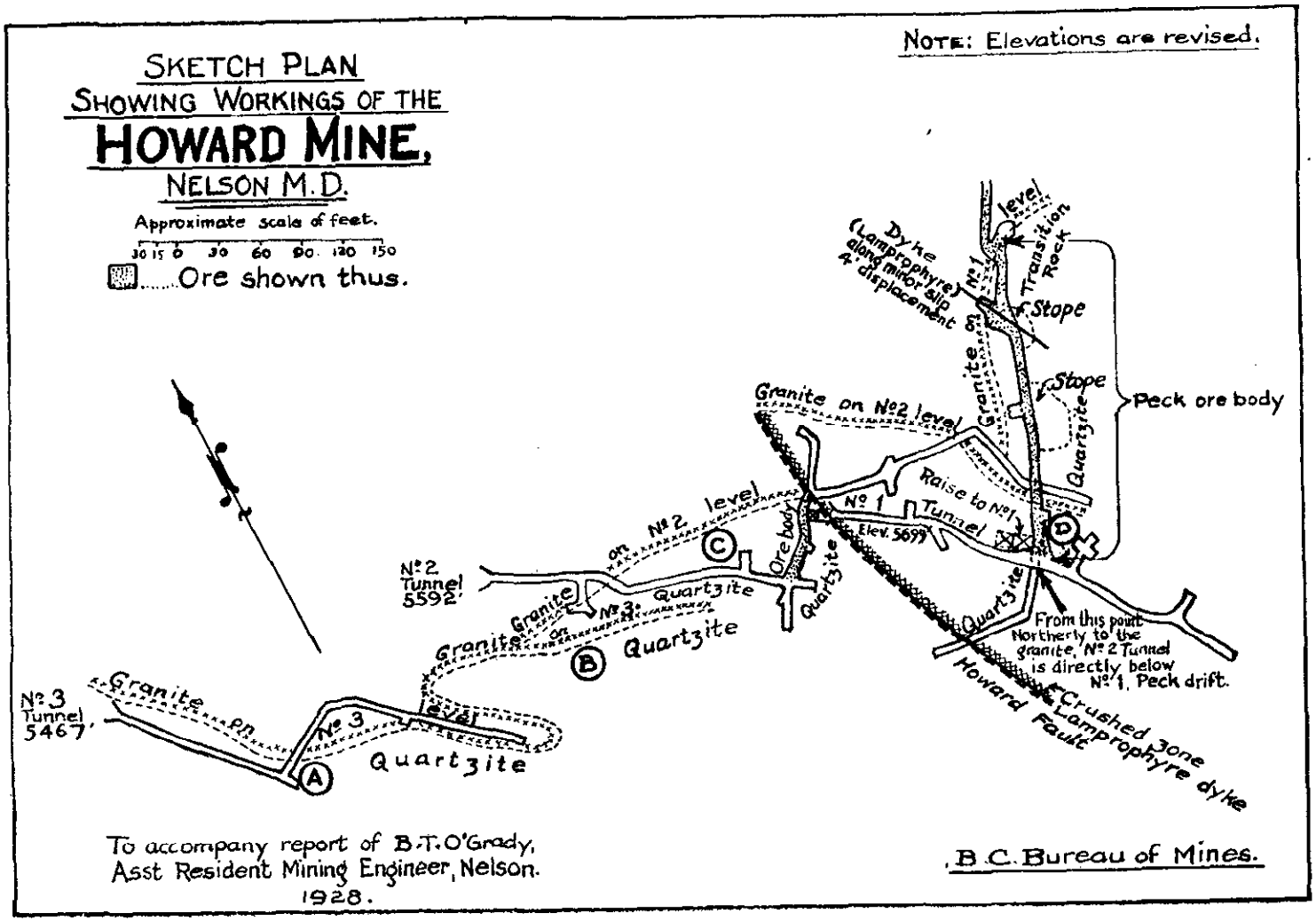
The principal claims constituting the property were surveyed and are now Crown-granted as follows: *Lochiel*, Lot 12543; *Jeremy Fraction*, Lot 12544; *Prince Charlie*, Lot 12541; *Paddy*, Lot 12538; *Alan Fraction*, Lot 12545; *Glencoe*, Lot 12539; *Howard*, Lot 12540; *Contact*, Lot 12542. Un-Crown-granted claims which have been acquired are *Blackbird*, *X.10.U.8*, *Souda*, *Titan*, *Webfoot*, *Jumbo*, *Doolittle*, *Skookum*, and *Straddlebug*.

Some addition to and revision of the description published in the Annual Report for 1927 will now be necessary in view of new information obtained regarding the geology and character of the deposits. The most important feature of the new work has been the information derived concerning ore-bodies in the area north of the possible faulting influence of the *Queen* vein. Active work is now in progress to determine the extent of the displacement of the ore-bodies to the south of this fault, where important ore extensions are expected. The ore is of chief interest for its gold content, the associated minerals being pyrite, pyrrhotite, galena (argentiferous), and zinc-blende, with occasional chalcopyrite. Fine specimens of free gold are sometimes found associated with the sulphides. The deposits occur in a zone of fissuring in quartzite and quartzose rocks along a granite-contact. The ore is not confined to the quartzite, but is also found in a highly siliceous transition rock which by insensible gradations blends from quartzite into granite.

The *Howard* deposits are of a very unusual type, hitherto unknown in this district, and the geology being unfolded opens up interesting economic possibilities for the marginal contact areas of similar rocks which are believed to extend throughout the length of the eastern portion of the Ymir map-area, and which were provisionally classified as the Summit series and tentatively referred to the Lower Cambrian or Pre-Cambrian age. (*See* Memoir 94, Geological Survey of Canada, "Ymir Mining Camp" and accompanying map.) The geology of the area is being revised by J. F. Walker, of the Geological Survey of Canada, but some considerable time must elapse before any new publication can be expected, as the new topographic map in preparation must be completed before the areal geology can be applied.

The writer is indebted to F. Holzheimer, mining engineer and geologist, in charge of operations, for the following interesting theory regarding the origin of the *Howard* deposits:—

"The main rock occurrence at the *Howard* is granite intruded into a metamorphosed sedimentary series which consists chiefly of quartzite. The following theory of origin of the deposits is submitted as presenting an unusual conception of contact formation of ore: At the time of intrusion the highly siliceous molten magma absorbed quartzite up to the point of saturation, this phenomenon being limited to the immediate zone of contact. After the saturation-point was reached, sufficient heat was generated to cause more quartzite to be introduced into


NOTE: Elevations are revised.
SKETCH PLAN
SHOWING WORKINGS OF THE
HOWARD MINE,
NELSON M.D.
Approximate scale of feet.
30 15 0 30 60 90 120 150
Ore shown thus.
Dyke (Lamprophyre) along minor slip & displacement
No 1 level
Transition Rock
Stope
Stope
Granite
Quartzite
Peck ore body
Granite on No 2 level
Raise to No 1
No 1 Tunnel
Elev. 5699'
No 2 level
No 2 Tunnel 5592'
Granite
No 3 Quartzite
Granite on
Quartzite
Ore body
Quartzite
Quartzite
From this point Northerly to the granite, No 2 Tunnel is directly below No 1 Peck drift.
Howard Fault
Crushed zone Lamprophyre dyke
No 3 Tunnel 5467'
Granite on
No 3 level
Quartzite
A
B
C
D
To accompany report of B.T. O'Grady, Asst Resident Mining Engineer, Nelson.
1928.
B.C. Bureau of Mines.

this zone as molten silica which was not absorbed but solidified as inclusions and small seams of quartz. The absorption of quartzite produced a transition rock grading imperceptibly from quartzite to granite. Due to loss of heat in melting, the transition area cooled first as compared with the interior of the magma. It can be assumed that this differential cooling caused shrinkage to some extent and consequent fissuring, the fissures being mainly in the quartzite but extending often for a short distance into the granite. With release of pressure mineralizing agencies deposited ore in the fissures developed along the zone of contact."

In the absence of a more definite classification of this type of deposit, which is not possible until more geological data are available, the above theory will afford a basis for further study and exploration. In the development of the *Howard* the study of the ore-deposits and their origin has been the chief consideration of the management, having in view the application of geology to mining, so that development can be carried on in the most scientific and economic manner. The blocking-out of ore has been a secondary consideration, although a very considerable tonnage has been indicated and developed incidentally to the plan of exploration adopted.

Most of the new work has been done in No. 2 tunnel. A small amount of work was done on No. 1 level. The ore-body so far developed on this level, which has apparently a general north-south strike and westerly dip, is about 230 feet in length, extending from the *Queen* fault to the granite. The strength and width of the mineralization is impressive. The full width of the ore-body is not yet known, but it evidently exceeds the width of the tunnel in several places. Granite is exposed at several points along the western side of the drift, indicating a local northerly trend of the granite-contact, which, as it has been stated before, follows a general east-west course.

At the southern end of the ore-body the ore occurs in quartzite, which towards the centre of the ore-body grades imperceptibly into the highly siliceous transition rock previously mentioned. Considerable sampling of the Peck vein was done on this level and on No. 2 level before the present management assumed control, and the results of the sampling are given in the Annual Report for 1927. Summarizing these results, it may be stated that the ore contains commercial values in gold, silver, lead, and zinc, in which the gold values alone indicate a profitable operation.

Side-swiping at the southerly end of the Peck ore-body on the No. 1 level disclosed a width of 39½ feet of remarkably strong mineralization, which consists of quartzite containing disseminated sulphides of iron, lead, and zinc, with wide included bands and large masses of heavy sulphide ore. About 150 feet along the Peck drift from the main tunnel a winze was sunk about two rounds on massive sulphides at a point where the ore is at least 10 feet wide.

Towards the centre of the ore-body there is a raise from 35 to 40 feet up from the level on both sides, of which a little stoping was done. At the foot of this stope a sample taken across 9 feet 2 inches, in two sections of 53 and 57 inches respectively, assayed: Gold, 0.57 oz. to the ton; silver, 4 oz. to the ton; lead, 5.5 per cent.; zinc, 20.1 per cent.; and: Gold, 0.11 oz. to the ton; silver, 2.5 oz. to the ton; lead, 5.4 per cent.; zinc, 11.3 per cent. At the present incomplete stage of development on this level it will be safe to assume an average width of at least 10 feet for the ore-body for a length of 230 feet. The above general description of the ore-body on the No. 1 level is based on the assumption that the mineralization follows a northerly and southerly course, paralleling the the granite-contact west of the tunnel, but this is subject to a revision as exploratory work progresses.

On No. 2 level the exploratory tunnel extending easterly was continued a short distance beyond a point vertically below the Peck drift in No. 1 tunnel. This tunnel being still in granite, work was discontinued at this point and a branch tunnel was driven southerly along the exact course of the Peck drift on the level above. This branch tunnel left the granite in a few rounds and entered massive quartzite containing in places very sparsely disseminated sulphides of iron, lead, and zinc. At a point directly below the wide showing at the southern end of the Peck drift in No. 1 tunnel a raise was put up at an angle of 70° with a view to crosscutting the downward continuation of the Peck ore-body on its assumed westerly dip of about 40°. At about 80 feet up this raise the foot-wall of the Peck ore-body was encountered, and the raise was continued as a crosscut through a width of 40 feet of strong mineralization without fully penetrating to the hanging-wall of the ore.

The angle of the raise was then reversed and the working continued along the ore-body, connection being made with the Peck drift on the No. 1 tunnel just north of the main crosscut.

The upper part of the raise is driven in the approximate centre of the ore-body for a length of about 40 feet on an angle of 45°. The foot-wall of the ore-body cut in the 70° raise shows a well-defined plane of fissuring striking north-westerly, with 40° dip to the south-west. A section of the showing is roughly as follows: Against the foot-wall and on the northern side of the raise there is a lens of massive sulphides 18 inches wide, which peters out in a few feet towards the south.

The hanging-wall side of the ore-body is marked by a band of solid sulphide ore 4 to 5 feet wide, which has not been fully penetrated, similar ore being visible in the top of the raise. The intervening space between hanging-wall and foot-wall ore is occupied by a series of parallel, flat-lying, ore-filled fractures, a few inches in width, each veinlet being separated by from 1 to 3 feet of quartzite. Sampling of the accessible portions of this big showing indicates commercial values across the entire width, with certain planes of mineralization of very good milling grade.

When the writer last visited the property preparations were being made to crosscut westerly at a point 25 feet below where the foot-wall was encountered in the raise. Subsequently this westerly crosscut is reported to have encountered the foot-wall of the ore-body at a distance of 28 feet. At the foot of the raise the exploratory tunnel on the No. 2 level was continued southerly a short distance and then westerly to where the *Howard* fault and accompanying dyke and crushed zone is cut.

This fault is exposed at one other point on No. 2 level where it cuts off the northern end of the ore-body, 60 feet in length, which extends northerly from near the end of the main tunnel. No more work has been done on this ore-body. On the No. 3 tunnel level no commercial ore has yet been developed, but it is not advanced far enough to encounter the ore-body on its dip. A quartzite area with very interesting possibilities lies a short distance ahead of this tunnel, which is still in granite. At the first bend in this tunnel at point A as shown on the accompanying illustration, an area of sparsely disseminated mineralization was encountered in quartzite just before the granite was entered. The same conditions existed at points B, C, and D, in other parts of the mine, indicating mineralization in some degree in the quartzites wherever the granite-contact is approached.

A very substantial tonnage is now assured, with large blocks of ore being indicated above the stope on No. 1 level and above and below No. 2 level. Results of exploration at the *Howard*, now in its very early stages, will be watched with great interest, since it may reveal important economic possibilities for the granite-quartzite contacts where other similar zones of fissuring may be expected. According to last advices, a tunnel is being driven south-easterly from the end of the main tunnel on No. 1 level to prospect for the faulted southern extension of the Peck ore-body, which is believed to lie about 225 feet to the east.

Canadian-Cariboo.* This property, adjoining the *Howard* to the north-east and south-east the *Canadian-Cariboo* group, comprises five claims—*Canadian*, *Cariboo*, *Sunset*, *Eagle*, and *Eyry*—which are located on the north-east slope of the South fork of Porcupine creek at elevations ranging from about 5,500 to 6,400 feet above sea-level. In the Annual Report for 1927 the property was briefly referred to under *Canuck*. The *Canadian-Cariboo* has been bonded by the owner, D. A. Cameron, to C. M. Everitt, of Seattle, who financed the exploratory work done during the summer and fall of 1928.

The formation of the area has not yet been mapped with any accuracy. It may be described as an area of altered sedimentary rocks intruded by stocks and tongues of granite related to the Nelson batholith. Aplitic dykes were noted on the *Cariboo* in the vicinity of the vein. The rocks, of sedimentary origin, include limestones, schists, and argillites.

On the *Cariboo*, which is located near the head of the South fork, the old workings consisted of two tunnels, 90 and 8 feet in respectively, and some open-cuts, which together developed a quartz vein for a length of several hundred feet along the outcrop. The 90-foot tunnel was caved for some distance in from the portal. The vein strikes northerly up the steep hillside and dips to the east. The country-rock is of an argillaceous, schistose character. The vein, which averages about 4 feet in width, is mineralized in places with galena, accompanied by occasional zinc-blende and pyrite, disseminated through the siliceous gangue. A representative sample across 4 feet assayed: Gold, 0.03 oz. to the ton; silver, 4.25 oz. to the ton; lead, 6.4 per cent.; zinc, 0.8 per cent. At the time the property was inspected it was not possible to form any idea of the length of the mineralization, only short lengths of vein being exposed.

Since the claim was visited the new interests are reported to have done some trenching and to have cleaned out and advanced the caved tunnel a short distance. According to the management, a lens of ore was revealed, averaging 4 feet in width, which extended in from the portal of the tunnel for a distance of 35 feet, and the continuation of the shoot is possible to the south or down the hill. A considerable amount of trenching and shallow exploratory work was also done on the *Sunset*, *Eagle*, and *Eyry*, which claims have not yet been examined by the writer. The *Eyry* adjoins the *Paddy* claim of the *Howard* property to the east and is staked along the trend of the *Queen* vein, which is followed by the original tunnels of the *Howard*.

In view of the importance of the granite-quartzite contact-zone as demonstrated at the last-mentioned property, the *Eyry* ground is considered to have interesting exploratory possibilities. It is understood that, during the coming season, trenching on this claim will be continued northerly towards the contact of the granite and altered sediments, where mineralization will be looked for in quartzites or limestones.

Big Horn.* This property, situated on the summit forming the divide between the South fork of Porcupine creek and Hidden creek, consists of the *Sunbeam*, *Buckeye*, *Mary A.*, and *Nora Marie* claims, which have been acquired recently by J. W. Peck, J. H. Pomeroy, F. R. Weeks, O. C. Thompson, and associates. A small amount of superficial exploratory work was done during the summer season on the property, which has not yet been visited. The old workings are reported to consist of a tunnel, 340 feet in length, and a shaft from which short drifts have been run. The ore, which contains gold values associated with iron and zinc sulphides in a siliceous gangue, is reported to occur in a vein along a granite-quartzite contact. The discoveries at the *Howard* have directed attention to the importance of the quartzite-granite contacts in this area.

Rainy Day.* This property consists of the *Rainy Day*, *Lucky Sunday*, and *Success* claims, situated on the south side of Porcupine creek, about a mile above its junction with the South fork. A considerable amount of exploratory work was done on the claims this season by J. Thexton, the owner. Starting from near the creek and going southerly up the hillside, and on the *Rainy Day*, three short tunnels and some open-cuts develop a band of altered, mineralized limestone along a granite-contact. The mineralization consists of irregular streaks, bands, and disseminations of zinc-blende, pyrite, and occasional galena, in the calcareous gangue. A wide belt of granite, lying to the east, separates the limestones from the roof-pendant rocks of the *Howard* deposits on the South fork of Porcupine creek. Selected material gave the following assays: Gold, 0.01 oz. to the ton; silver, 0.7 oz. to the ton; lead, 9.4 per cent.; zinc, 7.6 per cent.; and: Gold, trace; silver, 0.3 oz. to the ton; lead, *nil;* zinc, 27.1 per cent.

Sulphides, chiefly of zinc, have been exposed in the limestone at numerous points along the contact, but no continuity of mineralization could be seen. Some further prospecting might be done to advantage along the zone of contact.

Blue Bell.* A small amount of work was done during the season by T. Wilkinson and J. H. Dunn on the *Blue Bell*, situated on the northern side of Porcupine creek, opposite its junction with the South fork. The claim was visited in 1926 before the present activity materialized. Some superficial workings develop quartz veins containing, in places, disseminated sulphides of iron, lead, and zinc, with which gold and silver values are associated. The property is situated in an area of altered sediments intruded by granite.

Sheep Creek and South of Salmo.

Silver Dollar.* This property, situated on the south-western outskirts of the townsite of Salmo and owned by L. Clubine, has been taken over by the Consolidated Mining and Smelting Company. Work commenced towards the end of the year and the shaft was sunk to further depth. The ore carries values in silver, lead, and zinc. The property was described in the Annual Report for 1915, since when a small amount of drifting was done. New equipment recently installed includes two portable compressors and a hoist.

Udiville.* A small amount of superficial work was done on this property during the summer months by J. Sapples. The property, consisting of the *Udiville*, *Last Chance*, and *Lucky Jim* claims, is situated on the eastern side of Bear creek, which is a tributary of Sheep creek from the south. The cabin, at an elevation of about 3,300 feet above sea-level, is 700 feet higher than the Sheep Creek road, with which connection is

made by trail. On the *Udiville*, at a short distance from the cabin, some superficial workings, consisting of open-cuts, a tunnel, and a shaft, develop a band of limestone from an elevation of about 3,450 to 3,900 feet above sea-level. The limestone, striking northerly up the hillside, is irregularly mineralized in places with sparsely disseminated sulphides of iron, lead, and zinc over widths up to 6 feet wide. A sample taken across 3 feet in an open-cut at 3,450 feet elevation assayed: Gold, 0.01 oz. to the ton; silver, 0.3 oz. to the ton; lead, 0.5 per cent.; zinc, 7.7 per cent. Another sample taken across a 4½-foot section of rock exposed in a slide just below the cabin assayed: Gold, 0.01 oz. to the ton; silver, 0.4 oz. to the ton; lead, 0.4 per cent.; zinc, 10.8 per cent. A sample of selected material assayed: Gold, 0.02 oz. to the ton; silver, 0.6 oz. to the ton; lead, 6.9 per cent.; zinc, 4.8 per cent.

Reno Gold Mines, Ltd.*

The property of the Reno Gold Mines, Limited, was described at some length in the Annual Report for 1927 and it will only be necessary at the present time to refer to the progress which has since been made. An active campaign of development was recently inaugurated following the introduction of working capital supplied by English interests represented by C. E. Hutton. Towards the end of September work was started on the construction of new camp buildings, which are located on a bench below the No. 4 tunnel. The completed buildings include a large cook-house, an office building with sleeping accommodation for the staff, and a garage. A bunk-house, to which a dry and store house will be connected, is under construction. A branch road has been built by the company from the No. 4 level to the camp, which is connected by road with Salmo, on the Great Northern Railway. New equipment installed at the mine includes a 320-cubic-foot Ingersoll-Rand portable compressor and gas-engine, steel-sharpener, drifting-machines, ventilation-fan with gas-engine, and a 2-bucket aerial tram which connects Nos. 3 and 4 levels. A caterpillar tractor has been provided and is in use for bringing in supplies. In view of the late start made, and the winter conditions prevailing at the time construction of the new camp was started, the progress made at the mine is very satisfactory.

Altogether several hundred feet of underground development was done in the No. 3 and No. 4 tunnels. In both these workings a shoot of high-grade gold ore is being developed. Before the present work was started the writer sampled the vein, which was exposed for a length of 60 feet at the inner end of No. 3 tunnel, the assay giving an average of $35.55 gold to the ton and 1 oz. silver to the ton over an average width of 30 inches. This drift-tunnel has been advanced and the length of the ore-shoot increased to a total of about 220 feet. At the west or portal end of the ore-body the vein is now well exposed for a length of 96 feet, and channel samples taken by the management for this distance averaged $55.80 gold to the ton over a width of 20.4 inches. In this section of the vein, which consists of honeycombed rusty quartz, visible free gold is of common occurrence, and some fine specimens containing coarse gold were extracted when driving the tunnel. Beyond this point the vein is visible along the north wall of the tunnel, but is not sufficiently exposed to permit of accurate sampling. Drill-holes have been put in at intervals, however, and the vein is evidently continuous and carries good values.

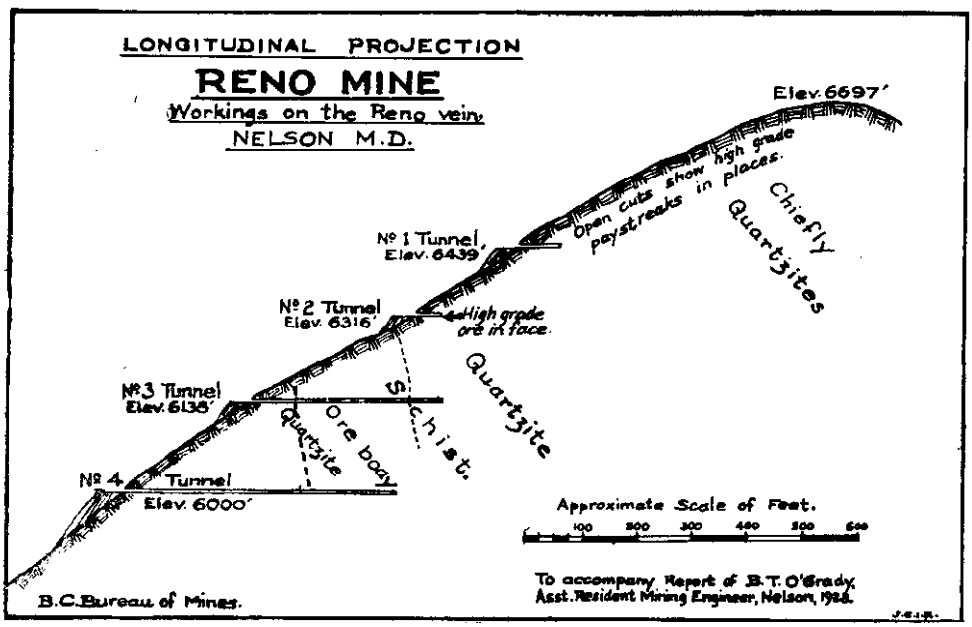
At about 175 feet from the west end of the ore-shoot the vein has been broken into and a sample across 54 inches assayed $21.60 gold to the ton. The backs on the ore-body would be approximately from 50 feet at the western end to 178 feet at the eastern end. Work done in the No. 4 tunnel, which is 158 feet vertically below the No. 3, indicates the continuation of the ore-body to that level. The vein is not well enough exposed for thorough sampling, as it has mostly been stripped and left in the wall of the tunnel. Drill-holes at short intervals prove the continuity of the vein, and where it has been broken into in places high-grade ore is visible similar to the ore on No. 3 level.

On both levels the ore-shoot starts in quartzite and continues for some distance into the schist. Where the quartzite is cut the vein is well defined with uniformly good values. In the schist the vein has a tendency to widen considerably and split, and the values are lower. The extremities of both tunnels are in schist, but another belt of quartzite lies a short distance ahead. Quartzite is exposed in the face of No. 2 tunnel, where a sample across a 9-inch pay-streak of oxidized quartz assayed: Gold, 3.28 oz. to the ton; silver, 1 oz. to the ton. No. 1 tunnel, in which the vein splits, as described in the Annual Report for 1927, is in schist, but quartzites lie a short distance beyond it, and between this tunnel and the apex of the mountain there is an area of quartzite of considerable extent indicated by surface cuts in which high-grade pay-streaks can be seen. The formation strikes northerly and dips to the east about 50°. In the Sheep

Creek gold camp the ore-bodies have generally been localized in the veins where they cut the quartzites. In the case of the *Reno* the quartzites have been but little explored in the limited underground workings. There are six other known veins on the property as exposed by surface workings and areas of float-ore indicate possibilities of other veins being found. All the veins have a similar strike and dip to the more extensively developed veins in the mines of the Sheep Creek camp and cut similar rocks.

The No. 2, No. 3, and *Crescent* veins, exposed in surface cuts, parallel the *Reno* (or No. 1) vein, a short distance away, and can be reached by crosscut tunnels from the underground workings on the last mentioned, which is the only vein to have been developed to any appreciable extent. A crosscut tunnel is now being driven from the *Reno* No. 4 level southerly to cut the No. 2 vein.

In conclusion, it may be said that the series of veins on the property are clean-cut fissure-veins of fair size; their persistence in a horizontal sense is indicated by the *Reno* vein, which has been traced for some 1,500 feet; and they contain high-grade ore-shoots. The oxidized zone of enrichment, in which the ore is free-milling, will probably go down to considerable depth judging from the unusual depth of oxidation encountered at the neighbouring mines.



The *Reno* veins apparently belong to the same series of veins which includes the *Queen*, *Nugget*, *Motherlode*, *Kootenay Belle*, and other veins. It is interesting to note that the elevation of the highest showing on the *Reno* is over 3,500 feet higher than the lowest horizon at which ore was developed in the *Queen*.

The property, though only slightly developed as yet, offers promise of becoming a profitable mine, and the ore-shoot being developed between Nos. 3 and 4 levels warrants the expectation that the production stage will soon be reached. In this connection the management is considering the installation of a 25-ton pilot mill.

News has just come to hand that Charlie Woodrow, well-known prospector, hunter, and trapper, was carried away in a snowslide while helping to clear the road below the *Reno*, where he had been employed since operations started last fall. His loss will be deeply regretted in the mining fraternity.

*Iron Cap.**—This group, situated on Fawn creek below the *Reno* and reached by the same road, has been bonded by the owner, N. McColeman, to J. C. Hesse and associates, of Toronto, who made a small cash payment. Some activity is therefore expected during the coming season. A description of the property is contained in the Annual Report for 1924.

*Queen.**—At this property the work done by A. Lavigne, R. E. Stayner, and associates, of Spokane, has chiefly consisted in stoping a small tonnage of the *Alexandra* vein, from which the ore was hauled to the *Queen* mill. A small amount of gold bullion was recovered and some concentrates were shipped. Work was discontinued towards the end of October.

Kootenay Belle.* This gold property, operated during the last two years by F. M. Black and associates, of Vancouver, is situated on the mountain ridge forming the angle between Sheep and Wolf creeks. It is connected by trail with the Sheep Creek road at the *Queen* mill, 9 miles from Salmo. An aerial tram connects the lower tunnel (No. 2) with ore-bins at the road on the northern side of Sheep creek. Other equipment includes a 325-cubic-foot Ingersoll-Rand compressor driven by 50-horse-power fuel-oil engine.

Previous references to the *Kootenay Belle* are contained in the Annual Reports for 1915 and 1927 and in the Summary Report of the Geological Survey of Canada for 1908. No. 1 and No. 2 tunnels, at elevations of 4,120 and 3,925 feet respectively, and connecting workings, comprise the main development. These tunnels crosscut and develop two nearly parallel quartz-filled fissure-veins known as the No. 1 and No. 2 veins. During 1927 and 1928 work has been concentrated by the present operators on the No. 1 vein, the smaller and richer of the two, from which eleven car-loads of high-grade ore has been shipped during these two years. Of this amount, seven car-loads was shipped during 1928. Work was temporarily suspended at the end of October.

Columbia.* This Crown-granted claim, Lot 8870, is situated on the northern side of Sheep creek and is connected by trail with the road near the *Queen* mill, 10 miles from Salmo. The claim, between 4,000 and 5,000 feet above sea-level, is situated near the centre of the Sheep Creek gold camp, which includes the *Queen*, *Yellowstone*, *Kootenay Belle*, *Nugget-Motherlode*, and *Reno* properties.

The *Columbia* veins have the characteristic north-easterly strike and south-easterly dip of the gold-quartz veins of the camp and occur in the same geological formation, consisting chiefly of quartzites, schists, and slates. The general strike of the rocks is northerly, with fairly steep dips to the east. The veins are fissure-veins, angling across the formation in a north-easterly direction and dipping steeply to the south-east. The ore consists of free gold and gold-bearing pyrite in a quartz gangue.

Of several parallel narrow fissures on the *Columbia*, only one vein has been developed to any extent. This vein, from a few inches to 1 foot in width, is well defined and has been traced underground and along the surface for several hundred feet. The country-rock throughout the tunnel, which is a drift along the vein about 220 feet long, is quartzite. Commencing at about 12 feet inside the portal, a small amount of stoping has been done for a length of about 45 feet. Towards the centre of this stope a raise, at present difficult of access, connects with the surface.

The ore extracted from the stope is reported to have been milled in the old *Kootenay Belle* mill, 1,000 feet below the tunnel, when the *Columbia* was under lease and bond to Warner and associates (in 1909), who built a wire-rope tramway to connect the *Columbia* tunnel with the mill. There is no record of the values recovered, as the gold returns were apparently included with those from other properties being operated by Warner.

The writer was only able to take one sample in the back of the stope at a point 30 feet in from the portal and 15 feet above the floor of the tunnel, owing to the rotten condition of the timbering. This sample, taken across 10 inches of iron-stained quartz, assayed: Gold, 0.21 oz. to the ton; silver, 0.4 oz. to the ton. In the tunnel beyond the area stoped there is a well-defined fracture, but the vein is too narrow to be sampled to advantage.

The schist-belt is believed to be a short distance beyond the end of the tunnel, so that possibilities for finding ore in that direction are limited. South-west of the portal of the tunnel, quartzite, which is the rock in which the best ore-shoots of the camp are found, extends for several hundred feet. Possibilities for finding ore consist, therefore, in prospecting the vein extension in the quartzite along the trend of the vein south-westerly from the portal of the tunnel and in deeper development of the ore-shoot below the stope in the tunnel. The fissure, which is very small but clean cut, appears to be persistent for some distance in a horizontal sense and is likely to be so vertically. There are other parallel narrow fissures on the claim which might be prospected to advantage. The veins can be developed at depth by short crosscuts and drift-tunnels.

Salmo Consolidated Mines, Ltd.*

This property, consisting of the *Sitting Bull, Yellowjack, Blue Jack, White Cloud, Yellowjack Fraction*, and *Blue Jack Fraction* Crown-granted claims, is situated on the eastern side of Cariboo (or Elk) creek, which is a tributary of Sheep creek from the north. A recently constructed branch road, 1.4 miles in length, connects the camp with the *Reno* road, which switchbacks up the steep mountain-side from the main Sheep Creek road to Salmo, the total distance being perhaps about 12 miles.

Many years ago the property was partially explored by surface work and a shaft. The above claims, which had reverted to the Crown, were acquired in 1926 by P. F. Horton, A. E. Place, and associates. Subsequently, and after a small amount of preliminary work was done, the Salmo Consolidated Mines, Limited, of Toronto, was formed. The company, capitalized at $3,000,000, started work this year. After building the branch road, camp buildings were erected and underground work was commenced with a portable gasoline-engine and compressor. Development-work done during the year includes extensive trenching on the surface and about 500 feet of tunnelling. The old shaft was unwatered and a small amount of work done in it.

According to the "Sketch Map of Sheep Creek Mining Camp" (Geological Survey of Canada, Map No. 1068), the formation on the property consists of schistose sedimentary rocks of the Pend d'Oreille group intruded by granitic stocks related to the Nelson batholith. The rocks in which the known deposits are explored by the workings herein described are now considered to be entirely of granitic nature, though in places, owing to their fine-grained texture and schistose character, they might be mistaken for rocks of sedimentary origin.

The deposits consist of a series of widely separated, narrow vein-like bodies which vary in strike from N. 20° E. to N. 65° E. and dip steeply to the south-east, or into the hill. These veins and stringers consist in part of quartz-filled fractures and partly of sheared zones in the granite where the wall-rock has been silicified and some metallic minerals deposited by replacement. The sulphide minerals, which occur sparingly disseminated in the gangue, are galena, sphalerite, pyrite, and pyrrhotite. In places considerable calcite occurs in the veins. In general the gold and silver values are low, but fair gold values are reported by the management from selected sulphide specimens.

The elevation of the collar of the shaft, which is on a level with the road near the camp, is 5,206 feet. This shaft is about 116 feet deep and develops a vein, from 1 to 6 feet wide, which dips on an average at about 58° to the south-east. At the collar of the shaft the vein is 1 foot wide and a sample taken across this width gave an assay of: Gold, 0.06 oz. to the ton; silver, 5.2 oz. to the ton; lead, 10.1 per cent.; zinc, 5.1 per cent. The shaft follows the vein part of the way down and then it (the vein) was left in the hanging-wall, but is exposed in two short crosscuts—one, 20 feet above the bottom of the shaft, and the other at the bottom. In the lowest of these crosscuts a sample taken across a width of 3 feet 2 inches assayed: Gold, 0.06 oz. to the ton; silver, 1.4 oz. to the ton; lead, 1.2 per cent.; zinc, 4 per cent. In the other crosscut the vein is about 6 feet wide but only very sparingly mineralized with galena, sphalerite, and pyrite. From an inspection of other parts of the vein in the shaft, where the mineralization is weaker than at the points sampled, it is apparent that the whole vein in this working would not stand up to milling grade.

On the northern side of the collar of the shaft a tunnel has been driven north-easterly by the present operators along a vein for about 160 feet, throughout which distance it lies entirely in granitic rock. Near the portal of the tunnel the vein is from 1 to 2 feet wide and then it swells out to 4 feet 2 inches at 65 feet in. At 75 feet from the portal it is 5 feet wide and at 85 feet it is 2 feet wide. From there to the face it narrows and splits into stringers. Throughout this drift mineralization of the vein is slight and irregular and as a whole cannot be considered to be of commercial milling grade. The following samples show the values:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
65 feet from portal, across 50 inches	0.02	2.6	4.0	4.0
75 feet from portal, across 5 feet	Trace	1.6	4.0	2.4
85 feet from portal, across 2 feet	Trace	1.4	2.8	3.8

In the same working, at approximately 48 feet in from the portal, a crosscut has been driven easterly about 90 feet in a semicircular direction without developing anything of interest. Since the property was visited a lower tunnel, at an elevation of 5,044 feet, has been driven 265 feet as a crosscut, which is being continued to connect by raise with the bottom of the shaft. Another tunnel, at an elevation of 5,163 feet and a little below the level of the road, is reported to have been driven 74 feet as a crosscut to cut another vein. There are a number of other veins and stringers, exposed in shallow diggings above the road-level and a little south of the shaft-collar, which, however, are too small to mine individually and too far apart to mine collectively. The following sampling results give an idea of the width and values of these other veins:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
Selected ore	0.04	2.2	*Nil*	0.8
15 inches	Trace	2.2	0.5	0.7
12 inches	0.02	2.2	3.1	3.6
24 inches	0.03	0.4	*Nil*	*Nil*
6 inches	0.01	1.7	3.0	*Nil*
4 feet	0.02	2.7	3.5	0.7
30 inches	0.03	1.3	6.7	1.1
Selected	0.04	0.4	*Nil*	*Nil*
6 inches	0.02	2.4	4.4	*Nil*
6 inches	0.04	1.4	3.9	0.5

News has just come to hand that the lower tunnel previously mentioned has cut the downward continuation of the vein-zone partially exposed in the bottom of the shaft. This lower tunnel is 65 feet vertically below the level of the bottom of the shaft. Throughout the last 90 feet of this tunnel, which crosscuts diagonally the general trend of the deposits, some very scattered mineralization, consisting of streaks of calcite with galena, pyrite, and zinc-blende, was encountered. Towards the inner end of this wide zone there is a width of 6 feet in which the mineralization is somewhat more concentrated, not sufficiently, however, to constitute commercial ore. The widespread mineralization encountered in the lower tunnel is of some interest and indicates better possibilities of commercial deposits being found in the vicinity.

Aspen.* At this property, situated on Deer creek, about 11 miles by road from Salmo, development has been continued by the Salmo-Malartic Mines, Limited, of Toronto, which took over the property from P. F. Horton and associates in the fall of 1927. Previous references to the *Aspen* are contained in the Annual Reports for 1915, 1917, 1926, and 1927. The property is situated towards the northern end of the Pend d'Oreille limestone-belt, about midway between the *Hunter V.* and *H.B.*

Geological conditions in general are good, but as yet the results of a considerable amount of development have not demonstrated any continuity of commercial mineralization. The formation consists of limestones and schists intruded by stocks of granite and basic dykes. Ore has been found in limestones in two parallel zones, striking north-westerly and dipping to the north-east, known as the upper and lower ore-zones. In the upper zone the ore contains high silver values, and a little gold, associated with lead, zinc, iron, and copper sulphides which are irregularly scattered through the silicified limestone gangue. This upper zone, which is about 50 feet wide, is developed by shallow surface workings—"A" tunnel, which is connected by a raise with the surface, and "B" tunnel. "A" tunnel, at an elevation of about 4,725 feet, is situated at the northern end of the underground workings and is a crosscut driven about 148 feet. Near the end of this tunnel some mineralization, chiefly consisting of iron sulphides, was encountered and a vertical raise was put up about 106 feet to where it comes to the surface. About 65 feet up this raise a short tunnel also connects with the surface. In these "A" tunnel workings the mineralization is irregular and scattered and as yet no definite ore-body is indicated.

Several hundred feet to the south, and at an elevation of 4,632 feet, "B" tunnel, which is a crosscut, has been advanced to about 550 feet from the portal, penetrating the ore-bearing limestone exposed in the surface workings, from which a small tonnage of high-grade silver ore was shipped some years ago. At points 457 and 500 feet in from the portal of the crosscut drifts extend northerly, which are about 40 and 120 feet long respectively. The last-mentioned drift

contains a 20-foot crosscut. In places in the workings developing the mineral-zone on "B" tunnel level there is some slight mineralization consisting chiefly of iron sulphides with occasional spots of lead and zinc sulphides. About 300 yards farther south the lower ore-zone, which is characterized by more lead and zinc and a lower silver content, is developed by "G" tunnel workings, at an elevation of 4,537 feet, and some surface trenches. These underground workings, comprising about 810 lineal feet of development, chiefly crosscut and develop a band of limestone in which promising sulphide mineralization has been found in places. The mineralization is apparently confined to a band of limestone, averaging about 20 feet in width, in which spots of commercial milling-ore have been exposed without, however, any continuity of the ore having been proved.

Future work, it is understood, will be concentrated on following the limestone-beds, which are known to be mineralized to some extent, into contorted and fractured areas which are expected to be more favourable for deposition. In this connection the marked anticlinal fold to the south of the "G" tunnel workings presents interesting exploratory possibilities. Towards the end of the year drifting was in progress from "G" workings to the south-east and encouraging mineralization containing lead and zinc sulphides was encountered in a short distance. Subsequently the property was shut down, but it is believed that exploratory work will be resumed before long. Late in the year C. C. Starr was retained by the company to make a detailed study of underground and surface geology with a view to advising on future work.

Mona.* This group, comprising some claims owned by W. H. Miller, of Salmo, is situated on the mountain ridge forming the angle between Lost creek and the South fork of the Salmon river. The deposits, exposed in shallow surface workings, consist of wide showings of disseminated sulphides, chiefly zinc-blende, with small amounts of galena, occurring in bands as replacement deposits in Pend d'Oreille limestone. Following some preliminary surface exploration, the Consolidated Mining and Smelting Company put down some diamond-drill holes to test the deposits at depth. Subsequently this company relinquished its option.

Reeves-McDonald. This property, comprising a group of fifty-seven claims, is owned by the Reeves-McDonald Mines, Limited. The capitalization is 3,000,000 shares of no par value, of which 2,000,000 are issued. H. H. Yuill is president and general manager; Harold Lakes is in charge of work at the mine. The claims cover an area of 480 acres, extending from the Pend d'Oreille river in a north-easterly direction along a belt of limestone in which important replacement deposits of zinc-lead ore have been discovered on either side of the International boundary-line. The limestone belongs to the Pend d'Oreille group of rocks and is a pronounced geological feature of the southerly portion of the Nelson Mining Division. The general uniformity of the strike and dip of the limestone, together with the evidence of strong mineralization at various points along the zone, lend confidence to the belief that the property has important potentialities in sections which have not as yet been explored.

Early prospecting done by the original owners, Reeves and McDonald, was naturally confined to surface outcrops, leaving unexplored long stretches where the bed-rock is covered by a considerable depth of overburden. The property was first acquired by R. H. Stewart for the Victoria Syndicate in 1925, when diamond-drilling, followed by underground work, disclosed the existence of an ore-body of large dimensions on the *Reeves* claim. Latterly development and exploration has been carried on under the direction of Colonel Yuill.

As a preliminary step to an extensive development and exploration campaign, a geological survey was made of the area by J. J. O'Neill during 1928, and it is understood that this work will be continued in 1929 as soon as the snow leaves the surface.

The results of the work so far accomplished and proposed work is fully described in an official statement made by H. H. Yuill, of which the following is a copy:—

"*Geology.*

"*General.*—A limestone series of rocks is traceable from the Hudson Bay Mine area in British Columbia to the Electric Point mine near Northport, Washington, a distance of 25 miles. Along this belt are found limestones with zinc and lead mineralization. In the 3-mile section of this belt covered by the company's mineral claims there are known to be five beds of limestone, two of which have been partly prospected. While it has been known for some time that the limestone formation carries lead and zinc mineralization, a considerable amount of prospect-

ing and exploration has been required to locate sections where conditions were favourable for concentration of the mineralization and the occurrence of workable ore-bodies. On the 3-mile stretch covered by the Reeves-McDonald ground, which is bounded at both ends by fault-zones, the conditions are favourable for the occurrence of large ore-bodies; the lime-beds conform in strike and dip with the important regional fracturing which provides the main channel of mineralization and local folding has provided structural conditions favourable for concentration of the minerals into large ore-bodies of even grade.

"When this company purchased the property, five promising ore-zones had been indicated by previous work, namely:—

"*River Ore-zone.*—This zone is at the west end of the property, abutting on the Pend d'Oreille river, which flows in a fault-valley. The lime is considerably faulted and forms a bluff about 100 feet high, which is well mineralized.

"This area has various open-cuts and surface indications immediately adjacent to the river, and extending into the river, where there are two islands uncovered at low water, carrying heavy lead and zinc sulphides.

"The lime horizon containing mineralization was traced along the river-bank to a point 1,100 feet distant, where the minerals were heavily oxidized.

"*McDonald Ore-zone.*—Here the McDonald tunnel was started and driven east along an oxidized zone 10 to 12 feet in width, containing both lead and zinc values for 635 feet, with crosscuts at regular intervals. The ore in this section contains lead and zinc carbonates assaying up to 25 per cent. lead and zinc, having no present commercial value, but indicating the position of a probable sulphide ore-body in depth which will be prospected below the zone of oxidation.

"*Reeves Ore-zone.*—Approximately 3,000 feet east from the McDonald tunnel and at 1,000 feet higher elevation, a tunnel was started in a large outcrop of sulphides. The main drift follows the mineralized area for 1,016 feet along its strike and crosscuts were driven at intervals of 75 feet. The ore-zone was tested by diamond-drilling for a further 800 feet below the tunnel (i.e., 1,100 feet below the outcrop) and was found to maintain its value and width to that depth.

"The ore is a replacement along the shattering in the lime parallel to the bedding-planes, with uniform values in the main ore-zones and gradually disseminating into the walls. What is classed as commercial zone extends from the portal of the tunnel 620 feet along the strike of the lime, with an average width of 32 feet and in places measuring 60 feet. This gives an ore area of nearly 2,000 square feet. A compilation of the assays from a large number of several independent samplings that have been made shows a grade from this ore-zone of 0.5 oz. silver, 1.7 per cent. lead, and 6.6 per cent. zinc over an indicated tonnage of about 2,000,000 tons.

"Under the present programme of work a long tunnel is being driven from the McDonald ore-body along the limestone to the Reeves ore-body, which it will cut at the level of the lowest diamond-drill, and will prospect the limestone for 3,000 feet between the McDonald and the Reeves ore-zones, in addition to providing a main haulage-way for Reeves ore.

"*O'Donnell Ore-zone.*—As a result of this work a zone of oxidized overburden was located and some surface-trenching was done which exposed heavy oxidized mineralization extending for over 400 feet along the lime, but, owing to the deep overburden of soil, surface work was disbanded in favour of a crosscut tunnel to intersect the lime at a depth of 50 feet. This tunnel has now cut across 105 feet of limestone mineralized with lead and zinc sulphides, 25 feet of which assayed 8 per cent. combined lead and zinc; 40 feet, 4.6 per cent.; 15 feet, 10 per cent.; and 25 feet of lower grade. Further work will be done to determine the size and value of this ore-body, which promises to add considerable potential tonnage of commercial ore. Later, the main tunnel will be extended from the Reeves a further 2,000 to cut the O'Donnell ore-zone at a depth of 500 feet below its outcrop, and at the same time explore the lime between the Reeves ore-zone and the O'Donnell ore-zone.

"*Prospect Ore-zone.*—A further result of the geological prospecting has been to locate a mineralized zone on a parallel bed of limestone about 4,000 feet east of the Reeves ore-zone. Surface cuts along the lime showed mineralization for 1,100 feet. The width and extent of this ore-body have not been determined to date, the lime being covered with heavy wash and a few exposures found. It will be necessary to trench this portion of the ground and investigate with diamond drilling. This is called the Prospect ore-zone.

"Much of the area along the lime-belt contained within the company's property has not been tested and it all justifies careful prospecting and detailed geological work, especially on the parallel lime-beds in corresponding positions to the known ore-zones on lime-belt No. 2.

"With the nature of the ore occurrences here any new ore-zones found may easily be of higher grade if conditions happen to be slightly more favourable. Any consideration of the value of the ore on this property should take into account the very favourable physical conditions for cheap mining; the ore-zones are wide, the limestone dips at an even angle of 56°, the ground holds up well and lends itself to the cheapest methods of mining. In addition to this, the nature of the mineralization and deposition of the ore is such that standard metallurgical practice will make high recoveries at a low cost. The zinc mineral is a light-coloured high-grade sphalerite which concentrates to a product carrying over 60 per cent. zinc.

"The work in hand and the policy of the company for the coming season is to drive the low-level tunnel along the limestone between the McDonald ore-zone and the Reeves ore-zone, and later extending it along the limestone to the O'Donnell ore-body. As soon as the snow is off the ground an intensive study of the surface geology will be made with a view to locating further favourable positions for testing by trenching or diamond-drilling.

"In the meantime, the West Kootenay Power Company is developing a power-site on the Pend d'Oreille river about 7 miles from the property, and according to press announcements the Canadian Pacific Railway has in its construction programme a railway from Trail to Metaline, the survey-line for which passes along the Pend d'Oreille river near the mouth of our new main tunnel. These developments should have a favourable bearing on the future operation of this property when it has reached a stage requiring power and transportation facilities.

"H. H. YUILL,
President and General Manager."

Red Bird.* At the *Red Bird*, across the river from the *Reeves-McDonald*, the lower tunnel was extended several hundred feet. The mine-workings contain extensive exposures of completely oxidized and decomposed zinc-lead ore, no sulphides having yet been encountered. The deposits are found in a wide fractured zone conforming in strike and dip with the enclosing limestone. The ore-minerals include the carbonates of zinc and lead, smithsonite and cerusite, with possibly some sulphate of lead, anglesite, and the zinc silicate—calamine. The silver content of the carbonate ores is low. The lead carbonates are so far confined to rather small areas in the more continuous zinc-carbonate mineralization. There is a constant lead content in the zinc ores and some zinc in the lead ores, and both are intimately associated with the oxides, and perhaps carbonates, of iron. The lower tunnel, some 1,200 feet in length when last visited, is about 800 or 900 feet in elevation above the Pend d'Oreille river. Other workings above the lower tunnel include two short tunnels, a shaft about 35 feet deep, and a number of open-cuts. In all the workings, which are situated on both sides of a gulch, there are wide exposures of oxidized decomposed material containing lead and zinc carbonates. Eight samples of oxidized material from the different workings, over widths up to 6 feet, gave assays showing: Gold, from 0.01 to 0.04 oz. to the ton; silver, from 0.6 to 4.6 oz. to the ton; lead, from 2.6 to 8.6 per cent.; zinc, from 3.8 to 17 per cent. A sample across a 2½-foot band of zinc-carbonate ore in the lower tunnel assayed: Gold, 0.02 oz. to the ton; silver, 4.2 oz. to the ton; lead, 3.3 per cent.; zinc, 24.1 per cent. During the latter part of the year some diamond-drilling was done with a view to ascertaining the depth to which oxidation extends.

Iva-Fern.* This group consists of the following seven Crown-granted claims: *Excelsior*, Lot 12657; *Fern*, Lot 12656; *Standard*, Lot 12658; *Iva*, Lot 12655; *Black Cap*, Lot 12654; *Jewel*, Lot 12653; and *Gem*, Lot 12652. The property is situated on the northern side of Cultus creek, about 7 or 8 miles by trail from Kootenay lake, on which transportation is afforded by steamers of the Canadian Pacific Railway Company. Cultus creek flows into the western side of the lake at a point 9 miles north-westerly from Kootenay Landing. There is a good wide trail on an easy grade from the lake-shore to the foot of the hill, a distance of about 5½ miles, from the end of which a switchback trail leads to the mine. The claims are staked in a northerly direction along the strike of the veins from the valley of Cultus creek to the summit of the rounded ridge separating the North fork from the main creek. The mine buildings include a bunk-house to accommodate about ten men, a combined dining-room and

kitchen to accommodate about twenty men, blacksmith-shop, etc. At the lake-shore there is a convenient cabin to accommodate men and supplies in transit.

There is little information available on the geology of the area, which has not yet been mapped with any accuracy. On the provisional West Kootenay sheet of the Geological Survey the area in which the property is situated is shown as entirely consisting of granite. This is not correct, however, and the formation in which the deposits are found consists of steeply tilted metamorphosed rocks, chiefly of sedimentary origin. Some distance east of this formation, however, there is a belt of granite several miles wide. These sedimentaries, which consist of banded argillites, schists, silicified dolomites, and quartzites, resemble the rocks of the Summit series, shown along the eastern margin of the Geological Survey map of the Ymir camp (Map 175A) and tentatively referred to the Cambrian or Pre-Cambrian period.

On the South fork of Porcupine creek the *Howard*, where new discoveries of importance have been made recently, is probably situated in a roof-pendant of the Summit series and farther south these rocks contain the deposits of the Sheep Creek gold camp. The mineral-belt in which the *Iva-Fern* is situated has been traced at intervals for several miles in a southerly direction, and during recent years a number of claims have been staked southerly from Cultus creek. The mineralization in the southern extension of the *Iva-Fern* mineral-belt consists of copper sulphides containing low values in gold and silver.

On the *Iva-Fern* two different types of mineralization were noted, one consisting of a fairly coarse galena, with which is associated chalcopyrite and zinc-blende, the other consisting of disseminated sulphides of lead and zinc without any copper. The gangue contains lime and silica and in places a considerable development of siderite was noted. In general the mineralization is of a character requiring concentration.

There are two veins exposed in the surface workings examined, which consist of numerous long shallow trenches dug across the strike of the formation and two shafts, 10 and 30 feet down respectively. These veins apparently coincide with the trend of the enclosing argillaceous rocks (slates), the strike of which is about N. 10° E. The dip of the veins is steeply to the west, apparently cutting the dip of the country-rocks, which is about 40° to the west. Basic lamprophyre dykes accompany the veins in places, but their possible connection with the ore-deposits has not yet been determined.

Most of the work has been done on the No. 2 vein, which is the most westerly or farthest up the hill. This vein is traced at short intervals on the surface by long shallow trenches and a shaft for a total length of about 600 feet of outcrop. The No. 2 tunnel, hereinafter described, develops the same vein a considerable distance farther south, so that altogether the No. 2 vein outcrop is traced over 2,000 feet in length. The elevation of the northern end of these workings at the summit is about 6,340 feet. At this point a trench shows iron-stained siliceous ledge-matter impregnated with galena over a width of several feet.

Farther south, at an elevation of 6,300 feet, there is a shaft, caved and inaccessible, at the southerly end of a trench about 36 feet long. On the dump of this shaft there are several tons of partially oxidized ore, heavily impregnated with galena and some chalcopyrite. Going south from the shaft for about 40 feet there is a trench at the easterly end, of which there is exposed a width of 10 feet of ore which is well mineralized with disseminated galena throughout. Some 70 feet farther south a trench 15 feet long exposes some ledge-matter containing disseminated galena. In this trench the full width of the mineralization is not exposed. The next trench to the south is off to one side of the strike of the vein. Continuing in the same direction, two more trenches expose oxidized ledge-matter only. The next two trenches, which are about 120 feet apart, were not accessible for debris, but the dumps show siliceous material well mineralized with galena. Therefore the strongest mineralization seen on the surface was in the trenches at the southern end of the outcrop workings and, farther north, at the shaft and trench just south of it.

The No. 1 vein lies a few hundred feet to the east of the main No. 2 vein, which it parallels at a slightly lower elevation. Surface workings seen on this vein consist of some eight or nine trenches and a shaft. Going south from the crest of the ridge, five trenches, distributed over a total length of around 180 feet, expose oxidized ledge-matter with some disseminated galena in places. Some 30 feet south of the last of these trenches there is a shaft, which was inaccessible for caving, on the dump of which are a few tons of good lead ore. A grab sample of this

ore assayed: Silver, 15 oz. to the ton; lead, 65 per cent. Some trenches south of the shaft show oxidized ledge-matter, no galena being noted.

The elevation of the upper tunnel and camp is about 5,950 feet. (All elevations herein are relative only, being based on aneroid readings.) This tunnel, which gains a depth of about 200 feet on the outcrop of the No. 2 vein, is driven westerly as a crosscut for about 500 feet. A drift to the north then extends along the No. 2 vein for about 120 feet. A basic lamprophyre dyke follows the hanging-wall side of the vein, but crosses to the foot-wall side of the vein at its intersection in the crosscut.

In the main crosscut, 22 feet east of the No. 2 vein, a 6-foot vein was cut, a sample across 4 feet of which assayed: Silver, 4.1 oz. to the ton; lead, 12.1 per cent.; zinc, 11.9 per cent. Continuing along the crosscut and a short distance beyond the main vein, there is, according to reliable report, a short drift developing a copper-silver showing which the writer missed seeing.

A cursory inspection of the 120-foot drift showed milling-ore in places through the first 100 feet of the tunnel, with continuous mineralization throughout the last 20 feet. A sample across 4 feet, 20 feet back from the face, assayed: Silver, 2.9 oz. to the ton; lead, 11.5 per cent.; zinc, 8.2 per cent.; and a sample across 4 feet in the face of the drift assayed: Silver, 2.5 oz. to the ton; lead, 5.9 per cent.; zinc, 15 per cent. A short distance back from the face a narrow stringer of massive galena and chalcopyrite is visible in the west wall of the drift.

According to the plans seen by the writer, the face of the drift is about 80 feet short of reaching a point vertically below the shaft and about 40 feet short of a point vertically below the trench just south of it, in which surface workings strong showings are developed. The drift, therefore, would only have to be extended a short distance to prove the downward continuation of the ore-body indicated on the surface. The No. 1 vein is cut in the main crosscut where it shows well-defined lines of fracturing but no appreciable mineralization.

The No. 2 tunnel, developing the No. 2 vein at an elevation of about 5,650 feet, has only been driven a short distance. Just inside the portal mineralization was encountered consisting of a width of 6 feet of disseminated galena, zinc-blende, and chalcopyrite, in a gangue of siderite and altered silicified country-rock. The dip of the vein in this working is apparently about 60° to the west. The hanging-wall of the vein is well defined, but the foot-wall is somewhat indefinite.

A short length of this ore is exposed near the portal of the tunnel, which continues for a short distance in a semicircular direction towards the west, but does not show any further appreciable mineralization. The ore at the portal has the appearance of being the apex of an ore-shoot to explore which it will be necessary to gain further depth. On the dump of this tunnel there are a few tons of ore which is heavily impregnated with galena and chalcopyrite. The above workings comprise the area examined by the writer, but there are, it is understood, other showings, and also areas where considerable amounts of float-ore have been found.

Some preliminary work was done on the *Iva-Fern* by the Consolidated Mining and Smelting Company in 1918 and 1919. Work done by this company included most of the surface-trenching and the driving of the first 237 feet, approximately, of the crosscut tunnel. In 1922 the Standard Silver Lead Mining Company bonded the property and continued the crosscut to the intersection with the main vein, which was drifted on 120 feet to the north. In 1923 work was discontinued by this company and no work has been done since.

The position is that, for various reasons not detrimental to the property, work done on the *Iva-Fern* has not been brought to full conclusions. By extending the drift a few hundred feet the downward continuation of the shaft ore-body will be tested and information gained which will be of value in developing the numerous other showings on the property.

The mineral-belt in which the *Iva-Fern* is situated presents very interesting exploratory possibilities, chiefly on account of the numerous indications of copper-deposits. The veins can be developed to very considerable depth by tunnelling, while conditions for timber-supply, water-power development, and aerial-tram location are favourable. All the development-work done on this property is localized towards the summit and much ground remains to be prospected. The interesting possibilities of exploration along the vein extensions at lower altitudes is indicated by the recent discoveries of gold-silver-copper ore in the continuation of the same belt south of Cultus creek.

Since the above report was written the Iva Fern Mines, Limited, was formed, but up to the end of the year no work resulted owing, it is reported, to disagreement among the principals.

News has just come to hand to the effect that the property has been taken under a development bond by the Consolidated Mining and Smelting Company.

Delaware.

This group comprises three Crown-granted claims located on the Arrow Creek slope of Rolfe mountain near Creston. The property was being worked under option by G. A. M. Young and J. E. Hayden, of Creston. The formation is Aldridge quartzites which have been invaded by igneous rocks of the Purcell sills. In the vicinity of the workings the quartzites have been subjected to shearing movements which conform with their strike of N. 7° S. and dip of 70° to the west. Prospecting has been confined to a quartz vein occupying a sheared fissure, which, striking N. 30° W. and dipping at a steep angle to the west, cuts the formation.

At an elevation of 4,350 feet a prospect-tunnel had been driven at a short distance below the outcrop in a direction of N. 30° W. for about 50 feet. The vein-filling consisted of quartz in which streaks and pockets of galena occurred, constituting a milling grade of ore. The greatest width noticed was at the face, where a sample taken across 2 feet gave the following returns: Gold, 0.02 oz. to the ton; silver, 6.5 oz. to the ton; lead, 14.2 per cent.; zinc, 0.6 per cent.

Beyond the face of the tunnel the hillside slopes at a flat angle, which allowed but little "backs" above the level, so while open-cuts had established the continuity of the vein for another 50 feet or so, no important tonnage could be expected from these shallow workings. A sample taken from a small pocket of clean galena exposed in the bottom of one of the cuts assayed: Gold, 0.04 oz. to the ton; silver, 44.8 oz. to the ton; lead, 70.6 per cent.; zinc, 0.7 per cent.

To further explore the vein at depth a tunnel had been driven along its strike at a point about 50 feet lower down the hill. This tunnel had been advanced for 211 feet to a point 50 feet beyond the face of the upper tunnel. Along this length the vein shows persistency and a little ore at intervals. The best showing seen was at the face, where galena was making its appearance in a strong width of quartz. This indicates that the mineralization has a rake to the north and favourable possibilities for the advancement of this drift. A grab sample considered to represent a shipping grade of ore was taken from a small pile near the portal of the tunnel; this assayed: Gold, 0.07 oz. to the ton; silver, 9.6 oz. to the ton; lead, 20.5 per cent.; zinc, 0.6 per cent.

It is understood that more ore has been encountered since the examination was made and the trail has been improved in order to make a trial shipment to Trail.

LIST OF SHIPPING-MINES, SHOWING TONNAGE PRODUCED, 1928.

Nelson Mining Division.

Mine.	Locality.	Tons.	Character of Ore.
Arlington	Erie	53	Gold, silver, zinc, lead.
Catherine	Nelson	46	Gold, silver, lead.
Euphrates	Nelson	11	Gold.
Goodenough	Ymir	1,608	Gold, silver, zinc, lead.
Golden Age	Nelson	3	Gold.
Hunter V	Ymir	11,682	Gold, silver.
Kootenay Belle	Salmo	282	Gold, silver.
Queen	Salmo	48	Gold, silver, lead.
Second Relief	Erie	23	Gold, silver.
Wynndell	Wynndell	9	Silver, copper.
Yankee Girl	Salmo	1,220	Gold, silver, lead, zinc.

TRAIL CREEK MINING DIVISION.

The year was an eventful one for Trail, for the birth of a new industry which promises to be of outstanding importance to Canada was conceived by the higher officials of the Consolidated Mining and Smelting Company. Plans, it is understood, have been formulated which will involve the expenditure in millions in power development and plant equipment.

Some years ago it was foreseen by the management that, if a large supply of phosphate rock could be located within a convenient distance of the reduction-works at Tadanac, it could be

utilized in the manufacture of a superphosphate fertilizer in conjunction with sulphur dioxide, which at present escapes in great volume from the tall stacks of the plant. This gas, which causes damage to vegetation, is objectionable to farmers on either side of the International boundary-line, and its presence in the atmosphere has already cost the company a considerable sum, in the form of claims for damages. The situation has been aggravated lately by the complaints of American farmers in the region surrounding Northport, which resulted in an investigation by an International Joint Commission. The manufacture of fertilizer will go a long way towards eliminating the trouble; for large quantities of this gas will be converted into sulphuric acid, which in turn will be utilized in the manufacture of superphosphate. Trial shipments of about 1,000 tons, made by the company to Government agricultural farms on the prairies, have demonstrated, it is understood, that it is highly beneficial to the prairie soils and that marketing possibilities are unlimited, providing it can be supplied at small cost. Ammonium phosphate is also being made experimentally and will be tested on the prairies.

Among the many improvements and additions to the Tadanac plant, the following are of outstanding importance:—

Zinc Plant.—This plant, which has a capacity of 300 tons of cathode zinc a day, is being increased by a 100-ton addition which will be completed in 1929.

Cadmium Plant.—This plant was put into commission during the year and is producing cadmium in the form of pencils and finished bars at the rate of 40 tons a month. This metal is a product of the *Sullivan* ore, the zinc concentrates of which carry 0.2 per cent. It is eventually precipitated by the addition of zinc-dust in the purification of the solutions for electrolysis.

This precipitate contains small quantities of copper, lead, some cadmium, and about 50 per cent. zinc. It is first leached with sulphuric acid; the residue, containing copper and lead, is sent to the lead-smelter, while the solution containing the zinc and cadmium is treated in precipitation-tanks, from which a solution containing zinc and some iron is returned to the zinc-leaching plant, and the precipitate of cadmium sponge containing some zinc and other impurities goes through a leaching and purifying process and eventually pure cadmium is obtained by electrolysis. It will be noted from the above that the zinc used for precipitation purposes, which formerly was wasted, is now recovered, resulting in an appreciable saving.

Sulphuric-acid Plant.—This plant, which will have a capacity of 35 tons a day, was nearing completion at the end of the year. Zinc roaster-fumes will be treated by the contact process.

At the lead plant no considerable changes have been made and its capacity remains at 430 tons of lead a day. An electric furnace is being installed with a capacity of at least 10 tons a day. This will be used for making steel castings.

A 30-ton electric furnace is also being operated in connection with research-work, including the smelting of ore and the manufacture of various grades of iron, but no plans are contemplated for the immediate production of high-grade steel, such as suggested in press dispatches towards the end of the year.

The final figures given for the output of the Tadanac plant for 1928 are as follows:—

Gold, 23,623 oz. at $20	$472,460
Silver, 7,673,762 oz. at 58.2 cents	4,466,129
Copper, 8,903 tons at 14.5 cents	2,581,870
Lead, 159,416 tons at £21.06	14,597,723
Zinc, 81,765 tons at £25.3	8,994,150
Cadmium, 246 tons at 62.6 cents	307,996
Total	$31,420,328

In connection with the above, it is interesting to note that the world's production for 1928 is estimated at 1,800,000 tons of lead and 1,560,000 tons of zinc, which, on the basis of 400 tons of zinc a day and 435 tons of lead, makes the contribution of the Consolidated Mining and Smelting Company of Canada in both cases approximately 9 per cent.

During the year the company treated approximately 81,300 tons of customs ore and over 564,000 tons of ore from its own properties. The power-consumption of the plant in 1928 was 416,860,000 kilowatt-hours.

Towards the end of the year the company revised the treatment rates on zinc ores and issued Schedule "C," which contains reduced smelting rates on ores and flotation concentrates, also slightly reduced rates on the smelting of residues and more liberal terms of settlement for the

lead contained therein. At the end of the year the announcement was made that there would be no penalty charged for zinc in lead ores.

At Rossland renewed interest materialized in the high-grade gold properties—namely, the *O.K.*, *I.X.L.*, and *Midnight*—when a strike of high-grade ore was reported on the *O.K.* This property and the *Midnight* have been worked for some years by local syndicates, composed chiefly of experienced Rossland miners, and the pluck and perseverance with which they have stayed with it are deserving of a handsome reward, so it is to be hoped that the new strike develops into an ore-shoot which will yield highly profitable returns. A couple of men were employed at the *Velvet*. The *Snowdrop* is being operated by Ole Osing and associates. The Consolidated Mining and Smelting Company maintained a small crew at mining and exploration work in its group of properties.

Judging by recent applications for road and trail work, there are indications of a renewal of interest being taken in prospects of the Rossland area.

Last Chance.* A small amount of underground work has been done by J. Kenney on the *Last Chance*, about 5 or 6 miles south-easterly from Trail and about a mile from the Columbia river. The formation in the vicinity is composed of schistose rocks of the Rossland Volcanic series. Several small parallel veins have been exposed on some steep bluffs rising to a height of 600 to 700 feet above the wide area of bench land bordering the river.

The veins strike north-westerly and dip steeply to the south-west. Their structural relation to the schists was not definitely determined owing to local contortion of the strata, but they probably coincide with the schistosity of the rocks, which in the vicinity of the veins are intruded by a siliceous, possibly aplitic, dyke. Two veins, known as the No. 1 and No. 2, were examined, but there is another similar vein not visited for lack of time.

The No. 2 vein, from 9 to 22 inches wide, contains streaks and lenses of ore consisting chiefly of chalcopyrite, with occasional bornite, in a gangue of altered country-rock, quartz, and calcite. Development on this vein consists of open-cuts and a short crosscut tunnel which has not yet reached the vein. The No. 1 vein, paralleling the No. 2 vein about 120 feet away, contains galena, zinc-blende, pyrite, and occasional chalcopyrite, in a similar gangue. This vein is about 3 feet wide and the ore occurs in pay-streaks up to 7 inches wide. In addition to surface-stripping, the No. 2 vein is developed by a drift-tunnel about 70 feet long. Towards the centre of the tunnel a pay-streak, 6 to 7 inches wide, is continuous for a length of about 40 feet. Both veins follow well-defined planes of fissuring and appear to be persistent horizontally. The following samples give an idea of the values:—

Description.	Gold.	Silver.	Lead.	Zinc.	Copper.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.	Per Cent.
Grab sample from small pile of ore from outcrop of No. 2 vein	0.02	7.6	.....	.....	3.68
Selected ore from open-cut above portal of 70-foot tunnel, No. 1 vein	0.02	14.9	15.3	5.4	.....
Grab sample from small pile outside portal of 70-foot tunnel, No. 1 vein	0.01	7.2	6.3	11.6	1.92

*Norway.**—A small amount of work has been done on this property, situated about half a mile southerly from Trail, by the Norway Mining Company. A small compressor was installed and some 70 to 80 feet of tunnelling was done.

LIST OF SHIPPING-MINES, SHOWING TONNAGE PRODUCED, 1928.

Trail Creek Mining Division.

Mine.	Locality.	Tons.	Character of Ore.
Midnight	Rossland	55	Gold, silver.
Rossland properties	Rossland	13,886	Gold, copper, silver.

ARROW LAKE MINING DIVISION.

During the early part of the season there was quite a little evidence of renewed mining activity around Burton, but owing to stress of work in other parts of the district this section was not visited.

R. R. Earle and associates, of Vernon, interested themselves in the *Chieftain*, on Cariboo creek, and, it is understood, are endeavouring to make arrangements to finance the further development of the property next season. A description of this property may be seen in the Annual Report for 1920. The *Hailstorm* and *Promestora* are also reported to have undergone further prospecting. The *Meadow View*, on the Vernon-Edgewood road, was operated under the direction of B. F. Lundy, of the Cotton Belt Mines, Limited. A little work was done on the *Big Ledge*, near Nakusp, by American interests during the early part of the year, but later work was discontinued.

Motherlode.* A small amount of work has been done by J. A. Baszczak on this claim on the eastern side of Dog creek, about half a mile by road from Renata, on the Lower Arrow lake. A short distance from and a little above the road some open-cuts have been made to explore a mineralized band of limestone striking in a southerly direction up the hill and following a granite-contact. The limestone, which is considerably silicified, dips at about 65° to the east, or into the hill. In the limestone along the granite-contact there is some very low-grade replacement mineralization consisting of disseminated sulphides of lead, zinc, and copper. The following samples give an idea of the values:—

Description.	Silver.	Lead.	Zinc.	Copper.
	Oz. to Ton.	Per Cent.	Per Cent.	Per Cent.
Across 6½ feet in small open-cut on foot-wall side of limestone adjoining granite	1.1	1.8	1.3	1.06
Across 3 feet in long open-cut on foot-wall side adjoining granite	1.6	2.2	0.7	0.67
Across 2 feet adjoining last sample	0.3	3.6	3.1	0.11
Two samples representing broken ore (selective) from upper 20 feet in long cut adjoining last two samples	0.5 1.0	3.2 4.1	1.7 2.4	0.16 Trace

The deposits are situated along the northern extension, or higher up the hill, of the mineral-belt developed on the *Mountain Chief* property, described in the 1927 Annual Report. The *Mountain Chief* deposits consist mainly of copper sulphides in silicified limestone.

WESTERN MINERAL SURVEY DISTRICT (No. 6).

By George A. Clothier, Resident Mining Engineer.

INTRODUCTORY.

The Western Mineral Survey District (No. 6) includes the seven Mining Divisions—Victoria, Alberni, Clayoquot, Quatsino, Nanaimo, Vancouver, and New Westminster. These cover Vancouver island and the Coast islands, and on the Mainland all of the Pacific Coast drainage area as far north as Seymour inlet.

There are two distinct geological areas—the western flank of the Coast range and the Vancouver Island range. The former is composed of granodiorite containing many belts of well-mineralized, highly altered sedimentaries and volcanics, of which the Britannia belt is, so far, the outstanding example from an economic standpoint. The Vancouver Island range consists mainly of volcanics and limestone-belts underlain and intruded in many places by batholithic rocks contemporaneous with the Coast Range granodiorite, creating favourable conditions for ore-bodies, as evidenced by the *Sunloch*, *Gabbro*, and others in the south end, and the Coast Copper and others on the north end of the island.

The reader is especially referred to geological map 196A, called the "Vancouver Sheet," recently issued by the Geological Survey of Canada and procurable from its Western office, 510 Winch Building, Vancouver, B.C.

A study of the map will convince any one of the wonderful natural advantages of the district, of water transportation and water-power, and with timber, climate, etc., suitable for mining in all its branches, smelting, and marketing facilities for smelter products.

The following references will be found of great assistance in obtaining the geological features of the different sections:—

References.

Vancouver Island—

South-east Portion of Vancouver Island, by Chas. H. Clapp. Summary Report, 1908, G.S.C.

Southern Vancouver Island, by Chas. H. Clapp. Summary Report, 1909, G.S.C.

Southern Vancouver Island, by Chas. H. Clapp. Memoir No. 13, 1912, G.S.C.

Nanaimo Map Area, by Chas. H. Clapp. Memoir No. 43, 1914, G.S.C.

Sooke and Duncan Map Areas, by Chas. H. Clapp and H. C. Cooke. Memoir No. 80, G.S.C.

Quatsino Sound and Certain Mineral Deposits of the West Coast of Vancouver Island, by V. Dolmage. Summary Report, 1918, Part B, G.S.C.

Barkley Sound, Vancouver Island, by V. Dolmage. Summary Report, 1919, Part B, G.S.C.

Sunloch Copper District, by V. Dolmage. Summary Report, 1919, Part B, G.S.C.

West Coast of Vancouver Island between Barkley Sound and Quatsino Sound, by V. Dolmage. Summary Report, 1920, Part A, G.S.C.

Gabbros of East Sooke and Rocky Point, by H. C. Cooke. Museum Bulletin No. 30, 1919, G.S.C.

Mainland and Islands—

North-western Portion of Texada Island, by R. G. McConnell. Summary Report, 1908, G.S.C.

Preliminary Report on a Portion of the Mainland Coast of B.C. and Adjacent Islands, by O. E. LeRoy. Publication N. 996, 1908, G.S.C.

Copper Deposits of Lasqueti Island, by J. D. Mackenzie. Summary Report, 1921, Part A, G.S.C.

Britannia Map Area, by S. J. Schofield. Summary Report, 1918, Part B, G.S.C.

Reconnaissance along the P.G.E. Railway between Squamish and Lillooet, also Indian River Copper Deposits, by Chas. Camsell. Summary Report, 1917, Part B, G.S.C.

Annual Reports of the Minister of Mines. Mines Department, Victoria, B.C.

Note.—The above publications, except the Annual Reports of the Minister of Mines, B.C., are obtainable from the Geological Survey, Mines Department, Ottawa, Canada.

Prospecting.

Prospecting has been general throughout the district this year and, though showing much more activity than heretofore, there is room and opportunities for a great deal more. Almost any portion of Vancouver island and the included belts in the Coast range on the Mainland is favourable ground, but, naturally, the most prospecting has been done in proximity to the beach, to the neglect of the interior. More attention must be given the construction of trails from the beach, back to the higher ground on both Vancouver island and the Mainland, if the interiors are to be made accessible for extensive exploration. New finds have been made in the Cowichan Lake, Elk River, Buttle Lake, Nimpkish Lake sections, and other places this year; the Nimpkish Lake area being especially promising.

Government office statistics show an increase of 150 per cent. in the number of claims staked over last year and an increase of 50 per cent. in the number of assessments done.

Besides the number of claims staked, seventy-five reverted Crown-granted mineral claims have been leased from the Government. As these claims were originally Crown-granted because of their mineral-showings, it is probable that the majority of them will be under development next season. The list for 1929 gives 277 such reverted claims in this district. These may be leased from the Government for one year on payment of $25 and renewed for another year only, on payment of a further $25; the lessee during that time can purchase the claims (two in each Mining Division) upon payment of all taxes, etc., against the claims.

Development.

The reader is referred to page 333 of the 1927 Annual Report for an index of all mineral claims, groups of mineral claims, and companies in this district since 1917. This index cannot be repeated each year.

During 1928 between fifty-five and sixty mining properties have been under development throughout the district by both individuals and companies. Twenty-five companies have been operating, of which twelve were incorporated in 1928.

The three outstanding companies operating were the Consolidated Mining and Smelting Company; the Britannia Mining and Smelting Company; and the Pacific Tidewater Mines, Limited, co-operating with the British Metals Corporation.

The Consolidated carried out work on the *Rafuse* group on Stawamus river near Squamish; the *Fitzsimmons* group near Alta lake, on the Pacific Great Eastern Railway; the *Millington* group on the north end of Quatsino sound; and, of course, the Coast Copper Company, a subsidiary of the Consolidated, has been working steadily all year on the *Old Sport* mine at Elk lake.

The Britannia Mining and Smelting Company, operating the big plant at Britannia Beach, Howe sound, created a new department, the Exploration Department, which under its chief engineer, C. V. Brennan, has been very active in the field during the season. The only exploratory work carried out in this district was on three groups of claims on Goat creek, 11 miles from Squamish. This work is referred to elsewhere.

The Pacific Tidewater Mines, Limited (British Metals Corporation), has had the following properties under development this year: The old *Tyee* on Mount Sicker; the *Blue Grouse* on the south end of Cowichan lake; the *Morning* group on Taylor river, up from the head of Sproat lake; the *Indian Chief* group (Tidewater Copper Company) on Sydney inlet; the *Star of the West* on Tasis canal in Clayoquot sound; and the *Stromberg* group on Texada island.

Besides these, there have been many smaller operations. A Duncan syndicate did further development-work on the *El Capitan*, *Cottonwood*, and *Silver Leaf* groups, reached from Cowichan lake.

The Alberni Mines, Limited, cleaned out the old workings of the "Hayes" mine on Alberni canal and made a thorough examination of it, later prospecting some adjoining ground.

The Canadian Quicksilver Company, Limited, has been formed to develop cinnabar-showings at Sechart, Barkley sound.

The Caledonia Mines, near Quatse lake, has installed a small compressor plant and done a considerable amount of underground work.

The Cambria Mines, Limited, is operating the old *Princess* group on Matsin creek, Knight inlet.

The Alexandria Mines has successfully developed the *Alexandria* group on Phillips arm.

The Thurlow Gold Mines has installed a compressor and will further develop a favourable quartz-showing on the east side of Thurlow island.

At the *John Bull*, on Malaspina peninsula, a mile of wagon-road was built and a good camp erected preparatory to development of the zinc-showing.

The Malaspina Mines, Limited, has worked all season on its property, 10 miles north of Powell river. This underground work has disclosed encouraging showings of chalcopyrite and zinc.

The Romana Copper Company is developing its property on Goat island in Powell lake. The ore is chalcopyrite.

The Texada Gulf Mining Company took over the property of the B.C. Gold Mines, Limited, on Texada island and did further exploratory work.

The Central Copper and Gold Company, Limited, is making an exhaustive examination and exploration of the Vananda properties on Texada island, with apparently very promising results.

The Lasco Development Company took on the exploration of the *Venus* group, owned by the Lasqueti Mining Company, Limited, on the north end of Lasqueti island.

The Britain River Mining Company and Mount Diadem Mines, Limited, further explored the copper and zinc showings up Britain river, on the west side of Jervis inlet.

The Pacific Copper Mines, Limited, has been organized to explore some old copper-showings at the head of Salmon arm.

The Radiant Copper Company, Limited, has been incorporated to electrically prospect and diamond-drill four groups on Ray creek, near Squamish.

The Britannia Mining and Smelting Company has had its most successful operating year and greatest production to date.

The Bowena Copper Mines has further developed its property on Bowen island.

The Pitt Mining Company, Limited, has completed construction of its concentrator, etc., and will install mill and power machinery at once.

The above, together with many individually worked claims, is indicative of the fast-growing attention being given to the development of mining properties in this district.

Production.

This branch of mining has been confined largely to the Britania Mining and Smelting Company, operating on Howe sound. In addition to the production shown in the following table, 69,113 tons of pyrite was produced by the Britannia Company.

Name.	Tons.	Gold.	Silver.	Copper.
		Oz.	Oz.	Lb.
Britannia	1,613,931	15,277	192,228	41,046,003
Malaspina	43	.....	126	3,950
Romana	4	.....	2	398
Totals	1,613,978	15,277	192,356	41,050,351

Roads and Trails.

Substantial assistance was granted by the Mines Department, under the "Mines Development Act," for roads and trails throughout the district. Roads and trails are essential for prospecting and development work and their progress in this district will depend a great deal on facilities provided to give access to mineralized areas and developing properties.

"Iron-ore Supply Act."

There has been no iron ore procured for experimental purposes this year as provided by the "Iron-ore Supply Act."

Esquimalt & Nanaimo Railway Land.

As there have been numbers f inquiries for information in connection with the Esquimalt & Nanaimo Railway grant, the following is given: The area within the boundaries of this grant is plainly indicated on every Government map and comprises approximately a third of the area of Vancouver island. All the base metals, copper, lead, zinc, etc., within the area belong to the

railway company, leaving only the precious metals, gold and silver, belonging to the Crown. The area is open to prospectors, who may stake mineral claims in accordance with the regulations of the "Mineral Act," but they are subject to the regulations laid down by the railway company. The locator of mineral claims on unsold areas may, for $1, procure an option for one year to purchase the surface rights at $5 an acre, which would be $260 for a full claim of 52 acres; also the timber at $1.50 a thousand in excess of 8,000 feet an acre, the timber to be used for mining and not to be removed from the claims.

On lead the royalty is 1/10 cent a pound of lead; that is, a 10-per-cent. lead ore would pay 20 cents a ton mined. On zinc the royalty is 1/20 cent a pound up to 40 per cent. zinc and 1/10 cent a pound above that; a 40-per-cent. ore would therefore pay 40 cents a ton and a 50-per-cent. ore 60 cents a ton. On copper the royalty is 1/10 cent a pound up to a 2-per-cent. ore, or 4 cents a ton; from 2 to 5 per cent. the royalty is on a sliding scale, a 5-per-cent. ore being taxed 16 cents a ton; over 5 per cent. the royalty is 3/10 cent a pound, making the charge on 10-per-cent. ore—about what a prospector would sort out to ship—46 cents a ton.

Mining Divisions.

The district will be reviewed under the separate Mining Divisions, subdivided as follows:—

Victoria Mining Division—Sooke section; Jordan River section; Koksilah River section; Cowichan Lake section; Mount Sicker section.

Alberni Mining Division—Alberni Canal section; Barkley Sound section; Sproat and Great Central Lake section.

Clayoquot Mining Division—Kennedy Lake and Elk River section; Clayoquot Sound section; Nootka Sound section; Esperanza Inlet section.

Quatsino Mining Division—Kyuquot Sound section; Quatsino Sound section.

Nanaimo Mining Division—Nanaimo River section; Horne Lake section; Campbell River section; Buttle Lake section; Sayward section; Nimpkish Lake section; Port Hardy section; Islands and North Coast section; Powell River section; Texada Island section; Lasqueti Island section.

Vancouver Mining Division—North Vancouver section; Howe Sound section; Pacific Great Eastern section; Jervis Inlet section.

New Westminster Mining Division—Pitt Lake section; Harrison Lake section; Chilliwack section.

VICTORIA MINING DIVISION.

This Mining Division, comprising the whole southern end of Vancouver island, has shown increasing mining activity this year, especially in the Cowichan Lake section. Late in the year the Pacific Tidewater Mines, Limited, made an examination of the *Gabbro* group, in the Jordan River section, which resulted in an option being taken on the property for development purposes. This is very encouraging, in that it may mean not only the making of another mine, but the revival of mining in this whole section, where the industry has been dead for some years.

Sooke Section.

Leech River.—I examined the flat at the confluence of the Leech and Sooke rivers for the purpose of sizing up the situation for dredging. Several old shafts, the deepest about 35 feet, had been sunk at different places on the flat, but, so far as I could learn, none had ever reached bed-rock. Good "pay" is said to have been obtained from one or more of these shafts, but this, of course, could not be verified under their present dilapidated conditions. During this season several shallow pits, the deepest about 10 feet, were sunk in the vicinity of the old shafts, but no pay-gravel was found. The indications, therefore, are that any existing gold is on bed-rock, and the first essential is to drill the ground to bed-rock at a sufficient number of points to determine the average values. With the indicated depth in barren top gravel and the limited area of dredgable ground contained in this flat, the bed-rock would have to be very rich to be profitable.

The richness of the "pot-hole" at the junction of the two rivers and the possibility of working it have been matters of discussion for many years. No one seems to know its depth to bed-rock, but the imaginary amount of gold there is plenty.

I understand that some gold is being recovered from the bank-gravels farther up the Leech river and also on Wolf creek, but apparently nothing of great importance is being taken out.

Willow Grouse. This group, situated on the north-west slope of Mount McGuire, was last worked in 1917–18, at which time there were eight claims in the group. I examined the property this spring and it struck me that a very small amount of exploratory work, either laterally or to depth, had been done in the shear-zone in the volcanics, in which the chalcopyrite ore occurs in short lenses. Apparently a considerable tonnage of ore had been sorted and shipped from the surface ore-exposures, but there was little evidence of any other work having been done than taking out the ore, which at places was from 15 to 20 feet wide.

I think that the chances of finding recurrences of such ore-bodies are favourable, and consider that a Radiore survey, tested by diamond-drilling, would be fully justified with such conditions.

Margaret. This old group of three claims is also situated on Mount McGuire and, like the *Willow Grouse*, has had considerable ore mined and sorted from surface ore-bodies. More exploratory work has, however, been done on this group. The minerals, consisting of chalcopyrite, magnetite, pyrite, and pyrrhotite, occur mainly in hornblende in a wide shear-zone in the volcanic country-rock. I was impressed with the extent of mineralization and the apparently small amount of exploration that has been done toward proving anything beyond what ore has been mined. The distribution of copper through such a wide belt would seem to indicate possibilities of a worth-while tonnage of milling-grade ore.

The *King George* claim, adjoining the *Willow Grouse* group, has similar showings of chalcopyrite.

Bauxite.—While in the Sooke section this spring I looked over these deposits on Demaniel and Stony creeks. They were thoroughly investigated and reported in the Annual Report, 1923, page 268. Since that time no use has been made of the material and therefore the deposits have not been further developed to any extent. For the information of the present reader the following analyses are given:—

	SiO_2.	Al_2O_3.	Fe_2O_3.	TiO_2.	Water at 100°.
Local bauxite	30.2	28.0	23.0	*Nil*	13.0
Arkansas bauxite	10.6	57.5	2.6	1.2	28.0

Pacific Tidewater Mines, Ltd.—This company was incorporated in February, 1928, under the Dominion "Companies Act" and registered in British Columbia in March, with its office at 417 Pemberton Block, Victoria. It is capitalized with 5,000,000 shares of no par value. The company is in co-operation with the British Metals Corporation.

Mount Skirt. This property was examined by the Pacific Tidewater Company this spring, but did not meet the company's expectations. There are four mineral claims and four fractional claims in the group, situated on Mount Skirt and near the Esquimalt & Nanaimo Railway. Old reports state that some 1,500 feet of underground work was done, including a 160-foot shaft, on the *Ralph* claim. Several hundred tons of clean chalcopyrite ore was shipped years ago, and it would therefore seem that the property still has possibilities.

Jordan River Section.

The possibility of the establishment of a copper smelting and refining plant on the Coast by the Consolidated Mining and Smelting Company would probably mean the reopening of the *Sunloch* in this section. This and the favourable possibilities of the *Gabbro* group, under option to the Pacific Tidewater Mines, developing into a large producer of milling-ore would again put the lower end of Vancouver island on the mining map.

Sunloch Mines, Ltd. Sunloch Mines, Limited, was incorporated in 1917 for $1,000,000, with shares at $1 par value, and is controlled by the Consolidated Mining and Smelting Company, Limited. The *Sunloch* is situated on Jordan river, in the formation termed the "Metchosin" volcanics. Within a width of 700 to 800 feet, three major shear-zones, and a number of smaller intervening ones, mineralized with pyrite and chalcopyrite, have been proven. Approximately a mile of diamond-drilling and an equal

footage of underground work have demonstrated the existence of large deposits of milling-grade copper ore. The property has not been under operation for the past four or five years, but is at the stage where it can be placed on a producing basis in a comparatively short time.

Gabbro. The *Gabbro* group adjoins the *Sunloch* on the south-west and a number of the more important claims of the group have been Crown-granted. The Gabbro Copper Mines, Limited, was organized in 1920 with a capitalization of $750,000, divided into 1,500,000 shares at 50 cents a share. Conditions and mineralization, as demonstrated by extensive surface exploratory work, are similar to those pertaining on the *Sunloch*. No extensive underground development has been done.

The property was examined late in the year by the Pacific Tidewater Company and later information is that the company has taken a bond on it for development purposes. This will mean probably a couple of years of intensive exploration and development work to arrive at any conclusions as to the importance of the property and its future operations.

Koksilah River Section.

Robertson Mining Property, Ltd. This company was incorporated early in April, 1928, with a capitalization of $204,000, divided into 204,000 ordinary shares of $1 each (1,700 units at $120 each). The company acquired the original *Robertson* Crown-granted mineral claim, staked in 1880, to which were added four more claims by location this year. They are situated on the north side of the Koksilah river and reached by 3 miles of auto-road from the Canadian National Railway, at the north end of Shawnigan lake; then 6 miles of fair foot-trail to an elevation of 1,000 feet; then dropping to 600 feet at the old camp on the river-bank.

The general rock formation is the Vancouver volcanics series. The vein consists of a shear in the volcanics up to 6 feet wide and composed of a breccia of quartz, calcite, and country-rock. Small seams of galena occur in places in the quartz and calcite filling. The vein strikes N. 60° E. and dips about 60° south-east.

Two tunnels have been driven and a third one above faced up ready to drive. The lowest tunnel is at the edge of the river and has been driven 140 feet, of which the first 78 feet follows the strike of the vein. The remainder makes a horse-shoe turn in a broken-up formation and heads towards the surface again, parallel to the first 78 feet. No ore of consequence was noted in the tunnel. The second tunnel, 50 feet above, has caved and could not be entered, but, judging from the extent of the dump, is over 100 feet long. A general sampling of the dump gave no values. About 60 feet above this tunnel another has been faced up, showing a width of breccia from 5 to 6 feet, but no mineral. A sample of the best ore obtainable on the lowest dump, showing small seams of galena and zinc, assayed: Silver, 0.4 oz. to the ton; lead, 2.6 per cent.; zinc, 7 per cent. The present indications are therefore not very encouraging.

King Solomon and Blue Bell. These are adjoining groups situated on the Koksilah river. The only mention of these old properties is in the Annual Report for 1907. At that time the *Blue Bell* was owned by the Vancouver Island Mining and Development Company, Limited, of Vancouver, which had done considerable diamond-drilling, considered as fairly encouraging. A shaft was sunk over 100 feet deep, which had not at that depth reached the ore indicated in the drilling, but showed ore of fair value. No further information is available.

Finlay. This claim is mentioned in the 1919 Annual Report as situated on Lot 18, Helmcken district. The minerals are pyrite, pyrrhotite, and chalcopyrite, occurring in a shear in the Vancouver volcanics formation. Three shafts have been sunk on as many outcrops of ore varying in widths up to 3 feet. One assay mentioned gave: Gold, trace; silver, 0.2 oz. to the ton; copper, 2 per cent.

Eva. This claim is described in the Annual Report for 1925 as situated on a Crown-grant from the Esquimalt & Nanaimo Railway owned by James Boal, of Koksilah village, about three-quarters of a mile from the Canadian National Railway at Napier Mill and on the east side of Koksilah river. A shaft has been sunk 35 feet and from the bottom of it a 60° incline drift run for 48 feet. A leaser took 500 tons of chalcopyrite ore from these workings, but there is little ore in evidence now. It might, however, be worth further exploration.

Cowichan Lake and Mount Sicker Sections.

These sections have been the most active this year in the Victoria Mining Division. I think all this area within transportation distance of the Canadian National Railway at Cowichan lake, and also through to Alberni canal, would repay close prospecting, and the trail from the lake to Alberni canal should therefore be kept open.

Alpha, Beta, and Toboga. These claims are adjoining Crown-granted mineral claims carrying both surface and mineral rights, though in the Esquimalt & Nanaimo belt. The first two are owned by C. Terrain and the last by H. Marsh, of Cowichan Station, the latter handling all three. They are 6 miles up the East fork of Robertson creek, which flows into the lower end of Cowichan lake from the south. The showings are at the mouth of a small creek tributary to the East fork, flowing into it from the north. The logging-railway of the Victoria Logging and Manufacturing Company, Limited, of Chemainus, runs within a short distance of the showings on the creek, thus assuring transportation.

The general country-rock is volcanic, with accompanying limestone-belts. The ore-showings of chalcopyrite occur in a belt over 100 feet wide of altered rocks, mainly garnetite and epidote. The ore lies in lenses and scattered throughout the gangue. An independent sampling across 40 feet of this belt gave 4.54 per cent. copper. Other showings have been found at a considerable distance up the hill in the same belt. The ore-exposures impressed me as having considerable possibilities, justifying further exploration of this belt.

Blue Grouse. This group was acquired by the Pacific Tidewater Company by leasing the base metals in Lot 107, which holds the greater portions of the showings, from the Empire Lumber Company, and also leasing the reverted Crown-granted claims from the Government. The property is situated about a mile from the south side of Cowichan lake at an elevation of about 1,400 feet. It is an old location that was under development by the Consolidated in 1917–18, when diamond-drilling was done, indicating important ore-bodies below the surface exposures. During the war over $50,000 worth of copper ore was shipped, obtained from surface workings.

The Pacific Tidewater Company this spring repaired the old road from the lake, reconditioned the old camp, and installed a water system and a small compressor plant. The work in hand consists of driving a crosscut tunnel along the line of the last drill-hole to intersect the indicated mineral-zone at a depth of 220 feet on its dip. The crosscut had been advanced about 83 feet at the end of the year.

Sunnyside. This group is situated on the North fork of Sutton creek and adjoins the *Blue Grouse*. From the 1917 Annual Report I gather that the mineralization of chalcopyrite occurs in a contact-metamorphic zone possibly 300 feet wide, the same as on the *Blue Grouse*. Three ore-bodies have been exposed in three sets of workings, indicating possibilities of developing a tonnage of milling-grade ore.

El Capitan. (*See* 1927 Annual Report.) This group of three claims is situated on the north side of Cowichan lake, at the head of Cottonwood creek, on the summit between that creek and the Chemainus river. The summit is 4,300 feet elevation. They are owned by the El Capitan Syndicate, of Duncan, which is under the direction of E. F. Miller. The claims are reached from Youbou, the terminal station on the Canadian National Railway, by way of an old logging-road up Cottonwood creek. Further assistance was granted this year by the Mines Department toward improving the foot-trail from the end of the logging-road to the camp at a small lake at 3,850 feet elevation.

The general rock formation in this area is andesitic. The showings consist of two veins at either side of a 10-foot dyke, the south vein being the largest and consequently the one on which the most work has been done. They strike east-west and dip slightly south. They are intensely oxidized on the surface and a 50-foot tunnel on the south vein, obtaining a depth of 100 feet under its apex, shows the same oxidized condition. Ribs of chalcopyrite ore in the oxides carry gold values up to $40 to the ton.

This year a tunnel was started 50 feet vertically lower than the first tunnel, with the idea of getting below the oxidized horizon. This tunnel was driven 20 feet through rock-slide; then 20 feet diagonally across the first vein; then about 25 feet across the dyke and from 30 to 35 feet of a drift on the main vein. This work shows a seam of 4 inches of ore on the foot-wall, then 3 to 4 feet of oxidized material, and about 6 inches of partially decomposed chalcopyrite ore on the hanging-wall. The foot-wall seam assays: Gold, $54 to the ton; silver, 3.5 oz. to

the ton; and a sample of the hanging-wall seam gave assays of: Gold, $82 to the ton; silver, 1.3 oz. to the ton; copper, 13 per cent. The higher silver values on the foot-wall may indicate less leaching and therefore a lessening of the oxidation.

Though no great width of ore has been developed, the values obtained certainly warrant the continuation of the tunnel and probably sinking later on at the most encouraging point. The work has been ably carried out by M. L. Douglas, who holds an interest in the property.

The combination of this property, the adjoining *Cottonwood* group, and the *Silver Leaf*, over the divide, might make an attractive undertaking.

Cottonwood.

(*See* 1927 Annual Report.) This group, adjoining the *El Capitan* on the north, consists of three claims—*Cottonwood*, *Cottonwood Cobalt No. 1*, and *Cottonwood Cobalt No. 2*—owned by Douglas, Lomas & Miller, of Duncan. The claims are situated on the *El Capitan* trail at 3,800 feet elevation. Further tracing of the vein for several hundred feet up the hill this year shows it to strike about N. 60° E. (mag.) and dip about 65° north-west, and therefore a different shear than the *El Capitan*, though occurring in the same volcanic formation.

The lower cut was faced up about 6 feet high, showing the vein at this point to have a width of about 6 feet, of which 2 feet on the foot-wall is slightly mineralized, broken-up country-rock; then 14 inches of a fair grade of ore consisting of cobalt sulphide (smaltite), chalcopyrite, and pyrrhotite; the balance of the hanging-wall is mainly quartz sparsely mineralized with chalcopyrite and pyrrhotite, and low grade. Another cut about 75 feet above this shows the quartz vein-filling to be slightly mineralized with chalcopyrite, pyrrhotite, and traces of cobalt. The quartz has been found at intervals for some distance up the hill from this cut. The whole shear-zone appears to be about 30 feet wide and may contain other veins. This shows possibilities and justifies driving the lower cut. The appearance of the vein 50 feet in a tunnel on it would decide upon the feasibility of crosscutting the whole zone.

Tyee, Richard III., and Lenora.

The Pacific Tidewater Mines, Limited, now owns all the property of the old Tyee Copper Company, consisting of the *Tyee*, *Imperial*, *Muriel*, *Tony*, *Donald*, *Thelma*, *Herbert*, *N.T.*, *Doubtful*, and *X.L.* mineral claims, and in addition has a lease on and option to purchase the adjoining claims, *Richard III.* above and *Lenora* below. They are all situated in the Mount Sicker area, which produced, between 1900 and 1907, about $5,000,000 worth of copper ore. Extending through the three properties are two parallel veins, filling the arms of a synclinal fold in graphitic schists. The south vein was of a higher copper and less zinc content than the north vein and therefore could be profitably worked; the north vein, carrying little copper and proportionately higher zinc, was left as unprofitable with the treatment methods of that time. Some 265,000 tons was extracted from the south vein.

In 1924 R. G. Mellin reopened the *Lenora* mine on a lease with the object of demonstrating the ore-bodies of the north vein. This lease has now been turned over to the Pacific Tidewater Mines, Limited. The work now in hand consists in driving on the main adit through the undeveloped portion of the *Lenora* to enter the *Tyee*, to connect ultimately with the old 255-foot level of that mine and so furnish drainage and working facilities for the whole property. Mr. Mellin, who is now mining engineer with the Pacific Tidewater Mines, Limited, informed me that, though this tunnel was not driven for exploration purposes, it has nevertheless connected with an old stope on the *Lenora* boundary, of which practically only the sill-floor had been mined. In the back of this stope and in the floor is 8 feet in width of massive ore of good workable grade, exposed for a length of 110 feet. In breaking into the stope the drift passed through 7 feet of massive ore previously undeveloped. It is planned to extend this drift 125 feet into the *Tyee* ground and drain the old workings by diamond-drill holes.

The work done so far on the *Lenora* consists of 243 feet of drifting, the construction of storage ore-bunker, blacksmith-shop, and the extension of the precipitation-tanks in which copper is recovered from the mine-water, the product assaying about 16 per cent. copper.

Copper Canyon.

This group lies below the *Lenora*, partly on the Mount Sicker side of the Chemainus river and extending across the river and on Mount Brenton. It is owned by the Chemainus Valley Mining Company, Limited, which was incorporated about fifteen years ago with a capitalization of $1,000,000, divided into 1,000,000 shares, and was a reorganization of the Mounts Sicker and Brenton Mines, Limited.

Considerable work was done on the property before the war, consisting of a 300-foot shaft and drifts from it on one claim, a short tunnel and a great deal of surface work on another claim, all exposing, it is stated, some attractive copper-showings. The company is contemplating resuming operations in the near future.

ALBERNI MINING DIVISION.

This Division was some years ago one of the most active on Vancouver island, but interest in mining has decreased during the past fifteen or twenty years to a point where practically nothing is being done. This is due, to a great extent, to the fact that the majority of the mineral claims are Crown-granted and on which taxes are paid instead of work performed. This year has, however, seen a healthy revival, judging from official statistics. Last year thirty-nine free miners' certificates were issued and this year seventy-four; seven claims were recorded last year, against eighty-five this year; only six assessments were done last year, while this year there were sixteen; of the seventy-five reverted Crown-granted properties redeemed from the Government, ten are in this Division.

It is one of the most accessible divisions on Vancouver island. Alberni and Port Alberni at the head of Alberni canal are reached from Vancouver in five hours, two being by boat to Nanaimo and three thence by motor-stage. From Alberni one can prospect in any direction.

Alberni Canal Section.

This section is reached by launch from Port Alberni.

Dauntless.—The four claims in this group are situated about 4 miles down the canal on its west side and are owned by Isaac C. Lewis, of Vancouver, who keeps up the yearly assessment-work. The reader is referred to the Annual Report for 1927.

Copper King. This block of thirteen claims, owned by Dendoff & Philpott, of Nanaimo, consists of the *Copper King Nos. 1, 3, 4, 5, 6, 7, Florence,* and *Copper Queen Nos. 1, 2,* and *3.* They are situated on the east side of Alberni canal, about 5 miles up Colman creek, starting from the old "headquarters" camp of the Canadian National Railway construction days. The property is made very accessible by way of the railway-grade and the old tote-road, which were repaired in 1928 with assistance from the Mines Department. The owners have had two or three men working on the property all summer and have accomplished a very creditable amount of work in trail repairs, surface-prospecting, open-cutting, etc. A hand-drilling machine purchased from an engineering firm in Vancouver was tried out, but was found to be useless in this class of rock.

The mineral-showings where exposed in the main open-cut consist of solid pyrrhotite with traces of chalcopyrite for a width of 6 to 8 feet in a contact-metamorphic vein of mainly hornblende, with garnetite, epidote, and quartz. The vein has been traced for some distance on the surface, showing chalcopyrite in places. It is characteristic of this formation that masses of chalcopyrite are often associated with masses of pyrrhotite, and I therefore think that some further work is justified on this vein.

I am informed by the owners that a showing of chalcopyrite has been recently found on another portion of the claims, on which an old crosscut tunnel shows a width of about 6 feet of clean chalcopyrite. I have not examined this exposure, but the owners are very optimistic as to its importance. Altogether the property is worth exploration.

Copper Prince. There are three claims in this group—*Copper Prince Nos. 1, 2,* and *3*—owned by Philpott & Dendoff, of Nanaimo, and situated about 2 miles from Alberni canal on the trail to the *Copper King* group. This is apparently an old property, as considerable work has been done on a small vein of chalcopyrite contained in granodiorite country-rock. The vein has been traced several hundred feet and several open-cuts put in on it, yielding some good-grade chalcopyrite, but it is a small, tight fissure with apparently no tendency to widen so far as exposed.

Thistle. (*See* 1927 Annual Report.) This group of four claims is situated about 10 miles east of Alberni canal, on the North fork of Colman creek, and is owned by Andy Watson, of Port Alberni, and associates. There is a very promising surface showing of chalcopyrite on which very little work has been done, and which I think justifies further exploration.

Alberni Mines, Ltd.

This company was incorporated in January, 1928, with a capitalization of $2,000,000, divided into 4,000,000 shares at 50 cents each par value. Its registered office is 525 Seymour Street, Vancouver. The company acquired the old "Hayes" mine, or *Three Jays* group, consisting of seven Crown-granted mineral claims and fractions, situated on the west side of Alberni canal a short distance below Nahmint river, at about 15 miles from Port Alberni. The claims extend from the beach to the top of the hill at about 2,000 feet elevation. Several adjoining claims have been staked during the season.

On the old property, up to 1901, three tunnels were driven at 1,150, 1,550, and 1,730 feet elevations respectively, aggregating over 6,000 feet of underground work, costing with equipment close to a quarter of a million dollars. About 2,000 tons of 8-per-cent. copper ore was shipped, obtained mainly from a surface ore-body, the balance being from a small stope in the No. 1 or top tunnel and from a raise in a small ore-shoot in the No. 3 or lowest tunnel.

The ore occurrences are lenticular bodies of magnetite and chalcopyrite associated with limestone, lying in parallel shear-veins in a wide belt of light-grey porphyritic rock. The three tunnels crosscut the belt, the balance of the exploration-work being drives in the shears in the hope of encountering ore-bodies such as exposed on the surface. There is no shipping-ore of any account exposed in the old mine and, contrary to statements made in old reports, I found no important tonnage of milling-grade ore.

Across the gulch, probably 1,000 feet east from the old workings, on adjoining claims restaked by the present company, two veins had been partially opened up by some old workings. The general rock formation here is a little different than across the gulch and the mineralization consists of pyrrhotite and chalcopyrite. At the time of my examination, about the middle of April, the easterly of these two veins was exposed at the mouth of an old crosscut tunnel which had caved in. As far as could be seen, the vein appeared to be about 6 feet wide, showing clean chalcopyrite where it was possible to chip it. It strikes S. 70° W. (mag.) into the hill and apparently dips north-west at a steep angle and impressed me as having possibilities. About 50 feet north of this an incline shaft had been sunk 40 feet, but it was tightly lagged all the way down and the bottom was filled with debris. I am informed that this has been cleaned out, an encouraging showing of copper ore being exposed in the bottom. About 25 to 30 feet west of this vein another had been opened up by two shallow trenches for a length of 60 feet, which were also filled with debris. The face of the lower trench is about 4 feet in height and shows a width of 5 to 6 feet of clean chalcopyrite. I understand that this showing has been cleaned up and traced for several hundred feet up the hill, showing an encouraging amount of mineralization.

Some promising showings of chalcopyrite-bearing magnetite have been exposed on some lower claims at a few hundred feet from the beach. This zone has been traced for about 400 feet, exposing irregular bodies of chalcopyrite in the magnetite occurring along dykes which intersect the shear.

Altogether the property impressed me as being of considerable prospective merit, warranting considerable exploration.

Cascade.

This claim is situated partly on the cannery ground at Kildonan, on Uchuck-lesit harbour, the showing being only a few hundred feet from the beach. The vein strikes N. 10° W. (mag.) into the hill and dips about 50° west. The cannery ground-line is just at the cropping and the vein would therefore dip out of that ground in a short distance down. It is about 8 feet wide and of contact-metamorphic origin, composed of garnetite, epidote, hornblende, and quartz. Some years ago about 100 tons of clean chalcopyrite was shipped from a surface showing about 20 feet long and 20 feet deep. A short tunnel was driven under this, but encountered little or no ore, for the reason, I think, that the tunnel is too far in the foot-wall. This vein might be well worth drifting on in the expectation of finding similar ore-masses to the one mined from the surface, and it is certainly worth prospecting on the surface farther up the hill.

East of the cannery, just above and paralleling the beach, are alternate belts of limestone and volcanics, striking about N. 70° E., which appears to be the general strike in this area. In one of the belts of volcanics is a metamorphic belt 3 to 4 feet wide of hornblende, epidote, and garnetite, carrying mainly pyrrhotite, massive in places, and chalcopyrite sparsely scattered throughout the epidote and garnetite, but more in small masses or bunches in the hornblende.

This belt has only been exposed in one or two places, but the copper content makes one wonder whether more extensive exploration would expose workable bodies of milling-grade ore.

Southern Cross. This old claim on Uchucklesit harbour, about a mile east of Kildonan cannery, had a considerable amount of work done on it years ago. At 200 feet elevation a large open-cut was put in on a vein about 8 feet wide occurring in the contact between volcanics and limestone. The face of the open-cut over the tunnel shows 5 feet in width of solid pyrites, carrying traces of copper, in a hornblende gangue. At 15 feet in the tunnel the mineralization cuts out and at the face, 60 feet in, there is only about 3 inches of unmineralized vein-filling left. At the mouth of the tunnel in the open-cut a shaft of unknown depth was sunk and this is full of water. Some chalcopyrite ore, evidently from this shaft, was found on the dump.

Down the hill 125 feet, at 75 feet elevation, another tunnel was driven 280 feet, which would be well under the upper tunnel. At 180 feet a crosscut was run 45 feet to the left, at 200 feet a winze was sunk, and at 260 feet a short crosscut was driven to the right, conclusively exploring the ground under the pyrite-body showing above. No ore could be found in this work nor on this dump.

Sunshine. This property, situated on Cascade creek, flowing into Uchucklesit harbour, is owned by L. Manson and E. G. Calvasky, of Nanaimo. It consists of the *Sunshine*, *Sunshine Nos. 1* to *5*, *Fern*, and *Fern No. 1*, all Crown-granted. There is a fair trail from the beach, kept in repair by James Wilkinson, who owns a claim above.

The general rock formation is the Vancouver series, consisting of belts of andesitic rocks and limestone. Considerable work has been done along Cascade creek. One tunnel at 650 feet elevation on the south side of the creek follows a 2-foot vein of magnetite, carrying small bunches of chalcopyrite, for 35 feet, the face showing about 1 foot of magnetite. This vein strikes S. 40° E. into the hill and the mineralization is very irregular. Another tunnel at 750 feet elevation was driven 75 feet in country-rock. There is a strong magnetite-showing at the mouth of the tunnel, but the tunnel is apparently too far to the right to follow the croppings, which appear along the main trail.

The more promising showings are to the right of Cascade creek, on, I think, the *Sunshine*. Here at 850 feet elevation a 20-foot tunnel has been driven on a N. 25° W. vein, showing from 2 to 3 feet in width of alternate masses of pyrrhotite and clean chalcopyrite; that is, it is not a mixed ore. The face shows 3 feet of good copper ore. About 7 tons was shipped from here several years ago and said to have netted $65 to the ton. This tunnel is worth extending, and, if satisfactory, greater depth could easily be obtained with a short crosscut.

Another showing just west of the discovery of the *Sunshine* shows a width of 6 feet or more of heavy iron sulphides in which are masses of chalcopyrite. This vein strikes east-west (mag.) and dips 80° north into the hill. The hill drops off abruptly to the south toward tidewater and 100 feet of depth could be obtained by short crosscuts to the vein. This is also worth some exploration, as the situation is ideal for mining, the elevation being 900 feet and distant about 1,500 from the beach.

My information is that this property is under option to the Canada British Finance Corporation, Limited, with its office at 602 Hastings Street West, Vancouver.

Black Prince No. 3. This claim is owned by James Wilkinson, of Alberni, and situated above the *Sunshine* group. It is reached by the extension of the *Sunshine* trail, which is kept in good repair by Mr. Wilkinson. The showings consist of several massive croppings of clean magnetite up to 30 or 40 feet wide. The owner has exposed the ore-bodies by stripping off the overburden and trenching and open-cutting. There are all the indications of an important tonnage of high-grade iron ore.

Belvidiere. This group of Crown-granted mineral claims is owned by L. Manson and E. G. Calvasky, of Nanaimo, and is situated a short distance up from the head of Snug cove on Uchucklesit harbour. Just off the trail on its upper side, at 350 feet elevation, an open-cut and short tunnel intersects a vein of pyrites of from 4 to 6 feet in width. The lack of copper content evidently discouraged further work here. Farther up the old trail and on its lower side an open-cut, and a short tunnel about 20 feet beyond it, show scattered pyrites across 6 to 8 feet; the only evidences of copper are stains in the rock. I am not sure that I saw all the showings on this group, but if so they are not very encouraging.

Canadian Quicksilver Co., Ltd.

This company was incorporated in August, 1928, with a capitalization of $250,000, divided into 1,000,000 shares at 25 cents each par value. Its holdings consist of the three mineral claims acquired by the Mercury Mines, Limited (*see* 1927 Annual Report), situated about a mile from the beach at Sechart. No work has been done on the property this year, though some interest has been taken in it by way of examinations. The cinnabar occurs in small seams and along the fracture-faces in the rock, across a width of 40 feet, although the best of it is confined to a few feet. A 40-foot shaft has been sunk and a couple of short tunnels driven across the zone, gaining little depth. A dump from the shaft shows some nice ore and averages about 0.4 per cent. mercury, which, with quicksilver $120 a flask of 76 lb., or over $1.50 a pound, gives a value of $12 a ton.

The new rotary furnaces for the treatment of this class of ore would produce the metal on the ground from this grade of ore at satisfactory cost.

The world's production for 1928 was 150,000 flasks, of which Spain and Italy produced 90 per cent., the United States output being 17,000 flasks. There is little or none produced within the British Empire.

I think this undertaking is worthy of support to continue development-work, with fair chances of making it profitable.

Rainy Day.

This Crown-granted claim is situated on the east shore of Henderson lake, about 1½ miles from the lower end. It is owned by the Rainy Day Syndicate, under the supervision of C. Dubois Mason, 2078 Goldsmith Street, Victoria. Henderson lake is reached by small boat from Kildonan cannery, preferably at high tide. Considerable work has been done by way of two tunnels. The west and lower tunnel at 25 feet above the lake has been driven 135 feet, exposing little or no ore. The east tunnel, which is a few feet higher, has two drifts, one at N. 40° E. for 40 feet in ore consisting of pyrite and some chalcopyrite, and another at S. 30° E. for 50 feet showing little mineralization. Some stripping has been done at the edge of the lake, showing good chalcopyrite ore. The work so far has exposed enough ore to indicate fair possibilities.

Other properties in the Alberni Mining Division and the Annual Reports in which they may be found are as follows: *W.W.W.*, 1927; *Gretna Green*, 1921; *Bank*, 1917; *Canadian*, 1916, 1917, 1918; *Monitor*, 1916, 1917, 1918; *Happy John*, 1916, 1918; *Torse*, 1916; and *Kitchener*, 1916.

CLAYOQUOT MINING DIVISION.

This Division is the west half of the middle 100 miles of Vancouver island and reached only by boat from Port Alberni, or Victoria by the west coast steamer, twice a week in summer and weekly in winter. The contemplated road from Alberni to Tofino, via Sproat lake and down Elk river to Kennedy lake to the coast at Longbeach, would not only open up a promising mineralized country between Sproat and Kennedy lakes, but would give much-needed all-year-round access to the Coast by automobile. Longbeach, with 14 miles of one of the finest beaches in North America, and hundreds of miles of inland waters in Clayoquot sound, made available by an auto-road, would make the west coast a wonderful summer resort.

Mining on the west coast, north of Alberni canal, has taken on a new interest this year. Assessments, claims recorded, and miners' certificates issued have about doubled. The outstanding feature is the development of the *Indian Chief* of the old Tidewater Copper Company, Limited, on Sydney inlet by the Pacific Tidewater Mines, Limited. Fifteen reverted Crown-granted claims in this section were leased from the Government this year.

The *Wreck Bay* placers on the west coast, reached from Ucluelet, were worked to some extent at the north end of the beach this season, but I have no information as to results obtained. The Geological Survey of Canada concludes that the *Wreck Bay* gold originates in the gold-bearing quartz veins found up the Elk river from the head of Kennedy lake.

Kennedy Lake and Elk River Section.

This section is reached by launch from Tofino up Kennedy river to within a few hundred yards of Kennedy lake, where the rapids are too strong for a gas-boat, but up which a small boat can be lined, without trouble, to the lake. Any part of the lake can then be reached by a small boat with an outboard motor, and a couple of miles can be made up Elk river at the head

of the lake. The Dominion hatchery at the head of Clayoquot arm has a small launch on the lake.

O.K. This Crown-granted group of four claims is situated on the range between Kennedy lake and Clayoquot arm (on Kennedy lake) at an elevation of 4,000 feet. A description of the property in the 1918 Annual Report states that a considerable amount of work has been done by way of a long trench following the ore on the surface and a 100-foot tunnel below it. The trench exposes some fine chalcopyrite ore in a contact-metamorphic belt, but in the tunnel the ore-showings are not so good. The indications are considered as very encouraging and worth extensive exploration. The group, which had reverted to the Government for unpaid taxes, was redeemed this year.

Northern Crown. This is an old location on which some work was done several years ago and since abandoned. It is situated about a mile up the Clayoquot river from the head of Clayoquot arm and at about 350 feet elevation. The general formation is Vancouver volcanics in contact with a wide belt of pure crystalline limestone. The mineral-showing consists of a 6-foot vein of pyrrhotite and pyrite, with a fair amount of chalcopyrite, striking about S. 45° W. along or near the contact between the volcanics and limestone. There is little evidence of metamorphism and the mineral appears to have been deposited along the contact and in the fractures of limestone. Bunches of pure chalcopyrite are embedded in the limestone and thin out to fine seams.

One tunnel was driven 60 feet in the limestone, starting on the right-hand side of the vein. At 30 feet in, some bunches of chalcopyrite were found, probably indicating the proximity of the vein, but the tunnel was swung to the right for another 30 feet, encountering masses of pure chalcopyrite in the limestone. I think that a crosscut to the left, anywhere from 30 feet in the tunnel to the face, would cut the vein exposed on the surface in a short distance. In my opinion the indications and the situation justify a little more work.

Elk River.—(*See* 1927 Annual Report.) There are a number of properties on Elk river, showing small quartz veins carrying gold values in a light-grey, siliceous, porphyritic rock. Several of these were worked years ago with various kinds of milling equipment, but without much success. I think the area is well worth prospecting farther up the river toward the divide between it and Taylor river. To this end a small grant was appropriated this year by the Department of Mines toward clearing out the present trail and extending it another mile up the river. As stated elsewhere, the extension of this trail through to Taylor river, which empties into the head of Sproat lake, would make accessible a very promising area containing gold-quartz veins.

Clayoquot Sound Section.

There are hundreds of miles of inland waters in this sound, up the many inlets and around the islands, on which a small launch can be used from Tofino, which is the port of call of the Canadian Pacific Railway Coast boats.

Kalappa. This is an old group of claims situated on Mears island, about a mile from tide-water. The property was at one time well equipped with ore-bunkers at the mine, corduroy road and big ore-loading bunkers at the beach, and shipped some sorted chalcopyrite ore in 1913, but, of course, everything is in a dilapidated condition now.

Considerable development-work was done in two tunnels, one at 350 feet and the other at 450 feet elevations, each showing where several short stopes of ore had been extracted. The vein strikes about S. 75° E. (mag.), dips 72° north-east, and was apparently from 1 to 2 feet in width, filling a shear in the volcanic formation. The reverted Crown-granted claims of this group were redeemed from the Crown in 1928.

Ormond. This group at one time consisted of nine claims, of which four were Crown-granted. They are situated on the east side of Flores island in Clayoquot sound, at the head of Matilda creek, about 1½ miles from the beach. The showings are at about 1,050 feet elevation.

The prevailing country-rocks are the volcanics of the Vancouver series, the mineralization occurring in a shear-zone apparently about 25 feet wide, in which are bands of light-coloured feldspathic rock and parallel hornblende dykes. The shear has had a number of open-cuts put across it at various intervals for a few hundred feet, showing, in general, bands of associated pyrite, chalcopyrite, and pyrrhotite; and disseminated pyrite through the hornblende dykes. The pyrite-chalcopyrite veins are up to 6 feet in width and certainly warrant some deeper

development. A sample of ore taken to ascertain the gold and silver contents, and not as an average sample, assayed: Gold, $1.60 to the ton; silver, 6.6 oz. to the ton; copper, 8.8 per cent.

On the south side of the hill there is an excellent opportunity for gaining depth by drifting on the vein. The property is ideally situated and altogether has favourable possibilities.

Copper King. (Formerly *Hetty Green.*) The four claims comprising the group—*Copper Queen*, *Copper King*, and *Copper King Nos. 2* and *3*—are restakings of the old *Hetty Green* ground. There was a wagon-road at one time from a point about a quarter of a mile up Tofino creek, accessible at high tide, to the property, a distance of about a mile. I am informed that several hundred tons of fair copper ore was shipped from surface workings.

The showings are at about 250 feet elevation and are exposed by a number of open-cuts across a feldspathic belt over 100 feet in width, which strikes east-west (mag.) across Deer creek. The ore is chalcopyrite occurring not only in a vein of magnetite on the upper or north wall of the belt, but also as enclosures of pure chalcopyrite in masses up to several tons across the lime-belt. On the north side of the belt, about 15 feet from the magnetite, a small vein of chalcopyrite has been followed 40 feet, paralleling the belt and still showing ore in the face of the trench. Between this and the magnetite are bunches and small veins of chalcopyrite lying in all directions. South of this chalcopyrite vein no copper is showing for 15 feet across the face of the stripped bluff; then in the next 15 feet bunches of copper were noted. South of this little work had been done, but there are indications of copper ore; altogether a width of between 60 and 70 feet has been so exposed.

Farther up the hill and farther south on the belt stripping has exposed more magnetite well mineralized with chalcopyrite, so that it is safe to estimate a width of at least 100 feet in which copper occurs. There are very little indications of metamorphism.

About 75 feet vertically below this, and a couple of hundred feet west, the belt crops along the east bank of Tofino creek. Here are two or three short open-cuts into the mineralized portions and a tunnel 135 feet long, just south of the magnetite vein, which here shows a width of 10 to 12 feet with good copper content. A crosscut north from the end of this tunnel should cut the magnetite vein in about 20 feet and another crosscut south would explore the balance of the belt. Though no crystalline limestone was seen on the surface above, here along the creek are alternate belts of limestone and feldspathic rock. Also there are small belts of garnetite in the creek croppings. All the magnetite exposed along the creek shows good copper values.

My impression was that the belt showed sufficient copper mineralization to justify extensive exploration, either electrical prospecting or diamond-drilling suggesting themselves as the most feasible. The magnetite-chalcopyrite vein is a promising prospect in itself and the balance of the belt may contain sufficient copper in masses and small veins to constitute a milling-ore.

Craigellachie. (Formerly *Crow.*) This group consists of eight mineral claims—*Craigellachie 1* to *6*, *Star*, and *Latchbrook*—situated on Copper river about a mile north-east from the head of Tofino inlet. It is a staking of the old *Crow* group, which was staked in 1898 and last worked in 1916, since which time the two Crown-granted claims, *Star* and *Latchbrook*, reverted to the Government and the others ran out. This year the two Crown-granted claims were redeemed by D. A. Grant, of Tofino, and six others staked around them. Considerable work was done in 1916 while the property was under option to Mr. Silverman. A big open-cut was made in the ore, the face being about 25 feet high. At the bottom of this is 5 feet of massive magnetite, some pyrrhotite, pyrite, and chalcopyrite. About 100 tons of ore was taken from this cut and piled on the dump. It ranges from large lumps of pure chalcopyrite to similar sizes of pure magnetite, and I judge the whole pile would average about 5 per cent. copper; this grade, of course, could be raised by close sorting.

The ore lies on a contact of andesite on the foot-wall and limestone on the hanging-wall. About 30 feet below the open-cut at the foot of the dump a tunnel was driven through shattered limestone to the contact, but found no ore. A shaft at the collar of this tunnel, of not great depth judging from the dump, produced about 10 tons of clean chalcopyrite piled on the dump.

About 75 feet vertically below this tunnel another was driven on a bearing S. 45° E., or at right angles to the vein. At a point 80 feet from the portal the limestone was encountered and a raise put up about 20 feet, finding no ore. No drifting was done along the contact in search of ore-lenses. There are no evidences of metamorphism and it is therefore possible that the contact has nothing to do with the mineralization.

The ore taken from the surface would seem to warrant deeper development with the expectation of the recurrence of similar ore-masses.

Walton's Claims. These claims are owned by W. Walton, of Tofino, and are four in number—*Alpha*, *Norman*, *Douglas*, and *Omega*—situated 2 miles up Tofino creek, which empties into the head of Tofino inlet. The showings are just above the cabin at 825 feet elevation. The minerals are chalcopyrite, pyrite, and pyrrhotite in a contact-gangue of garnetite and epidote. Some work has been done in the gulch above the cabin, but nothing of importance has been found.

The interesting feature of these claims is the quantity and sizes of clean chalcopyrite float found in the slide-rock below the canyon; 25 or 30 tons of clean ore has been sorted from this float. The property is worth some systematic prospecting.

Bedwell Sound Section.

The trail to the *Ptarmigan* begins at the beach at the head of Bedwell sound. I understand that a wagon-road was built for 12 miles up the valley and was thence continued as a trail through to the property. There are large reels of cable and other equipment lying on the beach as evidence of the extent of work contemplated when the war started. Nothing has been done since. The property is owned by Ptarmigan Mines Company, of London, England, and all old reports would seem to strongly favour the prospects of the property.

Seattle. There are seven claims in this group—*Gray Mule*, *Tacoma*, *Rebecca Fraction*, *Omaha*, *Seattle*, *New York*, and *Brooklyn*—all reverted Crown-granted claims that have been leased by a Vancouver company. They are situated about 1½ miles up Bedwell river on the west side. The old wagon-road is in fair condition as far as this group, except that two or three of the bridges have been taken out by high water. I understand that a lot of surface work has been done and two tunnels driven, but having no guide I did not find the property.

Sydney Inlet Section.

Indian Chief. This property was, prior to 1923, under operation by the Tidewater Copper Company and fully equipped. It has been idle since that time and consequently everything has greatly deteriorated. This summer the Pacific Tidewater Company made a thorough examination and negotiated a lease and option. The company immediately got to work, rebuilt the old dock, reconditioned the camps at the beach and mine, and put the tramway into commission.

A very substantial tonnage of milling-grade ore is estimated by the company to be in the mine, but it is proposed to develop further ore reserves before proceeding with the question of concentration. To this end diamond-drilling was commenced in November, but work is now closed down pending a decision as to future operations as a result of the drilling.

Prince. This group consists of eight Crown-granted mineral claims adjoining the *Indian Chief* on Sydney inlet. I have not examined the *Prince* group, but obtained the following information from an independent examination made in 1928. The ore is chalcopyrite and bornite occurring in fissures in shear-zones in the limestone formation, altered and silicified by the intrusions of granite and other igneous rocks. Considerable surface work has been done by way of trenching and open-cutting, and an incline shaft sunk from which some drifting has been done, all demonstrating similar conditions to those on the *Indian Chief*. The examining engineer expressed the opinion that the ore-bodies are in a continuation of the mineral-bearing zone of the *Indian Chief* and strongly recommended deeper development.

Nootka Sound Section.

This section is reached by the Coast boats plying between Victoria and Nootka, from which latter point one can take a launch to anywhere in the sound.

Shannon. This group is comprised of three claims—*Little Pete* at the beach and the *Shannon* and *Shannon No. 1* above. They are owned by A. Parke and William Poole, of Nootka, and are situated on the north side of Muchalat arm, opposite Gore island, about 14 miles from the Nootka cannery. There is a good foot-trail from the cabin on the beach, following the vein for about a mile to an elevation of 400 feet at the last showing. The first showing is at the beach, about 150 yards along the trail from the cabin. Here

three open-cuts show a vein 5 feet wide averaging from 15 to 20 per cent. zinc in altered limestone on a hornblende-feldspar hanging-wall. The vein has not been traced through from here to the next showing, probably three-quarters of a mile along the trail, but from that point the vein is opened up in five or six places by open-cuts in a distance of several hundred feet and between elevations of 200 and 400 feet. These upper exposures show the mineralization to be replacements in the limestone along its contact with the igneous rock. There is no defined foot-wall in the limestone, as the mineralization extends to varying widths in it from the igneous hanging-wall. There is little evidence of metamorphism. The lowest of these upper cuts show some nice galena, but the main mineral is zinc varying from 18 inches to 6 feet of good milling-ore. A sample taken to get the general values gave: Gold, trace; silver, 6.6 oz. to the ton; lead, 8 per cent.; zinc, 13 per cent. One of the middle cuts exposes about 6 feet of from 20 to 25 per cent. zinc ore. The top cut at 400 feet elevation shows more copper than elsewhere, there being a foot or more of clean chalcopyrite.

The general strike of the vein is S. 50° E., the dip varying, but averaging about 70° into the hill. The vein follows along the foot of a bluff on a steep side-hill and therefore a crosscut tunnel below would obtain good depth in a short distance. It is very probable that bodies of zinc ore will be encountered with development, with favourable possibilities of shoots of galena and chalcopyrite. Everything considered, the surface showings indicate a property of considerable prospective merit.

Star of the West.

There are three claims in this group—*Star of the West*, *Wolverine*, and *Hakadate*—situated at the head of Tasis canal, about 22 miles from the Nootka cannery. They are owned by William Poole, of Nootka, an old-time prospector on the west coast. There is a good cabin on the beach and a good foot-trail from there to the showings and cabin at about 1,400 feet elevation.

The minerals consist of pyrrhotite, magnetite, chalcopyrite, and zinc, the percentage of magnetite being much greater in the lower showings at 700 feet elevation. The minerals occur in a belt of altered limestone, mainly garnetite, to over 100 feet in width in contact with a granodiorite intrusion which strikes about N. 60° E., crossing diagonally at the head of the canal.

The owner has done a lot of work for one man, in open-cutting, trenching, and stripping, exposing many showings of ore here and there across the full width of the belt. The greatest depth obtained is probably 12 to 15 feet. Farther down the hill, at 700 feet elevation, two showings of magnetite with some chalcopyrite content have been shot into. At 450 feet elevation a shaft 10 feet deep shows bunches of clean chalcopyrite enclosed in limestone. The ground is heavily overburdened on top and consequently the structural features are obscured. My impression was, however, that the ore occurrences are of sufficient importance in size, values, and frequency to justify a rather extensive exploration of the belt. Samples from the different ore-exposures show values in gold up to $3 or $4 to the ton; silver, from 1 to 4 oz. to the ton; copper, up to 12 and 15 per cent.; zinc, from 2 to 6 per cent.

The Pacific Tidewater Mines, Limited, had an option on the property this spring, but the work consisted almost entirely of sampling the present showings. Nothing has been done since and I am not informed whether the company still holds the option.

Mark's Claims.—The examination of this property up the Zeballos river had to be postponed on account of the absence of the owner, Mr. Marks.

The reader is referred to the following additional properties in the Clayoquot Mining Division and the Annual Reports in which they may be found: *Jo Jo*, 1927; *Rose Marie*, 1927; *Gold Queen*, 1927; *Ptarmigan*, 1914, 1926; *Empress*, 1919; *You*, 1927; *Big Interior*, 1916; *Della*, 1916.

QUATSINO MINING DIVISION.

This Division takes in all the drainage area to the Pacific ocean, north of Esperanza inlet to Cape Scott. Mining has been much more active in 1928 than for many years, as, for instance, in 1927 eighty-one claims were staked; in 1928, 170. Eighty-nine assessments were done in 1928, as against thirty-two in 1927. Six reverted Crown-grants were redeemed.

Kyuquot Sound Section.

This portion of the Division is reached by the west coast boats which call at Cachalot cannery, at which point one can procure a gas-boat.

Canada Copper, Ltd.

This company was incorporated in March, 1928, with a capitalization of $5,000,000, divided into 20,000,000 shares at 25 cents each par value. The company's registered office is at 416 Standard Bank Building, Vancouver.

The company has acquired some forty-three mineral claims in the vicinity of Kokshittle arm in Kyuquot sound, on the north-west coast of Vancouver island. The holdings comprise an old group purchased from F. Devoe, the remainder having been staked this summer under the advice and direction of R. C. Campbell-Johnston and F. Devoe. So far as I know, no development-work has been done during 1928.

I understand that some work had been done on the old property for a number of years past, showing nothing of outstanding merit, and as the rest of the property has just been staked and not even prospected, the capital of the company appears to be enormous.

Quatsino Sound Section.

All the mining in the Quatsino Division is contiguous to Quatsino sound, which has about 70 miles of waterway and cuts almost through to the east coast. The section is very accessible either by the Coast boats, which call at Quatsino, Jeune Landing (Coast Copper Company), Port Alice (pulp-mill), and Holberg (logging camp); or from Port Hardy on the east coast, over 12 miles of automobile-road to Coal Harbour on Quatsino sound. Gas-boats may be procured at Quatsino and Coal Harbour, where may be found hotel accommodation.

Millington.

(*See* 1927 Annual Report.) This group, comprised of six claims, is owned by Spooner Bros., of Holberg, and is situated 3½ miles up the valley from Holberg, which is at the head of the West arm of Quatsino sound. Early in 1928 an option was taken on the property by the Consolidated Mining and Smelting Company of Canada. Two diamond-drill holes were put in, one 430 feet deep under the old showings and one 600 feet deep under the discovery made the previous fall. Neither of these holes encountered any ore and the option was therefore given up. This, of course, was not convincing to the owners and some further surface work was done by them previous to my examination.

This work consisted of an open-cut into the new vein, which shows the ore-shoot to be about 8 feet wide and dipping into the hill at about 20°. The drill-hole under this is a horizontal one and was started 125 feet vertically lower than the cropping. Assuming a slope of 45° on the hillside would throw the collar of the hole about 130 feet from a point vertically under the cropping. The vein, dipping at 20° into the hill, would throw about 350 feet in a vertical depth of 125 feet, making altogether a horizontal distance of 480 feet from the collar of the hole to the vein if dipping regularly. This would seem to indicate that the 600-foot hole should have intersected the vein. I believe the owners have done some further work, exposing some nice bornite ore, but I have not examined the property since.

Stuart.

This group consists of four claims—*Stuart*, *Emma*, *Donald*, and *Jack*—situated up the hill from the dock at Holberg. They were staked in the spring of 1928 by Mr. Stuart, who had done considerable preliminary prospecting in that vicinity. The rock formation and ore occurrences are similar to those on the *Millington;* that is, a basalt in which are small veinlets of bornite usually in quartz, but disseminated in the basalt as well. A little work had been done at 600 feet elevation in sinking a shallow pit, showing a few isolated quartz stringers carrying bornite, but I did not consider it sufficiently encouraging to advise further development.

Alice Lake.

(*See* 1927 Annual Report.) The seven claims in this group—*Alice Lake*, *Galena*, *Paystreak*, *Lucky Strike*, *Cedar*, *Hornet*, and *Iron Knob*—are owned by William Clancy and W. D. Kinsey, of Quatsino. As described in previous reports, the mineralization consists of galena, zinc-blende, and pyrite, occurring in a wide belt of crystalline limestone. A large amount of work has been done by the owners in open-cuts, shallow shafts, trenches, and a crosscut tunnel. This surface work shows good ore in spots but nothing continuous.

This year a tunnel had been driven 35 feet, of which the last 15 feet was in ore. The vein came in about 6 inches wide and has widened to 3½ feet in the face, striking about N. 80° W. and dipping 30° south. About 20 tons of ore has been piled on the dump from this work, from which a grab sample gave assays of: Gold, $12 to the ton; silver, 8.5 oz. to the ton; lead, 14 per cent.; zinc, 12 per cent. This could be hand-sorted to a good shipping-grade ore, and as transportation means a haul of only 4 miles over the Coast Copper road to Jeune Landing, there is a probability of making the property self-supporting for further development.

Quatsino Gold-Copper Mines, Ltd.

This company was incorporated in April, 1928, with an authorized capitalization of $3,000,000, divided into 3,000,000 shares of $1 par value. Its registered office is at 432 Standard Bank Building, Vancouver. The company's holdings consist of four groups of thirty-two mineral claims, of which twenty-five claims are Crown-granted. The claims are in one block, those of the *Merry Widow* and *Independent* groups adjoining the Coast Copper Company, Limited, property on the south. There is a trail from the Coast Copper tunnel, the terminus of the wagon-road, to the *Merry Widow* cabin at 1,600 feet elevation; and also one up Elk river to the *Independent* cabin at 550 feet elevation. This lower trail has been used by the Coast Copper in taking supplies and diamond-drilling equipment to properties up the river and is consequently in fair repair. With these trails and the available route of the Coast Copper Company from tide-water at Jeune Landing to the mine-tunnel, the Quatsino Company is in a position to proceed with exploration-work without the usual delay and expense of building trails.

The geological conditions are the same as on the Coast Copper, where the ore occurs in lenticular bodies within a contact-belt between diorite and crystalline limestone. The limestone-belt lying west of and up the hill from the diorite is intruded by many dykes in all directions.

There are two main mineralizations, one up the hill at from 2,500 to 3,000 feet elevation and the lower one at approximately 1,000 feet elevation. The higher mineral-belt extends across both properties, but has had comparatively little done on it by the Coast Copper Company. The lower belt is the contact-belt referred to on which the Coast Copper is developing its mine. This belt no doubt extends southward through the *Independent* group of the Quatsino Gold-Copper Company. The farthest south underground working in the Coast Copper is over half a mile from the *Independent* line, and consequently no inference can be made at this time as to the extension of the Coast Copper ore-bodies into the Quatsino ground. Any ore-body which may be found on the *Independent* group will therefore be a distinct ore-body from the known Coast Copper ore-bodies, but will be in the same belt.

The showing in the upper belt consists of great masses of magnetite up to 100 feet or more in width, with which are associated masses of pyrrhotite and arsenical iron, with an occasional bunch of chalcopyrite. These outcrops of magnetite extend north into the Coast Copper and south across the *Merry Widow* and *Blue Bell* groups of the Quatsino Gold Copper Company, with a general north-west, south-east strike. No commercial ore has been found so far in this belt.

Between the two belts several small outcrops of pyrrhotite and arsenical iron were noted, but as no work has been done on them it is impossible to judge their significance. They are known to carry good gold values, but whether they are large enough to amount to anything remains to be proved. The exploration and correlation of these showings would give valuable information and possibly lead to the development of important ore-shoots.

On the *Independent* along the trail is a large outcropping of magnetite and pyrrhotite on which a 4-foot shaft has been sunk. Chalcopyrite occurs very sparingly. Above the *Independent cabin at 950 feet elevation there is a good showing of chalcopyrite about 4 feet wide.*

Only sufficient work has been done for Crown-granting purposes; no extensive work has been done in any one place, nor has any depth been obtained on any of the showings. The property is therefore purely in the prospect stage, with the encouraging feature that a mine is being developed on the adjoining property at a cost, so far, of over $1,000,000 and has not yet reached the stage necessitating a concentrator nor ore-transportation facilities.

Coast Copper Co., Ltd.

(*See* 1927 Annual Report.) This company was incorporated in 1916 with a capitalization of $1,000,000, divided into 200,000 shares at $5 each par value, with its head office at Trail, it being a subsidiary company of the Consolidated Mining and Smelting Company of Canada. The holdings consist of several groups of claims in the Elk Lake area. All the development has been on the *Old Sport* group, where the ore-bodies are contained in a contact-belt up to 80 feet wide between diorite and crystalline limestone. The minerals are sulphides of iron and copper occurring in lenses varying from a low-grade ore of disseminated sulphides to clean chalcopyrite.

It is noted on the tenth and twelfth levels that bornite is becoming more plentiful and also that there is an appreciable increase in gold values. The mine so far has been opened up on five levels, giving a depth of 1,400 feet on the vein. The three upper levels, the fifth, seventh,

and eighth, were opened by tunnels from the surface; the tenth and twelfth by sinking a 3-compartment shaft from the eighth level.

The underground work in 1928—3,413 feet of drifting, 240 feet of crosscutting, and 110 feet of raising—has been confined chiefly to the two lower levels, which are 200 and 400 feet respectively below the eighth. About 4,000 feet of diamond-drilling also was done this year. Altogether there are about 4 miles of underground work.

The result of the work on the lower levels has been satisfactory in that the downward extensions of the ore-bodies exposed in the levels above have been proven, with the additional encouragement, as stated, of a greater bornite content and an increase in gold values. Besides the underground development, the shaft has been double-tracked for counterbalance hoisting, the ore-pockets enlarged, and an electrical hoist installed, and electrical haulage-motors are being installed on the No. 8 level.

This has necessitated the enlargement of the Raging River power plant by the addition of a 200-horse-power a.c. electrical generator driven by direct-connected Pelton wheel. The flume was also enlarged to provide the extra supply of water for the units. The truck-road was completed from Kathleen lake through the camp to the No. 8 tunnel, and there is now uninterrupted truck and boat transportation from Jeune Landing, the port of call for Coast boats, on Quatsino sound.

C. A. Seaton is superintendent in charge at the mine and of the company's operations on the north end of the island.

Yreka. This property, situated on the South-east arm of Quatsino sound, is comprised of two groups of eight Crown-granted mineral claims each. The original claims were staked in 1898 and developed up to 1903, when operations stopped, to reopen again in 1916, when additional extensive work was done.

W. M. Brewer, Resident Mining Engineer at that time, reporting on the property in the fall of 1916, makes the following concluding remarks: That the new work done on the *Yreka* has exposed a large ore-body, especially important when the extremely favourable transportation facilities by which ore could be freighted to smelters at a very low cost are considered. That probably 20,000 tons of ore can be quarried for shipment, with a reasonable possibility that further work will expose much greater tonnage. That while sampling shows the ore to average 3 per cent. copper, a higher grade could be hand-sorted out for shipment.

A more recent independent examination in 1927 describes the mineralization as veins from 5 to 14 feet wide, up to 200 feet long, occurring across a width of 200 feet of a contact-belt between limestone and igneous rocks extending for a length of 2,000 feet. The ore will average about 3 per cent. copper and 3 oz. silver. This report also mentions an occurrence of lead-zinc ore as a replacement in limestone at 1,500 feet elevation, between the copper-belt and the beach.

From these reports I judge that the property has prospective merit and is therefore mentioned here for the consideration of the reader.

NANAIMO MINING DIVISION.

This is the largest Division in the district, containing about one-third of Vancouver island and one-half of the Mainland portion of the district. With practically the whole of the east coast of Vancouver Island and 160 miles of the west coast of the Mainland, it is probably the most ideally located Division in the Province.

Government office statistics are distinctly encouraging, as they show an increase in 1928 over 1927: In miners' licences, from 136 to 301; claims recorded, from 124 last year to 370 this; assessments, from 175 to 229; and 36 reverted Crown-granted claims redeemed.

NANAIMO RIVER SECTION.

Silver Leaf. (*See* 1927 Annual Report.) The three claims comprising this group—*Silver Leaf*, *Mountain Ash*, and *Hemlock*—are situated at the head of Jump creek, a south branch of Nanaimo river. They are owned by T. Service, the original staker; E. F. Miller, of Duncan; and others, forming the Silver Leaf Syndicate. The best way to reach the property is from Youbou, the last station on the Canadian National Railway on Cowichan lake, and then up Cotfonwood creek, a distance of about 10 miles. One may also go over the divide at 3,625 feet elevation from the *El Capitan* trail on the Cowichan Lake slope, but it is a hard trip from the summit down to the cabin at 2,000 feet elevation.

The showings consist of three shears in the andesite of the Vancouver volcanics, mineralized with pyrrhotite, arsenopyrite, and chalcopyrite. Two of these have had considerable work done on them, while the third one, on the *Mountain Ash* claim, has not been prospected to any extent. The first two are about 50 feet apart on the level of the tunnel driven on the south vein. The south vein strikes S. 30° W. (mag.) and dips south-east; the north vein strikes east-west and dips east; and therefore the veins will come together a short distance down the hill from the tunnel, and, judging from the mineralization of both, their intersection should be worth prospecting.

A tunnel has been driven 70 feet on the south vein under a surface ore-showing. This work shows an ore-shoot, about 50 feet in length, of from 16 inches of clean chalcopyrite to 2 feet or more of mixed ore, assaying: Gold, $10 to $15 to the ton; silver, 1.5 oz. to the ton; copper, 9 to 17 per cent. This year a winze was sunk, 25 feet back from the face, to a depth of 6 feet, showing the downward continuation of the clean chalcopyrite in a vein-width of 2 feet. The clean ore does not show in the 3-foot vein in the face of the tunnel, but I think can be picked up by cutting over to the hanging-wall. This tunnel should certainly be extended.

On the north vein, 50 feet from the mouth of the tunnel, a few shots put in this season show the vein to be 2 feet wide, of streaks of chalcopyrite and oxidized material. A sample across the 2 feet gave assays of: Gold, $13 to the ton; silver, 2.2 oz. to the ton; copper, 16 per cent. About 500 feet above this showing, at 2,800 feet elevation, an open-cut on this vein shows the width to be 5 feet, of which 18 inches on the hanging-wall is clean chalcopyrite. Another stripping 200 feet above this shows the same width of vein, but it has not been broken into.

These two veins, though small so far as opened up, make a very attractive property that could be profitably operated under favourable transportation conditions. If the three properties, the *Silver Leaf*, and *El Capitan* and *Cottonwood* on the Cowichan Lake slope, were worked in combination it might be feasible to tram the *Silver Leaf* ore over the summit and down to the Canadian National Railway on Cowichan lake.

Campbell River Section.

There are two old properties in this section, the *Big G.* group and *Sumpter* group, on which a considerable amount of development-work was done some years ago.

From the 1916 Annual Report I gather that the *Big G.* group is situated at Little Campbell river, on Greenstone creek, reached from Forbes Landing by launch to the corduroy road at Campbell River, from which point the road was built 6 miles to the mine. In 1916 40 tons of chalcopyrite ore was shipped. Quoting in part from the Government report, "The mine-workings are on the side of a deep precipitous canyon through which the Little Campbell (Greenstone creek) flows and about 100 feet above the river-bed. They consist of several large open-cuts and two adits; one of the latter is 60 feet long, with an upraise about 30 feet high at the face of the adit, and the other is 30 feet long. Outcroppings of considerable extent made up of gossan and pyrrhotite with some chalcopyrite form the summits of bold bluffs. The occurrence of ore exposed by the workings has the appearance of being a blanket outcrop, covering a bluff, rather than a deposit filling a fissure in a shear-zone in igneous rock. The country-rock resembles andesite, but is very much altered and fractured. In the first-mentioned adit no well-defined ore-body occurs, but the country-rock is mineralized to some extent with iron pyrites, some chalcopyrite, and pyrrhotite. In the other adit there is a lens of ore that is about 3 feet wide at the entrance, but this width gradually contracts until at the face of the adit the ore is only a few inches wide. This ore is an association of pyrrhotite and chalcopyrite."

Sumpter. This group is situated on the north-westerly shore of Upper Campbell lake, near the north-east end of the lake. The Annual Report for 1916 states in part: "An occurrence of mineral, made up chiefly of copper carbonates developed between two limestone walls in a gangue chiefly composed of garnetite with some iron-stained, crushed limestone, occurs at a slight elevation above the lake and within 300 feet from the shore the width of mineralized material is about 9 feet.

"On another claim there is a lens of copper ore that outcrops in limestone at a point about 300 feet from the shore and about 200 feet elevation. There is a shaft sunk on this outcrop 25 feet deep, on the bottom of which is a stringer 18 inches wide, of bornite mixed with chalcopyrite. After the shaft was sunk the owners drove an adit 150 feet long from a point about

60 feet lower elevation in the hope of intersecting the ore below the bottom of the shaft, but no ore had been exposed at the time of the writer's examination. A sample from the bottom of the shaft assayed: Gold, trace; silver, 2.8 oz. to the ton; copper, 3 per cent."

Buttle Lake Section.

This section includes the Strathcona Park area and is reached by way of Campbell River, from which the auto-road extends 10 miles to Forbes Landing, and a further 12 miles of poor road to Sutherland's camp on Upper Campbell lake. The Sutherland Bros. operate a small launch to the head of the lake, 5 miles, and from there a pack-trail to the foot of Buttle lake, a distance of 9 miles over a fair horse-trail. Saddle-horses are available. Arrangement can also be made with the Sutherlands for boat-hire or service on Buttle lake, which is 25 miles long and 720 feet elevation.

The section would be rather handicapped at present for ore transportation, but it is a matter of only a short time until the logging-railway will be pushed through to the northern end of the lake from the Coast.

The general geological structure consists of zones, up to 1,000 feet wide, of highly altered schists resulting from shearing action in the igneous rocks which comprise the greater part of the island. These metamorphosed schists vary from greenstones to talcose and sericitic schists, the latter weathering to loose, laminated material. Iron pyrites is disseminated throughout in tiny crystals, the oxidation of which gives the surface a general yellow to red colour.

Within the wide zone are smaller ones, 30 feet or more in width, somewhat silicified and showing some barite and calcite, mineralized with pyrite, zinc-blende, galena, chalcopyrite, and arsenopyrite in lenses, bunches, and veinlets of sulphides. These belts impressed me as being important prospecting areas.

Some prospecting has been done from the southern end of the lake on Price and Myra creeks, and probably between forty and fifty claims are in good standing, several of which have been Crown-granted.

Paramount Mining Co., Ltd. This company was registered in the Province in November, 1919, with its office at McGeer, McGeer & Wilson, 1815 Hastings Street West, Vancouver. It is capitalized at $500,000 and operated in the Buttle Lake section in 1920, when its holdings consisted of about forty claims, situated on both sides of Myra creek, which flows into the south end of Buttle lake from the west. About 2,000 feet of diamond-drilling was done at that time, but the property has been idle ever since. The two bonded groups of sixteen claims constituting part of the holdings reverted to the original owners and some of the company's un-Crown-granted claims were allowed to revert to the Government. These have been redeemed this year and it is hoped that something further will be done toward developing the property.

Cross, Eleanor, and Du Bois. (*See* 1927 Annual Report.) These groups are situated on Price creek, which empties into the south end of Buttle lake, and are composed of the following claims: The *Eleanor* group—*Eleanor*, *McQuaig*, *Revercomb*, *Du Bois;* the *Cross* group—*Eleanor*, *Cross*, *Cross No. 2*, *Atkinson*, *Barnett;* *Du Bois* group—*J. Du Bois*, *Leontine*, *Du Bois No. 2*, *A. J. Wakeman*, *George H. Knight*, and *Charles H. Revercomb*. Assessment-work has been performed on these in 1928, with reported improvements in the showings. I did not get into this section in 1928.

Sayward Section.

Lucky Jim. This group of three claims is situated on Adams river, which empties into Johnstone strait about 15 miles above Sayward, which is at the mouth of Salmon river. The property is reached by trail from Sayward up the Salmon river, 7 miles, to the junction of the Salmon and White rivers, and from there about 10 miles across to the head of Adams river. The trail was put in good repair last year by the Department of Mines when the Consolidated Mining and Smelting Company had an option on the property.

From the Annual Report of 1918 I gather that the ore, consisting of pyrites, arsenopyrite, and chalcopyrite, carrying good gold values, occurs in a brecciated gangue of hornblende and calcite. Considerable work has been done by the owners. The Consolidated Mining and Smelting Company diamond-drilled it, but the results were not sufficiently encouraging for the company to continue work and the option was dropped.

Copper King. The two claims of this group, *Copper King* and *Pott*, owned by Thomas Russell, of Vancouver, and associates, are situated about a mile back from Humpback bay, on Johnstone strait, on the north-east coast of Vancouver island. This year the trail was improved from the beach to the claims, and Mr. Russell informs me that a 45-foot drift was driven, of which 33 feet was timbered, the intention being to crosscut from a point from 70 to 80 feet in the tunnel. The mineralization is chalcopyrite in a quartz gangue in greenstone formation.

Nimpkish Lake Section.

This area lies east of the head of Nimpkish lake about 4 miles. It is reached by way of Englewood, on the east coast of Vancouver island, a port of call of the Union Steamship boats. From Englewood it is about 12 miles over the English-Wood Logging Company's railway to the foot of the lake and about the same distance from there to the company's No. 8 camp at the head of the lake.

Assistance was granted by the Department of Mines for the construction of a 4-mile trail from the east side of the head of the lake up Lime creek to the mineral area.

The general rock formation consists of an intrusion of granodiorite extending westward from the head of Lime creek toward the summit and probably constituting the main range of northern Vancouver island. East of the granite are wide belts of limestone and the volcanics of the Vancouver series.

This season's prospecting by E. L. Kinman, of Vancouver, and partners has resulted in the discovery of several promising-looking showings of chalcopyrite, associated with pyrrhotite, pyrite, and some arsenopyrite. The ore occurs not only in altered belts bordering a wide belt of limestone lying between granite on the west and volcanics on the east, but also in veins within the granite itself and in broad belts mineralized with disseminated chalcopyrite. At 2,300 feet elevation, Copper creek, a small tributary of Lime creek, has cut a canyon across a limestone-belt to a depth of 50 feet or more, showing a width of altered rocks of about 75 feet, striking approximately north 60° (mag.) and dipping 65° east. This belt is more or less mineralized all the way across, but so far as could be seen from the creek is better on the hanging-wall side. It has been traced for 1,500 feet or more up the hill by stripping off the overburden in places, showing chalcopyrite all the way to the last exposure at 3,000 feet of elevation, where there is a width of from 12 to 15 feet of chalcopyrite somewhat decomposed on the surface, but a very fine cropping of ore.

West of this belt and lying in the granite three or four veins have been found, one showing 2 feet in width of clean chalcopyrite, and two others showing considerable width of pyrite and pyrrhotite with a low chalcopyrite content, with, in places, galena and zinc-blende.

No work had been done on the showings at the time of my examination other than a little stripping mentioned, but the number of veins and the favourable mineral-showings in so many places impressed me as strongly indicating an important area. The owners have staked about forty claims, built a 4-mile trail, constructed a cabin, taken in a winter's supply, and will go ahead with exploratory work this winter.

Port Hardy Section.

Caledonia Mines, Ltd. (*See* 1927 Annual Report.) This company was incorporated in 1926 with a capitalization of $250,000, divided into 2,500 units of $100 each, with its registered office at 403 Pacific Building, Vancouver. The company's holdings consist of the three original claims, *Caledonia*, *Cascade*, and *Blue Bell*, to which were added the *Scotia*, *Maple*, and *Thistle*. They are situated near Quatse lake, about 5 miles north of the 6-Mile post on the Port Hardy–Coal Harbour auto-road, from which point a road was built last year to the mine, assisted by the Department of Mines. It has been improved this year and hauling is now done with a small caterpillar and crawler-trailer.

Several long, deep open-cuts to bed-rock had exposed a fairly well-mineralized vein or zone up to 25 or 30 feet wide, and averaging about 10 feet, in a granodiorite-limestone contact. The mineralization consists of zinc-blende, galena, and chalcopyrite. Last fall a small compressor plant was installed and a crosscut tunnel started which would obtain about 75 feet depth below the surface ore-exposures. This work was resumed this spring, but unfortunately the compressor plant burned down, necessitating stopping underground work. Hand-work was resumed on the surface showings, resulting in opening up some fine copper ore, from which 5 tons were

sent to Trail for testing purposes. As soon as the compressor plant was in commission again work was resumed underground and the crosscut continued. This, however, crossed the vein, which here lies in the granite and rather obscure, and continued for some distance beyond the ore-zone. After a compass survey the crosscut was discontinued and work was started from it just beyond the vein on a bearing to get under the surface showing. This was under way at the time I examined the property. I am informed that the ore was not found at the objective point, and a raise was started toward the ore-body, which I presume is in the granite here as well. Altogether 417 feet of underground work was done this year, which includes 358 feet of tunnel, 44 feet of raising, and 35 feet of drifting, from which I infer that the drifting was done on the vein from the raise.

When the ore is defined underground the property will be well away toward making a successful undertaking. I have later been informed that the property has been bonded to the Consolidated Mining and Smelting Company.

Islands and North Coast Section.

Cambria Copper Co., Ltd.

This company was incorporated in October, 1928, with a capitalization of $1,500,000, divided into 1,500,000 shares of $1 each. Its registered office is 52–53 Exchange Building, Vancouver. The holdings consist of a total of sixteen mineral claims on Matsin river, Knight inlet—the *Cambria* group of five claims staked in 1927 and eleven additional claims staked this year. The *Cambria* group is evidently the old *Princess* group, on which work was done in 1918–19 and reported in the Annual Report for 1919 by the Resident Mining Engineer.

The work done and showings exposed at that time consisted of a 210-foot tunnel at 1,500 feet elevation; an open-cut about 12 feet from the portal of this tunnel; about 400 feet higher up the hill another open-cut and short tunnel 10 feet long to cut a cropping 20 feet above; and about 50 feet south of this a steep bluff of iron-stained rock. In the 210-foot tunnel there was about 3 feet of low-grade copper ore showing about 24 feet back from the face and another vein in the face about 6 inches wide. On the surface in the open-cut, about 12 feet from the portal of the tunnel, a showing of ore about 3 feet wide assayed: Gold, trace; silver, 1 oz. to the ton; copper, 2 per cent.; zinc, 24 per cent.

Wm. M. Brewer, the Resident Mining Engineer, considered that the mineral occurrences were somewhat irregular, but the indications were sufficiently encouraging to justify further well-planned development-work.

A report in spring of 1928 by an independent engineer states that the upper tunnel had been extended to 20 feet and the lower or main tunnel driven a total of 312 feet, which included an 18-foot crosscut to the south at the face, which has since been extended to over 100 feet on contract-work. In this report several assays of samples are given, averaging: Gold, 60 cents to the ton; silver, 2.6 oz. to the ton; copper, 6.32 per cent.; zinc, 33.1 per cent.; but for some reason no widths of ore samples are mentioned, and one is left to guess whether the samples were taken to obtain values or whether they represent workable widths of commercial ore.

The management states that a 4-foot vein was cut in the south crosscut, averaging: Silver, 2.5 oz. to the ton; copper, 5.7 per cent.; zinc, 5.88 per cent.; with a considerable width of low-grade ore beyond this.

Alexandria Mining Co., Ltd.

(*See* 1927 Annual Report.) This company was incorporated in September, 1925, with a capitalization of $500,000, divided into 1,000,000 shares of 50 cents each. The registered office is 905 Credit-Foncier Building, Vancouver.

The property consists of the Crown-granted mineral claims *Alexandria, Waterloo, Emperor Fraction, Highland Laddie, Duke, Jubilee,* and *Duchess,* situated on the north side of Cordero channel, at the entrance to Phillips arm. The nearest port of call for Coast boats is Shoal Bay (Thurlow Post-office), just across the channel from the mine. The mine is now equipped with a float where any heavy equipment may be discharged.

The main tunnel is at the beach, where a good dock has been built during the year by crib-work filled in with waste from the mine, giving additional space for mine buildings, etc. The property is equipped with good accommodations for thirty men, blacksmith-shop, small compressor, etc., all on the beach—altogether an ideal location.

As will be seen from the last Annual Report, a considerable amount of work has been done—namely, a 530-foot tunnel at the beach and three shorter ones above. The lowest or beach

tunnel follows the quartz vein all the way; the first 300 feet comprises the ore-body, averaging 5 feet in width, of $9-to-the-ton ore, principally gold. The upper tunnels are in a more or less crushed area and mineralization has therefore been irregular and good values found only in spots.

The work for 1928, under the supervision of T. D. Davey, mining engineer, has been mainly the exploration of the ground above the beach tunnel. The vein was traced up the hill for about 1,000 feet. In the No. 2 tunnel a crosscut was driven north from the crushed condition for a distance of 100 feet through an irregularly mineralized quartz-diorite rock showing values up to $5 to the ton in spots, but no commercial ore. At a favourable point below the outcrops, about 400 feet north of and 200 feet above the beach tunnel, a new crosscut tunnel was driven, encountering the downward extension of the vein at 125 feet in the tunnel and 100 feet below the surface. A drift south was then run on the vein, showing it to be 3 to 4 feet wide, composed mainly of shattered and oxidized quartz carrying low values, but these conditions are apparently improving as greater depth is obtained; that is, the fracturing is diminishing and the mineralization increasing.

It was decided to continue the winze started from the beach tunnel, and in cutting out for hoist, etc., a parallel lens of ore about 4 feet wide was encountered in the hanging-wall, assaying up to $32 to the ton. A sample above the winze across 15 feet gave assays of $12 to the ton. The hanging-wall ore has been opened up for a length of 30 feet. It is proposed to sink the winze to a depth of 100 feet and drift on the vein at that depth.

The season's work has been well planned and well carried out and has materially bettered the possibilities of the property, and present indications may be considered as very promising.

The possibility of a favourable treatment rate from the Granby Consolidated Mining, Smelting, and Power Company for this siliceous ore is under investigation. Scows can be loaded at the dock at the mouth of the tunnel and towed to Anyox at minimum cost, and would solve the problem of disposing of ore from development-work where space is limited.

Thurlow Gold Mines, Ltd.

This company was incorporated in August, 1928, with a capitalization of $500,000, divided into 2,000,000 shares of 25 cents each. The registered office is 804 Dominion Building, Vancouver. The company acquired the *Hope* group (*see* 1927 Annual Report) of three mineral claims—*Hope*, *Hope No. 1*, and *Hope No. 2*—situated on the east side of Thurlow island, to which were added twelve claims staked in 1928. The showings are about half a mile from the beach in a direct line at sufficient elevation to suit a gravity surface tramway to the beach. The company has attacked the property in a businesslike way and with a small crew has accomplished a commendable amount of work this season. About a mile of old logging-road was improved into a serviceable tractor-road; a comfortable frame building, 16 by 32 feet, built; the tunnel advanced about 20 feet and some surface prospecting done above the tunnel; compressor building erected; small compressor installed and necessary equipment laid down at the tunnel.

The showing consists of a pyritized quartz vein, showing some chalcopyrite, in a wide belt of altered rocks of argillite, schists, greenstone, etc., probably the same belt in which the *Alexandria* is situated. The quartz vein is from 1 to 4 feet wide, carrying values mainly in gold, with a little silver. Values occur somewhat irregularly, depending on the pyrite content. A shipping-ore may be made by hand-sorting or the whole may make a milling-grade ore. Recent work in the tunnel shows about 16 inches of ore in the bottom of the face said to assay $85 to the ton in gold.

The compressor plant will be in operation early in the year and it is then planned to continue the driving of the tunnel. The property has the prospects of making a small profitable mine.

Doratha Morton.

This old property on Fanny bay, Phillips arm, was under option to the Glasord Mining Corporation, but no work has been done on it for the past two years. Although about 10,000 tons of $12 ore was mined from the property years ago, no extensive development-work has been done; the greatest depth obtained, I think, is about 350 feet. The property therefore might be worth some further investigation.

Enid and Julia.

These groups, adjoining the *Alexandria* group on the north, had some prospecting-work done on them a year ago, with reported favourable results, but the work was not resumed during 1928. These groups are owned by the Morton Woolsey Consolidated Mines, Limited, incorporated in March, 1928, with a capitalization of $3,000,000, divided into 12,000,000 shares, with office in Williams Building, Vancouver.

Nimrod Mining and Development Co., Ltd.

This is an old company capitalized for $1,000,000, divided into 4,000,000 shares of 25 cents a share, with office at 612 Standard Bank Building, Vancouver. The holdings consist of seven Crown-granted claims and three others held by annual assessments, situated on the north side of the entrance to Frederick arm. The claims extend from the beach up the hill and adjoin the *Blue Bells* (*see* 1927 Annual Report) on the south-west. They have been purchased from the owners for a stock consideration and are therefore owned outright by the company.

The Annual Report for 1923 states that the showings consist of pyritized gold-bearing quartz veins similar to the *Blue Bells* vein. It seems to have been fairly conclusively established that these veins are the southward extension of the *Blue Bells* ore-body.

I am informed that the work on the property will be resumed next season under the supervision of R. F. Hill, mining engineer.

Colossus.

This group of Crown-granted mineral claims is on Estero basin at the head of Frederick arm. I visited the property this fall, but by the time I found it I had little time to gain much information. The upper tunnel is about 100 feet below the croppings and has a considerable amount of work done, showing irregular occurrences of chalcopyrite. The surface above the tunnel shows a very much distorted formation, probably accounting for the irregular ore-bodies. Two lower tunnels are caved at the portals and the water backed up in them, and are therefore inaccesible until drained.

Lucky Jim and Wyho.—These two groups are on Quadra island back of Granite Bay. Work has not been resumed on the *Lucky Jim* in 1928. My information is that the owner of the *Wyho*, Albert Ross, of Granite Bay, has been working steadily on this group during the season.

Powell River Section.

John Bull.

(*See* 1926 Annual Report.) There are three claims in this group—*John Bull*, *Hematite*, and *Extension*—owned by William Uzzell, of Powell River, and situated north of and adjoining the property of the Malaspina Mines, Limited, about 11 miles north of Powell River. In the spring of 1928 the John Bull Mines, Limited, was organized in Winnipeg under Dominion charter, but was not registered in British Columbia.

The company built, under the supervision of Mr. Uzzell, a good serviceable road from the main Lund–Powell River highway to the mine, a distance of about 1½ miles, and constructed log buildings for a camp. Work was suspended on the completion of this, though I understand the bond on the property is still held.

Malaspina Mines, Ltd.

(*See* 1927 Annual Report.) This is a 1927 incorporation with a capitalization of $1,500,000, divided into 1,500,000 shares, with its head office now at 10 McGregor Block, Victoria. The property consists of the six mineral claims—*Florence*, *Scott*, *Red Metal*, *Hope Fraction*, *Victory*, and *United*—about 10 miles north of Powell River and just off the main highway, from which there is a road to the mouth of the tunnel. There is a good camp on the beach about half a mile from the tunnel.

The general rock formation of this area is limestone underlain and intruded by granodiorite. Many dark-coloured basic dykes cut through the limestone, but do not appear to have any influence on mineralization. No ore has been found on the immediate contact of the granite and limestone.

In 1928 work was steadily carried on by a small crew, making nearly 300 feet of underground work, in general paralleling the contact. This makes a total about 800 feet of underground work. The first 80 feet of the drift run in 1928 showed ore composed of zinc and chalcopyrite, from which about 75 tons was sorted out and 43 tons shipped to Tacoma, which gave returns of: Silver, 3.1 oz. to the ton; copper, 4.9 per cent.; zinc, 12.4 per cent. The rest of the work followed the more or less crushed vein, but no ore was encountered until about the last 25 feet, in which bunches of ore occur in the gangue, which is becoming more regular. A diamond-drill hole from the surface about 30 feet ahead shows fair copper values. Everything considered, the development during 1928 has been satisfactory.

Romana Copper Mines, Ltd.

This company was incorporated in August, 1928, with a capitalization of $500,000, divided into 2,000,000 shares of 25 cents each par value. The registered office is at 303 Rogers Building, Vancouver. The company acquired the *Victoria* group of mineral claims, consisting of *Victoria*, *Victory No. 2*, *Peter*, and *Victory Fraction*, situated on the west side of Goat island in Powell lake, about 15 miles up

from Powell River. Transportation therefore presents no difficulties, as ore can be delivered at the foot of the lake, from which it is about half a mile truck-haul to the dock.

A single-cable tramway has been put in from the lake to the showings at about 1,000 feet above and the camp built near the workings. The general rock formation here consists of a wide zone of altered rock enclosed in the Coast Range granodiorite. Within the zone is a contact-metamorphic belt, 100 feet or more in width, of garnetite, epidote, etc., in which occur irregularly small masses and lenticular bodies of chalcopyrite.

The work done prior to the present operations consists of two or three open-cuts along the face of the bluff near the top, and a long, deep trench across a portion of the belt about 50 feet back from the edge of the steep bluff. From these old workings some 140 tons of ore was mined and shipped several years ago, assaying: Copper, 8 to 11 per cent.; silver, 7 to 20 oz. to the ton; gold, about 60 cents to the ton.

There is practically no ore in sight at present, but the company expects that further development in the zone will prove the recurrence of such masses and lenses of ore in sufficient quantities to make it a profitable enterprise. It is altogether probable that other ore-bodies do exist, but whether they will be found in sufficient amount to make it pay is rather speculative.

Copper Bowl. This is an old group held by A. Gilfillan and others in 1921, but allowed to lapse and again taken up this year. The claims are situated about 5 miles up Siwash creek from the head of Powell lake, on the west side. The first couple of miles from the lake follows an old blazed trail to Siwash creek, which is followed the rest of the way.

The showings occur in a deep gulch about 700 feet above the creek-bed and 2,700 feet elevation. From the creek up to the foot of the croppings is an immense rock-slide. The vein, from 4 to 6 feet wide, lies on the south wall of a deep canyon striking westerly into the hill, and is therefore exposed by nature for several hundred feet up the gulch and from 50 to 150 feet high. Only the lower portion of the steep gulch was accessible at the time I was on the property, the upper end being choked with immense boulders, around or over which was impossible. The vein has the appearance of a feldspathic dyke, lying along the granite-contact, which has been intensely crushed and cemented with quartz, giving the whole a brecciated appearance. In one or two places the quartz stringers were noted to be very sparsely mineralized with pyrite and chalcopyrite. At the lower end of the gulch the vein had broken away to the foot-wall, giving a complete cross-section of it, while along the vein up the gulch a few shots had broken into it. I could not find sufficient mineral anywhere to give it any possibilities. Many large boulders from the face, lying in the slide below, were examined, but no minerals to amount to anything were found. A few small pieces of float from higher up the gulch showed a little galena, chalcopyrite, and pyrite in a quartz gangue. My conclusion was that there was insufficient indications of mineral in the extensively exposed vein to justify any further work.

Texada Island Section.

The investigation of the old Vananda properties by the Central Copper and Gold Company, Limited, gives promise of again bringing Texada island into the mining limelight.

Pacific Lime Co. (*See* 1927 Annual Report.) This company's plant on Blubber bay, on the north end of Texada island, has been operating steadily throughout the year. It operates limestone-quarries and kilns for the production of about 900 barrels of lime a day, and a sawmill as well; employing altogether about 180 men. The finer limestone, too small for the kilns, is shipped to Granby smelter at Anyox, where from 1,200 to 1,500 tons a month is used.

Powell River Co., Ltd. This company's pulp and paper plant at Powell River uses from 500 to 600 tons of limestone a month. The company operates its own quarry at Sturt Bay, Texada island, where a very pure white limestone is obtained, analysing; Calcium carbonate, 95 per cent.; magnesium carbonate, 3.6 per cent.; iron and aluminium, 0.3 per cent.; silica, 1.1 per cent.

Texada Gulf Mining Co., Ltd. This company, with its office at 626 Pender Street West, Vancouver, was incorporated in March, 1928, with a capitalization of $1,500,000, divided into 3,000,000 shares of 50 cents par value. The property of the B.C. Gold Mines, Limited, consisting of five Crown-granted mineral claims—*Gem*, *Gerald D.*, *Harold D.*, *Dandy Fraction*, and *Cracker Jack Fraction*—situated on Texada island, was taken over by the company.

Considerable underground work had been done on this property by way of a shaft 150 feet deep, from which levels were run at 50 and 100 feet. Also a small amalgamating-mill had been built and operated one season unsuccessfully. The Texada Gulf Company unwatered the workings and altogether expended about $20,000 in exploratory work in the hope of opening up a commercial ore-body, without any success. It was therefore considered inadvisable to proceed further and the project was dropped.

Central Copper and Gold Co., Ltd.

This company was incorporated in August, 1928, with a capitalization of $500,000, divided into 2,000,000 shares of 25 cents each, with its main office at 1104 Standard Bank Building, Vancouver. It has acquired, for exploration and development purposes, the properties of the old Vananda Copper-Gold Company, consisting of the *Copper Queen*, *Cornell*, and *Little Billie*, situated at Vananda, on Texada island. These mines were operated prior to 1900, when between $8,000,000 and $9,000,000 worth of copper ore was mined. They have an area about 1½ miles long by 1 mile wide, adjoining the old *Marble Bay* on the south. The *Marble Bay* was mined to a depth of 1,600 feet and the shaft sunk to 1,700 feet; the *Copper Queen* to 640 feet; the *Cornell* to 560 feet; and the *Little Billie* to 280 feet. The latter three are at a little higher elevation on the surface than the *Marble Bay* and have therefore from 1,000 feet in the *Copper Queen* to 1,300 feet in the *Little Billie* of virgin depth to prospect before reaching the same depth as the lower ore-bodies in the *Marble Bay*.

The ore-bodies lie in two general zones, one extending from the *Cornell* through to the *Marble Bay*, and the other paralleling it through the *Copper Queen* and possibly the *Little Billie*, giving a mile along each zone to a known mineralized depth of 1,600 feet, warranting exploration.

The ore-bodies are lenticular irregular deposits in limestone along diorite intrusions. The ore consists of bornite and chalcopyrite in a gangue of garnetite, diopside, some epidote, and calcite. The shipped ore varied: In copper, from $5 to 12 per cent.; in silver, from 2 to 6 oz. to the ton; in gold, from 0.3 to 1.2 oz. to the ton; $12 to the ton being about the minimum profitable value. Under up-to-date mining and metallurgical methods it is estimated that $6 ore will yield a profit.

The property has been under investigation for the past two or three years under the direction of Charles D. Davis, consulting engineer, of Seattle, who has made an exhaustive study of geological conditions, which has from time to time been verified by other prominent engineers. As a result of this work the camps were reconditioned this year, diamond-drilling commenced early in the summer, and five holes drilled. Later a portion of the ground was platted in 150-foot squares and over 30 miles of lines cut to enable a Radiore survey to efficiently traverse the ground and accurately indicate its findings. The indications of the Radiore survey have so far been tested by only one diamond-drill hole, which has proven the existence, at a depth of 514 feet in the hole, of 12 feet of $55 copper-gold ore.

Altogether this has been a most thorough investigation, and if brought to a successful issue, which certainly appears probable, will have a very far-reaching, encouraging effect on the Coast and Vancouver island.

Nancy Bell.

There are six Crown-granted claims in this group—*Nancy Bell*, *Silver Tip*, *Thyee*, *Whistler*, *Golden Arrow*, and *Mountain Chief*—situated about three-quarters of a mile from the beach and reached by wagon-road from Vananda. They are owned by H. McMillan, of Nanaimo, and the Estate of Wm. McDonald and Wm. Lee.

The general rock formation is porphyry, in which are belts of crystalline limestone. Extensive work was done several years ago on the west veins in open-cuts and two shafts, which, however, did not develop anything very promising. A few hundred feet east of this, another vein about 6 feet wide was discovered later and explored by a shaft 40 feet deep and a little open-cutting south of the shaft. About 100 sacks of ore was sorted from the shaft material, assaying: Gold, 0.64 oz. to the ton; silver, 4.4 oz. to the ton; copper, 1.5 per cent.; lead, *nil;* zinc, 12 per cent. The open-cuts show the vein to be 6 feet wide, of which 2 feet 6 inches on the hanging-wall assays: Gold, 0.14 oz. to the ton; silver, 10 oz. to the ton; copper, 7.4 per cent.; zinc, 12 per cent. I think this vein is worth some further work.

Reverted Claims.—About twenty reverted Crown-granted claims around the north end of Texada island have been leased from the Government in 1928 and Crown grants obtained for the majority of them.

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	28	.....	14	.....	42	.....
Whites—						
Miners	122	.....	.....	.....	122	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	80	.....	47	.....	127	.....
Mechanics and skilled labour	96	.....	59	.....	155	.....
Boys	13	.....	9	.....	22	.....
Japanese—						
Miners	31	.....	.....	.....	31	.....
Miners' helpers	31	.....	.....	.....	31	.....
Chinese—						
Miners	65	.....	.....	.....	65	.....
Miners' helpers	52	.....	.....	.....	52	.....
Labourers	57	.....	30	.....	87	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	575	.....	159	.....	734	.....

REPORT BY J. W. JEMSON, INSPECTOR.

WELLINGTON EXTENSION MINES.

This division of the Canadian Collieries (Dunsmuir), Limited, mining properties comprises Nos. 1, 2, 8, and Vancouver slope, No. 5 South Wellington, and No. 9 Wellington; the latter two each form a separate section of this report. The entire output of the Extension Collieries is brought to Ladysmith over the Wellington Extension Collieries Railway, which also affords means of transportation to and from their work for the employees of the company residing at Ladysmith.

LADYSMITH.

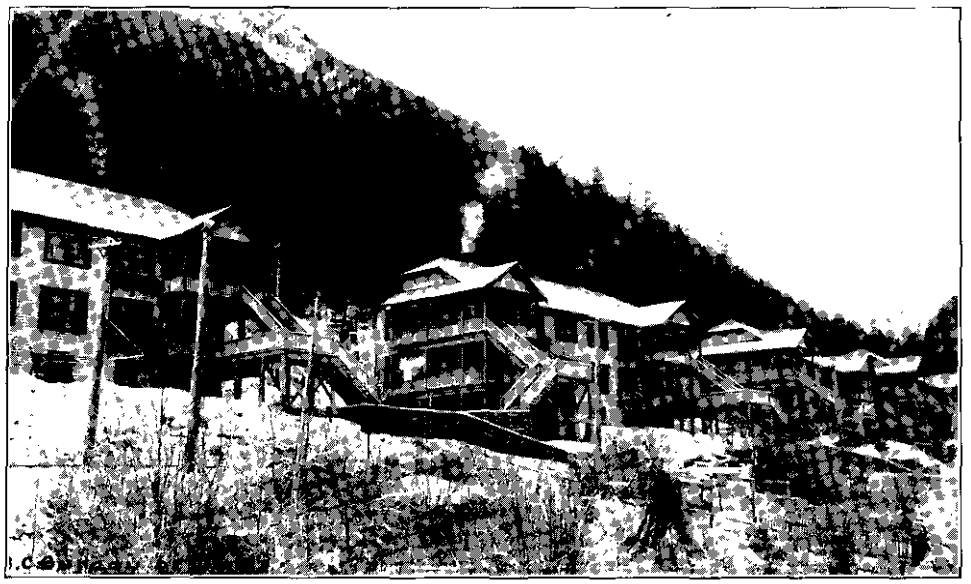
The general shipping-point for the output of these mines is Ladysmith, where the coal is either loaded on vessels or sent to Mainland points in railway-cars by means of transfer-barges. The coal-washery is equipped with three washers, each having a computed capacity of 200 tons in twelve hours, 6-compartment jigs, and four 14- by 17-foot Mascoe tables taking care of the smaller-sized coal. Power for the washery is supplied by a Pelton wheel. Provisions are made to replace the ordinary fresh-water supply by salt water in case of abnormally cold weather and during part of the dry season. A 40-kw., 240-volt Allis-Chalmers-Bullock generator furnishes the power for lighting purposes to the washery and wharves.

EXTENSION COLLIERY.

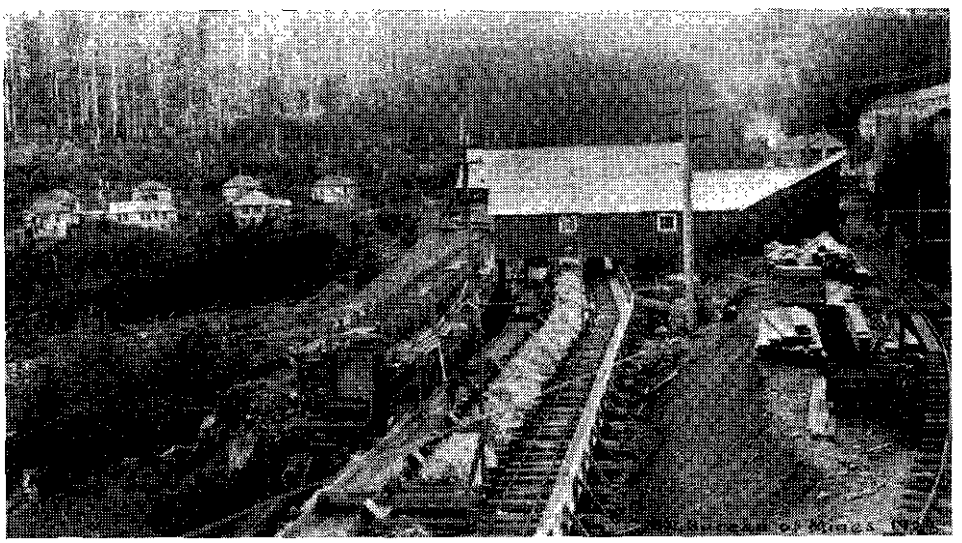
William Roper, Manager.

The workings of this colliery are situated partly in the Cranberry and partly in the Douglas districts. Here the Wellington seam underlies an area of some 2 miles in width at its south-east end, in the vicinity of the Nanaimo river, and extending about 4 miles in a north-westerly direction. The presence of the coal was accidentally discovered in the year 1895 and rapid development followed.

All the Extension mines are in the western limb of an important anticline, the axis of which is closely followed by the Extension valley. The field is traversed by several minor folds, all running in a north-westerly direction, as do the two major faults. The latter is by far the most important, both as to continuity and displacement, its throw sometimes approaching 500 feet. At some points it has a comparatively low dip to the south-west and there assumes all the



Britannia Mining and Smelting Co.—Upper Camp, Vancouver M.D.



Britannia Mining and Smelting Co.—Copper Precipitation Plant.

Stromberg. (*See* 1927 Annual Report.) The seven claims in this group—*Edith, Kate, Delora, Ethel, Hill, Bullion,* and *Big Bluff*—are situated on the west side of Texada island, opposite the head of Lasqueti island, and owned by Wm. Stromberg, of Vananda. The claims are under bond to the Pacific Tidewater Mines, Limited, which did about 50,000 square feet of stripping and 250 feet of open-cutting in preparation for diamond-drilling. The ore is bornite, occurring in veinlets, and more or less disseminated across a width of 60 feet or more in the porphyrite stock. The situation and general conditions are very favourable for quarrying a mass of low-grade ore.

LASQUETI ISLAND SECTION.

Lasco Development Co., Ltd. (Venus). This company, with its head office at 701 Vancouver Block, Vancouver, was incorporated in March, 1928, with a capitalization of $200,000, divided into 200,000 shares of $1 each. It took over the *Venus* group from the Lasqueti Mining Company, Limited (*see* 1927 Annual Report), for the purpose of further development-work. The *Venus* group is comprised of four Crown-granted claims—*Venus, Mars, Hill 60,* and *Venus Fraction*—and the *Leo,* held by yearly assessment.

The work of 1928 consisted mainly in advancing the beach tunnel a further 140 feet to a point almost under No. 2 open-cut on the surface. The ore in the face at the start was about 8 inches wide, assaying: Gold, $16 to the ton; copper, 14.5 per cent. Continued work showed this vein to be faulted in two places. Beyond the main fault the ore was 6 inches wide for a distance of 26 feet, assaying $4.40 in gold to the ton and 7.1 per cent. copper, ending at another small cross-fault. The tunnel-work was therefore not very encouraging, though it demonstrated that the best mineralization occurs in diorite, which extends some distance in from the portal of the beach tunnel and is again found on the farthest claim south, the *Leo,* where an open-cut exposed a very promising showing in the diorite.

The west vein, which is partially on this group and mainly on the adjoining property, the *Juneau* group, owned by Kurtzhals Bros., lies wholly in the diorite and has some promising ore-showings. Work was suspended in June pending further property adjustment.

Juneau. This group comprises six Crown-granted claims—*Juneau, Juneau Fraction, Ohm, Morore, Kim,* and *Bayview*—owned by Kurtzhals Bros., of False Bay, Lasqueti island, and adjoining the *Venus* group on the west. Considerable surface work has been done by the owners in open-cutting, stripping, and shallow shafts, showing a series of three veins lying in diorite. The east vein of this group extends into the *Venus,* adjoining, and is the west vein of that group. There are several very promising ore-exposures on the *Juneau* ground which might easily develop enough ore to supply a small concentrator. As in the case of the *Venus,* the situation for mining is ideal, except that depth would have to be obtained by sinking.

B.C. Mineral Development Co. This company was incorporated in October, 1928, with a capitalization of $150,000, divided into 600,000 shares at 25 cents each, with its registered office at 302 Pacific Building, Vancouver. The company acquired the six mineral claims—*Strike, Hope, Luck, Don, Cheer,* and *Chance*—staked in 1928 on Lasqueti island by LeRoy H. West. I have not been informed of any work done this year.

VANCOUVER MINING DIVISION.

This Division takes in the drainage areas of Burrard inlet, Howe sound, and Jervis inlet. It has the only producing mine in the district, the *Britannia,* whose output this year was 42 per cent. of the copper of the Province.

The Government office statistics are interesting as evidence of the greater interest being taken in mining. In 1927 there were only fifty-five claims staked in this Division, while in 1928 216 were recorded, and against 151 assessments in 1927 there were 225 for 1928.

HOWE SOUND SECTION.

Bowena Copper Mines, Ltd. This company was incorporated in 1913 with a capitalization of $250,000, divided into 250,000 shares of $1 par value. The company's office is at 640 Hastings Street West, Vancouver. Some further underground work was done this summer, but was closed down early in November. I have not examined the property, but hope to do so early in the coming year.

Princess Royal and Hazel.

There are fifteen claims in these groups, situated on the east side of McNab creek, about half a mile from the beach, at 350 feet elevation. McNab creek empties into the west side of Howe sound, opposite the north end of Granville island. One of the claims is owned by Mr. Hyde, who was on the property, and the remaining fourteen by J. F. Stirsky, of 408 Robson Street, Vancouver, and associates.

The minerals are zinc-blende and pyrite in a quartz gangue up to 6 or 8 inches wide in granodiorite. The vein has been exposed in a couple of places about 50 feet apart, showing a few inches in width of fairly clean sulphides, but the vein appears too small and too tight in the granite formation to give very much promise.

Britannia Mining & Smelting Co., Ltd.

This company's mine and concentrator have operated continuously throughout the year, resulting in the greatest production and best all-round operating year the company has ever had. The feature of the mining end of operations for this year has been the inauguration of all ore-haulage on the 2,700-foot level. This level, over 11,000 feet long, was completed last year, from which long raises have since been put in, connecting all the mine-workings with it, and ore from all parts of the mine is now delivered to this level, through which it is hauled 2 miles to the top of the 4,100-foot raise, where the first crushing is done. Here the ore passes through a 36- by 48-inch Buchanan jaw-crusher into the raise below, delivering it to the 4,100-foot level, from which it is hauled to the mill ore-bins.

In the mines there has been normal satisfactory development for the year. *Victoria* mine has been opened down to 2,650-foot level, finding the continuance of the ore from the levels above. The Bluff ore-deposit will be developed farther or below the 2,700-foot level, and to this end the preliminary work toward sinking the No. 4 Bluff shaft is under way. Lateral work from the shaft will explore the Bluff ore-body at depth. Increasing copper prices later in the year permitted the resumption of operations in the *Empress* mine. A total of 18,558 feet of underground development-work was done during 1928, segregated into 4,952 feet of drifting, 2,242 feet of crosscutting, 5,276 feet of raising, 626 feet of winzes, 4,975 feet of stope raises, and 487 feet of filling raises, altogether over 3½ miles of work.

The copper-precipitating tanks at the portal of the 2,200-foot level consist of a series of 1,000 feet of small flume, filled with scrap-tin, over which the mine-water runs, and precipitates the copper from the water. About 1.7 lb. of scrap-tin produces 1 lb. of copper. The output for 1928 from this plant is estimated at 644,179 lb. of metallic copper. Extensive new tanks are being built to increase this capacity.

The ore production from the various sections of the mine was 1,661,325 tons, an increase of over a quarter million tons over last year. Of this, 1,613,931 dry tons was milled, which is 264,000 tons greater than 1927. The concentrator produced 102,629 dry tons of concentrates and 69,113 dry tons of iron pyrites, the latter shipped to chemical plants for the manufacture of sulphuric acid.

An Exploration Department was organized and has been very active not only in this district, but other parts of the Province, with C. V. Brennan, chief engineer, in charge. Many properties have been examined and an extensive amount of actual exploratory work done. In this district the "Goat Creek" groups were under investigation. The company had the more promising portions of the claims thoroughly prospected by a Radiore electrical survey. The indicated ore-body or conductors were then checked by extensive surface stripping and trenching and six diamond-drill holes, aggregating 1,743 feet. The results, however, were not sufficiently encouraging to the company and the option was dropped.

The company staff consists of C. P. Browning, general manager; J. I. Moore, mine superintendent; A. C. Munro, mill superintendent.

Pacific Great Eastern Section.

This includes the country contiguous to the railway from Squamish at tide-water to Alta lake at the summit of the Coast range, the eastern limit of District No. 6. The railway and Howe sound gives a cross-section of the Coast range from the coast to its summit, a distance of about 55 miles. Geological surveys have shown the existence of many belts of altered sedimentaries and volcanics, overlying and included in the granodiorites, identical with the Britannia belt, in which has been proven one of the greatest mines of the Province.

The mineralization of these belts invites prospecting and gives this section splendid mining possibilities. This is recognized by the big companies, who are making every effort to develop other mines in this area.

There has been a considerable amount of prospecting in this section this year. In the Cheakamus River area, around McGuire, Garibaldi Park, and in the vicinity of Squamish, about seventy claims were staked this year.

Radiant Copper Co., Ltd.

(See *Rafuse*, 1927 Annual Report.) This company, with its office at 515 Rogers Building, Vancouver, was incorporated in December, 1928, with a capitalization of $2,000,000, divided into 4,000,000 shares of 50 cents each par value. The company has acquired three groups of mineral claims on Ray creek, a tributary of the Stawamus river, about 10 miles from Squamish. The groups are the *Bruce* and *McKinnon* groups of ten claims, owned by Don McKinnon and associates, of Vancouver.

Last year the Consolidated Mining and Smelting Company had an option on this same ground and diamond-drilled a portion of it, but it did not come up to expectations and the option was dropped. The owners, however, were not convinced and have now turned their different groups over to the Radiant Company for a stock consideration. The company proposes to first survey the ground by some electrical method and, if warranted, prove the findings by diamond-drilling.

The claims are located on one of the typical belts of altered rocks contained in the granodiorite of the Coast range. Within these belts are zones of schistose rocks, the results of shearing, in which occur masses and lenses of iron sulphides containing chalcopyrite. On this property the schistose-belt is probably over 1,000 feet in width, in which surface prospecting, stripping, and open-cutting have disclosed promising ore-showings. As stated, the lower portion of this zone has been partially explored by diamond-drilling and it is now proposed to explore the upper part, known as "the basin," near the granite.

The company has clearly and fairly outlined the situation and I think it a commendable undertaking.

Goat Creek.

There are three adjoining groups in this area—the *McVicar-Brown* claims, *Manson* group, and *Tocher* group—all situated on Goat creek, a tributary of The Mamquam river and about 11 miles by horse-trail from Squamish. These are old groups on which the Britannia Mining and Smelting Company had a bond in 1925, doing some diamond-drilling. This year the company again took an option on them and used the Radiore electrical survey, which was then checked by diamond-drill holes aggregating about 1,700 feet and extensive surface stripping and trenching. The results, however, were not sufficiently encouraging to the company and the option was thrown up.

Fitzsimmons.

This is a group of six Crown-granted mineral claims—*Yellow Jacket, Blue Jacket, All Up, Sunrise, Last Chance*, and *Leona Fraction*—situated on Fitzsimmons creek, 4 miles from Alta lake, which is on the Pacific Great Eastern Railway at 2,200 feet elevation, the summit of the Coast range. There is a good trail from the railway at the upper end of the lake to the property at 2,650 feet elevation. The property has been under bond this year to the Consolidated Mining and Smelting Company, which has carried out a programme of surface work and diamond-drilling.

There are two types of minerals on the claims, a pyrite-zinc mineralization in a lime gangue and a pyrite-chalcopyrite in a contact-metamorphic gangue of mainly epidote. The zinc-showings occur as massive outcrops up to 30 feet wide at intervals along a general strike of about N. 10° W. (mag.). Extensive stripping and trenching have exposed several such outcrops, ranging from a few feet to over 30 feet in width, the intervening gangue consisting only of pyritized limestone. The lowest of these ore-exposures, at 2,400 feet elevation, is certainly an attractive showing. Two years ago the Porcupine Mining Company, an Ontario incorporation, put in two diamond-drill holes at a pitch of 45°. The one under the showing just mentioned indicated a very satisfactory body of ore, but the other lower down the hill was in pryitized limestone all the way. This zinc-belt has been traced southward up the hill for a couple of thousand feet to an elevation of 2,700 feet. The Consolidated Mining and Smelting Company has drilled five holes, each at a dip of 30°, under these croppings, two of which have shown satisfactory indications of ore, but the remainder nothing but pyritized limestone.

South of the zinc-bearing belt a copper-bearing belt of altered rocks strikes about N. 35° to 40° W. (mag.) as nearly as could be estimated. At one point a 2-foot vein of good chalco-

pyrite was exposed by stripping off the overburden, but a short tunnel, 10 feet under it, failed to locate it. Farther south the lower portion of an outstanding bluff shows some very promising chalcopyrite-exposures across a width of over 30 feet. A tunnel across this underneath did not encounter any encouraging amount of ore. A horizontal diamond-drill hole was being drilled across this altered belt and, I understand, found no mineral of importance.

The surface ore-exposures on this property are exceptionally attractive, but the results of diamond-drilling have not been very encouraging, with the exception of the one hole, which entered ore at 230 feet and continued in it to 270 feet. I have not learned whether the Consolidated still holds this option or not.

Other Groups.—Other groups in this section and the Annual Reports in which they are described are as follows: *Blue Jack*, 1927; *Brandywine*, 1927; *Amedra*, 1927; *Eleanor*, 1925; *Collander*, 1918; *Blue Grouse*, 1918; *King Solomon*, 1918.

Jervis Inlet Section.

This includes the country adjacent to the inlet, Sechelt inlet, and Salmon arm. That prospecting was active in this section during the year is evidenced by the fact that about eighty claims were staked.

Britain River Mining Co., Ltd.

This company was incorporated in February, 1928, with a capitalization of $1,000,000, divided into 1,000,000 shares of $1 each. The holdings consist of the *Red Mountain* group of twelve claims—*Vergo Nos. 1* to *5*, *Jupiter Nos. 1* to *4*, *Leo*, *Sun*, and *Star*—owned by Phil White, of Vancouver, and T. Groven. The claims are situated at about 4,000 feet elevation on the west side of Britain river, which empties into Jervis inlet from the west at the head of Prince of Wales reach. A trail has been partially built from the beach camp up the hill with assistance from the Department of Mines.

The prevailing country-rocks are typical altered sedimentaries and volcanics occurring in wide zones in the Coast Range granodiorite; within the main zone are lesser shears, here mineralized with pyrrhotite, pyrite, chalcopyrite, and zinc-blende. Several such exposures have been found on the property and opened up in a small way. The lowest showing is at the lower cabin at 2,750 feet, reached by going over a summit of 3,250 feet elevation. "The cabin showing," striking N. 40° W. (mag.) up the hill, has been exposed in the face of a perpendicular bluff, in which a tunnel has been started on some small lenses of good chalcopyrite-zinc-blende ore. These showings apparently warrant considerable exploration. "The middle showing," at 3,850 feet elevation, strikes north-south and dips steeply west into the hill. A 12-foot tunnel was driven on this, this year, showing 6 feet in width of fairly solid ore at the collar of the tunnel, mainly zinc-blende with a little chalcopyrite. The mineral breaks up somewhat in the tunnel and the face shows the same width of vein, but with ribs of waste; it is nevertheless a very encouraging showing to drive on. A grab sample from a pile of about 40 tons of ore on the dump assayed: Gold, 40 cents to the ton; silver, 6 oz. to the ton; copper, 0.5 per cent.; zinc, 14 per cent. Three other outcrops of chalcopyrite within a short distance of the tunnel have had a few shots put in them, showing bunches of clean chalcopyrite; also a small vein showing clean galena has been traced up the bed of a small creek for some distance; all these showings, however, require further work before any idea of their possibilities can be obtained.

Trails were built from a lower cabin to the showings this year and the property is now in good shape to have work done on it. The indications are fairly promising.

Mount Diadem Mines, Ltd.

This company, with its registered office at 151 Eighth Avenue West, Vancouver, was incorporated in August, 1928, with a capitalization of $400,000, divided into 4,000,000 shares at 10 cents each. Its holdings are comprised of the three mineral claims—*Diadem Nos. 1* and *2* and *Alice*—situated adjoining the Britain River Mining Company, Limited, on the north-east and in the same zone of mineralized altered rocks.

The only showing so far is a small vein of galena, 3 or 4 inches wide, assaying: Silver, 88 oz. to the ton; lead, 68 per cent.; zinc, 7 per cent. As no work has been done the assays mean nothing, except to give the silver content in the galena. Further development, of course, will be necessary to find out whether the vein amounts to anything or not. Some encouraging-looking float-ore has been found on other portions of the claims, but nothing in place The property therefore is so far only a piece of ground worth prospecting.

Assistance was granted by the Department of Mines toward putting a trail from the beach through this property and to the Britain River Mining Company's showings, not only to help out these, but to make the whole belt more accessible for prospecting.

Pacific Copper Mines, Ltd.

This company was incorporated in October, 1928, with a capitalization of $1,000,000, divided into 4,000,000 shares of 25 cents each. The holdings consist of two old Crown-granted lots of land, No. 353 containing 320 acres and 354 containing 40 acres, granted to Alexander Donaldson in 1877. The remainder of thirty-six full claims and three fractional claims were staked in 1928 around the old Crown grant. The original land was the property of the Howe Mining Company, registered in British Columbia in 1877.

The claims are situated at the head of Salmon arm, at an elevation of about 4,500 feet and about 2½ miles from tide-water. I have not examined the property yet, but I gathered from old reports that the minerals are chalcopyrite and high-grade copper carrying good silver values in quartz veins up to 2½ feet wide in Coast Range granodiorite. The only definite work mentioned is a crosscut tunnel 30 feet long, which cut a vein, showing it to be nearly 4 feet wide at that point. No widths of ore sampled are given in any of the old reports and recent stock advertising matter, though giving a number of high assays, are equally obscure regarding the widths of any of the ore. One is left to conclude that there may not be any appreciable width or length of ore and that the samples should probably be called specimens.

The property no doubt is a fair prospect, requiring a trail, equipment, and much development before it can be classed as a possible shipper.

NEW WESTMINSTER MINING DIVISION.

This Division comprises the drainage area of the Fraser river; on the north from Point Grey to near Hope, which includes the areas of Pitt, Stave, and Harrison lakes; and on the south to the International boundary-line.

Renewed interest is obviously being taken in mining in this Division, as 127 claims were staked this year, against 85 last, and 127 assessments done, compared with 84 in 1927. Prospecting seems to have been general throughout the whole Division.

Pitt Lake Section.

Pitt Lake Mining Co.

(*See* 1927 Annual Report.) This company was incorporated in June, 1921, with its head office at 25 Hastings Street West, Vancouver, with a capitalization of $250,000, divided into 250,000 shares of $1 par value. The company's property consists of the old *Viking* group of eight Crown-granted mineral claims, situated on the east side of Pitt lake, about 15 miles from Coquitlam. There is launch service three times a week from New Westminster to the head of the lake, calling at the Pitt Mines' Landing as necessary. The claims are staked from the beach up the hill, with a lower tunnel at 630 feet elevation, to which a wagon-road has been built from the beach. The situation is perfect for cheap mining and shipping; a scow or boat can be loaded at the company's landing and unloaded at the Tacoma smelter.

There are two veins occupying shears in the granodiorite country-rock. Only one of these has been explored to any extent, the north vein, on which the lower tunnel has been driven and a raise from a point 270 feet from the portal through to the surface. Two levels have been opened up from the raise, one at 90 feet and the other at 135 feet above the tunnel, each showing a good width of milling-ore. At the lower level the ore-shoot is about 150 feet long and stoping can be started on this level on milling-grade ore. The average values from several hundred samples are: Gold, $12 to the ton; silver, $2.40 to the ton; copper, 3.9 per cent.

The work for 1928 has been confined to surface construction. Two hundred thousand feet of lumber was sawed at the camp on contract and utilized for the construction of several buildings—an office; a combined compressor, machine-shop, concentrator, and crusher building; ore-bunkers at the mill and mine, etc. The concentrator is designed to treat 75 tons every twenty-four hours, with plenty of crushing capacity, so that enlargement can easily be made in the future. A Pelton wheel has been purchased which will furnish 280 horse-power under an effective head of 650 feet and the survey has been made for a hydraulic electric plant.

I understand that a recent issue of stock has placed the finances of the company in good condition, and it is stated by the management that the mill machinery will be installed at once and the plant ready for operation early the coming summer.

A discovery of a new ore-body has been announced, but its importance has not as yet been proven.

Under the management of W. H. Wooley, the affairs of the company are apparently being efficiently handled.

Cox Claims. Altogether there are twenty-one claims staked in a block of three claims wide and seven claims long and owned by Marcus Cox, of Vancouver. They are situated 5 miles up Canyon creek, from its confluence with Pitt river at a point 9 miles up the valley at the head of Pitt lake. There is a good wagon-road for 4½ miles up the valley to within half a mile of the Dominion Government hatchery; this half-mile was washed out some years ago and never rebuilt. The main trail extends on up the Pitt valley, on the east side of the river, for 20 miles beyond the hatchery. Assistance was procured from the Department of Mines toward improving the 5 miles of trail up Canyon creek to the cabin on the claims.

The mineral-bearing formation is a wide belt, 4,000 feet or more, of light-coloured, pyritized feldspathic rock, schistose in places, enclosed in the Coast Range granodiorite. The minerals are pyrite and molybdenum, occurring both separately and in combination in small quartz veins, which strike in all directions, and also in small veinlets of pure sulphides. Chalcopyrite is conspicuous by its absence. So far as exposed, there is not enough molybdenum to indicate the probability of commercial quantities. A sample taken of mineralized quartz exposed on the bank of Canyon creek by a short tunnel and some open-cutting gave: Gold, a trace; silver, a trace; molybdenum, 0.35 per cent. On a small tributary creek about a quarter of a mile from the main creek a sample was taken from a number of small pyritized quartz-seams, giving: Gold, $4 to the ton; silver, 0.4 oz. to the ton; molybdenum, 0.16 per cent. A sample of solid pyrite assayed only a trace in gold and silver.

Further prospecting on this belt might discover more encouraging showings than so far exposed. I am informed that an English company using molybdenum is willing to explore the property.

INSPECTION OF MINES.

REPORT BY JAMES DICKSON, CHIEF INSPECTOR OF MINES.

I have the honour to submit my annual report as Chief Inspector of Coal and Metalliferous Mines for the year ended December 31st, 1928. Appended thereto are the reports of the District Inspectors relative to the production of coal and number of persons employed; reports of the District Inspectors on metalliferous mines; reports of Instructors at Mine-rescue Stations; report of the Secretary to the Board of Examiners for coal-mine officials; and a list of the accidents reported under the provisions of section 71, subsection (1), "Coal-mines Regulation Act," and section 19, subsection (1), "Metalliferous Mines Regulation Act." A list of prosecutions carried out under the "Coal-mines Regulation Act" is also appended.

PERSONNEL OF STAFF OF INSPECTORS, INSTRUCTORS, AND BOARD OF EXAMINERS, AND THEIR ADDRESSES AT HEADQUARTERS.

Inspectors.

James Dickson	Chief Inspector, Victoria.
James Strang	Inspector, Victoria.
Robert Strachan	Senior Inspector, Fernie.
Henry E. Miard	Inspector, Fernie.
John MacDonald	Inspector, Fernie.
H. H. Johnstone	Inspector, Rossland.
James W. Jemson	Inspector, Nanaimo.
Thomas R. Jackson	Inspector, Nanaimo.
John G. Biggs	Inspector, Merritt.
Thomas J. Shenton	Inspector, Prince Rupert.

Instructors, Mine-rescue Stations.

John D. Stewart	Nanaimo Station.
John Thomson	Cumberland Station.
John T. Puckey	Fernie Station.
Wm. C. Stone	Middlesboro Station.

Board of Examiners for Coal-mine Officials.

James Dickson	Chairman, Victoria.
James Strang	Secretary, Victoria.
Henry E. Miard	Member, Fernie.

Messrs. Strang and Miard and the Inspector of Mines of the district in which an examination is being held form the Board for granting certificates of competency to coal-miners.

An Inspector of Mines is empowered to grant provisional certificates to miners for a period not exceeding sixty days between regular examinations.

INSPECTION DISTRICTS.

The Province is divided into six Inspection Districts, as follows:—

Inspection District.	Mining Divisions covered by Inspection District.
Vancouver Island	Victoria, Alberni, Clayoquot, Quatsino, and that portion of the Nanaimo Division situated on Vancouver Island.
Southern Coast	Vancouver, New Westminster, and that portion of Nanaimo Division situated on the Mainland.
Northern	Atlin, Liard, Stikine, Portland Canal, Nass River, Omineca, Peace River, Skeena, Bella Coola, and Queen Charlotte Islands.
Nicola-Princeton	Cariboo, Quesnel, Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, Similkameen, and Osoyoos.

Inspection District.	Mining Divisions covered by Inspection District.
West Kootenay and Boundary	Revelstoke, Lardeau, Trout Lake, Ainsworth, Slocan, Arrow Lake, Slocan City, Nelson, Trail Creek, Greenwood, and Grand Forks.
East Kootenay	Fort Steele, Windermere, and Golden.

The Inspectors inspect both the coal and metalliferous mines in their respective districts.

PRODUCTION.

The total tonnage produced by the coal-mines of the Province for the year ended December 31st, 1928, was 2,526,702 tons, being an increase of 72,875 tons or 2.97 per cent. above production of 1927.

The Coast District, which includes Vancouver Island, Nicola-Princeton, and Northern District, produced 1,525,179 tons, a decrease of 21,129 tons or 1.36 per cent. from 1927.

Vancouver Island collieries produced during 1928 1,277,533 tons, a decrease of 53,792 tons or 4.04 per cent. from 1927.

The Northern District produced 1,668 tons, a decrease of 23 tons compared with 1927.

Nicola-Princeton District produced 245,978 tons, an increase of 32,686 tons or 15.32 per cent. over 1927.

East Kootenay District produced 1,001,523 tons, an increase of 94,004 tons or 10.35 per cent. over 1927.

The coal companies producing during the year were: The Crow's Nest Pass Coal Company, Limited, and Corbin Coals, Limited, in East Kootenay District; the Coalmont Collieries, Limited, Middlesboro Collieries, Limited, Tulameen Valley Coal Company, Lynden Coal Company, Limited, Normandale Collieries, Limited, and Pleasant Valley coal-mine in the Nicola-Princeon District; Telkwa Collieries Company, Limited, in the Northern District; and on Vancouver Island the Western Fuel Corporation of Canada, Limited, Canadian Collieries (Dunsmuir), Limited, Granby Consolidated Mining, Smelting, and Power Company, Limited, at Cassidy, East Wellington Coal Company, Diamond Jubilee mine, Fiddick mine, Consumers' Coal Company, Limited, Little Ash mine, and Richardson mine.

The following table shows the output and *per capita* production daily and for the year of the various mines:—

Colliery and Mine.	Gross Tons of Coal mined during Year.	Days worked.	Total No. of Employees.	Tons of Coal mined per Employee daily.	Tons of Coal mined per Employee for Year.	No. of Employees Underground.	Tons of Coal mined per Underground Employee daily.	Tons of Coal mined per Underground Employee for Year.
Nanaimo—								
No. 1 mine	316,449	259	722	1.68	438	519	2.35	609
Reserve mine	149,340	259	301	1.91	496	194	2.70	700
Wakesiah mine	75,981	259	151	1.94	503	103	2.80	737
South Wellington, No. 5 mine	63,277	269	112	2.10	565	83	2.83	762
Extension Colliery	162,157	249	443	1.47	366	310	2.10	523
Wellington, No. 8 mine	34,652	130	136	1.95	254	104	2.56	333
Wellington, No. 9 mine	12,841	65	139	1.41	92	103	1.90	124
Comox Colliery	266,383	300	734	1.20	362	575	1.54	463
Granby Consolidated M.S. & P. Co.	186,709	289	226	2.86	826	161	4.01	1,160
Diamond Jubilee mine	750	142	4	1.31	187	3	1.76	250
East Wellington Coal Co.	5,357	33	88	1.85	61	76	2.12	70
Fiddick mine	1,805	271	12	0.54	150	8	0.83	225
Little Ash mine	1,532	162	12	0.78	127	7	1.35	219
Richardson mine	72	48	6	0.25	12	4	0.37	18
Coalmont Collieries, Ltd.	164,816	279	334	1.77	493	207	2.85	796
Middlesboro Collieries, Ltd.	44,646	247	120	1.50	372	87	2.07	513
Tulameen Valley Coal Co.	17,886	265	50	1.35	358	30	2.25	596
Lynden Coal Mine, Ltd.	18,398	251	59	1.23	311	47	1.56	391
Telkwa Collieries, Ltd.	1,668	194	8	1.07	208	6	1.43	278
Coal Creek Colliery	462,733	282	763	2.14	606	564	2.90	820
Michel Colliery	359,547	247	665	2.18	540	475	3.06	757
Corbin Coals, Ltd.	179,243	278½	193	3.33	928	114	5.64	1,572

Collieries of Vancouver Island Inspection District.

The output of the Vancouver Island collieries was 1,277,533 tons and 28,167 tons was taken from stock. Of this amount, 139,106 tons or 10.6 per cent. was lost in preparation for the market; 111,330 tons or 8.5 per cent. was consumed by producing companies as fuel; and 1,055,264 tons or 80.9 per cent. was sold in the competitive markets.

Of the amount sold in the competitive markets, 965,748 tons or 91.5 per cent. of the amount sold and over 70 per cent. of the total output mined was sold in Canada, and 89,516 tons or 8.5 per cent. of the amount sold and 6.8 per cent. of the total amount mined was sold in the United States.

Collieries of the Nicola-Princeton Inspection District.

Of the gross output of 245,978 tons produced by collieries of the Nicola-Princeton District, 16,331 tons or 6.6 per cent. was consumed by producing companies as fuel, and 228,179 tons or 92.7 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 225,273 tons or 98.7 per cent. of the amount sold and 91.6 per cent. of the total amount mined was sold in Canada, and 2,906 tons or 1.3 per cent. of the amount sold and 1.2 per cent. of the total amount mined was sold in the United States.

Collieries of the East Kootenay Inspection District.

Of the gross output of 1,001,523 tons produced by the collieries of the East Kootenay District, 60,450 tons or 6.03 per cent. was consumed as fuel, 92,607 tons or 9.24 per cent. was made into coke, and 827,571 tons or 82.66 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 587,548 tons or 70.9 per cent. of the amount sold and 58.6 per cent. of the total output was sold in Canada, and 240,023 tons or 29.1 per cent. of the amount sold and 23.9 per cent. of the total output was sold in the United States.

The following table shows the output and the *per capita* production of the various districts for the past twelve years:—

OUTPUT AND PER CAPITA PRODUCTION OF VARIOUS DISTRICTS.

Year.	District.	Gross Tons of Coal mined during Year.	Total No. of Employees at Producing Collieries.	Tons of Coal mined per Employee for Year.	No. of Men employed Underground in Producing Collieries.	Tons of Coal mined per Underground Employee for Year.
1917	East Kootenay District	551,751	1,481	372	944	584
	Coast District	1,846,964	3,689	501	2,816	656
	Whole Province	2,398,715	5,170	463	3,760	638
1918	East Kootenay District	732,864	1,327	552	814	900
	Coast District	1,845,860	4,100	450	2,844	645
	Whole Province	2,578,724	5,427	475	3,658	705
1919	East Kootenay District	558,806	1,369	409	1,000	559
	Coast District	1,850,142	4,597	402	3,145	588
	Whole Province	2,408,948	5,966	404	4,145	581
1920	East Kootenay District	847,389	1,582	536	1,062	798
	Coast District	1,849,385	4,767	388	3,129	591
	Whole Province	2,696,774	6,349	425	4,191	643
1921	East Kootenay District	759,755	1,774	428	1,207	629
	Coast District	1,809,884	5,111	354	3,515	515
	Whole Province	2,569,639	6,885	373	4,722	544
1922	East Kootenay District	554,361	1,538	360	1,063	521
	Coast District	2,026,554	5,106	396	3,649	551
	Whole Province	2,580,915	6,644	388	4,712	547
1923	East Kootenay District	740,531	1,434	516	965	767
	Coast District	1,802,456	4,715	395	3,377	546
	Whole Province	2,542,987	6,149	413	4,342	585
1924	East Kootenay District	273,518	1,147	238	797	343
	Coast District	1,714,015	4,271	401	3,097	553
	Whole Province	1,987,533	5,418	366	3,894	510
1925	East Kootenay District	854,480	1,466	582	989	864
	Coast District	1,589,812	3,977	399	2,839	559
	Whole Province	2,444,292	5,443	449	3,828	639
1926	East Kootenay District	848,448	1,431	592	962	881
	Coast District	1,481,588	3,891	380	2,795	530
	Whole Province	2,330,036	5,322	437	3,757	620
1927	East Kootenay District	907,519	1,494	607	1,033	876
	Coast District	1,546,308	3,731	414	2,613	592
	Whole Province	2,453,827	5,225	469	3,646	673
1928	East Kootenay District	1,001,523	1,621	617	1,153	886
	Coast District	1,525,179	3,713	411	2,661	573
	Whole Province	2,526,702	5,334	473	3,814	662

The following table shows the production and distribution of coal and coke by the various collieries and districts, compiled from returns furnished by the owners:—

Collieries of British Columbia—Production, 1928.

Mine.	Sold.			Total Sales.	Lost in Washing.	Used in making Coke.	Used under Co.'s Boilers, etc.	Total for Colliery Use.	Stocks.		Difference.		Output for Year 1928.
	In Canada.	In U.S.A.	Elsewhere.						First of Year.	Last of Year.	Added to.	Taken from.	
Vancouver Island.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons (2,240 lb.).
Canadian Collieries (D.), Ltd.—													
South Wellington No. 5 mine	45,635	.....	.....	45,635	12,840	.....	4,802	17,642	.....	.....	.....	.....	63,277
Extension Nos. 1, 2, and 3 mines	95,593	36,366	.....	131,959	24,861	.....	14,888	39,749	11,492	1,941	.....	9,551	162,157
Wellington Extension No. 8 mine	28,366	.....	.....	28,366	3,755	.....	2,531	6,286	.....	.....	.....	.....	34,652
Wellington Extension No. 9 mine	*11,994*	.....	.....	*11,994*	*480*	.....	*367*	*847*	.....	.....	.....	.....	*12,841*
Comox	235,880	901	.....	236,781	24,611	.....	4,049	28,660	8,959	9,901	942	.....	266,383
Western Fuel Corporation of Canada, Ltd.—													
No. 1 mine	212,078	49,304	.....	261,382	11,724	.....	45,604	57,328	18,334	16,073	.....	2,261	316,449
Reserve mine	128,250	.....	.....	128,250	9,827	.....	19,678	29,505	8,415	.....	.....	8,415	149,340
Wakesiah mine	60,516	.....	.....	60,516	9,548	.....	8,904	18,452	2,987	.....	.....	2,987	75,981
Granby Cons. M. S. & P. Co., Ltd.	139,144	2,945	.....	142,089	41,007	.....	9,598	50,605	6,492	597	....	5,895	186,799
Diamond Jubilee mine	750	.....	.....	750	.....	.....	.....	.....	.....	.....	.....	.. ...	750
East Wellington Coal Co., Ltd.	*3,995*	.....	.....	*3,995*	*453*	.....	*909*	*1,362*	.....	.....	.....	.....	*5,357*
Fiddick mine	1,805	.....	.....	1,805	.....	.....	.....	.....	.....	.....	.....	....	1,805
Consumers Coal Co., Ltd.	138	....	.....	128	.....	.....	.....	.....	.....	.....	.....	.. ...	138
Little Ash mine	1,532	.....	.....	1,532	.....	.....	.....	.....	.....	.....	.....	.....	1,532
Richardson mine	72	.....	.....	72	....	.....	.....	.....	.....	.....	.....	.. ...	72
Totals, Vancouver Island	965,748	89,516	.....	1,055,264	139,106	.....	111,330	250,436	56,679	28,512	942	29,109	1,277,533
Nicola-Princeton District.													
Coalmont Collieries, Ltd.	152,385	....	.....	152,385	.....	.....	12,431	12,431	.....	.....	....	.....	164,816
Middlesboro Collieries, Ltd.	42,920	.....	.....	42,920	.....	.....	1,369	1,369	179	536	357	.....	44,646
Tulameen Valley Coal Co., Ltd	15,694	340	.....	16,034	567	.....	1,287	1,854	16	14	.....	2	17,886
Lynden Coal Mines, Ltd.	14,119	2,566	.....	16,685	469	.....	1,244	1,713	.....	.....	.....	.....	18,398
Normandale Colliery	135	.....	.....	135	... ..	.....	.....	.....	.....	27	27	.....	162
Pleasant Valley Coal Co.	20	....	.....	20	.....	.....	.....	.....	.....	50	50	.....	70
Totals, Nicola-Princeton District	225,273	2,906	.....	228,179	1,036	.....	16,331	17,367	195	627	434	2	245,978
Northern District.													
Telkwa Collieries, Ltd.	1,668	.....	.....	1,668	.....	.....	.....	.....	.....	.....	.....	.....	1,668
Totals, Northern District	1,668	.....	.....	1,668	.....	.....	.....	.....	.....	.....	.....	.....	1,668
Grand totals, Coast District	1,192,689	92,422	.....	1,285,111	140,142	.....	127,661	267,803	56,874	29,139	1,376	29,111	1,525,179
East Kootenay District.													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek Colliery	176,275	220,075	.....	396,350	.....	32,982	31,994	64,976	202	1,609	1,407	.....	462,733
Michel Colliery	283,582	.....	.....	283,582	.....	59,625	16,340	75,965	.....	.... .	.....	.....	359,547
Corbin Coals, Ltd.	127,691	19,948	.....	147,639	22,783	.....	12,116	34,899	32,959	29,664	.....	3,295	179,243
Totals, East Kootenay District	587,548	240,023	.....	827,571	22,783	92,607	60,450	175,840	33,161	31,273	1,407	3,295	1,001,523
Coal.													
Grand totals for Province	1,780,237	332,445	.....	2,112,682	162,925	92,607	188,111	443,643	90,035	60,412	2,783	32,406	2,526,702

Collieries of British Columbia—Men employed, 1928.

Mine.	White Men.																		Indians.			Japanese and Chinese.									Total Men employed.		
	Supervision and Clerical.			Miners.			Helpers.			Labourers.			Mechanics and Skilled Labour.			Boys.			Labourers.			Miners.			Helpers.			Labourers.					
	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.
Vancouver Island.																																	
Canadian Collieries (D.), Ltd.—																																	
South Wellington No. 5 mine	6	5	11	52	..	52	..	..	..	19	12	31	6	7	13	..	5	5	..	..	..	..	..	..	..	..	..	..	..	..	83	29	112
Extension Nos. 1, 2, and 3 mines	20	10	30	194	..	194	5	..	5	70	24	94	15	41	56	..	15	15	..	..	..	..	..	..	..	..	..	6	43	49	310	133	443
Wellington Extension No. 8 mine	5	2	7	17	..	17	29	..	29	37	..	37	16	10	26	..	..	..	..	..	..	..	..	..	..	..	..	..	20	20	104	32	136
Wellington Extension No. 9 mine	7	2	9	62	..	62	3	..	3	25	19	44	6	11	17	..	2	2	..	..	..	..	..	..	..	..	..	..	2	2	103	36	139
Comox	28	14	42	122	..	122	..	..	..	80	47	127	96	59	155	13	9	22	..	..	..	96	..	96	83	..	83	57	30	87	575	159	734
Western Fuel Corp. of Canada, Ltd.—																																	
No. 1 mine, Nanaimo	30	21	51	188	..	188	..	..	..	210	68	278	63	47	110	27	14	41	1	..	1	..	..	..	..	..	..	..	53	53	519	203	722
Reserve mine	8	10	18	98	..	98	3	..	3	51	25	76	19	28	47	14	6	20	1	..	1	..	..	..	..	..	..	..	38	38	194	107	301
Wakesiah	6	5	11	60	..	60	..	..	..	24	15	39	6	12	18	7	5	12	..	..	..	..	..	..	..	..	..	..	11	11	103	48	151
Granby Cons. M. S. & P. Co., Ltd	7	4	11	113	..	113	..	..	..	41	28	69	..	28	28	..	5	5	..	..	..	..	..	..	..	..	..	..	..	..	161	65	226
Diamond Jubilee mine	1	1	2	2	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	1	4
East Wellington Coal Co., Ltd	2	3	5	32	..	32	..	..	..	29	..	29	11	..	11	2	..	2	..	..	..	..	..	..	..	..	..	..	9	9	76	12	88
Fiddick mine	..	..	..	6	..	6	2	..	2	..	4	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	4	12
Consumers Coal Co., Ltd	1	2	3	4	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	2	7
Little Ash mine	1	..	1	6	..	6	..	..	..	..	4	4	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	5	12
Richardson mine	..	..	..	3	..	3	..	..	..	1	2	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	2	6
Totals, Vancouver Island	122	79	201	959	..	959	42	..	42	587	248	835	238	244	482	63	61	124	2	..	2	96	..	96	83	..	83	63	206	269	2255	838	3,093
Nicola-Princeton District.																																	
Coalmont Collieries, Ltd	12	14	26	123	.	123	..	..	..	65	70	135	1	39	40	6	3	9	..	..	..	..	..	..	..	..	..	..	..	..	207	126	333
Middlesboro Collieries, Ltd	7	3	10	42	..	42	20	..	20	18	12	30	..	12	12	.	6	6	..	..	..	..	..	..	..	..	..	..	..	..	87	33	120
Tulameen Valley Coal Co., Ltd	4	4	8	11	..	11	13	..	13	..	8	8	2	8	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30	20	50
Lynden Coal Mines, Ltd	4	2	6	30	..	30	..	..	..	13	8	21	..	2	2	..	.	..	..	..	..	..	..	..	..	..	..	..	..	..	47	12	59
Normandale Colliery, Ltd	1	..	1	1	..	1	2	..	2	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	..	5
Pleasant Valley Coal Co	1	1	2	12	..	12	9	..	9	..	10	10	2	10	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24	21	45
Totals, Nicola-Princeton District	29	24	53	219	..	219	44	..	44	97	108	205	5	71	76	6	9	15	..	..	..	..	..	..	..	..	..	..	..	..	400	212	612
Northern District.																																	
Telkwa Collieries, Ltd	1	..	1	3	..	3	2	..	2	..	..	..	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	2	8
Totals, Northern District	1	..	1	3	..	3	2	..	2	..	..	..	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	2	8
Grand totals, Coast District	152	103	255	1181	..	1181	88	..	88	684	356	1040	243	317	560	69	70	139	2	..	2	96	..	96	83	..	83	63	206	269	2661	1052	3,713
East Kootenay District.																																	
Crow's Nest Pass Coal Co., Ltd.—																																	
Coal Creek Colliery	23	14	37	291	..	291	.	..	..	27	72	99	204	102	306	19	11	30	..	..	..	..	..	..	..	..	..	..	..	..	564	199	763
Michel Colliery	16	16	32	240	..	240	..	..	..	15	78	93	178	83	261	26	13	39	..	..	..	..	..	..	..	..	..	..	..	..	475	190	665
Corbin Coals, Ltd	9	12	21	67	..	67	2	..	2	33	43	76	3	23	26	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	114	79	193
Totals, East Kootenay District	48	42	90	598	..	598	2	..	2	75	193	268	385	208	593	45	25	70	..	..	..	..	..	..	..	..	..	..	..	..	1153	468	1,621
Grand totals for Province	200	145	345	1779	..	1779	90	..	90	759	549	1308	628	525	1153	114	95	209	2	..	2	96	..	96	83	..	83	63	206	269	3814	1520	5,334

NOTE.—U = underground; A = above ground; T = total.

LABOUR AND EMPLOYMENT.

During the year 1928 there were 5,334 persons employed in and about the coal-mines of the Province, an increase of about 2.1 per cent. as compared with 1927.

The collieries were practically free from labour disputes during the year, the only time lost being through lack of trade.

Apart from the regular holidays, the mines in Vancouver Island District lost about 14 per cent. of the working-days through lack of trade.

In the Nicola-Princeton District the different collieries worked from 82 to 93 per cent. of the working-days, averaging for the district about 87 per cent. of the working-days.

The mines in the East Kootenay District worked from 82 per cent. at the lowest to 94 per cent. at the highest of the working-days during the year and worked for an average for the whole district about 90 per cent. of the time.

The table on page 396 shows the number of persons ordinarily employed in and about the mines, distinguishing the persons and different classes employed underground and above ground, compiled from returns furnished by the owners as required by section 66 of the "Coal-mines Regulation Act."

FUEL-OIL AND IMPORTED COAL COMPETITION.

The importation of fuel-oil for use in British Columbia amounted to 38,125,000 gallons in 1928, as compared with 42,954,000 gallons in 1927 and 62,214,000 gallons in 1926.

The importation of foreign coals has also decreased, as shown by the following figures, namely: 49,150 tons in 1926, 37,281 tons in 1927, and 31,637 in 1928 (importation in short tons).

HYDRO-ELECTRIC DEVELOPMENT.

There is at present in British Columbia about 500,000 horse-power developed by water-power, most of which has been installed since 1910.

In the years 1910 and 1912 the gross output of the coal-mines in the Province reached 3,000,000 tons and at that time the developed water-power was 64,000 horse-power.

From that date the increase of developed water-power in the Province is very marked, as shown by the following table:—

Year.	Water-power developed. Horse-power.
1900	9,366
1905	29,334
1910	64,474
1915	254,065
1920	309,184
1921	309,762
1922	329,057
1923	355,718
1924	355,718
1925	414,702
1926	460,562
1927	473,142
1928	523,902

When it is realized that one developed horse-power per year is equivalent to the power value of 6 tons of coal it will be seen that water-power really displaces more coal than does fuel-oil.

ACCIDENTS IN AND AROUND COAL-MINES.

During 1928 there were 5,334 persons employed in and around the coal-mines. Fourteen fatal accidents occurred during the year, as compared with eleven for 1927.

The ratio of fatal accidents per 1,000 persons employed was 2.64, as compared with 2.10 in 1927; in 1926 the ratio was 1.88; in 1925, 1.10; in 1924, 1.66; in 1923, 7.32; in 1922, 4.66; in 1921, 1.45; in 1920, 2.67; in 1919, 2.10; the average for the ten-year period being 2.81.

The number of fatal accidents per 1,000,000 tons produced during 1928 was 5.54. During 1927 the fatalities per 1,000,000 tons of coal mined was 4.48; in 1926, 4.3; in 1925, 2.45; in 1924, 4.52; in 1923, 1.76; in 1922, 12.01; in 1921, 3.98; in 1920, 6.30; in 1919, 4.98; the average for the ten-year period being 6.72 per 1,000,000 tons of coal mined.

The following table shows the collieries at which the fatal accidents occurred during 1928 and comparative figures for 1927:—

Name of Company.	Name of Colliery.	1928.	1927.
Western Fuel Corporation of Canada, Ltd.	Wakesiah mine	....	1
Western Fuel Corporation of Canada, Ltd.	No. 1 mine	....	2
Western Fuel Corporation of Canada, Ltd.	Reserve mine	4	....
Canadian Collieries (D.), Ltd.	Extension	1	....
Canadian Collieries (D.), Ltd.	Comox	....	1
Granby Consolidated M.S. & P. Co., Ltd.	Cassidy, No. 1	1	3
Coalmont Collieries, Ltd.	No. 4 mine	....	1
Crow's Nest Pass Coal Co., Ltd.	Coal Creek	7	1
Corbin Coals, Ltd.	No. 4 mine	1	....
Corbin Coals, Ltd.	No. 6 mine	....	2
Totals		14	11

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for 1927:—

Cause.	1928.		1927.	
	No.	Per Cent.	No.	Per Cent.
By blowout of coal and gas	8	57.15	....	.....
By falls of roof and rock	2	14.28	3	27.27
By falls of coal	....	.....	4	36.37
By mine-cars and haulage	2	14.28	2	18.18
Miscellaneous	2	14.28	....	.....
Explosions of fire-damp	....	.....	2	18.18
Totals	14	100.00	11	100.00

The following table shows the number of tons of coal mined for each fatal accident in the respective classes in the years 1928 and 1927:—

Cause.	1928.		1927.	
	No. of Fatal Accidents.	No. of Tons of Coal mined per Fatal Accident.	No. of Fatal Accidents.	No. of Tons of Coal mined per Fatal Accident.
By blowout of coal and gas	8	315,837	....	.....
By falls of roof and rock	2	1,263,351	3	817,942
By falls of coal	....	.....	4	613,456
By mine-cars and haulage	2	1,263,351	2	1,226,913
Miscellaneous	2	1,263,351	....	.....
Explosions of fire-damp	....	.....	2	1,226,913
Totals	14	180,479	11	223,075

The number of tons mined per fatal accident during 1928 was 180,479 tons, compared with 223,075 tons for 1927. The average for the last ten years was 148,733 tons.

The following table shows the fatalities from various causes in coal-mines during the year 1928, compared with 1927, according to Inspection Districts:—

District.	Number of Deaths from Accidents.						Total.		Accident Death-rate.			
	Explosions of Fire-damp.	Falls of Ground.	Blowouts of Coal and Gas.	Haulage and Mine-cars.	Miscellaneous (Underground).	On Surface.	1928.	1927.	Per 1,000 Persons employed.		Per 1,000,000 Tons of Coal mined.	
									1928.	1927.	1928.	1927.
Vancouver Island	....	2	2	2	....	....	6	7	1.94	2.21	4.69	5.25
Nicola-Princeton	....	....	....	....	....	....	....	1	.....	1.80	.....	4.68
East Kootenay	....	....	6	1	1	....	8	3	4.93	2.67	7.98	3.30
Northern	....	....	....	....	....	....	....	....	.....	.....	.....	.....
Province (1928)	....	2	8	3	1	....	14	....	2.64	.....	5.54	.....
Province (1927)	....	....	....	....	....	....	....	11	.....	2.10	.....	4.48

The following table shows the ratio of accidents per 1,000 employees and per 1,000,000 tons of coal mined in the Coast and East Kootenay Inspection Districts for the ten-year period ended December 31st, 1928:—

District.	No. of Fatalities.	Accident Death-rate.	
		Per 1,000 Employees.	Per 1,000,000 Tons of Coal mined.
Coast	143	3.32	8.4
East Kootenay	22	1.48	2.9
For Province	165	2.81	6.72

The details regarding the occurrences of the fatal accidents in coal-mines during 1928 are as follows:—

The fatal accident which occurred to Frank Bruno, tracklayer, No. 3 mine, Coal Creek Colliery, was supposed to be due to his stumbling over a tie on April 18th. After two operations he died on May 15th. Bruno had been under medical treatment for internal trouble for some months prior to April 18th.

The fatal accident which occurred to Andrew Slater, miner, Reserve mine, on May 23rd was due to a fall of rock.

The fatal accident which occurred to William Cooper and Eli Ruski, miners, Reserve mine, on July 20th was due to a blowout of coal and gas in their working-place. This is dealt with in another part of this report.

The fatal accident which occurred to Martin Schremick, labourer, No. 4 mine, Corbin Colliery, on August 27th was something of a mystery. Schremick was found lying on the side of the road where he had taken a car of coal to dump. The road was almost level and had ample room, but it is supposed that he had in some way been squeezed by the car. He died from shock.

The accident which was fatal to the following six miners: Peter Dowey, George Perkins, Guiseppe di Georgio, Joseph Sprlak, Tony Cassola, and Joseph Sedrovich, in No. 1 East mine, Coal Creek Colliery, on August 30th was due to a blowout of coal and gas. The men had got some distance away from their working-places but were overtaken by the gas and dust. This occurrence is dealt with in another part of this report.

The fatal accident which occurred to Thomas Smith, miner, Reserve mine, on September 25th was caused by a fall of rock in his working-place; this place was found to be defectively timbered. This is dealt with in another part of this report.

The fatal accident which occurred to Richard Morgan, tracklayer, No. 2 mine, Wellington Extension Colliery, on October 25th was due to his being squeezed or knocked down by a horse and an empty car. He was discovered lying unconscious on the roadway and died some days later.

The fatal accident which occurred to Thomas Radford, winch-driver, No. 1 mine, Granby Consolidated Mining, Smelting, and Power Company, Cassidy, on December 20th was due to his being caught in the gears of his hoist.

EXPLOSIVES.

The following table shows the quantity of explosives used in coal-mines during 1928, together with number of shots fired, how shots were fired, tons of coal produced per pound explosive used, and the average pounds of explosive per shot fired (these quantities include all explosives used for breaking coal and for rock-work in coal-mines) :—

Vancouver Island District.

Colliery.	Quantity of Explosive used in Pounds.	Tonnage for Mine.	Total No. of Shots fired.	Tons of Coal per Pound of Explosive used.	Average Pounds of Explosive per Shot fired.
No. 1 mine, Nanaimo	73,395	316,449	105,956	4.31	0.69
Reserve mine, Nanaimo	49,897	149,340	67,585	2.99	0.73
Wakesiah mine, Nanaimo	27,292	75,981	40,279	2.78	0.67
South Wellington, No. 5 mine	31,720	63,277	48,300	1.99	0.65
Wellington Extension Colliery	63,717	162,157	70,088	2.54	0.89
No. 8 mine, Wellington	20,868	34,652	24,575	1.66	0.85
No. 9 mine, Wellington	16,618	12,841	14,176	0.76	1.17
Comox Colliery	46,724	266,383	63,335	5.70	0.73
Granby Consolidated M.S. & P. Co.	12,851	186,799	11,052	14.53	1.16
Diamond Jubilee mine	300	750	200	2.50	1.50
East Wellington Coal Co.	1,879	5,357	3,098	2.85	0.60
Fiddick mine	500	1,805	400	0.80	1.25
Round Island mine	.....	138	.....	.....	.....
Little Ash mine	250	1,532	550	6.12	0.45
Richardson mine	200	72	150	0.36	1.33
Totals for district	345,411	1,277,533	450,644	3.64	0.76

Nicola-Princeton District.

Coalmont Collieries	33,408	164,816	55,000	4.93	0.62
Middlesboro Collieries	10,050	44,646	17,650	4.44	0.52
Tulameen Valley Coal Co.	2,772	17,886	5,600	6.45	0.49
Lynden Coal Mines, Ltd.	3,000	18,398	6,133	6.06	0.48
Normandale Colliery	80	162	190	2.02	0.42
Pleasant Valley Coal Co.	8,000	70	7,500	.....	.....
Totals for district	57,310	245,987	92,073	4.25	0.62

Northern District.

Telkwa Collieries, Ltd.	1,225	1,668	1,125	1.36	1.08

EAST KOOTENAY DISTRICT.

Colliery.	Quantity of Explosive used in Pounds.	Tonnage for Mine.	Total No. of Shots fired.	Tons of Coal per Pound of Explosive used.	Average Pounds of Explosive per Shot fired.
Coal Creek Colliery	2,955	462,733	2,500	156.59	1.18
Michel Colliery	23,499	359,547	24,195	15.30	0.97
Corbin Colliery	15,085	179,243	12,490	11.22	1.20
Totals for district	41,539	1,001,523	39,185	24.11	1.06
Totals for Province	445,485	2,526,702	583,027	5.67	0.76

QUANTITIES OF DIFFERENT EXPLOSIVES USED.

	Lb.
Monobels of different grades	386,635
Miner's Friend	14,517
Dynamite	8,000
Permissible rock-powder	36,333
Total	445,485

The following is a list of explosives permitted for use in coal-mines by the Honourable the Minister of Mines under the provisions of section 101, General Rule 11, clause (2), "Coal-mines Regulation Act":—

Nobel Monobel.
Polar Monobel No. 3.
Polar Monobel No. 4.
Polar Monobel No. 6.
Coalite "C" L.F.
Miner's Friend No. 6.
Miner's Friend No. 9.
Polar CXLite.
Gelpermite No. 1.
CXLite No. 2.

MACHINE-MINED COAL.

During the year 1928 mining-machines produced approximately 180,000 tons of coal or 7.1 per cent. of the total.

The following table gives the district, number of machines, how driven, and type of machine used:—

District.	Number driven by		Type of Machine used.			
	Electricity.	Compressed Air.	M.C. Pick-quick.	Siskol.	Sullivan.	Rand.
Vancouver Island	5	18	7	10	6	....
Nicola-Princeton	....	4	....	2	....	2
East Kootenay	....	....	....	....	....	....
Northern	....	....	....	....	....	....
Totals	5	22	7	12	6	2

SAFETY-LAMPS.

There were 4,626 safety-lamps in use in the coal-mines of the Province. Of this number, 308 were flame safety-lamps of the Wolf type and 4,318 were electric lamps of various makes, as follows: Edison, 3,939; Wheat, 379. No open lights are allowed in the coal-mines of British Columbia.

The following table shows the distribution of lamps by district, method of locking, and the illuminant used:—

VANCOUVER ISLAND DISTRICT.

Colliery and Mine.	Method of Locking Lamp.		Illuminant used.	
	Magnetic Lock.	Screw or Automatic Clip.	Naphtha Gasoline.	Electricity.
No. 1 mine, Nanaimo	22	543	22	543
Reserve mine, Nanaimo	9	197	9	197
Wakesiah mine, Nanaimo	8	110	8	110
No. 5 mine, South Wellington	9	223	9	223
Extension and No. 8 mine	22	604	22	604
No. 9 mine, Wellington	5	140	5	140
Comox Colliery	26	575	26	575
Granby Colliery	7	150	7	150
East Wellington Coal Co.	6	80	6	80
Diamond Jubilee mine	5	.....	5	.....
Fiddick mine	12	6	12	6
Round Island mine	6	.....	6	.....
Little Ash mine	2	8	2	8
Richardson mine	6	.....	6	.....
Totals for district	145	2,636	145	2,636

NICOLA-PRINCETON DISTRICT.

Coalmont Colliery	10	263	10	263
Middlesboro Colliery	7	90	7	90
Tulameen Valley Coal Co.	2	38	2	38
Lynden Coal Co.	3	30	3	30
Normandale Colliery	6	.....	6	.....
Pleasant Valley	6	20	6	20
Totals for district	34	441	34	441

NORTHERN DISTRICT.

Telkwa Collieries, Ltd.	8	.....	8	.....

EAST KOOTENAY DISTRICT.

Coal Creek Colliery	72	630	72	630
Michel Colliery	29	503	29	503
Corbin Colliery	19	109	20	108
Totals for district	120	1,242	121	1,241
Totals for Province	307	4,319	308	4,318

The following is a list of safety-lamps permitted for use in the coal-mines of British Columbia:—

APPROVED (ELECTRIC) SAFETY-LAMPS.

No. 1.—The electric lamp manufactured by the Edison Storage Battery Co., Orange, N.J., U.S.A., under approval No. 10 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD–17. The only bulbs approved for use with this lamp are the symbol BM–10 bulbs, manufactured by the National Lamp Works of the General Electric Co., Cleveland, Ohio; the symbol BM–10 bulbs, manufactured by the Edison Works of the General Electric Co., Harrison, N.J.; the symbol 26–V bulbs, manufactured by the Miniature Incandescent Lamp Corporation, 95 Eighth Avenue, Newark, N.J.; and the symbol BM–10 bulbs, manufactured by the Westinghouse Lamp Co., Bloomfield, N.J.

No. 2.—The Concordia approved portable electric (hand-lamp) mine-lamp, manufactured by the Concordia Electric Co., Pittsburgh, Pa., under approval No. 12 of the United States Bureau of Mines. The only bulbs approved for use with this lamp are the symbol Osram 08510 bulbs, sold by the Concordia Electric Company.

No. 3.—The Wico approved portable electric mine-lamp, manufactured by the Witherbee Igniter Co., Springfield, Mass., under approval No. 14 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD–43. The only bulbs approved for use with the lamp are the symbol BM–14 bulbs, manufactured by the Edison Lamp Works of the General Electric Co., Harrison, N.J.

No. 4.—The Concordia approved permissible portable electric mine-lamp, manufactured by the Concordia Electric Co., Pittsburgh, Pa., under approval No. 12 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD–17. The only bulbs approved for use with this lamp are the BM–15 bulbs, manufactured by the National Lamp Works of the General Electric Co., Cleveland, Ohio.

No. 5.—The Pioneer approved portable electric mine-lamp, manufactured by the Pioneer Electric Mine Lamp Co., Philadelphia, Pa., under approval No. 16 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification No. CD–31, and with battery-plates manufactured by the Electric Storage Battery Co., Philadelphia, Pa. The only bulbs approved for use with this lamp are the BM–16 bulbs, manufactured by the Edison Lamp Works of the General Electric Co., Harrison, N.J.

No. 6.—The Wheat approved portable electric mine-lamp, manufactured by the Koehler Manufacturing Co. (Inc.), Marlboro, Mass., under approval No. 17 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD–31, and with battery-plates manufactured by the General Lead Battery Co., Newark, N.J. The only bulbs approved for use with this lamp are the BM–17 bulbs, manufactured by the National Lamp Works of the General Electric Co., Cleveland Ohio.

(Unless otherwise specified, all lamps are cap-lamps.)

Approved (Flame) Safety-lamps.

No. 12.—The bonneted, double-gauze lamp, with magnetic lock, known as the Wolf lamp.

No. 13.—The flat-wick steel-frame lamp, as specified in approval No. 201 of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

No. 14.—The round-wick steel-frame lamp, as specified in approval No. 201–A of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

No. 15.—The flat-wick steel-frame lamp, as specified in approval No. 202 of the United States Bureau of Mines, manufactured by Ackroyd & Best, Ltd., Arrott Power Building, Pittsburgh, Pa., U.S.A.

No. 16.—The flat-wick aluminium-frame lamp, as specified in approval No. 203 of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

No. 17.—The round-wick aluminium-frame lamp, as specified in approval No. 203–A of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

Approvals Nos. 201, 201–A, 203, and 203–A apply to magnetic-lock lamps that are equipped with steel gauzes. The only glasses approved for use with these lamps are marked "Macbeth No. 2100 High Speed." The only igniter approved for use with these lamps is the Koehler pyro internal igniter, 1915 model, using a cerium-zinc-copper alloy for igniter-points.

Approval No. 202 applies to a magnetic-lock lamp. The only glasses approved for use with this lamp are marked as follows:—

ACKD
BEST
A–1

This lamp is relighted electrically. The only relighter approved for this lamp is the Ackroyd & Best underground relighter.

Note.—*While the use of flame safety-lamps is permitted, it is the policy of the Department of Mines to encourage the use of approved electric safety-lamps for all persons underground in the coal-mines, except such flame-lamps as may be required by the officials of the mines in the carrying-out of their duty.*

ELECTRICITY.

Electric power is used for various purposes on the surface at twelve mines and underground at six. The purpose for which it was used, together with the amount of horse-power in each instance, is shown in the following table:—

Above ground— Nature of its Use.	Aggregate H.P.
Winding or hoisting	1,130
Ventilation	2,505
Haulage	475
Coal-washing	1,613
Miscellaneous	3,931
Total horse-power	9,654
Underground—	
Haulage	1,802
Pumping	1,040
Coal-cutting	150
Miscellaneous	201
Total horse-power	3,193
Total horse-power above and under ground	12,847

Of the above amount, approximately 2,600 horse-power was operated as direct current and 10,247 as alternating current.

The electrical regulations passed in 1925 prohibits the use of electric locomotives by the open trolley-wire system after the 1st day of January, 1930; power being given to the Minister of Mines to grant exemption in special circumstances.

VENTILATION.

The District Inspectors' reports give details regarding the ventilation in the splits and main returns of the various mines. In one or two instances demands had to be made during the year for increases in the amount of air being circulated in a few of the splits in a few mines, but on the whole the provisions requiring adequate ventilation were generally well observed at the different mines.

USE OF THE BURRELL GAS INDICATOR.

The Burrell Gas Indicator is used in practically every ventilating-split at least once a month and continues to be the approved method of determining the CH_4 content in the mine atmosphere where the percentage is too small to be detected by means of the flame safety-lamp.

MINE-AIR SAMPLES.

Mine-air sampling was carried out as usual during the year and 165 samples were collected in the coal-mines of the Province; of this number, nineteen were spoiled in transit and accidents in the laboratory. While samples were taken in all the mines at intervals, this method is carried out most intensively in the mines of the Crowsnest Pass District, where the gas-outflow is much higher than in the other mining districts of the Province. In Vancouver island a large number of the samples were taken in old workings and near the seat of fires.

The following table shows the analyses of mine-air samples taken in the various splits and main returns of the coal-mines in the Province during 1928 (the detailed analyses of mine-air samples taken in other portions of the various mines are on file in the office of the Chief Inspector of Mines):—

Returns from Mine-air Samples taken in the Various Splits and Main Return Airways of the Coal-mines of the Province during the Year 1928.

Sample No.	Date.	Mine.	Ventilating District.	Working or Idle.	Tonnage per Day.	Tonnage of Split per Day.	Chemical Analyses.				Velocity of Air in Feet per Minute.	Quantity of Air in Cubic Feet per Minute.	Barometer.	Hygrometer.			Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Cubic Feet of Methane per Ton.	Tons Methane per Day.
							CO_2.	O.	CH_4.	N.				Wet Bulb.	Dry Bulb.	Humidity.				
			Vancouver Island.																	
29J	July 13	Wakesiah	Main return	Working	275	....	0.22	20.44	0.15	79.19	400	16,000	30.10	62.0	62.0	100.0	24	34,560	126	0.73
33J	Oct. 27	No. 1, Extension	"	"	220	....	0.23	20.49	0.04	79.24	....	20,000	29.90	53.0	55.0	88.0	8	11,520	52	0.24
36J	Nov. 14	No. 5, S. Wellington	"	"	300	....	0.05	20.75	0.40	78.80	...	15,000	29.50	55.0	58.0	94.0	60	86,400	288	1.85
42J	" 16	Wakesiah	"	"	260	...	0.17	20.52	0.12	79.19	400	16,000	30.40	58.0	59.0	94.0	19	27,300	105	0.68
			Coal Creek.																	
1581	Jan. 10	No. 3 mine	No. 1 split	"	400	100	0.17	20.41	1.56	77.86	310	12,400	....	59.0	60.0	93.0	193	277,920	2,779	5.14
1582	" 10	"	No. 2 split	"	400	300	0.27	20.26	1.39	78.08	460	32,000	.....	69.0	69.0	100.0	445	640,800	2,136	11.85
1583	" 10	"	Main return	"	400	....	0.27	20.22	1.48	78.03	1,150	69,000	.....	65.0	66.0	93.0	1,021	1,470,240	3,675	27.20
1584	" 12	No. 1 East mine	No. 1 split	"	885	450	0.15	20.29	1.93	77.63	250	25,000	25.70	56.0	57.0	93.0	483	695,520	1,545	12.86
1586	" 14	No. 2 mine	No. 2 split	"	350	175	0.45	20.02	1.01	78.52	440	28,600	25.70	70.0	70.0	100.0	289	416,160	2,378	7.70
1587	" 14	"	Main return	"	350	....	0.49	19.96	0.78	78.77	800	56,000	25.70	69.0	69.0	100.0	437	629,280	1,798	11.64
1589	" 24	No. 1 East mine	No. 3 split	"	805	160	0.16	20.39	1.62	77.83	400	32,000	25 98	48.0	52:0	74.0	518	745,920	4,662	13.80
1590	" 24	"	No. 4 split	"	805	140	0.14	20.54	1.24	78.08	200	17,600	25.98	50.0	54.0	74.0	218	313,920	2,242	5.80
1592	" 25	No. 2 mine	Diagonal district	"	350	175	0.25	20.42	1.08	78.25	200	15,000	26.10	59.0	63.0	82.0	162	233,280	1,333	4.31
1595	" 26	No. 1 East mine	East Side return	"	805	435	0.17	20.44	1.17	78.22	1,200	108,000	26.35	50.0	53.0	89.0	1,264	1,820,160	4,184	33.67
1596	March 5	"	No. 3 split	"	885	150	0.17	20.38	1.67	77.78	390	33,150	25.60	51.0	53.0	86.0	553	796,320	5,309	14.73
1597	" 6	"	No. 4 split	"	885	135	0.14	20.44	1.56	77.86	260	22,880	25.60	51.0	52.5	90.0	357	514,080	3,808	9.51
1598	" 12	No. 2 mine	No. 1 split	"	350	175	0.25	20.46	0.86	78.43	90	9,000	25.60	62.0	62.0	100.0	77	110,880	633	2.05
1599	" 13	No. 3 mine	"	"	400	100	0.23	20.40	1.54	77.83	460	18,400	25.70	59.0	59.5	98.0	283	407,520	4,075	7.54
1600	" 13	"	No. 2 split	"	400	300	0.26	20.14	2.22	77.38	500	35,000	25.70	68.0	69.0	93.0	777	1,118,880	3,729	20.70
1601	" 13	"	Main return	"	400	....	0.34	20.09	1.77	77.80	1,100	66,000	25.70	65.0	66.0	93.0	1,168	1,681,920	4,204	31.11
1602	" 27	No. 1 East mine	No. 1 split	"	885	450	0.14	20.37	1.69	77.80	350	28,000	25.60	56.0	56.5	97 0	473	681,120	1,513	12.60
1603	" 27	"	No. 2 split	"	885	100	0.24	20.19	1.91	77.66	400	28,000	25.60	55.0	56.0	93.0	535	770,400	7,704	14.25
1604	" 29	No. 2 mine	"	"	350	125	0.62	19.80	1.18	78.40	340	22,100	25.70	72.0	72.0	100.0	261	375,840	3,307	6.95
1605	" 29	"	Main return	"	350	....	0.49	20.11	0 60	78.80	650	45,500	25.70	71.0	71.0	100.0	273	393,120	1,123	7.27
1608	" 30	No. 1 South mine	"	"	280	....	0.31	20.22	0.40	79.07	650	39,000	25.90	61.0	61.0	100.0	156	224,640	802	4.15
1612	May 3	No. 1 East mine	No. 2 split	"	885	100	0.19	20.21	2.22	77.38	300	21,000	26.20	56.0	57.0	93.0	466	671,040	6,710	12.41
1613	" 10	No. 2 mine	No. 1 split	"	350	175	0.50	19.95	1.59	77.95	....	.....	26.00	63.0	63.0	100 0	....	.....	.....	.....
1614	" 15	No. 3 mine	"	"	400	100	0.26	20.33	1 54	77.87	200	12,000	26.20	62.0	63.0	93.0	185	266,400	2,664	4.90
1615	" 15	"	No. 2 split	"	400	300	0.37	19.89	2.42	77.32	550	38,500	26.20	69.0	71.0	89.0	932	1,342,080	4,473	24.83
1616	" 15	"	Main return	"	400	....	0.35	20.05	1.79	77.81	1,100	66,000	26.20	66.5	67.0	98.0	1,181	1,700,640	4,251	31.46
1618	" 30	No. 2 mine	No. 2 split	"	350	125	0.64	19.73	0.85	78.78	350	17,500	25.90	74.0	74.0	100.0	149	214,560	1,716	3.97
1619	" 30	"	Main return	"	350	...	0.55	19.89	0.66	78.90	850	51,000	25.90	71.0	71.0	100.0	337	485,280	1,386	8.97
1620	June 5	No. 3 mine	No. 1 split	"	400	100	0.19	20.37	1.47	77.97	160	9,600	26.05	62.0	62.5	97.0	141	203,040	2,030	3.75
1622	" 5	"	No. 2 split	"	400	300	0.20	20.08	1.18	78.54	600	42,000	26.05	69.0	71.0	89.0	566	815,040	2,716	15.07
1623	July 7	No. 1 East mine	"	"	885	100	0.21	20.30	1.34	78.15	300	21,000	26.00	59.0	60 0	93.0	281	404,640	4,046	7.48
1624	" 10	No. 3 mine	No. 1 split	"	375	100	0.25	20.34	1.50	77.91	200	12,500	25.90	62.5	63.0	97.0	187	268,280	2,683	4.96
1625	" 10	"	No. 2 split	"	375	275	0.31	19.99	2.10	77.60	550	38,500	25.90	70.0	72.0	89.0	808	1,163,520	4,260	21.52
1627	" 13	No. 1 East mine	No. 1 split	"	885	450	0.13	20.37	1.49	78.01	540	37,800	26.00	58.0	58.5	97.0	563	810,720	1,801	14.99
1628	" 19	No. 2 mine	Diagonal district	"	350	175	0.20	20.37	0.85	78.58	120	12,000	26.00	62.0	62.5	97.0	102	146,880	839	2.71
1630	" 24	No. 1 East mine	No. 3 split	"	885	150	0.04	20.57	0.95	78.44	350	24,500	26.10	58.0	60.0	89.0	233	335,520	2,236	6.20
1631	" 24	"	No. 4 split	"	885	135	0.08	20.49	1.49	77.94	400	24,000	26.10	56.0	56.5	97.0	357	514,080	3,808	9.51

RETURNS FROM MINE-AIR SAMPLES TAKEN IN THE VARIOUS SPLITS AND MAIN RETURN AIRWAYS OF THE COAL-MINES OF THE PROVINCE DURING THE YEAR 1928—*Continued.*

Sample No.	Date.	Mine.	Ventilating District.	Working or Idle.	Tonnage per Day.	Tonnage of Split per Day.	Chemical Analyses.				Velocity of Air in Feet per Minute.	Quantity of Air in Cubic Feet per Minute.	Barometer.	Hygrometer.			Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Cubic Feet of Methane per Ton.	Tons Methane per Day.
							CO_2.	O.	CH_4.	N.				Wet Bulb.	Dry Bulb.	Humidity.				
		Coal Creek—Contd.																		
1632	July 26	No. 2 mine	No. 2 split	Working	350	175	0.58	19.37	1.08	78.97	300	15,000	26.00	74.0	74.0	100.0	162	233,280	1,333	4.31
1633	" 26	"	Main return	"	350	....	0.44	19.49	0.76	79.31	800	48,000	26.00	71.5	72.0	97.0	365	525,600	1,502	9.72
1635	Sept. 10	No. 1 East mine	No. 2 split	"	885	150	0.11	20.53	1.65	77.71	340	27,200	26.50	60.0	62.0	88.0	449	646,560	4,310	11.96
1636	" 10	"	No. 4 split	"	885	135	0.19	20.50	1.33	77.98	250	25,000	26.00	54.5	55.0	97.0	332	478,080	3,541	8.84
1638	" 13	No. 2 mine	Diagonal district	"	350	175	0.22	20.64	0.24	78.90	450	40,500	26.00	62.0	62.5	97.0	97	139,680	792	2.58
1639	" 24	No. 1 East mine	No. 1 split	"	885	450	0.19	20.37	1.61	77.83	300	24,000	26.15	59.0	60.0	93.0	386	555,840	1,235	10.28
1640	" 25	No. 2 mine	No 2 split	"	400	200	0.17	20.67	0.15	79.01	950	47,500	26.00	68.5	69.0	97.0	71	102,240	511	1.89
1641	Nov. 1	"	No. 1 split	"	400	200	0.20	20.56	0.46	78.78	450	40,500	26.30	62.5	63.0	97.0	186	267,840	1,339	4.95
1642	" 8	"	"	"	400	200	0.10	20.70	0.25	78.95	450	40,500	26.50	62.5	63.0	97.0	101	105,440	527	1.95
1646	" 13	No. 1 South mine	Main return	"	300	....	0.18	20.42	0.38	79.02	880	52,800	25.60	58.5	58.5	100.0	200	288,000	960	5.32
1647	" 27	No. 3 mine	No. 1 split	"	375	100	0.10	20.49	0.58	78.83	180	10,800	26.00	62.0	63.0	93.0	62	89,280	297	1.65
1650	" 28	No. 1 East mine	No. 4 split	"	885	135	0.09	20.55	1.45	77.93	250	25,000	26.20	51.0	51.0	100.0	362	521,280	5,213	9.64
1651	" 28	"	No. 3 split	"	885	150	0.03	20.36	2.19	77.42	320	25,600	26.20	54.5	56.0	89.0	580	806,400	5,376	14.91
1652	" 28	"	No. 1 split	"	885	450	0.12	20.40	1.66	77.82	280	22,400	26.20	57.0	58.0	93.0	372	535,680	1,190	9.91
		Michel.																		
612	Feb. 29	No. 3 mine	No. 1 split	"	845	190	0.12	20.83	0.10	78.95	250	19,000	26.20	44.0	45.0	93.0	19	27,360	144	0.50
613	" 29	"	No. 2 split	"	845	30	0.08	20.79	0.41	78.72	600	18,000	26.20	47.0	47.0	100.0	74	106,560	3,552	1.97
614	" 29	"	Main return	"	845	....	0.21	20.55	0.59	78.65	1,300	130,000	26.20	49.0	49.0	100.0	767	1,104,480	1,307	20.43
620	March 6	"	No. 4 split	"	845	190	0.11	20.46	1.35	78.08	500	20,000	26.20	53.0	53.0	100.0	270	388,800	2,046	7.19
621	" 23	No. 8 mine	No. 1 split	"	800	440	0.38	20.33	0.29	79.00	250	17,500	25.40	....	....	.....	51	73,440	167	1.36
622	" 23	"	No. 2 split	"	800	360	0.36	20.24	0.29	79.11	2,000	15,000	25.40	....	....	.....	43	61,920	172	1.14
623	" 23	"	Main return	"	800	....	0.27	20.41	0.19	79.13	1,450	79,750	25.40	....	....	.....	151	217,440	272	4.02
629	April 27	No. 3 East mine	No. 2 split	Idle	....	....	0.08	20.63	0.36	78.93	720	28,800	26.00	....	....	.....	104	149,760	.....	.....
630	July 20	No. 3 mine	Main return	Working	800	....	0.22	20.45	0.63	78.70	1,150	115,000	26.20	53.0	53.0	100.0	724	1,042,560	1,303	19.28
631	" 26	"	No. 5 split	"	800	100	0.09	20.60	0.92	78.39	440	13,200	26.20	51.0	51.5	97.0	121	174,240	1,742	3.22
633	" 20	"	No. 3 split	"	800	100	0.12	20.05	1.32	78.60	200	8,000	26.20	51.5	52.0	97.0	98	141,120	1,411	2.61
634	" 20	"	No. 2 split	"	800	245	0.13	20.56	0.73	78.58	150	19,500	26.20	49.0	49.0	100.0	142	204,480	835	3.78
635	" 20	"	A and B Seam return	"	800	165	0.05	20.58	0.28	79.09	200	20,000	26.20	49.0	49.0	100.0	56	80,640	488	1.49
636	" 23	No. 8 mine	No. 1 split	"	800	450	0.48	20.08	0.26	79.18	160	12,800	25.50	58.0	58.5	97.0	33	47,520	105	0.88
637	" 23	"	No. 2 split	"	800	350	0.61	19.82	0.29	79.28	1,800	16,200	25.50	58.0	59.0	93.0	47	67,680	193	1.25
638	" 23	"	Main return	"	800	....	0.56	20.06	0.22	79.16	1,900	57,000	25.50	59.0	59.0	100.0	125	180,000	225	3.33
641	" 25	No. 3 East mine	No. 2 split	"	....	....	0.12	20.74	0.37	78.77	700	21,000	26.30	51.0	51.0	100.0	78	112,320	.....	.....
		Corbin.																		
47	Sept. 26	No. 4 mine	Main return	"	150	....	0.28	20.70	0.50	78.52	350	12,600	24.70	45.0	45.0	100.0	63	90,720	605	1.67
48	" 26	No. 6 mine	"	"	350	....	0.14	20.80	0.29	78.77	400	16,800	24.70	45.0	45.0	100.0	49	70,560	201	1.40

INSPECTION COMMITTEES.

Practically all the mines throughout the Province have had inspection committees, appointed by the workmen under General Rule 37, section 101, "Coal-mines Regulation Act," who made monthly inspections on behalf of the employees.

The courtesy of many of the inspection committees in forwarding copies of their reports to this office is acknowledged. The different operations were reported by the above inspection committees to be in good condition generally.

COAL-DUST.

During 1925 regulations for precautions against coal-dust were put into force pursuant to the provisions of the "Coal-mines Regulation Act."

The floor, roof, and sides of every road or part of a road which is accessible must now be treated in one of the following ways: Either they shall be treated with incombustible dust in such manner and at such intervals as will ensure that the dust on the floor, roof, and sides respectively shall always consist throughout of a mixture containing not more than 50 per cent. combustible matter; or they shall be treated with water in such manner and at such intervals as will ensure that the dust on the floor, roof, and sides respectively is always combined throughout with 30 per cent., by weight, of water in the intimate mixture.

Tests of samples of dust, so taken as to be representative of the normal composition of the dust throughout the roads of the mine on the floor, roof, and sides respectively, shall be made as often as may be necessary, but not less frequently than once a month.

The results of the tests shall be posted at the entrance to the mine and recorded in a book to be kept at the mine for the purpose.

Since the passing of the regulations for precautions against coal-dust the operating companies have been giving this matter great attention, and through courtesy from them the Chief Inspector of Mines' office is furnished with copies of all tests made.

Practically all the coal-mines in the Province have now got their roadways up to standard required by the regulations.

INTERNATIONAL CONFERENCE ON BITUMINOUS COAL.

Pursuant to the instructions of the Honourable the Minister of Mines, I attended the Second International Conference on Bituminous Coal, held in Pittsburgh, Pa., during the week beginning November 19th, 1928, for the purpose of gaining first-hand information for the Department of Mines regarding the progress being made in the low-temperature carbonization of coal, use of pulverized coal, and other matters of importance to the coal-mining industry.

Representatives of practically all the better-known processes of low-temperature carbonization systems were present and gave details of their individual methods and patents. The following is a list of systems and papers dealt with: "The Work of the British Fuel Research Board," by Dr. C. H. Lander, London, Eng.; "The Economics of Low Temperature Carbonization," by the Continental Engineering Company, Chicago; "Low Temperature Carbonization," by Colonel W. A. Brestow, of Low Temperature Carbonization Company, London, Eng.; "Low Temperature Carbonization of Coal by the Hayes Process," by Coal Carbonization Company of Pittsburgh; "Low Temperature Distillation of Coal," by Professor S. W. Parr, President, American Chemical Society; "The Low Temperature Carbonization Plant at the Imperial Research Institute, Tokio, Japan"; "Low Temperature Coke by the C.T.G. Process," by Joseph Plassman, Berlin, Germany; "Low Temperature Distillation of Superheated Steam," by Jacques Weiss, Paris; "The Turner Retort," by Charles Turner, Glasgow, Scotland; "Low Temperature Distillation of Coal by the Carbocite Process," by W. H. Allen, American Gas and Electric Company, New York; "The 'L. and N.' Process," by the "L. and N." Coal Distillation Company, London, Eng.; "Low Temperature Distillation," by Mineral Oils Extraction Company, London, Eng.; "Low Temperature Distillation of High Moisture Coals," by Professor F. Seidenschum, Freiberg, Germany; "Low Temperature Carbonization of Coal by the Trumble Process," by Colonel J. W. E. Taylor, San Francisco; "The K.S.G. Low Temperature Carbonization Plant at New Brunswick, N.J.," by Dr. R. P. Soule, International Coal Carbonization Company, New York.

In addition to these, a number of technical papers dealing more or less directly with the problems concerning low-temperature carbonization of coal were presented.

The papers submitted show that a vast amount of preliminary work has been carried out in devising and testing the different processes.

Most of this has been carried out in plants varying in size from what may be called a technical-sized plant to a small commercial-sized plant, the capacities of which were from 10 to 50 tons in twenty-four hours' operation.

The largest plant of which information was given is that of the International Coal Carbonization Company at New Brunswick, N.J. This is on the "K.S.G." system, which has been successful in dealing with low grades of coal in Germany. This plant is nearing completion and is expected to be in operation early in 1929 with a daily capacity of 700 to 800 tons.

While the designers and owners of this plant are optimistic regarding the success of the operation, they point out that any successful carbonization operation must depend on individual circumstances, and will be affected by different factors, such as utilization of the gas produced, market for the tars and liquors, and the solid fuel. It is estimated that the cost of carbonizing at the New Jersey plant will be $2 a ton. The operation at this plant will be watched with much interest.

The Turner Process attracted much attention as it presented many different features from the others. In this retort only superheated steam is used and no gas is produced by the carbonization, while the tar and oil yield is much higher than when the same coal is treated in directly heated retorts.

Many of the processes show a technical success, but the question of commercial success can be determined only after some large-scale plants have been operated for a considerable period.

The estimated cost of a carbonization plant varies from $1,000 to $1,500 a ton-day capacity.

VANCOUVER ISLAND COALS.

In order to obtain information regarding the possibilities of Vancouver Island coals, the Inspection Department, on the orders of the Honourable the Minister of Mines, took samples of different coals in the Nanaimo and Ladysmith districts and forwarded them to the "Low Temperature Carbonization, Limited," Barnsley, England, for testing in this low-temperature carbonization plant.

Samples of 100 lb. each of the following coals were sent and the results obtained were as follows:—

No. 5 Mine, South Wellington, Canadian Collieries (D.), Ltd. (Lump Coal.)

Analysis of Coal.			Yield of Products.
	As Charged.	Dry State.	Coal-oils (dry): 25.92 gals. per ton. Liquor: 14.79 gals. per ton. Gas: 4,409 cu. ft. per ton. Coalite: 13.92 cwt. per ton=69.60 per cent. yield. Coalite: Easy discharge. Good quality but would break up into rather small pieces. Contains 9.20 per cent. V.M. Coal-oil: Specific gravity at 60° F.=1.0355. Gas: 769.08 B.T.U.'s per cubic foot (calculated).
	Per Cent.	Per Cent.	
F.C.	52.87	53.74	
V.C.M.	37.87	38.50	
Ash	6.69	6.80	
Sulphur	0.94	0.96	
Moisture	1.63	.....	
Coal charged to retort, 10 lb. (crushed to ¾ inch and under).			

No. 5 Mine, South Wellington, Canadian Collieries (D.), Ltd. (No. 1 Washed Pea Coal.)

F.C.	50.76	51.50	Coal-oil (dry): 20.31 gals. per ton. Liquor: 14.69 gals. per ton. Gas: 4,055 cu. ft. per ton. Coalite: 14.78 cwt. per ton=73.90 per cent. yield. Coalite: Extremely easy discharge in one piece. Good quality. Contains 9.50 per cent. V.M. Coal-oil: Specific gravity at 60° F.=1.036. Gas: 808.26 B.T.U.'s per cu. ft. (calculated).
V.C.M.	34.68	35.20	
Ash	12.40	12.59	
Sulphur	0.70	0.71	
Moisture	1.46	.....	
Coal charged to retort, 10 lb.			

Extension Mines, Canadian Collieries (D.), Ltd. (Washery Fines.)

Analysis of Coal.	As Charged.	Dry State.
	Per Cent.	Per Cent.
F.C.	46.20	47.01
V.C.M.	33.12	33.70
Ash	18.38	18.70
Sulphur	0.58	0.59
Moisture	1.72	.....

Coal charged to retort, 10 lb.

Yield of Products.

Coal-oil (dry): 18.33 gals. per ton.
Liquor: 14.30 gals. per ton.
Gas: 3,897 cu. ft. per ton.
Coalite: 15.12 cwt. per ton=75.60 per cent. yield.
Coalite: Extremely easy discharge in one piece. Good quality. Very strong structure. Contains 9.90 per cent. V.M.
Coal-oil: Specific gravity at 60° F.=1.031.
Gas: 824.58 B.T.U.'s per cu. ft. (calculated).

Extension Mines, Canadian Collieries (D.), Ltd. (Washed Nut.)

F.C.	52.29	52.95
V.C.M.	33.36	33.80
Ash	12.53	12.70
Sulphur	0.54	0.55
Moisture	1.28	.....

Coal charged to retort, 10 lb.

Coal-oil (dry): 24.46 gals. per ton.
Liquor: 13.57.
Gas: 4,045 cu. ft. per ton.
Coalite: 14.62 cwt. per ton=73.10 per cent. yield.
Coalite: Extremely easy discharge in one piece. Good quality. Lumpy outside appearance. Contains 7.50 per cent. V.M.
Coal-oil: Specific gravity at 60° F.=1,012 (would be difficult to separate by decantation).
Gas: 840.25 B.T.U.'s per cu. ft. (calculated).

Wakesiah Mine, Western Fuel Corporation of Canada, Ltd. (Lump Coal.)

F.C.	47.27	48.26
V.C.M.	38.67	39.50
Ash	10.38	10.60
Sulphur	1.60	1.64
Moisture	2.08	.....

Coal charged to retort, 10 lb. (crushed to ¾ inch and under).

Coal-oil (dry): 20.60 gals. per ton.
Liquor: 16.81 gals. per ton.
Gas: 4,547 cu. ft. per ton.
Coalite: 14.24 cwt. per ton=71.20 per cent. yield.
Coalite: Extremely easy discharge. Rather poor quality. Friable as the coal is not a good caking coal. Contains 10 per cent. V.M.
Coal-oil: Specific gravity at 60° F.=1.043.
Gas: 808.71 B.T.U.'s per cu. ft. (calculated).

No. 1 Mine (Douglas Seam), Western Fuel Corporation of Canada, Ltd. (Lump Coal.)

F.C.	46.30	47.07
V.C.M.	40.52	41.20
Ash	11.20	11.39
Sulphur	0.33	0.34
Moisture	1.65	.....

Coal charged to retort, 10 lb. (crushed to ¾ inch and under).

Coal-oil (dry): 22.04 gals. per ton.
Liquor: 17.30 gals. per ton.
Gas: 4,771 cu. ft. per ton.
Coalite: 14.06 cwt. per ton=70.30 per cent. yield.
Coalite: Easy discharge as breeze for the most part. Coal is practically non-caking. Contains 9.80 per cent. V.M.
Coal-oil: Specific gravity at 60° F.=1.033.
Gas: 807.37 B.T.U.'s per cu. ft. (calculated).

Reserve Mine, Western Fuel Corporation of Canada, Ltd. (Washed Slack.)

F.C.	44.22	45.24
V.C.M.	36.79	37.50
Ash	15.86	16.00
Sulphur	1.24	1.26
Moisture	1.89	.....

Coal charged to retort, 10 lb.

Coal-oil (dry): 19.18 gals. per ton.
Liquor: 17.36 gals. per ton.
Gas: 4,054 cu. ft. per ton.
Coalite: 14.42 cwt. per ton=72.10 per cent. yield.
Coalite: Easy discharge. Rather poor quality. Coal not strongly caking. Large amount of breeze. Contains 10.50 per cent. V.M.
Coal-oil: Specific gravity at 60° F.=1.047.
Gas: 777.68 B.T.U.'s per cu. ft. (calculated).

In addition, all available information regarding the different carbonization systems has been obtained. The information so far tends to the belief that there can be no standardized system and that what may be a success in one area would not be suitable for other areas.

In some cases the object in view is the more profitable utilization of the smaller sizes of coal which are sometimes difficult to dispose of at a profit; in other cases the production of a smokeless fuel is the main issue.

Many of the different processes produce the carbonized coal in such form that it must be crushed and used as pulverized fuel or else briquetted.

At the present prices prevailing on the Pacific Coast of 5 to 6 cents per gallon for the tar-oils and 2 cents per gallon for the ammoniacal liquor recovered from ordinary coal, it would appear that some further advance is necessary before low-temperature carbonization can be accepted generally as a commercial success.

There is no doubt that the vast amount of research being carried on at present in all coal-producing countries will result in more definite knowledge of the possibilities of this potential help to the coal industry.

SULPHUR-POISONING.

While some evidence, principally by smell, shows that sulphur exists in some of the areas being worked, no complaints have reached this office during 1928 to the effect that any miners were seriously affected by this condition.

DANGEROUS OCCURRENCES.

During 1928 there were reported, as provided for by section 71, subsections (*c*) to (*h*), twenty-six occurrences, as follows: Twelve blowouts of gas and coal; one bump; nine underground fires; one inrush of water from old workings; one inrush of water, gravel, and clay; one inflow of noxious gases from a gob-fire; and one case of men having to be withdrawn during the shift owing to failure of electric-power line for the ventilating-fans. Of the above occurrences, two of the blowouts resulted in loss of life.

BLOWOUTS.

Two disastrous blowouts of coal and gas occurred during the year; the first in the Reserve mine of the Western Fuel Corporation of Canada, Ltd., on July 20th, involving the loss of two lives, and the second in No. 1 East mine, Coal Creek Colliery, on August 30th, in which six miners were killed.

In the case of the blowout in the Reserve mine, this occurred in new development-work on the east side of the mine and in the deepest area being worked.

A number of blowouts occurred in the west side of this mine in the early days of its development, but the east side had been free from this phenomenon until 1928.

The site of this blowout was in a crosscut being driven between two levels in No. 8 slope; the crosscut had been driven about 35 feet from the lower level on a pitch of about 45° at the time of the accident.

Very few shots were fired in this section as the coal was fairly friable and easily mined; on the day shift prior to the accident one shot had been fired in the face of this crosscut.

The day-shift miners left the place about 2.30 p.m. and stated the place was normal at that time, and the afternoon shift miners, William Cooper and Eli Ruski, who descended at 3 p.m., reached the place about 3.30 p.m., and the blowout occurred shortly after, so that the miners had been only a short time at the face; in fact, it is believed that one of them, Ruski, who had been fixing his tools, had not reached the working-face.

The level from which the crosscut was driven had been advanced 50 feet from the crosscut, and the two miners, Patterson and Dunn, who were in the level face at the time of the blow-out, stated that the first intimation they had of the blowout was the noise of the blown-out material being thrown on to the level, followed by the outflow of gas.

They at once made their way out past the material deposited on the level and raised the alarm; they then returned to investigate and found Ruski pinned behind some timbers at the foot of the crosscut. Ruski was alive and spoke to Dunn and Patterson, who set to work to extricate him.

The high percentage of gas in the air made this work difficult and dangerous, and the two miners and several others who had arrived by this time were partially overcome by the gas. When Ruski was finally got out it was found that he had succumbed, due to the effects of the gas.

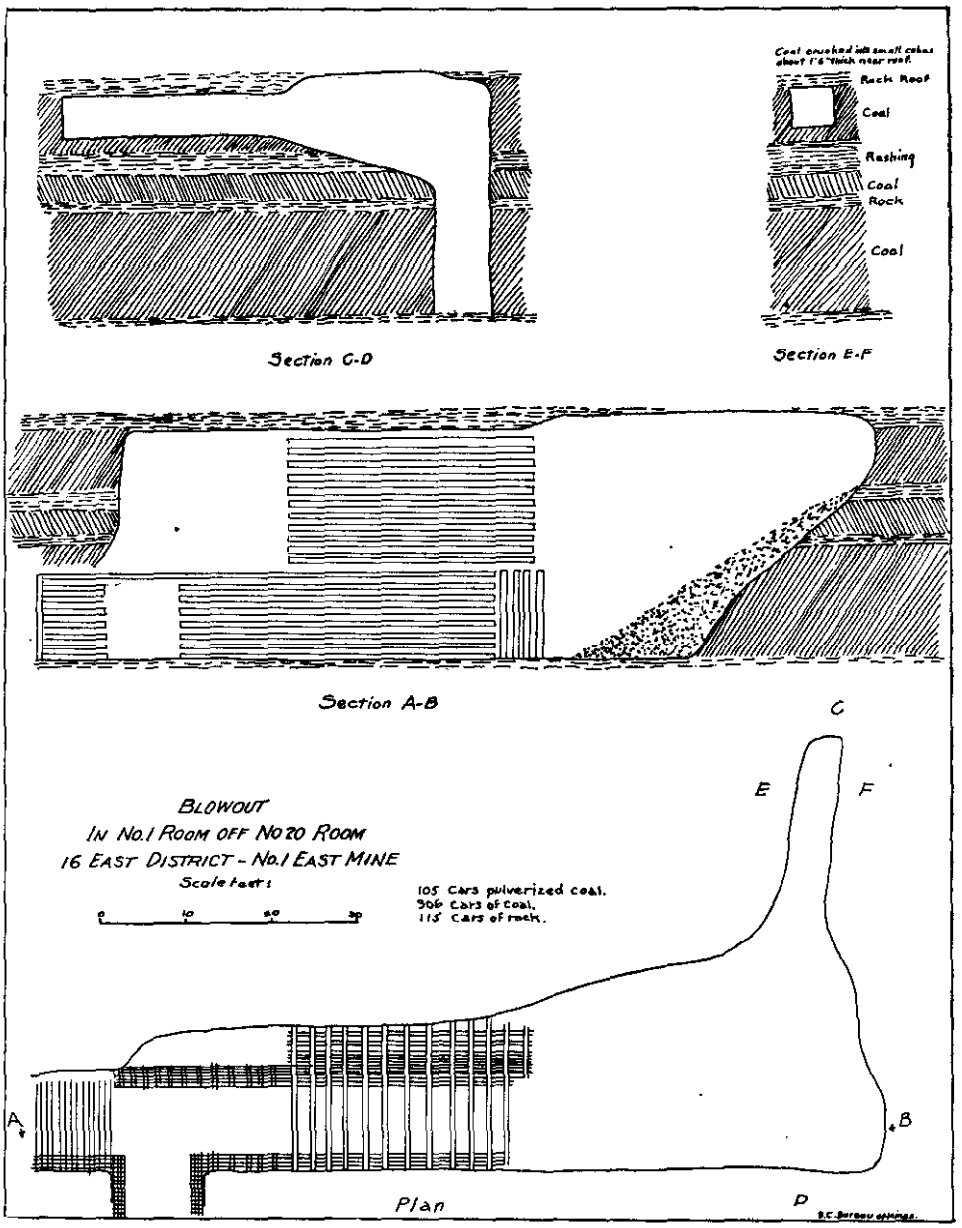
The body of Cooper, who had been instantly killed, was recovered shortly after.

The amount of material blown out was comparatively small as blowouts go, but it would appear that there was no appreciable warning such as usually occurs. No further advance was made in this area and the pillars already blocked out are being extracted.

BLOWOUT IN No. 1 EAST, COAL CREEK COLLIERY, ON AUGUST 30TH, 1928.

This blowout occurred in No. 1 room off No. 20 level, No. 16 East slope, about 11 a.m. on August 30th, and, as stated above, resulted in the death of six miners and imperilled a number of other employees.

The accompanying plans show the workings of this area, position of previous blowouts, where the bodies were found, and details surrounding the blowout of August 30th (No. 43).



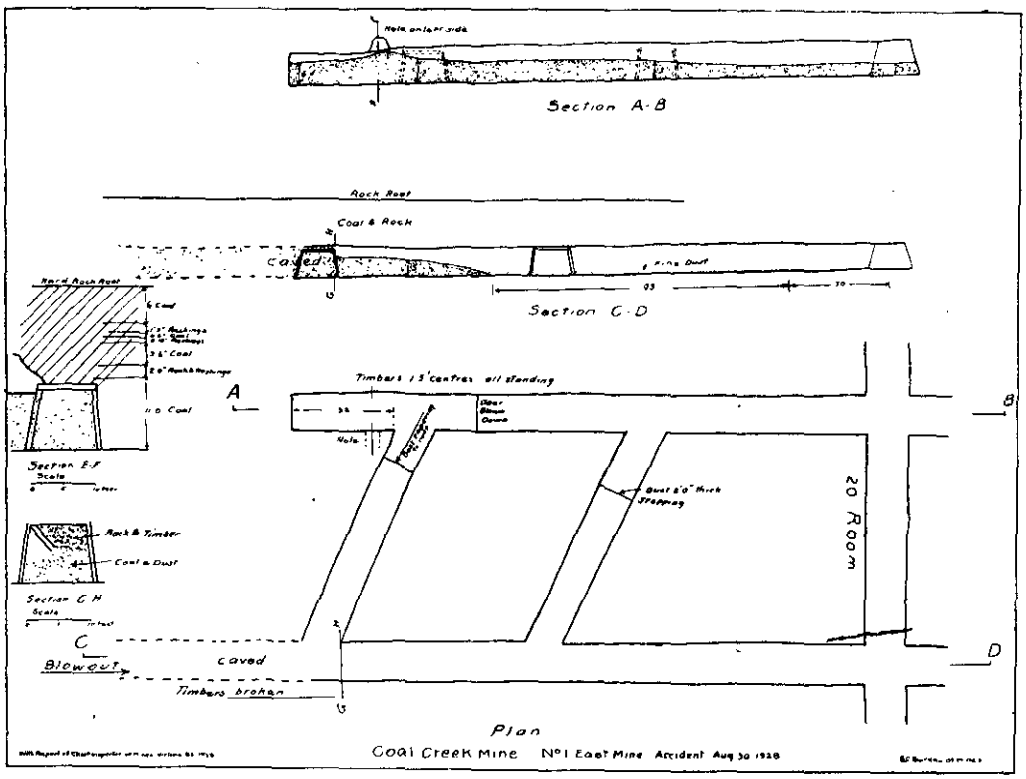
Alarm was first raised when a temporary reversal of the air-current, noted in the main intake of the mine, indicated that something unusual had occurred.

James Taylor, acting-manager, was on the surface at the time, and on being informed of the reversal of the air, at once ascertained that the fan was not operating normally, and then entered the mine to investigate. On reaching No. 14 East, he learned that a blow-out had occurred in No. 16 East district and that the lower part of that area was filled with gas.

It was found that explosive gas had ascended No. 16 East slope to No. 6½ room; almost 3,000 feet from the blowout.

No. 16 East slope is the haulage-road for this district and No. 18 East, farther inby, is the intake for this ventilating-split; an attempt was next made to enter the gas-filled area by this intake airway, but on reaching No. 15 room explosive gas was also met.

Senior Inspection of Mines Strachan and Inspector Miard joined the exploring party at this point and directed and assisted the work of exploring the area.



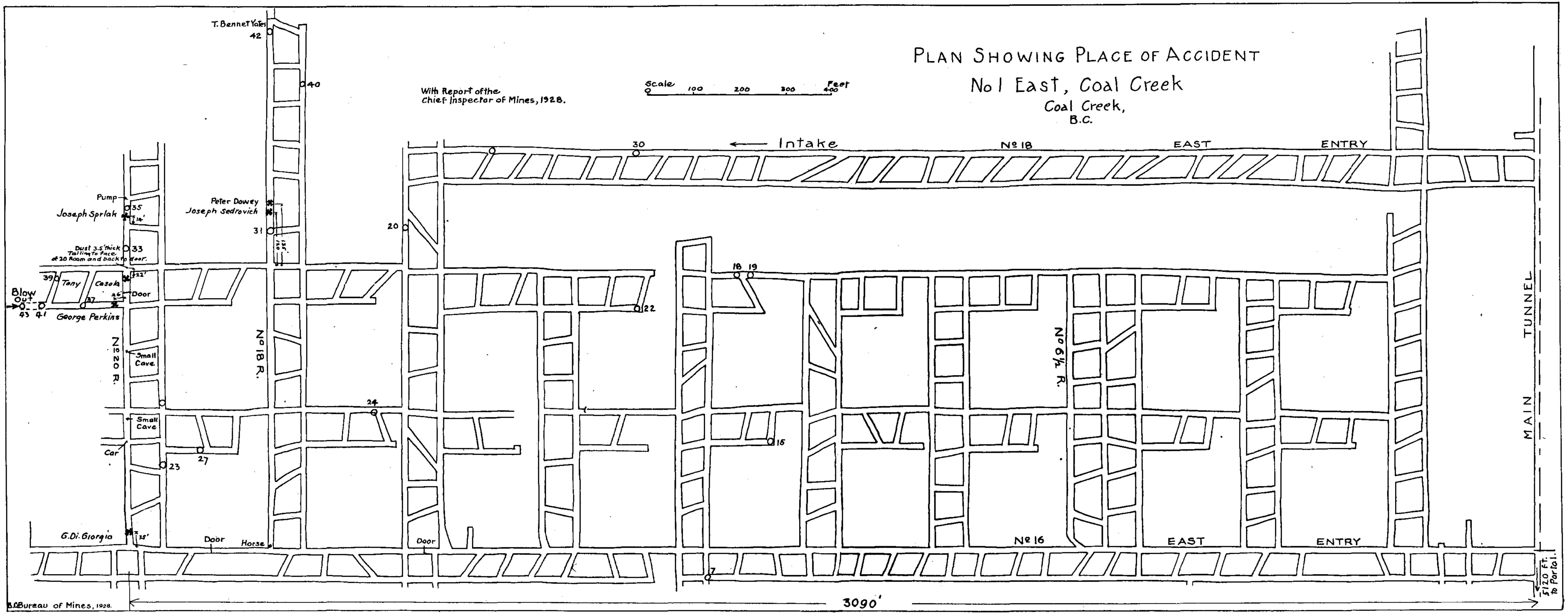
The gas gradually receded from the points where it was first encountered and about noon the exploring party was able to reach No. 18 room, where the bodies of Joe Sedrovich and Peter Dowie were found.

Later the bodies of Tony di Georgia, T. Cassola, and J. Sprlak were found on No. 20 room; the last body to be recovered, that of George Perkins, was found about 20 feet down No. 1 room off No. 20 room.

The body of Perkins was recovered by a team equipped with the oxygen rescue apparatus; the other bodies were found by the exploring party, which did not wait for the arrival of the team, as the hope of saving life urged them to exert every effort to reach the missing men; this they did at very considerable risk of their own lives.

Of the eight miners at work in this section at the time of the blowout, only T. Bennett and John Yates, who were driving No. 18 room, escaped with their lives.

The face of this place is some 1,500 feet, by line of travel, from the seat of the blowout and on the intake side of same.



Plan Showing Place of Accident
No 1 East, Coal Creek
Coal Creek,
B.C.
With Report of the
Chief Inspector of Mines, 1928.
Scale 100 200 300 400 Feet
Intake
No 18 EAST ENTRY
No 16 EAST ENTRY
MAIN TUNNEL
No 20 R.
No 18 R.
No 6½ R.
T. Bennet Yates
Pump
Joseph Sprlak
Peter Dowey
Joseph Sedrovich
Tony
Casola
Door
Blow out
George Perkins
Small Cave
Car
G. Di. Giorgio
Horse
5120 Ft. To Portal.
3090'
B.C. Bureau of Mines, 1928.

In their evidence given at the inquest concerning the deaths of the others, Bennett and Yates stated that immediately they heard the blowout they ran from the face and had travelled about 150 feet when they met the gas-outflow coming against the pressure of the intake air; they likened the gas-pressure as affecting them like a hurricane, but managed to struggle through although almost overcome.

At the time of the blowout there were two drivers in the section, one on No. 20 room and one on No. 18 room.

The driver on No. 20 room was on his way out with a loaded car and the noise of the blowout startled the horse so that several hundred feet were covered before the driver could unhitch the horse from the car. The driver then held on to the horse and both got out safely.

The driver on No. 18 room was on his way in with an empty car when he heard the blowout; he immediately stopped and tried to bring his horse out, but the road at this point was somewhat narrow, and while trying to derail the car to make sufficient space for the horse to pass out the gas reached the place and compelled the driver to abandon his horse and save his own life. The horse apparently was able to struggle past the car after the driver left as it was found dead near No. 16 East slope.

I left Victoria immediately I was informed of the disaster and arrived at Fernie on September 1st, and on reaching the mine examined the blowout area as far as was possible.

Nos. 1 and 2 rooms, off No. 20 room, still showed explosive gas, but it was possible to reach almost to the face of No. 2 room, where it was suspected the blowout had originated.

The blown-out material in this room was 3.5 feet deep at the intersection of No. 20 room and gradually increased in depth towards the face, leaving barely room to crawl.

In No. 1 room there was very little material, with the exception of some very fine dust, for a distance of 93 feet from No. 20 room.

On September 2nd a party was able to reach the face of No. 2 room and found that the blowout had not occurred there. This left only No. 1 room as the probable site of the blowout. The blown-out material having been removed this proved to be the case.

Apparently the first of the blown-out material had dislodged the supporting timbers on No. 1 room at the intersection of the crosscut nearest to the face and had heavily caved the roof of No. 1 room at this point; the cave and blown-out material completely closed No. 1 room and deflected the remaining material through the crosscut to No. 2 room, where it was again deflected up and down this room.

As shown by the plan, the roadway from the face of No. 1 room, through the crosscut to the intersection of No. 2 room, was completely filled with blown-out material; from this point the deposit of fine coal and coal-dust decreased in depth to No. 20 room, where it was 3.5 feet deep. The deposit decreased in depth along No. 20 room to the face, where it was a few inches in depth.

There must have been some preliminary warning, as all of the men had got some distance from their respective working-places before being overcome by the gas and dust.

None of the bodies showed any material signs of violence; death in each case being due to suffocation.

Advance boreholes were kept in advance of the working-faces, which appeared to be susceptible to blowouts, in the hope that some additional warning or indication might be obtained of a pending blowout.

Experience has proved that bore-holes do not prevent blowouts, but in some mines the advance holes give indications of a change in the nature of the seam.

Owing to the number of blowouts and their increasing violence in this No. 16 East district, it was decided that no further advance would be made here until some safer method of work shall be devised.

The work of cleaning out the coal ejected by this outburst was followed down No. 2 place, which is the haulage-road for these places, and through the lower crosscut into No. 1 place, where the outburst had occurred.

It was found on clearing up No. 1 place that all the timbers had been swept out from the inner end of the crosscut to the face of No. 1, a distance of about 50 feet, and the roof caved. On getting to the face it was found that on the left side a round funnel-shaped opening about 2 feet in diameter extended into the solid a distance of 37 feet, as shown on the accompanying plan and sections. On the sides of this opening, from the roof downwards, there was a band

18 inches thick of finely crushed coal that could be scratched out with the fingers, and the particles of coal that came off were cubes varying on size from dust to ¼ inch. The only abnormal conditions met with were the furrowed glazed roof and the finely crushed coal.

From this outburst there has been loaded: 120 tons of powdered coal; 1,400 tons of coal; 250 tons of rock; a total of 1,770 tons of material. It is estimated that about 25 per cent. of this amount came from caved ground, leaving approximately 1,300 tons from the outburst.

The amount of gas given off could not be estimated, but it must have been very great.

ORDER STOPPING WORK UNDER AUTHORITY OF SECTION 87.

During 1928 the further advance of No. 16 East district, No. 1 East mine, Coal Creek Colliery, and No. 8 slope, Reserve Colliery, was abandoned after discussion between the Inspection staff and the management of the respective collieries. In both instances the stoppage was due to the probability of further blowouts.

INQUIRIES.

Following the fatal accident to Thomas Smith, miner, Reserve mine, on September 25th, due to a fall of roof, the Honourable the Minister of Mines appointed William M. Brewer, mining engineer, to hold an inquiry, in accordance with the provisions of the "Coal-mines Regulation Act" (sections 48 and 49), into the conduct of the firebosses and miner in charge of the place where deceased was killed. The place was obviously insufficiently timbered. After hearing the evidence Commissioner Brewer severely censured the men into whose conduct the inquiry was directed.

PROSECUTIONS.

During 1928 there were eleven prosecutions made for infractions of the "Coal-mines Regulation Act" and special rules, all of which resulted in convictions.

MINE-RESCUE AND TRAINING.

The Vancouver Fire Department sent one of their firemen, John Anderson, to Nanaimo Mine-rescue Station to receive a complete course of instruction in the use of the oxygen breathing apparatus and the Burrell all-service gas-masks. At the completion of his course he was awarded a certificate and is now training the members of the Vancouver Fire Department in the use of these machines.

During 1928 five sets of the new McCaa 2-hour oxygen breathing apparatus were added to the equipment of the Mine-rescue Stations at Nanaimo, Cumberland, and Fernie. These machines have a minimum number of connections, so that the possibility of leaks has been reduced.

MINE-RESCUE AND FIRST-AID COMPETITIONS.

The East Kootenay Mine Safety Association held its seventh annual mine-rescue and first-aid meet at the Government Mine-rescue Station, Fernie, on June 23rd.

In the mine-rescue contest there were five teams—two from Fernie, two from Michel, and one from Coal Creek. All the teams did excellent work, only 5 per cent. in marks gained separating the highest and lowest teams.

First place was gained by the Coal Creek team, consisting of John Caufield (captain), John Parker, Joseph Haile, Wm. Cockburn, and Jos. Graham; this team obtained 98.6 per cent. of the marks available. Fernie No. 1 team—M. Hilton (captain), John Yates, Arthur Hilton, Alf Williams, and Jos. Hamer—took second place with 96.4 per cent.; and Fernie No. 2 team, composed of Wm. Hynds (captain), N. Cockburn, Edward Caufield, Robert Alstead, and R. S. Phillips, was third with 95.6 per cent. Michel Nos. 3 and 8 teams obtained 94.6 and 93.2 per cent. respectively.

In the first-aid competition Fernie No. 1 team, captained by Jos. Hamer, gained first place with 94 per cent.; the other teams were: Coal Creek No. 2, 87 per cent.; Coal Creek No. 1, 86 per cent.; Fernie No. 2, 83 per cent.; and Kimberley, 68 per cent.

In the ladies' first-aid event the first prize was gained by Michel team, composed of Misses Linda Causey (captain), Jean Moon, E. Whalley, Ada James, and Hilda James, with 96 per cent.; while Fernie team, composed of Mrs. Anne Wilson (captain), Mrs. L. McLaren, Mrs. R. P. Walker, Mrs. B. Taylor, and Miss Grace Douglas, took second place with 91 per cent.

In the first-year event Fernie team, captained by Jas. Pearce, took first place, and Coal Creek team, captained by Ed. Atkinson, was second, while the first and second prizes in the junior competition were captured by Captain Ed. Atkinson's Coal Creek team and Captain Jas. Davies's Kimberley team respectively.

The thirteenth annual meet of the Vancouver Island and Coast District Branch of the British Columbia Mine Safety Association was held at Nanaimo on September 3rd, and in point of interest was the most successful meet ever held on Vancouver island. Teams were entered from Britannia, Cumberland, Extension, Cassidy, and Nanaimo.

There were six mine-rescue teams in the contest—two from Nanaimo, two from Cumberland, one from Cassidy, and one from Extension. The first team had passed the examination of their machines at the bench and were proceeding to the mine at 8 a.m., and the sixth team had finished their test in the mine at 11.30 a.m., exactly according to schedule. All six teams showed a high standard of training and the placing of the teams was found by the judges to be a hard task. Captain Newbury's team of Nanaimo was awarded first place and holds the mine-rescue shield for one year.

In the first-aid events the junior boys from Cassidy, under R. Holmes (captain), won first prize, and in the junior girls' event the Nanaimo team, under Florence Aitken (captain), gained first prize.

The intermediate boys' competition was won by a Nanaimo team (Sid Storrie, captain) and the intermediate girls by Miss Hilton's team from Royston.

The ladies' first-aid event was won by Mrs. Sharp's team of Nanaimo.

The British Columbia Department of mines cup was won after a very close competition by D. Stobbart's team of Nanaimo.

The Coulson cup was won by Captain Goulding's team of Cassidy.

The one-man event was won by D. Simpson and W. Barclay, of Nanaimo; and the two-man event by S. Hunt, W. Whyte, and H. Waterfield, of Cumberland.

In all, thirty-six teams entered the first-aid competitions and six teams entered the mine-rescue competitions.

Honourable W. A. McKenzie, Minister of Mines, and Mr. Robert Dunn, Deputy Minister of Mines, were on the grounds all day and were keenly interested in the competitions.

In the evening the prizes were presented by the Honourable the Minister of Mines, who expressed his appreciation of the work done by the various teams and hoped to see still further interest taken in the work. To stimulate this interest he promised to present a cup for novice teams. No individual would be allowed in these teams who had previously taken a prize at a competition.

On December 8th an indoor first-aid competition was held in Nanaimo; thirty-three teams, all told, competing in the various events. At this meet the new cup presented by the Honourable W. A. McKenzie, Minister of Mines (for novice teams), was competed for and after keen competition was won by Captain W. Unsworth's team of Cassidy.

In the junior boys' event first prize was obtained by R. Dickenson's team, Nanaimo; and in the junior girls' event Miss Barton's team, Nanaimo, took first prize. In the ladies' event first prize was obtained by Mrs. Scott's team, Nanaimo, and in the men's event C. Wharton's team, Nanaimo, took first prize.

The prizes were presented by the Honourable the Minister of Mines, who expressed great pleasure at the keen interest taken in the work, which was demonstrated by the fact that over 600 were present to witness the competition.

These mine-rescue and first-aid competitions which are held in the mining centres are made possible by substantial grants from the Department of Mines; in addition, the resources of the different mine-rescue stations are at the service of the meets.

The help of the Instructors at the different stations is also an important factor in the intensive training of the teams.

EXAMINATIONS FOR CERTIFICATES OF COMPETENCY.

Two examinations for certificates of competency for coal-mine officials were held during 1928; details of these examinations are dealt with in the report of the Secretary to the Board.

Examinations for certificates of competency as coal-miners were held regularly during 1928 at the various mines.

SUPERVISION OF COAL-MINES.

During 1928 eighteen coal companies operated twenty-five collieries, with forty mines, employing 3,814 men underground.

In the supervision of underground employees there were twenty managers, two safety engineers, twenty-four overmen, 160 firebosses and shotlighters, a total of 206, or one official for every eighteen persons employed underground.

METALLIFEROUS MINES.

PRODUCTION.

The output from the metalliferous mines for 1928 was 6,241,310 tons, an increase of 921,926 tons over the tonnage for 1927. This tonnage was produced from 110 mines, of which forty-nine shipped 100 tons or more.

ACCIDENTS.

There were fourteen fatal accidents in and about the metalliferous mines in 1928, an increase of six compared with the figures for 1927.

There were 5,176 persons employed in and about the metalliferous mines in 1928.

The ratio of fatal accidents was 2.70, compared with 1.74 for 1927. The ratio for the last ten-year period was 2.03.

The tonnage mined per fatal accident was 445,807, compared with 664,920 tons per fatal accident for 1927.

The tonnage mined per fatal accident for the last ten-year period was 428,602 tons.

The following table shows the mines at which fatal accidents occurred during 1928 and comparative figures for 1927:—

Mining Division.	Mine.	No. of Accidents.	
		1928.	1927.
Vancouver	Britannia	4	3
Nanaimo	Caledonia	1	....
Slocan	Noble Five	....	3
Fort Steele	Sullivan	1	1
Similkameen	Copper Mountain	1	....
Kamloops	Aberdeen	1	....
Northern	Hidden Creek	3	1
Northern	Lakeview	1	....
Northern	Premier	2	....
Totals		14	8

The following table gives the cause, the percentage to the whole of the fatal accidents, with comparative figures for 1927:—

Cause.	1928.		1927.	
	No.	Per Cent.	No.	Per Cent.
By blasting	3	21.43	1	12.50
By falling into chutes, raises, shafts, etc.	5	35.71	1	12.50
By falls of ground	6	42.86	....	.....
Miscellaneous (underground)	....	.....	3	37.50
By falling cage	....	.....	3	37.50
Totals	14	100.00	8	100.00

Details surrounding the occurrence of fatal accidents in and around metalliferous mines during 1928 were:—

The fatal accident which occurred to Mike Plecash, chuteman, on February 3rd was caused by being crushed by a rock which he was trying to dislodge from where it was hung up in a chute. Deceased overbalanced and fell in front of the rock when it moved down the chute.

The fatal accident which occurred to Thomas Schonenberger, engineer's helper, *Aberdeen* mine, on March 14th was caused by falling 70 feet in a shaft. Deceased was disconnecting pipes in the shaft at the 100-foot level and was told to cover the shaft at this level with timbers prepared for the purpose. He failed to cover the shaft and while at work on the pipes had apparently slipped and fallen down the shaft.

The fatal accident to H. Novak, miner, and L. G. Peck, nipper, in *Britannia* mine on March 15th was due to a fall of ground. Novak had just finished barring down, when a large rock fell, killing both men.

The fatal accident which occurred to S. Aoki in the *Caledonia* mine on March 19th was due to blasting. Deceased and his partner had prepared a round of five shots and Aoki sent his partner out while he spit the round. For some undetermined reason Aoki had not left the face when the shots went off.

The fatal accident to J. C. Packham, mucker, *Britannia* mine, on August 1st was due to falling down a raise. Deceased had told his partner that he was going to get some water for his carbide-lamp and had apparently lost his light and in the dark had lost his way.

The fatal accident which occurred to P. G. Anderson, miner, *Lakeview* mine, on August 11th was due to being covered with loam and sand while working in an open-cut on the surface. Deceased was kneeling to examine the floor when one of the sides collapsed.

The fatal accident which occurred to Walter Swanson, miner, *Hidden Creek* mine, on August 25th was due to falling into a stope when coming off shift.

The fatal accident which occurred to Tom Rubcich, miner, *Hidden Creek* mine, on August 25th was due to falling down a stope for some 35 feet. Deceased was barring down after blasting and in some way lost his footing.

The fatal accident which occurred to Marko Roskovich, miner, *Hidden Creek* mine, on September 12th was due to being caught by a fall of ground while barring down. The miners had tried to bar down this piece of ground without apparent result, and were preparing to drill and blast it when it broke loose and fell on deceased.

The fatal accident which occurred to John Modic, barman, *Sullivan* mine, on December 19th was due to deceased falling from, or being thrown from, a ladder while barring down. The piece of rock that deceased was working on gave way unexpectedly and either struck him or caused him to lose his balance; the ladder was not moved.

Mine-air Sampling.

During the year mine-air samples were taken in all mines where it was thought necessary to ascertain the conditions of the atmosphere. The samples were sent to the Mines Branch, Ottawa, for analyses, and only in a few cases was the oxygen content found to be below normal and no appreciable amount of noxious gases was found.

Mine-rescue Work.

At *Britannia* mines, *Sullivan* mine, *Copper Mountain* mine, *Anyox*, *Premier*, and several others, mine-rescue apparatus have been purchased and men selected for training in the use of same.

The Burrell all-service gas-mask has been found particularly satisfactory for this work, as it is seldom that an emergency will arise where there is not sufficient oxygen to sustain life, provided that the men dealing with such emergency are protected against the effect of poisonous gases.

First-aid and Accident-prevention Work.

All the larger operating companies have carried on or inaugurated accident-prevention work during the year.

In the case of the larger mines a safety-first engineer devotes all his time to the promotion of safety methods of performing the work both underground and above.

Meetings are held and every effort made to interest the employees to take an individual share in this work, as it is realized that a very large percentage of accidents is due to some act or commission or omission on the part of the injured party.

It is only by complete co-operation on the part of all concerned that greater safety, with a consequent reduction of accidents, can be attained.

Second only to accident-prevention, the first-aid work carried on by the different companies and employees has made distinct advances during the year. The service rendered by qualified first-aid men is often of vital importance to injured men, particularly in the more isolated camps, where a considerable time may elapse before the services of a medical man can be secured.

CONCLUSION.

I desire to express my appreciation of the faithful co-operation and assistance afforded during the year by the District Inspectors and Instructors in mine-rescue work. I also wish to thank the management and employees at the various collieries for the assistance and support given in making operations as safe as possible and look forward to a continuation of the same during the coming year. It is only by the closest and efficient co-operation of all parties concerned that we can keep down the number of accidents and make the mining industry a safer and more congenial occupation.

I am much indebted to the Director of the Mines Branch at Ottawa for co-operation in the work of mine-air sampling, and the Dominion Government for furnishing the sample-bottles and making all analyses free of charge.

REPORTS OF METALLIFEROUS MINES INSPECTORS.

NORTHERN INSPECTION DISTRICT.

REPORT BY THOS. J. SHENTON, INSPECTOR.

I have the honour to submit my annual report for the year 1928 on the Northern Inspection District, including the following Mining Divisions: Atlin, Portland Canal, Liard, Nass River, Omineca, Stikine, Skeena, Bella Coola, and Queen Charlotte.

ATLIN MINING DIVISION.

Engineer.—This mine is operated by the Engineer Gold Mines, Limited; Chas. V. Bob, president, New York; L. P. Jubien, secretary; C. H. Herscham, manager, Engineer, B.C.; C. P. Fairhurst, superintendent at Engineer. This mine is situated on Taku arm, Tagish lake, some 65 miles from Carcross. Work commenced on June 16th, 1928, and continued until October 14th, with an average of twenty-five men a day.

During my inspection of the above mine I found conditions to be in accordance with "the Metalliferous Mines Regulation Act."

Owing to a change in management early in the fall of 1927, the provision of the gas-masks ordered by me was not made and I have repeated my request with the present management.

Atlin Silver Lead.—Operated by the Atlin Silver Lead Mines, Ltd.; J. M. Ruffner, manager, Atlin. This mine is situated some 16 miles from Atlin in a north-easterly direction and is located on Vaughn mountain. At the time of my visit in the month of June fifteen men were employed. An average of twenty men was employed from January until August, when the mine ceased operations temporarily.

There was good camp accommodation and the ventilation, timbering, and workings of the mine were good.

PLACER OPERATIONS.

During the year I inspected the following placer mines: Ruby Creek, Ruby Creek No. 1, Ruby Creek No. 2, Boulder Creek No. 1, Boulder Creek No. 2, and Discovery; and also the following placer-workings on Spruce creek: Clysedale, Storm Lease, Dorothy Lease, Lynx, Key Quick, Hard Gravel, and No. 4.

The above placer operations are of varying magnitude and some are underground operations, one being 1,800 feet from the portal to the working-face, and employ from two to eighteen men in the individual operations.

In several cases I had occasion to request improvements in underground timbering and ladder-ways, and in one case ordered the reduction of the number of men to be hoisted at one time; this was owing to the somewhat small size of the hoisting equipment.

In general I found the different operators willing to make full provision for the safety of employees.

OMINECA MINING DIVISION.

BURNS LAKE SECTION.

North Shore, Silver Island.—Operated by the Silver Island Mining Company, Limited; E. F. Campbell, manager. This mine is located on the north shore of Babine lake, about 30 miles north-east of Burns Lake. From the end of May work has been continuous throughout the year, with an average of six men working.

South Shore, Silver Island.—Operated by the Silver Island Mining Company, Limited; E. F. Campbell, manager. This mine is situated on the south shore of Babine lake. At time of my visit the work consisted of tunnelling and development generally, with an average of six men employed. In connection with operations, I requested that a first-aid man be kept at the mine, first-aid supplies being provided, and matter of operation I found to be in reasonable compliance with the "Metalliferous Mines Regulation Act."

Taltapin.—Operated by the Taltapin Mining Company, Limited; W. S. Bacon, superintendent. This mine is situated some 23 miles from Burns Lake, on the Canadian National Railway, or 3 miles by road from Baine lake on the south shore.

The workings are entered through a shaft 100 feet deep. In my examination of the shaft I discovered that the timbering was not, in my opinion, properly placed, nor substantially pinned together as the case demanded; also that the partition between working-compartment and hoisting-compartment was not in accordance with the "Metalliferous Mines Regulation Act." These defects were pointed out and were remedied.

A Campbell Halifax engine of 72 horse-power, coupled by belt to a Holman compressor having a capacity of 272 cubic feet, was installed, and in July the mine closed down. Camp accommodation was found to be adequate and in a sanitary condition.

Topley Section.

Richfield.—This mine is operated by the Topley Mining and Development Company, Limited; F. H. Taylor, manager. The shaft to the workings is down 200 feet, and quite a body of water has been encountered during the sinking of the last 100 feet. Two pumps are in action—a No. 6 Cameron sinking-pump and one centrifugal pump. Hoisting is done with a Nova roller-machine of 25 horse-power.

The mine has been worked continuously with an average of twenty-eight men a day. The mine has been provided with a second opening for ventilation and to provide the necessary ingress and egress as required by the "Metalliferous Mines Regulation Act." Provisions for first aid are satisfactory, camp accommodation adequate for present requirements, and timbering and ventilation of mine in fair order. Work during the year has been conducted in accordance with the "Metalliferous Mines Regulation Act" and no serious accident has occurred.

Sunset.—This mine is worked by the Topley Silver Mining Company, Limited; T. D. Pickard, manager; A. Beaton, superintendent. The mine is situated 8 miles north-east from Topley. Work continued throughout the year with an average of eight men.

The mine is entered by an inclined shaft 120 feet deep. Timbering and ventilation is safe and fair; manway also is in reasonable order. Hoisting is done by a small Nova hoist with gearing. Power plant consists of one Fairbanks-Morse Diesel 25-horse-power engine, coupled by belt to compressor, capacity 25 cubic feet. I found that some of the mine buildings had been placed too close to the mine entrance, but after some negotiations with the management this was rectified. Other matters of camp accommodation and first-aid supplies are satisfactorily arranged, the whole being operated in accordance with the "Metalliferous Mines Regulation Act."

Smithers Section.

Duthie.—Worked by the Duthie Mines, Limited; J. F. Duthie, managing director; J. R. Turner, manager. The mine is situated on the west side of Hudson Bay mountain, 16 miles from Smithers. A new steam-turbo electric-power plant, with an output of 500 kw., was installed during 1928 and started up in the middle of December. The mill was shut down temporarily to allow certain additional machinery to be installed. A new camp is in the course of construction; also a bunk-house to accommodate sixty-four men, which will be completed early in the year.

The development of the mine is being continued on a large scale, and during my inspections operations were found to be in accordance with the "Metalliferous Mines Regulation Act."

King Tut.—Owned by J. J. O'Brien, managing director; O. E. Herriet, mine foreman. This mine is situated close to the *Duthie* mine. Work began in January and continued to September with an average of five men. A small portable compressor was used during the latter part of operations.

During inspections timbering and ventilation were found to be good, safety-first work duly cared for by the management, and all matters to be in fair compliance with the "Metalliferous Mines Regulation Act."

Victory.—Under option to J. J. O'Brien; A. Chisholm, mine foreman, who carried on work. Development in drifting was carried on from November 4th, with an average of nine men. The power plant consists of one Nova engine coupled by a belt to a 2-drill Gardener compressor. An auxiliary fan aided ventilation, which was fair; timbering was good and camp accommodation adequate and sanitary.

During my inspections conditions were found to be in accordance with the "Metalliferous Mines Regulation Act."

Hazelton Section.

Silver Cup.—Duke Mining Company, Limited; J. Dornberg, managing director. Operations, except for a short period during the early part of the year, have been held up due to works of construction and instalment of machinery to complete plant. The power-house and mill are nearing completion and are expected to be in operation early in 1929. The primary power is from Diesel engines which drive generators having an output of 160 kw. An aerial tram 3,800 feet long, with a fall of 1,390 feet, conveys the ore from the mine to the mill. There is a good camp with adequate accommodation and of a modern character.

The timbering of the mine, ventilation, and general arrangements during my inspections were found to be in compliance with the "Metalliferous Mines Regulation Act."

Mohawk.—Owned by W. S. Harris and associates, New Hazelton; J. Lewis, manager; H. Harris, superintendent. Operations started early in 1928 and, with little interruption, continued to the end of the year.

To assist ventilation a raise is being driven from the main tunnel to connect with the surface. Timbering of the mine is safe, but the ventilation is not quite up to requirements. This will be rectified as soon as the raise is completed. A new bunk-house was built late in the year, affording ample accommodation. An average of nine men was employed.

During all my inspections operations were found to be in accordance with the "Metalliferous Mines Regulation Act."

Comet.—This property was worked for a short time by the owners of the *Mohawk*. During my inspection timbering was fair, ventilation fair, and other matters were found to be within reasonable compliance with the "Metalliferous Mines Regulation Act."

Aurimont.—Operated by the Aurimont Gold Mines, Limited; N. Thompson, president; W. S. Harris, superintendent. This mine is situated on Rocher Déboulé mountain at an elevation of 6,000 feet. Seven men were employed and a small amount of ore was shipped during 1928.

Timbering and ventilation was good, conditions in general being fair and in accordance with the "Metalliferous Mines Regulation Act."

Cedarvale Section.

D.W.—The D.W. Mines, Limited; W. Davies, managing director; E. Davies, superintendent. This mine is situated on Seven Sisters mountain at an elevation of 4,100 feet and is 7 miles from the ferry across the Skeena at Cedarvale. The mine is entered by an inclined shaft. During the year a new camp was built.

Timbering and ventilation I found to be fair and provisions made for first aid. During my inspections I found work being carried on in accordance with the "Metalliferous Mines Regulation Act."

Usk Section.

Shenandoah.—Owned by A. A. McDonald, Usk; G. Glover, mining engineer; D. McLarty, mine superintendent. The mine is situated some 12 miles from Usk, up the North fork of St. Croix and Chimdemash creeks, at an elevation of 5,000 feet.

At the time of my visit ten men were employed and the work proceeding was by stripping and tunnel. I found accommodation adequate and provisions made for first-aid supplies. The operation was being carried on in reasonable compliance with the "Metalliferous Mines Regulation Act."

I.X.L.—A. J. Lowary, Seattle; J. M. Hoar, superintendent. Work was begun during May and continued to the end of the year with an average of eight men. A new camp has been built by the company during the year, which is adequate. During my inspection the mine was well timbered and ventilation fair. Provisions for first aid were made, and the operation as a whole I found to be in good order and in compliance with the "Metalliferous Mines Regulation Act."

Valhalla, Kleanza.—Columario Gold Mines, Limited; J. Williams, superintendent. This mine is situated 7 miles from Usk. Work was begun early in May and continued until the end of the year with an average of ten men. A new camp was constructed early in the year, which affords adequate accommodation.

The mine was well timbered, provisions made for first aid, and all other matters relative to safety and health were in reasonable compliance with the "Metalliferous Mines Regulation Act."

TERRACE SECTION.

Smith.—Kalum Lake Mines, Limited; C. A. Smith, manager. This mine is situated some 23 miles from Terrace. It is entered by an inclined shaft and owing to being idle for some considerable time the workings and shaft filled with water. An attempt was made to pump out the water during the summer, but apparently the pumps were not adequate for the work. It was requested that accurate plans be provided to ascertain the possibility of water entering this mine from Kitsumgallum lake.

SKEENA MINING DIVISION.

COAST SECTION.

Serf Point.—Owned by Patterson and associates; J. B. Woodworth, manager; M. R. O. Shaughnessy, superintendent. This mine is situated on Porcher island, some 35 miles south of Prince Rupert. Camp accommodation here is rather poor, so poor that I have been compelled to request the management to make certain improvements. At the time of my last visit thirteen men were employed.

Ventilation and timbering were found to be fair and all other matters in reasonable compliance with the "Metalliferous Mines Regulation Act."

Drum Lummon.—Owned by the Los Angeles-Vancouver Mining Company; W. C. Rannells, manager. This mine is situated 25 miles north of Hartley Bay, on the shore of Douglas channel. Owing to the distance from medical aid I requested that a special boat be maintained in readiness for any emergency that may arise. The company readily provided for this.

A Snow crude-oil engine of 125 horse-power has been installed, coupled to a compressor of 8-drill capacity. Eight men were employed in preparing for work at the mine, such as establishing new air-lines and making ready to open a second tunnel to connect workings at a lower elevation. A short railway is operated from landing at sea-coast to a point near to mine and the hauling is done by a small speeder of Ford type.

Timbering and ventilation was satisfactory, there being a main tunnel some 500 feet long connected with a raise to the surface to aid ventilation. Accommodation for employees was fair and provisions made for first aid. All other matters I found to be in accordance with the "Metalliferous Mines Regulation Act."

Khutze Inlet.—Operated by the Detroit Western Mining Company; W. Smith, superintendent; D. Watson, mine foreman. This mine is situated about 95 miles from Prince Rupert and similarly from Bella Bella. From these towns only can medical aid be secured in case of necessity. From tide-water in Khutze Inlet harbour to the mine is 5 miles on a motor-car over the railway. A first-aid man is kept by the company and first-aid equipment is provided. In order to meet any emergencies that may arise, the company keeps a special boat in readiness.

Development in tunnel and shaft has been carried on throughout the year with an average of thirty-five men. A rather large camp has been constructed at the foot of the hill during the year and a second camp has been provided near the mine; ample room is thus provided for the employees and conditions are fairly sanitary.

The power plant consists of gas-engine, 180 horse-power; Seiffle Diesel engine, 35 horse-power, belted to an electric alternating generator, 2,300 volts; aerial tram, 3,000 feet, operated by a 25-horse-power Fordson hoist; one Fairbanks-Morse hoist, 4 horse-power, with motor 50 horse-power and compressors of 2,280 cubic feet capacity.

During my inspection I found timbering to be good, ventilation fair, and all other conditions of operation to be in fair compliance with the "Metalliferous Mines Regulation Act."

James Island.—Operated by the Granby Consolidated Mining, Smelting, and Power Company; W. R. Lindsay, general superintendent; J. Peacock, mine foreman. This property is situated 25 miles south of Swanson Bay, on St. James island. Work began early in August with an average of four men. Owing to the nature of the work being chiefly surface in character, operations were discontinued at the end of September, but it is expected that work will be continued early in 1929.

I did not visit this mine during the short time that it operated, but arranged with the superintendent in charge regarding matters of magazine permit and competency of men as blasters; also in furnishing Metalliferous Mine Regulations.

NASS RIVER MINING DIVISION.

Anyox Section.

Hidden Creek.—Granby Consolidated Mining, Smelting, and Power Company; C. Bocking, general manager; W. R. Lindsay, general superintendent; J. A. Swanson, mine superintendent; F. S. McNicolas, assistant superintendent; J. Peacock, safety-first inspector. This mine has been worked continuously through the year with an average of 350 men. Production of ore has been considerably increased over year 1927, the tonnage being 1,410,963 tons. Over 700 tons of explosives were used in this mine during the year.

There has been an increase in accidents in this mine during 1928. This is partly due to increased turnover in labour and the introduction of new men to the industry. To overcome this condition a special safety department has been organized which should do much to increase the safety of the operation.

During the winter months night-school for teaching English is carried on, school being held twice a week, and workmen requiring such training are urged by the company to attend. There are many men of foreign birth now seeking work in the mines of the north and entering the mine scarcely able to understand anything said in the English language.

In my different inspections I found conditions in this mine to comply with the requirements of the "Metalliferous Mines Regulation Act."

Golskeish.—Granby Consolidated Mining, Smelting, and Power Company; W. R. Lindsay, general superintendent; C. Hollingsworth, superintendent; J. D. Ferguson, mine foreman. This mine is situated in Deep bay, some 3 miles south of Anyox, and has been worked continuously with an average of ten men. The product of this mine is used for fluxing. The tonnage produced for 1928 was 13,111 tons.

The workings are entered by a tunnel and inclined shaft. Stoping has been on the shrinkage system and at present breaking of ore has been discontinued. Sufficient pillars to sustain the main entrance of shaft connection with tunnel and workings have been provided for. No serious accident has happened and camp accommodation of a temporary character has been ample.

This operation during all my inspections was found to be in full compliance with the "Metalliferous Mines Regulation Act."

Bonanza.—Granby Consolidated Mining, Smelting, and Power Company; A. Anderson, mine foreman. This mine is located about 2 miles south of the smelter. During the year an aerial tram was installed, making connection with the mine bins and bunkers for unloading close to smelter. Grades are very even and favourable; there is only about 80 feet of difference in elevation between the terminals. So far no shipment of ore has been made from this mine.

Owing to difficulties of transport for injured in case of accident during the winter period, at my request the company has provided a proper cage for transport over the aerial tram. A first-aid room is provided with all necessary material and equipment and a first-aid man kept on the ground. A new modern camp has been constructed, consisting of a bunk-house, for sixty-four men, mess-house, and dry-room, with shower-baths, etc. The buildings are all heated with steam and a water system installed to provide against fire.

The plant installed consists so far of Ingersoll-Rand compressor, capacity 1,000 cubic feet; this is driven by belt from a 100-horse-power generator.

Thirty men were employed at the time of my last visit, but this number will increase as conditions demand in developing the ore-body. The mine was well timbered and all conditions of operation in fair compliance with the "Metalliferous Mines Regulation Act."

Hastings Arm Section.

Saddle.—Silver Crest Mining Company; W. McDonald, president; J. Knox, superintendent. This mine is situated at the head of Hastings arm. The work done during the period of operation was chiefly construction of an aerial tram of the jig type and the construction of camp buildings. Operations began about the end of May and terminated about the month of October, an average of twelve men being employed for the season.

All information respecting mine operations under the "Metalliferous Mines Regulation Act" were forwarded to the management.

Alice Arm Section.

Esperanza Group.—Esperanza Mines, Limited; N. Fraser, mine superintendent. Six men have been employed since March. No ore has been shipped this year, but development-work is being carried on and a new compressor will be installed. A new camp has been constructed during the year and provisions for first aid, with necessary equipment, has also been made.

During my inspection I found timbering conditions to be good, ventilation fair, and all other matters to be in compliance with the "Metalliferous Mines Regulation Act."

Eagle.—Kitsault Eagle Silver Mines, Limited; W. G. McMorris, managing director; H. McGuire, superintendent. This mine was worked during the month of September. Two men were employed driving the tunnel at the time of my visit. Camp accommodations were found to be adequate, provision for first-aid supplies made, and operation in general to be reasonably in compliance with the "Metalliferous Mines Regulation Act."

North Star.—Alice Arm Silver Mining Company. At the time of visit four men were employed in development of tunnel. Camp accommodation was found to be adequate and sanitary, with necessary provisions for first-aid supplies and equipment. Timbering and ventilation was fair and all other matters in accordance with the requirements of the "Metalliferous Mines Regulation Act."

Toric.—Toric Mines Company, Limited; C. H. Gerhardi, managing director; G. Hayes, superintendent. Operations began about the month of May, after 18 miles of railway-bed had been cleared and made passable, and continued until the first week in December. The average number of men was twenty-eight a day. I made three visits during operations, when I found the timbering and ventilation to be fair. To improve the ventilation I advised that a raise be driven to connect with the surface, but this was not fully effected when the mine was closed down. All other matters in general were within reasonable compliance with the "Metalliferous Mines Regulation Act."

Tiger.—Utility Mines (Number One), Limited; W. McDonald, president; W. M. Brewer, vice-president; J. Knox, mine superintendent. The mine was worked throughout the year with from four men a day in the early part to ten later in the year. So far no ore has been shipped from this property. A new camp has also been built this year. The ground does not require much timbering. In my examination of the mine I found the timbering adequate, mine ventilation fair, safety-first work provided for, and general condition to be in accordance with the "Metalliferous Mines Regulation Act."

Illiance River Section.

Silver Cord.—Kitsault Eagle Silver Mines, Limited; W. G. McMorris, managing director; H. McGuire, superintendent. This mine is situated on the north side of McGrath mountain, about 7 miles from tide-water at Alice arm. At the time of my inspection eight men were employed in tunnelling and crosscutting. I found ample accommodation for employees in camp buildings, safe provision for storage of powder, timbering and ventilation fair, provisions for first aid made, and all other matters to be in fair compliance with the "Metalliferous Mines Regulation Act."

PORTLAND CANAL MINING DIVISION.

Salmon River Section.

Silver Bar.—First National Security Company, Vancouver; F. C. Outland, manager. This mine is situated 7 miles south-west of the *Big Missouri*, on the west side of Salmon River glacier. Work was begun on July 8th and continued until September 29th, with a daily average of fourteen men. During my inspection of this mine conditions were found to be within reasonable compliance with the "Metalliferous Mines Regulation Act."

Silver Crest.—Silver Crest Mining Company; S. Campbell, superintendent. This mine is situated 3 miles north-west of the *Big Missouri*. Work was carried on during the month of September only, two men being employed. I was unable to visit this mine during this short working-period.

Silver Tip.—Silver Tip Mining Company, Limited; J. V. Clegg, superintendent. Four men worked from August to December 15th, when work was discontinued for the winter. There is adequate accommodation in camp buildings, the mine well ventilated, and the operations in general found to be in fair and reasonable compliance with the "Metalliferous Mines Regulation Act."

Big Missouri.—Buena Vista Mining Company. A. Aitcheson, superintendent. Work was continuous with an average of twenty-five men a day. Some 1,800 feet of crosscut, tunnelling, and a considerable amount of drifting have been accomplished. The mine is fairly well ventilated by means of a fan. Orders for a raise to the surface as a final requirement to bring the ventilation up to normal were given by me and this will be accomplished as soon as the workings have reached a point where it will be of most service. There is fair camp accommodation, first-aid supplies are provided, and, being only 6 miles from the *Premier*, with wire communication, medical aid is within easy reach.

In all my inspections during the year I found operations being carried out in reasonable compliance with the "Metalliferous Mines Regulation Act."

Bush.—Bush Consolidated Mines, Limited; O. Bush, managing director; W. Irvin, superintendent. This property is situated 4 miles north of the *Premier*. Work was continued throughout the year until September, when there was a temporary stoppage of operations. Six men were employed.

During my inspections I found timbering, ventilation, bunk-house accommodation, and safety-first arrangements to be very satisfactory, and all other matters to be in reasonable compliance with the "Metalliferous Mines Regulation Act."

Premier.—Premier Gold Mining Company, Limited; D. L. Pitt, general manager; B. Smith, assistant general manager; H. MacDonald, mine superintendent. Operations have been continuous throughout the year, with an average employment of 300 men. Two hundred tons of explosives were used during the year. During the early part of the year a destructive fire was encountered; the large bunk-house of 105 rooms, together with the library, reading-room, store, and post-office, were burned. Great credit is due the management for the manner in which they provided immediate temporary accommodation for the 300 men who had occupied the destroyed bunk-house. The new camp, of most modern type, was completely constructed within a period of three months. It consists of 133 rooms, a large dining-room with many improved arrangements, an athletic hall, store, and post-office. A new hospital has been erected near the No. 4 mine entrance, with a resident doctor and nurse in attendance.

During all my inspections I found operations to be in accordance with the "Metalliferous Mines Regulation Act."

Northern Light.—Northern Light Mines, Limited; G. R. Bancroft, manager; A. McKenzie, mine foreman. This mine is situated alongside of the new trail to the *Big Missouri* mine, about a mile from the *Premier* road. This mine has operated continuously since the month of May with an average of six men a day. There has been no shipment of ore during the year.

During my inspections I have found camp accommodations to be good and the operation at all times conducted in reasonable compliance with the "Metalliferous Mines Regulation Act."

Sebakwe.—Sebakwe and District Mines, Limited; C. A. Banks, managing director; C. B. North, superintendent; C. Creighton, mine foreman. Operations have been continuous throughout the year with an average of sixteen men. No ore has been shipped during the year. Camp accommodation is good and timbering and ventilation of mine I found to be conducted in accordance with the "Metalliferous Mines Regulation Act."

B.C. Silver.—B.C. Silver Mines, Limited; C. A. Banks, managing director; C. B. North, superintendent. Operations have been continuous throughout the year with an average of forty men. No ore has been shipped, but a large amount of development-work has been done in shaft-sinking, tunnelling, and crosscutting. Camp accommodation is both adequate and sanitary.

In all of my inspections throughout the year I found operations to be conducted in reasonable compliance with the "Metalliferous Mines Regulation Act."

Woodbine.—Woodbine Gold Mining Company, Limited; M. Malcolm McKenzie, superintendent. This mine is situated on the *Old Missouri* trail. Operations were continuous until the month of November with an average of fifteen men; since that time diamond-drilling has been carried on under the supervision of J. M. McDonald.

During my various inspections I found operations conducted in accordance with the "Metalliferous Mines Regulation Act."

Bear River Section.

Bayview.—W. Dan and associates. Operations commenced in August and ended in October with an average of three men.

I did not visit this mine during operations, but supplied them with information regarding proper operations and copies of Metalliferous Mines Regulations.

Dalhousie.—Dalhousie Mining Company, Limited; C. Cameron, superintendent. This mine is situated 12 miles from Stewart, up the Bear River valley. Operations were continuous until November with an average of eight men a day.

During my inspections I found accommodation for the employees to be good, first-aid material supplied, the mine well timbered, and general condition of operations in accordance with the "Metalliferous Mines Regulation Act."

Independence.—Independence Gold Mining Company, Limited; A. McLeod, superintendent. Eight men were employed all year. Work done was diamond-drilling for a portion of the time and tunnelling 125 feet. A fan has been installed to assist the ventilation and a new camp of reasonable accommodation has been constructed. Much of this work has been done since my last visit of inspection.

During my inspections conditions were found to be good and in accordance with the "Metalliferous Mines Regulation Act."

Mountain Boy.—Pat Daly Mining Company; Pat Daly, superintendent; N. Mathieson, mine foreman. This mine is situated on the north side of American creek. Operations commenced in May and discontinued for the winter in October. At the time of my visit ten men were employed in development-work in the tunnel. I found camp building adequate, mine sufficiently timbered, ventilation fair, first-aid material provided, and all other conditions of the operation to be in accordance with the "Metalliferous Mines Regulation Act."

Terminus.—Terminus Mining Company, Limited; H. A. Heywood, manager. This mine is situated 20 miles from Stewart, at the head of American Creek range of hills. At the time of my visit three men were employed. In my inspection of the mine I found timbering rather poor, ventilation fair, camp building also poor and unsanitary, and no proper provisions for the storage of powder. These different matters I ordered to be improved as required by the "Metalliferous Mines Regulation Act."

Rufus Argenta.—J. F. Duthie, Seattle; M. Reece, manager. This mine is situated some 20 miles from Stewart, on upper Bear river. At time of my visit fifteen men were engaged in diamond-drilling and camp building. I found camp accommodation to be fair and all other matters to be in reasonable compliance with the "Metalliferous Mines Regulation Act."

George Copper.—George Gold-Copper Mining Company; M. J. Donaghue, superintendent. At the time of my visit nineteen men were employed in diamond-drilling. Camp accommodation I found to be rather insufficient and of a poor order. In the tunnel I found conditions in reasonable compliance with the "Metalliferous Mines Regulation Act."

Red Top.—Owned by Niel McQueen, Vancouver. This property is situated 20 miles from Stewart, on upper Bear river. Four men were engaged until October, when work ceased for the winter. Camp accommodation was of a temporary and somewhat insufficient nature and I have requested this matter to be attended to.

Conditions in the mine were in fair order, but no provision for first aid had been provided. Conditions of operation in general were not strictly in reasonable compliance with the "Metalliferous Mines Regulation Act."

George Enterprise.—George Enterprise Mining Company; W. Smitheringale, manager, Stewart. This mine is situated within a short distance of the Bear River glacier. At the time of my visit sixteen men were employed. I found ample provision made in camp accommodation, timbering good, ventilation fair, first-aid provisions made, men of a competent character employed, and all other matters concerned in reasonable compliance with the "Metalliferous Mines Regulation Act."

Dunwell.—Dunwell Mines, Limited; R. Stewart, president; M. Little, manager. Operations began in April on a small scale. During my visit seven men were employed in driving a tunnel on the *Ben Ali* and prospecting on the South fork. The work on the *Ben Ali* was being performed under contract. During my inspection of the *Ben Ali* tunnel I discovered that the two blasters in charge were committing acts of carelessness with respect to the handling of powder, and in consequence cancelled their blasting certificates for two months. Operations, with above exception, were found to be in accordance with the "Metalliferous Mines Regulation Act."

Emperor.—Emperor Mines, Limited; S. Seiffert, manager. Work was carried on until the end of August. At the time of my visit twelve men were employed in drifting-work on the ore-

body. A very comfortable and sanitary camp is provided. The mine is well timbered, ventilation fair, and necessary provisions made for first aid. All other matters concerned in this operation were found to be in accordance with the "Metalliferous Mines Regulation Act."

Lakeview.—Lakeview (Stewart, B.C.) Mining Company, Limited; M. Little, manager; J. McNutt, superintendent. Operations continued for a period of three months. At the time of my visit seven men were employed in development-work and making a winze for connecting lower and upper tunnels. Fair accommodation in camp buildings was provided, also first-aid material and adequate equipment necessary kept on hand. The mine was well ventilated and timbering good. All other matters were found to be in accordance with the "Metalliferous Mines Regulation Act."

L. & L.—L. & L. Consolidated Mines, Limited; J. H. Thomey, superintendent. At the time of my visit six men were employed in developing tunnel, and it was the intention of the company to continue work throughout the winter. Camp accommodation was fair and the work in general was found to be in accordance with the "Metalliferous Mines Regulation Act."

Marmot River Section.

Prosperity.—Premier Gold Mining Company, Limited; D. L. Pitt, manager; B. Smith, assistant manager; S. Manning, mine superintendent. Operations have been continuous throughout the year, during which time a new camp has been built providing adequate accommodation for the men. The construction for the aerial tram is under way and will serve, when completed, both the *Prosperity* and *Porter-Idaho* mines. At the time of my inspection eighteen men were employed. First-aid material and equipment was provided, the mine well timbered, and ventilation fair. Operations in general were found to be in accordance with the "Metalliferous Mines Regulation Act."

Porter-Idaho.—Premier Gold Mining Company; D. L. Pitt, manager; S. Manning, mine superintendent. At the time of my visit eighteen men were employed. A new camp with good accommodation has been built and provisions made for first aid. The *Porter-Idaho* and *Prosperity* aerial tram is connected with this property and from this point the ore produced in both mines will be shipped over 7 miles to tide-water. A power-house necessary to operate the tram, and to otherwise control the movement of ore into bunkers and thence into the ships, has been installed at tide-water. In my different inspections I found conditions to be in accordance with the "Metalliferous Mines Regulation Act."

Marmot River.—Marmot River Gold Mines, Limited; G. Bancroft, manager. This property is situated on the South fork of Marmot river, 7 miles from tide-water. At the time of my visit fourteen men were employed in tunnelling and stripping. The camp, which is of a temporary nature, was fully adequate and in a fairly sanitary condition. Ventilation was fair and provisions for first aid were also made. All other matters concerned were found to be in accordance with the "Metalliferous Mines Regulation Act."

A number of new mines were started during 1928, which I was unable to visit while they were in operation, but in all cases when the opening of mining operations came to my knowledge a copy of the "Metalliferous Mines Regulation Act" and copies of the Regulations *re* Blasting were forwarded to the superintendent in charge of the operations.

A number of the mines which were working during 1927 did not operate during this year, but it is likely that some of them will resume in 1929.

SOUTHERN COAST INSPECTION DISTRICT.

Reports by Jas. Strang and Thos. R. Jackson, Inspectors.

VANCOUVER MINING DIVISION.

Report by Thos. R. Jackson, Inspector.

Britannia Mining and Smelting Co.—C. P. Browning, general manager; James I. Moore, superintendent; J. Emmans, assistant superintendent; Michael Curran, foreman; C. G. Dobson, mine foreman of *Victoria* mine. The mines operated by this company are situated near Howe sound, about 30 miles north of Vancouver, and are several miles inland.

The main transportation in this operation is on the 2,700-foot level, 11,222 feet long; near the portal of this level the ore is discharged into a chute and descends by gravity for 1,400 feet

to a point in a tunnel at the same elevation as the storage-bins at the concentrator. The above tunnel was finished in June and has been the means of greatly concentrating and simplifying the haulage problems. The main living camp is situated near the 2,200-foot tunnel, by which most of the men travel to their work. This camp, which is some 3½ miles from the beach, is quite conveniently reached by means of an inclined rope-haulage system in connection with an electric railway.

A number of fine new residential quarters were built during 1928. These have all modern conveniences and are a distinct advance in real welfare-work.

The number of men employed in and about the mines (which comprise the following: *Fairview*, *Bluff*, *Barbara*, *Empress*, and *Victoria*) is 875 as at December 31st, 1928. In addition to the tunnel camp, there is a camp at the *Barbara*, *Empress*, *Victoria*, and the 2,700-foot level.

The output of ore per working-day amounts approximately to 5,000 tons. The ore broken for the year 1928 was 1,025,189 tons and the ore drawn amounted to 1,664,535 tons, a difference of 639,346 tons.

Total development of mine equals 18,558 feet, made up as follows: Drifts, 4,952 feet; cross-cuts, 2,242 feet; raises, 5,276 feet; winzes, 626 feet; stope, 4,975 feet; and waste-filling, 487 feet.

Mr. Bothwell is the safety engineer of the company and is on the go all the time, devoting his time and energy to the cause. Safety councils meet each two weeks to offer suggestions for safety, welfare, and efficiency. Three first-aid classes are being carried on, with an attendance of seventy-three. It is hoped to hold a first-aid competition early in the spring, which should prove very helpful and beneficial as well.

Throughout the year considerable time and attention has been devoted to inculcating safety-first ideas into the minds of the workmen by the different officials in charge of mining operations. This is accomplished in different ways, but chiefly by means of literature, meetings, and advice on the proper methods of work.

During the visits of inspection in 1928 I found the general welfare of the various camps good. The conditions of the mines, generally speaking, were good, ventilation fairly good, and the timbering well carried out. The use of caps and powder were, with few exceptions, well looked after.

The hoisting-ropes on skips and cages are kept in good condition and replaced as soon as signs of wear or a few broken wires are reported. The engineers in charge are required to note and enter in a daily report every broken wire found in any rope, together with its exact location. The fencing-off of roadways leading to bulldoze chambers was carried out reasonably well.

It is with regret that I have to report the occurrence of four fatal accidents during the year; in addition there were several accidents involving serious results.

REPORT BY JAMES STRANG, INSPECTOR.

Clayburn Company, Ltd.—Head office, Vancouver; J. W. Ball, manager; Edward Wilkinson, mine manager. The company's kilns and pits are situated about 50 miles east of Vancouver. The mines are at Straiton and Kilgard. They are well timbered and the ventilation is good.

The company is proposing to build a new factory at Kilgard, thus dispensing with their kilns at Clayburn and concentrating all their work at the Kilgard operations.

The total tonnage of all clays mined underground for the year ending December 31st, 1928, was 31,704 tons and from the open workings 2,088 tons. Total number of men employed in the mines was twenty-three underground.

An electric 30-horse-power hoist is in use at Straiton mine, but at Kilgard the mines are operated without the use of machinery. No accidents occurred this year at any of these mines.

NEW WESTMINSTER DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Pitt Lake Mining Co.—Head office, 25 Hastings Street East, Vancouver. The holdings of this company are situated on the east side of Pitt lake, about 15 miles from Coquitlam. At the time of my visit ground was being cleared for the compressor-house and machine-shop, a good powder-magazine was built, office buildings and ore-bunkers were constructed, and preparations

were being made for the construction of the mill buildings. The company expected to be operating the mines early in 1929.

VICTORIA MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Blue Grouse.—This group is situated on the south side of Cowichan lake, about 6 miles from the lower end and about 1 mile up the hill from the lake. This mine was under development by the Pacific Tidewater Mines, Limited. It was the intention of the company to start diamond-drilling operations.

Lenora mine, situated in the Mount Sicker section, was under development by the Pacific Tidewater Mines, Limited. A tunnel is being driven through the *Lenora* to the *Tyee* mine and at present has reached an old stope on the *Lenora* boundary. It is estimated that this tunnel will have 125 feet to go before tapping the *Tyee* workings. Four men are employed.

NANAIMO MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

PHILLIPS ARM SECTION.

Alexandria Mining Co.—Head office, 905 Credit Foncier Building, Vancouver; situated on Phillips arm. Four tunnels have been driven in this property, but work is proceeding in only the lowest one at the beach. Preparations are being made to sink a shaft in the No. 1 tunnel. At present a 12-14-horse-power Petters engine and small compressor sufficient for one drilling-machine is used, but a site is being cleared to install a larger plant. Eight men are employed at this mine.

PORT HARDY SECTION.

Caledonia mine, 1½ miles east of Quatse lake, is owned and operated by the Caledonia Mines, Limited. Work during the year was confined to open-cut on the surface along the outcrop and a crosscut tunnel about 80 feet below the outcrop. The surface equipment consists of a 2-drill compressor plant, machine-shop, and a new powder-magazine. Seven men have been employed steadily throughout the year. I regret to state that one blasting fatality occurred at this mine early in March.

QUATSINO MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Coast Copper Co., Ltd.—*Old Sport* mine; C. A. Seaton, superintendent. This mine is situated on the south-west shore of Elk lake, in the Quatsino Mining Division. In addition to the present power equipment installed at Raging river, a new 150-kw. a.c. generator driven by a double Pelton-type 250-horse-power water-wheel is under construction. At the mine a new 75-horse-power electric hoist and electric haulage-motors are being installed. On surface and underground about sixty men have been employed steadily throughout the year. Ventilation in the mine is good and the "Metalliferous Mines Regulation Act" is well adhered to.

It is a matter of great satisfaction to again report that no serious accidents occurred at this operation throughout the year.

Drifing, crosscutting, etc., for 1928 was as follows: Drifting, 3,413.5 feet; crosscutting, 240.5 feet; raising, 109.5 feet; sinking, 31.5 feet; diamond-drilling, 3,963.5 feet.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS, INSPECTOR.

I have the honour to submit my report as Inspector of the Metalliferous Mines operating in the Nicola-Princeton Inspection District for the year ended December 31st, 1928.

Copper Mountain.—John McLaughan, superintendent; Mike Plecash, mine foreman. This mine is operated by the Granby Consolidated Mining, Smelting, and Power Company and is situated in the Similkameen Mining Division, 12 miles from Princeton, and is accessible by a good road, which has been greatly improved during the year, to the camp, and is the largest and most important mine in this district. About 370 men are employed. Operation has been continuous during the whole year.

Developments conducted on the lower or No. 3 level of the mine consist chiefly of diamond-drilling and the extension of this level towards the *Gardiner*, where raises and stopes have been driven to the surface and connected by crosscut drifts from the *Sunset* shaft; chiefly for the purpose of ventilation. A fair amount of surface and glory-hole work has been done during the year in this section of the property. All the work is above the lower or No. 3 level, situated on the same elevation as the coarse-crushing plant, which greatly facilitates the handling of the ore. The No. 2 level, situated at the same elevation as the camp and 800 feet above the No. 3 level, is chiefly used for drawing off the ore into the mine-cars from the glory-holes above.

The haulage-levels are large and well maintained, as it is necessary to provide ample room on these levels in a large mine of this description. The block system of signals is in use on the main haulage. Chute platforms are well protected and all dangerous openings fenced off. Blasting-signals, given by a whistle operated by compressed air, are in use for surface-blasting. The various stope walls and roofs are well cleaned and scaled by the miners after each round of shots.

Electric power, supplied by the West Kootenay Power Company, Limited, is the only power in use at this mine. It is brought a distance of some 230 miles at a tension of 60,000 volts to transformers located near the mine, where it is reduced to 2,200, 550, and 100 volts for motive power. Compressed air is provided by a Rand duplex cross-compound compressor having a capacity of 3,000 cubic feet of free air a minute, rope-driven by a 600-horse-power alternator; also a Rand cross-compound air-compressor having a capacity of 2,500 cubic feet of free air a minute, rope-driven by a 400-horse-power alternator; and an auxiliary electric-driven Rand compressor having a capacity of 1,000 cubic feet of air a minute. A 14- by 20-inch Jencks geared hoist is in use at the *Sunset* shaft for carrying men and materials between the No. 2 and the lower level, and a smaller hoist is in use for carrying men and material on the surface incline. A 3-throw pump, situated at the river and pumping against a head of 1,700 feet, provides an ample supply of water for the mine and the camp buildings.

This camp is provided with modern accommodations for the employees, consisting of good sleeping-quarters, cook-house, kitchen, stores, billiard-room, reading-room, and library. All are well lighted, steam-heated, and maintained in a sanitary condition.

A modern first-aid room is maintained and provided with an ample supply of equipment, under the supervision of a first-aid man who is at all times ready for any emergency. During 1928 two sets of self-contained mine-rescue apparatus, with an oxygen-pump, have been placed at the mine, and a number of men have been trained in the use of same.

During the year a new bunk-house was erected to replace the No. 3, which was destroyed by fire during the early part of the year. This consists of a two-story building, 30 by 160 feet, provided with twenty double rooms, wash-house, shower-baths, toilets, and lockers on the lower floor and twenty-eight double bedrooms on the upper floor. These are provided with steam-radiators and electric lights. The whole interior of the building is partitioned and covered with Gyproc for the purpose of making the building as fire-proof as possible. Five hydrants with fire-extinguishers and fire-alarms are installed inside the building and are ready for use in any emergency.

During my last inspection I found 255 men employed in the mine and 121 at the surface. The mine and the surface plant were in good condition and the provisions of the "Metalliferous Mines Regulation Act" well complied with.

Nickel Plate.—G. P. Jones, general manager; W. B. Knowles, mine superintendent. This mine is on Nickel Plate mountain at an elevation of 5,600 feet, 3,800 feet above the town of Hedley, in the Similkameen Mining Division, where the mill and power plant are located. The ore is transported down the side of the mountain on a 10,000-foot gravity-tram, with 5-ton skips operated in two sections and controlled by friction-brakes and compressed-air engines. The mine is entered by an adit-tunnel running into the mountain, and is developed to the dip by a 16- by 8-foot, 20° slope, provided with double tracks and a manway, extended to the 1,500-foot level, with branch crosscuts driven off to the different ore-bodies. The ground is of a very hard nature and as a result little timber is in use on these operations. The ore-bodies lie at an easy angle of inclination and the stopes are somewhat large. The ore is loaded into mine-cars and taken to the top of the tramway.

During 1928 considerable diamond-drilling and drifting have been carried on in the lower section of this mine for the purpose of proving the extension of the ore-bodies with depth.

This work depends upon a 2,000-horse-power hydro-electric power plant, situated on the Similkameen river, about 2 miles below the town of Hedley, which provides power for the mine and the mill, while an auxiliary steam power plant, situated near the mill and consisting of three return-tubular boilers and a single Goldie-Corliss engine, coupled direct to a 375-horse-power generator, may be used in case of emergency; this has not been operated during 1928.

Operations at this mine generally cease during the winter months owing to the freezing of the river and consequent shortage of water. Operations were temporarily suspended on November 21st, 1928, and will no doubt open up as soon as the river conditions permit.

During my inspections I have found the general conditions of this mine to be very good and the provisions of the "Metalliferous Mines Regulation Act" well complied with, sixty men being employed underground.

Pioneer.—David Sloan, superintendent; Robert Sloan, mine foreman. This mine is situated in the Bridge River district, 50 miles north of the Pacific Great Eastern Railway, and is accessible by a good road from the Bridge River Station to the mine. Active developments both at the surface and underground during the last two years have resulted in this mine being grouped among the most important gold-mines in the Province.

The old inclined shaft has been replaced by a new well-timbered 2-compartment 7- by 8-foot vertical shaft, situated about 200 feet west. It was raised from the 600-foot level to the face of an old adit-level 255 feet in length, through which the ore, after being crushed underground, is drawn and then conveyed in mine-cars to the ore-bin at the mill. This shaft is provided with 4- by 4-inch wood guides, steel cage with safety-catches, which is operated by a 10 by 12 Rand hoist situated a short distance from the shaft, where a large chamber has been excavated, providing facilities for the shaft head-frame, landing, and a hoist-room.

The chief lateral developments are being conducted on the 600-foot level. An electrically driven 9 by 16 jaw coarse crusher is situated on the 500-foot level near the shaft and connected by a raise to the 400-foot level, where practically all the stoping is being done at present.

One of the great assets of the *Pioneer*, as of the other Bridge River properties, is the large amount of power obtainable from Cadwallader creek, which flows through this gold-bearing belt. Power is obtained at the *Pioneer* by 6,000 feet of 3-foot wood-stave pipe laid along the west side of the creek, which, at the mill, provides a head of 260 feet and is used for operating four Tuttall water-wheels connected to the mill machinery by belt-drive. A 72-inch Pelton wheel connected direct to a 2-stage Ingersoll-Rand air-compressor, with a capacity of 1,700 feet of free air a minute, provides power for the mining-machines, pumps, and mine-hoist.

As was necessary, camp accommodation has progressed with mine-development, and ten dwelling-houses have been built on the side of the hill near the mine for the use of families, while several small houses have been built by employees themselves. The main bunk-house is a two-story 30- by 50-foot building, with ten bedrooms on the upper floor and five on the lower. A reading-room and a wash and change room is also provided in this building. During my last visit of inspection thirty men were employed underground and fifteen on the surface. I found general conditions in this mine to be good and the provisions of the "Metalliferous Mines Regulation Act" well carried out.

Coronation.—H. C. Wilmot, superintendent; M. McGregor, mine foreman. This mine is situated in the Bridge River district, about a mile south of the *Pioneer*. It has been developed by a well-timbered 4 by 8 vertical 2-compartment shaft, in which a steel cage, fitted with safety-catches, is operated by a small 6 by 9 Lidgerwood compressed-air hoist, situated in a large chamber at the terminus of the main adit-drift, through which the ore is trammed in cars from the shaft to the mill.

The mill has not been worked during 1928 and the only work done has been for the purpose of proving further ore-bodies. A 5 by 6 adit-drift has been driven to the north-west on the 200-foot (or lower) level, which attained a distance of some 700 feet from the shaft. During the year eight men were employed underground and four at the surface.

The *Coronation*, like the *Pioneer*, is provided with power from Cadwallader creek, which runs close to the mine. There has been installed 930 feet of 3-foot wood-stave pipe along the creek to the mill, where a head of 45 feet is obtained, providing 140 horse-power at a Pelton wheel which operates the mill and an air-compressor.

During my inspections of this mine I found conditions very satisfactory and the provisions of the "Metalliferous Mines Regulation Act" complied with.

Lorne.—E. P. Crawford, superintendent. This mine is situated about 2 miles south of the *Coronation*, and after being idle for several years has been the scene of active developments during 1928, intended to place it among the producing mines at an early date. The old camp-site, situated a short distance above the road leading to the *Pioneer*, where all previous work was conducted, has been replaced by a new and modern camp situated at the foot of the hill near Cadwallader creek, 500 feet lower elevation than the main haulage-level being driven into the hill. The new mill will be built below the portal of this tunnel near the creek during 1929.

During 1928 the road necessary for the transportation of the equipment was built down the side of the hill. A wood-stave pipe-line laid down the side of the creek provides power for a new 2-stage Ingersoll-Rand air-compressor, belt-driven by a 3-foot Pelton wheel. A 10,000-foot sawmill was erected in 1928, driven by water-power, for providing the lumber for the camp buildings. A large two-story cook-house and dining-hall, 30 by 110 feet, has been erected, the upper floor being used for the above purpose, while the lower floor I understand will be chiefly used for storage. A well-equipped two-story bunk-house, 30 by 110 feet, has been erected also and will provide sleeping-quarters for about sixty men.

During my last inspection about seventy men were employed. Every indication is given that the Bridge River district will, at an early date, be one of the most important gold-mining areas in the Province. Conditions appeared to be very satisfactory and every attempt being made to comply with the provisions of the "Metalliferous Mines Regulation Act."

Planet.—Gordon Grant, superintendent. This mine is situated in Stump Lake district, 30 miles from Merritt and close to the Kamloops–Merritt highway. It has been the scene of active developments during 1928, with the object of commencing operations as a productive mine during the early part of 1929.

The inclined shaft following the ore has been extended to the 300-foot level and a limited amount of lateral work has been done on the lower level. To facilitate future operations it has been decided to drive a 750-foot 6 by 7 adit-level into the side of the hill, to be used as the main working-tunnel. This will be situated close to and on the same elevation as the ore-bin at the mill, and will be 243 feet below the portal of the inclined shaft above. This will greatly simplify the ventilation and pumping and the working of the mine. This tunnel has already been driven 240 feet.

During 1928 most of the work has been carried out at the side of the hill, immediately below the entrance to this adit-level. A modern mill and concentrator has been erected and a water system for the camp and mill installed. This mill consists of the usual ore-bin, jaw-crusher, large ball-mill, together with flotation-cells, settling-tanks, etc. It is operated from a line-shaft, provided with clutch-gear, by belt-gearing from a 4-cylinder 250-horse-power Petters oil-engine, running at a speed of 275 revolutions a minute. This engine operates the mill and a belt-driven 2-stage Ingersoll-Rand air-compressor having a capacity of 750 cubic feet of free air a minute. A large bunk-house, kitchen, and dining-room is being erected.

During my inspections I found this mine to be in good condition and the provisions of the "Metalliferous Mines Regulation Act" well complied with.

Aberdeen.—I. Rosenthal, superintendent: William Adamson, mine foreman. This mine is situated in the Mamit Lake district and is accessible by a good road, 10 miles in length, north of Lower Nicola. The mine, while one of the oldest in this camp, has been inactive since the year 1926, at which time the Merritt Mines, Limited, dewatered the mine and did a small amount of work underground. It may be described as worked through a vertical shaft, sunk to a depth of 166 feet below an adit-level driven into the side of the hill. The head-frame, landing, and dumping arrangements are situated on the side of the hill, some 23 feet above the entrance of the adit-drift. Near the entrance to this drift a raise has been driven from below and is provided with staging; ladders are used as a means of ingress and egress from the mine below.

The mine was worked during the early part of 1928 by Aberdeen Mines (1928), Limited. It was found to be filled with water and a Cameron sinking-pump was installed in the shaft, and after considerable work the mine was drained. A fairly large sump, having a capacity of twenty-four hours' run of water, was cut below the floor of the 110-foot level a short distance east of the shaft, which made it rather a simple matter to cope with the water. This level was extended 100 feet and the shaft sunk 50 feet below the lower level. A small

amount of crosscutting was done at the foot of the shaft for the purpose of encountering the ore-chute found above.

About 2,000 feet east of the *Aberdeen* a new 2-compartment timbered shaft was sunk on a gravel flat 75 feet from the creek. A shaft-frame was erected and a gas-driven hoist installed as this shaft is to be used in future development. However, after the shaft was sunk 40 feet a considerable amount of water was found to be draining in. This operation was therefore abandoned.

The power plant, which consisted of a 25-horse-power loco-type steam-boiler, was further augmented during 1928 by a larger but similar type boiler equipped with the necessary fittings for the use of fuel-oil. This provides power for a small steam-driven shaft-hoist and a steam-driven 3-drill air-compressor, used for operating the machine-drills and the mine-pumps.

During 1928 fifteen men were employed. The company ceased operations during the latter part of the year.

I found the general conditions of this mine to be fairly good, camp buildings in good condition, and the provisions of the "Metalliferous Mines Regulation Act" adhered to.

Iron Mask.—J. P. McFadden, superintendent; Joseph Fisher, mine foreman. This is a shaft operation, situated about 7 miles from the city of Kamloops. It has been the most important mining operation in this district. A large amount of development-work has been done on the lower level during the past few years. This development was suspended and the mill placed in operation during the summer. Operations were suspended during the month of November.

During my last visit of inspection twenty-eight men were employed. The provisions of the "Metalliferous Mines Regulation Act" were well complied with; good accommodation was provided for the employees and the cook-house; wash-rooms and bunk-house were found to be in a sanitary condition.

Thelma.—J. Green, superintendent. This mine is situated 10 miles west of Nicola at an elevation of 5,000 feet. Operations have been carried on during the whole of the year by a small crew of men, the work generally being of an exploratory nature. An inclined shaft has been sunk into the side of the hill and a limited amount of drifting done on the ore; a gas-driven hoist being used for power purposes, while the road to the mine has been greatly improved during the year.

I found general conditions of the mine and the camp accommodations to be very good and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

Arum.—Fred Bradley, superintendent. This mine is situated 4 miles from Jessica, on the South fork of Ladner creek, in the Yale Mining Division. Operations commenced during 1928 with an average of ten men. The work is of an exploratory nature and consists of adit-levels driven into the side of the mountain, at different levels, along a contact in a greenstone formation carrying free gold. A road has been constructed around the side of the hill from the *Emancipation* and the necessary camp buildings have been erected. I found the general conditions of the mine and the camp very satisfactory and the provisions of the "Metalliferous Mines Regulation Act" well complied with.

Big Horn.—A. T. Millar, superintendent; T. H. Millard, mine foreman. This mine is situated 15 miles south of Keremos. The camp, power plant, and the mill are located at the foot of the mountain, a short distance east of the highway. The mine is 1,600 feet above and is connected to the mill by an overhead tramway 3,000 feet in length.

The mill has not been in operation during the year, but a small amount of drifting, raising, and crosscutting has been done in the east drift for the purpose of exploration. This work was suspended during the fall of the year. During my inspections I found the general conditions of the mine to be satisfactory, good accommodation provided for the employees, and the "Metalliferous Mines Regulation Act" well complied with.

WESTERN KOOTENAY AND BOUNDARY DISTRICTS.

REPORT BY H. H. JOHNSTONE, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for the West Kootenay and Boundary Districts for the year 1928. This does not include properties in the Kaslo and Slocan districts, which were under the office in Fernie.

TRAIL CREEK MINING DIVISION.

The Rossland properties operated by the Consolidated Mining and Smelting Company were the *Le Roi* and the *Centre Star*. An average of eighty-two men was employed in and about these mines throughout the year. Operations consisted mainly in recovering what ore was in sight, and, in the latter months, of salvaging pipe, track, pumps, and all underground equipment. A diamond-drill hole was run from the sixth level of the *Centre Star* into the old workings of the *Nickel Plate*. These latter workings were unwatered down to that level and a connection made by means of a crosscut. After extensive sampling the crosscut was closed by means of a strong barrier of reinforced concrete and the workings allowed to refill.

The *O.K.*, *I.X.L.*, *Midnight*, and *Snowdrop* of the free-gold belt on Little Sheep creek were operated by small forces of leasers.

The *Velvet*, owned by the Rossland-Velvet Mining Company, had two men working with hand-steel in the long drainage-tunnel, to pick up the downward continuation of the ore-chutes in the upper levels.

The *Norway*, situated on the Columbia river south of Trail, was operated in a small way by the Norway Mining Company. W. McKay, of Trail, was manager.

NELSON MINING DIVISION.

The *Yankee Girl* at Ymir was operated throughout the year with an average force of forty men, first by the Yankee Girl, Limited (O. C. Thompson, superintendent), and later by the Enterprise Consolidated Mining Company, Limited (G. L. Thompson, superintendent). The name of this last company was afterwards changed to the Yankee Girl Consolidated Mining Company, Limited.

Under the last-named management, work was discontinued in the old workings on Bear creek and a new and quite commodious camp built on the Wildhorse side of the mountain, the purpose being to drive a low-level tunnel from that side. Work on this tunnel was started with a small gas-driven compressor. Electricity was brought in by the West Kootenay Power and Light Company, and a Sullivan compressor with 1,800-cubic-feet-a-minute capacity, electrically driven, is now supplying the power. The new bunk-houses and boarding-houses are very comfortable and up-to-date.

The *Goodenough*, on Wildhorse creek, was operated at different times by different parties. Latterly it was being worked by the original owners, but is now closed. An average of fifteen men was employed.

The *Howard*, on Porcupine creek, owned and operated by Howard, Mines, Limited (F. W. Holzheimer, superintendent), operated throughout the year with an average of twelve men.

The *Hunter V.*, on Porcupine creek, owned and operated by the Consolidated Mining and Smelting Company (D. Matheson, superintendent), was operated throughout the year, with the exception of a shut-down for about a month. This shut-down was due to the breaking of a cable on the aerial tramway. A second raise from the lower tunnel to the upper works has been completed recently.

The *Reeves*, *McDonald*, and *O'Donnell* groups, on the Pend d'Oreille river, were operated by the Victoria Syndicate, with M. O'Donnell in charge of all three. The work consisted entirely of development. An average of twenty-one men was employed.

The *Kootenay Belle*, on Sheep creek, was operated during most of the year. The work had to be discontinued owing to danger from snowslides. Ten men were employed.

The *Red Bird*, situated across the Pend d'Oreille river from the *McDonald* group, was operated for part of the year on development. Five men were employed. At present diamond-drilling is being done.

The *Alexandria*, on Wolf creek, a free-milling property belonging to the *Queen* group, was operated under lease by Staggner & Allen with nine men. The ore was milled at the *Queen* mill.

The *Aspen*, on Deer creek, was operated by the Salmo-Malartic Mining Company (P. Horton, superintendent) throughout the year with an average of fifteen men.

The *Salmo Consolidated*, on Elk creek, was operated by the Salmo Consolidated Mines, Limited (P. Horton, superintendent). An average of ten men was employed. Work consisted of development by means of tunnels.

The *Silver Dollar*, at Salmo, was worked for a short time by the owner. The Consolidated Mining and Smelting Company afterwards took a bond on it and has started to sink the shaft another 100 feet.

The *Perrier*, situated near Apex, on the Nelson & Fort Sheppard Railway, is a free-gold property which has been idle since the war. It has been re-equipped and is now worked in a small way.

The *Silver Reef*, on Anderson creek, near Nelson, has been operated in a small way by the Silver Leaf Mining Company (J. H. McLean, superintendent). Three men were employed.

The *Iolanthe* and *Susceann*, at Ginol, on Kootenay lake, were operated by the Associated Mining and Milling Company, Limited. An average of eleven men was employed.

The *Relief*, one of the old properties on Erie creek, was operated by the Second Relief Mining Company, Limited (P. E. Oscarson, superintendent). Six men were employed.

The *Arlington*, another of the old properties on Erie creek, was operated by the Arlington Mining Company (A. D. Westby, superintendent). Four men were employed.

The *Granite-Poorman* has shown signs of revival. Ground was broken for a low-level tunnel on a level with the mill at Taghum, on the Kootenay river. Work was suspended later.

The *Royal Canadian* was operated for a short time by the Kootenay-Premier Mining Company, after which work was discontinued.

The *Golden Age* and *Euphrates*, at Golden Age Siding on the Nelson & Fort Sheppard Railway, were worked spasmodically. Four men were employed on the *Euphrates* and eight on the *Golden Age*.

AINSWORTH MINING DIVISION.

The *Florence*, on Princess creek, is owned and operated by the Kootenay-Florence Mining Company, Limited (Howard B. Dennis, superintendent). Work on the long tunnel driven from just above the level of the mill on Kootenay lake was continued. Several crosscuts have been driven from the main tunnel. Several of these broke into water, which for a time forced discontinuance of work. At one time over 2 feet of water was flowing out of the tunnel. This gradually drained off and work was continued. Ventilation has been a serious problem in this tunnel, but the management has shown itself alive to the need and has kept the air at the face in good condition. At the present time there is one ventilating-pipe delivering fresh air and another one exhausting bad air. A fine new camp has been built. An average of twenty-seven men was employed.

The *Banker* and *Albion* were under bond to the Consolidated Mining and Smelting Company. L. W. Oughtred was in charge of work. An average of ten men was employed. The bond was finally dropped. At present four men are leasing on the *Banker*.

The *Richard 1st* is a new property located at Deanshaven, on the east side of Kootenay lake and a short distance south of Riondel. The owners did some work and eventually leased it to William Smith and partners. Seven men are working.

SLOCAN CITY MINING DIVISION.

The *Piedmont*, located on Lemon creek, was worked with an average of fourteen men by the Piedmont Mining Company. The property is well equipped with machinery and a new tram-line from the mine-workings to the lower camp.

The *Meteor* has been worked under lease by William Cullinane and associates.

The *Arlington* is one of the old mines of this district and is being reopened by a Coast syndicate. The tunnels were badly caved and considerable work had to be done cleaning them out and retimbering.

TROUT LAKE, LARDEAU, AND REVELSTOKE MINING DIVISIONS.

The *Silver Cap*, one of the old producers, after having lain idle for a number of years, was worked for a few months with a force of eight men.

The *True Fissure*, which has been worked steadily for a number of years on development, was worked for part of the year. D. Morgan, of Ferguson, was in charge with ten men.

The *White Quail*, situated on the east side of Gainer creek, was worked by the White Quail Syndicate (G. B. McMillan, superintendent). Seven men were employed on development-work, which consisted of tunnels and open-cuts. On my last visit (in October) supplies were being sent in for the continuance of the work during the winter.

The *Snowflake*, situated on Clabon creek, near Albert Canyon, on the main line of the Canadian Pacific Railway, was worked continuously throughout the year by the Snowflake Mining Company, Limited (D. H. Lougheed, superintendent). Fourteen men were employed on development. The property is well equipped with machinery and with camp buildings.

The *Silver Creek* group, owned and operated by McCullogh & Bush, is situated on Woolsey creek. R. F. Hill, of Revelstoke, is superintendent. Eleven men were employed on development. This property is also well equipped.

GRAND FORKS DIVISION.

The principal work in the Grand Forks Division is being done on the *Union*, in Franklin camp, where the Hecla Mining Company is employing twenty men on development. The mine is very well equipped with machinery and camp buildings. Paul Schulz, who is in charge of the work, is always anxious to comply with the requirements of the mining regulations.

The *Molly Gibson*, in the Burnt basin, owned by a group of Rossland men, was worked occasionally during the year. Three men were employed.

The *Manitou*, also in Burnt basin, owned by J. Grafton, of Rossland, was worked for short periods. Three men were employed.

GREENWOOD DIVISION.

The *Providence*, at Greenwood, was worked for part of 1928 under lease to Loomis & Wilson. A new shaft was sunk to connect with some of the old workings. Work was discontinued later and the property was again leased to the Providence Leasing Association, O. Kron being in charge.

The *Elkhorn* was worked for a short time by leasers.

The *D.A.* was worked at different periods during the year. Four men were employed.

The Wallace Mountain district has been the most active in the Greenwood Division.

The *Bell*, owned and being operated by McIntosh & Lee. Twenty men were continuously employed. This property has been a steady shipper of high-grade ore.

The *Sally*, owned and worked by Sally Mines, Limited (E. Nordman, superintendent), employed an average of twenty-six men. Development and production have been carried on. The camp is well equipped with camp buildings for single men and with cottages for married men.

The *Wellington*, owned and worked by the Wellington Syndicate (A. J. Morrison, superintendent), was worked continuously with an average of nine men. Work was discontinued in the upper workings and concentrated on the driving of a lower tunnel, which will be connected by a raise with the upper workings.

The *Beaver*, operated by Beaver Silver Mines, Limited (Roy Clothier, superintendent), employed an average of nine men. The shaft was deepened and a drift run from the bottom to pick up the ore.

The *Highland Lass* was operated under lease and bond by the Highland Lass, Limited. A compressor has been installed and new camp buildings erected.

The *Laurion*, situated on Westkettle river, about 4 miles south of Beaverdell, was worked by the Laurion Mining Company (W. E. Johnston, superintendent). The property is equipped with a compressor. Eight men were employed.

There were no fatal accidents in these districts.

Conditions in and about the mines have been found to be good and the requirements of the "Metalliferous Mines Regulation Act" and Regulations *re* Blasting well complied with. Infringements have been corrected when pointed out to operators.

EAST KOOTENAY, WEST KOOTENAY, AND BOUNDARY INSPECTION DISTRICTS.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit the annual report covering the operation of metal-mines in the Kootenay-Boundary District during 1928, as provided for by section 9 of the "Metalliferous Mines Regulation Act." To provide for inspection of the increasing number of mines during 1928, H. H. Johnstone, Inspector of Mines, Rossland, had charge over the West Kootenay and Boundary District (except the mines around Sandon and Kaslo, which were inspected by Henry

Miard, Inspector of Mines, Fernie). H. Miard also carried out the inspection of the metalliferous mines situated in the East Kootenay District.

The increased activity in mining has resulted in the opening or reopening of many mines, previously abandoned, and during the year eighty-three came under our inspection. The mines are widely scattered and in some places difficult to reach, and it would greatly assist in the work if the operators or leasers would comply with section 20 of the "Metalliferous Mines Regulation Act" as to giving notice of the opening or reopening of their mines or on the cessation of operations. Failure to give such notice makes it extremely difficult to keep in touch with many of the smaller operations. Such notice is extremely desirable, in order that we may assist owners to comply with the regulations especially *re* blasting, approval of powder-magazines, and the granting of blasters' certificates.

WEST KOOTENAY AND BOUNDARY DISTRICTS.

In this district seventy-seven mines were inspected during 1928, and the general conditions with respect to safety and compliance with the regulations were very good.

In many of the smaller operations it was necessary to draw attention to sections of the Blasting Regulations, and we found a ready response in the adoption of operations conforming to these regulations. Many of the small properties, situated high up in the mountains, find it difficult to find places free from snowslides to erect magazines, but in such cases advantage was taken to build an artificial mound in front of the magazine.

The reports of H. Johnstone and H. Miard cover this district in detail.

EAST KOOTENAY DISTRICT.

In this district only six mines were in operation during 1928.

The *Sullivan*, at Kimberley, operated by the Consolidated Mining and Smelting Company, as usual was the largest, and many improvements were made during 1928 for greater safety, better living accommodation for their employees, and for greater production. The report of H. Miard gives these in greater detail.

Practically no work was done at the *Alice* at Creston, the *Aurora* at Moyie, or the *Globe* mine at Skookumchuck.

The *Paradise*, at Invermere, was in operation during the entire year and an experimental concentrator was built close to the mine. The conditions in the mine and in the living-quarters for the workmen were very good and the "Metalliferous Mines Regulation Act" very well conformed to. At present this property is being operated by the Victoria Syndicate.

The *Giant*, at Spillimacheen, was worked in the early part of the year by Messrs. Greenshields and associates, with Charles Hanna as superintendent, but was closed down later. During operation the mine conditions were very good with respect to safety, and living accommodation for the workmen equally so. The same interests operated the *Monarch*, at Field, during the entire year, with Frank Eichelberger in charge. The conditions in and around the mine were well maintained and every attention paid to the "Metalliferous Mines Regulation Act."

Some work was done on the *Royal Crown*, situated near Lumberton, but the claim was abandoned late in the year. Conditions here were far from being according to the regulations and work was stopped until this was attended to.

The *Payroll*, in the same neighbourhood, was operated by leasers during the year and conditions were found to be very good.

INSPECTION.

Visits to the larger mines are made frequently, to the smaller at longer intervals, the conditions found generally determining the interval between the visits. Where conditions are found to be good and the "Metalliferous Mines Regulation Act" well complied with, frequent visits are not necessary and the time is spent in visiting other mines.

While we have on a few occasions been obliged to draw attention to failure to comply with the regulations, the inclination is, on the whole, to comply with these, and we generally find operators ready to do so.

ACCIDENTS.

Seven accidents were reported to this office during 1928 under section 19 of the "Metalliferous Mines Regulation Act," all under subsection (*b*). These accidents all occurred underground and one proved fatal.

The fatal accident occurred in the *Sullivan* and involved a barman, who, while attempting to bar down a piece of loose rock, had his crowbar struck by a larger piece from above, thus upsetting his balance. He fell from the ladder and rolled down the chute, where he was afterwards found in a dying condition.

This work is dangerous and the men are especially picked, experienced workmen; special ladders are provided and every facility is afforded them to make the work as safe as possible. In this case, however, an unforeseen condition arose, by the falling of a large piece of rock from above on to his crowbar.

The majority of the other (non-fatal) accidents were due to pieces of rock rolling down the muck-pile, inflicting injuries to the workmen's foot or leg, and in one case a small piece of rock flying from the drill struck a workman in the eye, causing him to lose it.

All the accidents occurred in the *Sullivan*, which is a very large operation, and I desire to state that in all my mining experience I have never come in touch with mining operations where more interest was taken in endeavouring to prevent accidents, or greater facilities afforded for officials and workmen to suggest means for the prevention of accidents than in this mine.

Only one fatal accident occurred during 1928, as compared with four the previous year, being a decrease of three, or about 0.4 per thousand.

In non-metallic mining some work was done during 1928 on the phosphate-deposits near the Crowsnest pass by the Consolidated Mining and Smelting Company of Canada and a shipment of 500 tons made during the summer. At the end of the year commencement was made on the shipment of another 500 tons. Indications point to further production in 1929 on the completion of the concentrating plant at Trail, as this company has large holdings of phosphate ore in this district.

Work on the gypsum-deposits at Mayook was discontinued early in 1928.

WELFARE-WORK.

The only mine at which any attempt was made to carry out this work was the *Sullivan*, where classes in first aid to the injured and other educational subjects are maintained during the winter months. Instructions and practice in mine-rescue apparatus is also maintained at this mine, the all-service mask being used. The lesson taught by the sad disaster at the Hollinger mine in Ontario has not been overlooked at the *Sullivan* and regular practices in mine-rescue work with the all-service masks are maintained.

Apparatus for dealing with fires, either inside the mine or outside, are maintained on a high level, fire-hydrants and hose being installed at every strategic point in the mine. Careful inspections of the bunk-houses are also carried out and every angle is searched to prevent accidents. The success of this care is a matter of comment to all who visit the camp.

I wish again to thank the workmen and officials for their assistance and co-operation, as I realize that it is only through the co-operation of all parties that safety can be maintained.

EAST KOOTENAY AND WEST KOOTENAY DISTRICTS.

REPORT BY H. E. MIARD, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines on the operations visited during the year 1928 in the Fort Steele, Ainsworth, and Slocan Mining Divisions. Under the Regulations *re* Blasting,, 139 certificates of competency were granted in the course of these inspections, six being issued as substitutes.

EAST KOOTENAY DISTRICT.

FORT STEELE MINING DIVISION.

Sullivan.—Consolidated Mining and Smelting Company of Canada, Limited; general superintendent, E. G. Montgomery; mine superintendent, William Lindsay. This very important operation employed throughout the year a working-force of approximately 650 men, 350 underground. The mine is worked on a modified pillar-and-chamber system well adapted to the existing natural conditions. A detailed description of it would undoubtedly be extremely interesting, but would also, unfortunately, exceed the scope of this report. The mine is divided

in two sections connected by an inclined blind shaft nearly 600 feet high, ore and waste chutes, and a ventilating-raise.

The ventilation, entirely natural, is very good, and during the colder part of the winter season it becomes so powerful that it has to be checked by means of doors. A shallow air-shaft sunk during the year from one of the highest points of the surface above the upper mine workings completes the ventilating system very effectively. The installation of a fan as an auxiliary means of air-propulsion is being considered, as, at some times of the year, the difference in temperature between the mine and the surface may become insufficient to ensure the circulation of the desired quantity of air.

The power plant consists of four 2-stage compressors, with a total rating of 14,500 cubic feet of free air a minute, delivered at a receiver-pressure of nearly 100 lb. a square inch. Three of them are driven by synchronous motors and the other can be run by either steam or water power. The capacity of this section of the plant will shortly be increased to more than 20,000 cubic feet by the installation, now in progress, of two Bellis-Morcom high-speed compressors. Under ordinary conditions the two steam-boilers are used for heating purposes only.

Direct current for haulage and other purposes is supplied by eight motor-generator sets of various capacities, four of them in the power-house and four underground. Electrical power is brought to the mine from the hydro-electric stations of Elko and Aberfeldie at a line-pressure of 66,000 volts. This is lowered to 2,200 for use at the power plant and for secondary transmission; then, further, to 220 by the underground transformers. The d.c. pressure on the trolley-lines is also 220 volts.

The output, about 5,000 tons a day, is hauled by electric locomotives exclusively. This occupies two 24-ton tandem locomotives, four smaller units of the same type, two storage-battery locomotives, and two "Mancha mules." There are ten loading-machines in use. All trolley-wires are kept more than 7 feet above the rail and especially designed switches permit disconnection of any branch line from the general system.

The old-fashioned chute-doors are being replaced as rapidly as possible by compressed-air-controlled gates, which eliminate the possibility of a large number of minor accidents.

Timber is used in the lower mine only in the construction of chute-batteries, loading-platforms for the drag-line scrapers, or in the erection of partitions and platforms in raises. Wherever the ground requires permanent support concrete and steel sets are erected. The blind shaft is lined with reinforced concrete exclusively, wood appearing there only in the form of guides, ladders, and platforms.

All roadways are of very generous dimensions and they are kept surprisingly clean. The sanitary conditions are excellent. Drinking-water is brought in the mine by a special pipe-line and is distributed through three drinking-fountains and a number of taps. Where this system does not extend, pure water is supplied in small portable metal tanks.

For all other purposes (such as drills, supply, fire-protection, etc.) two underground reservoirs, having capacities of 60,000 and 13,000 gallons respectively, have been provided by the erection of dams in blind drifts of the upper mine. Water will shortly be delivered from these to the workings of the 3,900-foot level under a pressure approaching 250 lb. a square inch.

The matter of fire-protection has been carefully studied, both underground and on the surface. In the mine fire-hydrants and hose-racks have been installed at four different points; that is, wherever there might be at any time an accumulation of inflammable material. All constructions such as power-station, hoist-room, drill-repair shop, carpenter and machinist shops, etc., have been made largely fire-proof. Dry sand and also five chemical fire-extinguishers are kept underground. There are sixteen all-service masks and two H.H. oxygen inhalators on hand at the mine.

The bunk-houses are detached, two-story buildings, with central steam-heating, outside open stairways, and no communication between floors. Each contains sixteen rooms and houses a maximum of thirty-two men. Ropes permanently fastened to the wall by each room window provide an additional means of exit for the inmates of the upper story should they be prevented from reaching the regular fire-escapes. Fire-hoses and chemical extinguishers are in evidence everywhere.

R 72 machine-drills, on either tripod or column bar, and Ingersoll-Rand pluggers are used almost universally. Steel-netting goggles are provided free of charge and their use is strongly recommended to the workmen when either starting holes or using the plugger for any purpose.

I regret to say that this very wise precaution is not always observed as strictly as it should be by the directly interested parties.

The most dangerous work performed in the mine seems to be the barring-down of loose rock after blasting. This task is of course entrusted only to experienced and specially chosen miners. The ground to be trimmed is lighted by powerful electric lamps of the search-light type and the ladders are securely anchored. The pinch-bars used are made of special steel and are as light as their required length and strength allows. Safety-belts are available, but in most cases the men object to being fastened to their ladders, and no doubt this point of view does not lack reason.

A large and remarkably well-appointed hospital is maintained close to the mine on the company's ground. First-aid requirements have not been overlooked. There are six fully equipped ambulance-stations (two outside and four underground). Ten first-aid boxes containing emergency supplies are distributed through the mine-workings. A motor-ambulance is available to transport injured men from the mine to the hospital. There are many qualified first-aid men among the staff and employees, one of whom, H. Parsons, holds an instructor's certificate.

A safety-first committee has been organized, with D. Campbell, chief underground surveyor, as chairman, and H. Twells, superintendent of transportation, as secretary. This committee is very active and has already attained important results. An interesting feature has been the installation of "suggestion-boxes" at different points, with a notice, posted above each one, inviting the men to commit to writing and drop in the box any idea of theirs which might increase the safety or the efficiency of the operations. It is a significant fact that fifteen such suggestions were acted upon during the month of December, their authors being suitably rewarded when their identity was known.

Six serious and one fatal accidents were reported during 1928. They are described in detail in another part of this report.

A three-story, 116- by 51-foot, concrete, steel, and brick warehouse and office building was completed at the beginning of the winter and is now occupied. A new carpenter-shop, also of fire-proof construction, was erected during the year.

In conclusion, I must state that the conditions found to prevail at the *Sullivan* were always entirely satisfactory. Not only were the provisions of the "Metalliferous Mines Regulation Act" strictly observed, but at all times the spirit responsible for the high degree of efficiency characterizing the management of the operations from the economic standpoint manifested itself in the measures introduced in the interest of safety. Our thanks are due to the official staff and to the employees at the *Sullivan* for their intelligent and sincere co-operation during the past year.

WEST KOOTENAY DISTRICT.

Ainsworth Mining Division.

The *Cork-Province*, situated on Keen creek, near Nashton, is operated by the Cork-Province Mining Company, with A. M. MacPherson as superintendent. The power plant was destroyed by fire in the early part of 1928 and underground operations, limited to the driving of prospecting-drifts, were hampered thereby for a considerable period. At the time of the last inspection eight men were employed underground and five on the surface. The mine was well ventilated. Difficult ground, inclined to swelling, is encountered at some points, and owing to this peculiarity close attention must be paid to the timbering.

The provisions of the "Metalliferous Mines Regulation Act" were well carried out and the general conditions prevailing in and around the mine were satisfactory.

The *Whitewater*, at Retallack, is operated by the Whitewater Mines, Limited, with Donald S. MacLellan as superintendent. At some points the nature of the hanging-wall led to a modification of the method of stoping formerly in use, and at the time of inspection the introduction of a form of the pillar-and-chamber system was considered. However, this bad ground was skilfully handled and the workings were well timbered, square sets and stulls, with waste-filling, being used for the purpose. The ventilation was good and the provisions of the "Metalliferous Mines Regulation Act" were closely observed. The mine is decidedly wet. The ore is brought to the surface by a storage-battery locomotive.

The power plant consists of two electric generators driven by oil-engines and an air-compressor driven by a Pelton wheel. During 1928 provisions have been made to drive the dynamos by water-power as well. The installation of a flotation-mill was completed early in

the year. The workmen's living-quarters are comfortable and well kept. The working-force comprised forty-eight men, of whom thirty-six were employed underground.

At the *Wellington*, also situated near Retallack, a small force of men was engaged in driving exploratory drifts, while a new camp was being erected near the railway-station. Intersection of the ore-body at depth by driving a crosscut tunnel at a comparatively low elevation above drainage-level is contemplated. Only six men were employed in and around the mine at the time of inspection. The property is operated by the Wellington Mines, Limited, with W. G. Harris as superintendent.

The *Silver Bear* on Keen creek and the *Revenue* on Sturgis creek employed small crews, the work being limited to exploration. The *Silver Bear* is owned by Francis Helm, with Chas. C. Starr as superintendent, and the *Revenue*, worked by the Sturgis Creek Mines, Limited, is under the supervision of F. G. Harbour. Considering the nature and restricted extent of the operations, the conditions prevailing as regards the management of the workings and the surface installations were satisfactory in both cases.

Slocan Mining Division.

The *Lucky Jim*, at Zincton, is operated by the Lucky Jim Lead and Zinc Company, Limited, with T. P. Lane as superintendent and Wm. Callin as mine foreman. Fifty-eight men were at work underground and fifteen on the surface at the time of inspection. Pillar and chamber is the method of mining followed and the ground requires but little artificial support. At the time of inspection there was only one exit available for the men employed in No. 6 level, a condition which, at the stage reached by operations in this part of the mine, is practically unavoidable. The new raises being now driven will establish a communication between this and the upper levels. A blowing-fan is used in No. 6 level, but natural ventilation suffices to the requirements of the other workings.

The surface installation, which was thoroughly described by the Resident Mining Engineer in his report for 1927, is remarkably good. The general conditions prevailing were quite satisfactory and the provisions of the "Metalliferous Mines Regulation Act" were well complied with.

The *Slocan-Rambler*, on McGulgan creek, is worked by the Slocan-Rambler Mining Company, with Jas. Robertson, of Silverton, as superintendent, and Bruce Kirk in charge of the mine. The work done underground was limited to exploring by drifts on the lower level, in which, owing to the nature of the ground, no timbering was required. The natural ventilation is very good and the conditions prevailing were always found quite satisfactory. Ten men were employed underground and six on the surface when the property was visited at the beginning of November. The construction-work planned for the year had then been completed.

The newly erected bunk-house is remarkably good. It is a well-finished two-story building, designed to accommodate about thirty men, standing on a basement occupied by a well-fitted dry-room and the heating apparatus. Efficient means to combat incipient fires have been provided. The important point in chosing the location of the bunk-house was to place it out of the reach of snowslides, which are heavy and frequent in the district. A new cook-house is to be built during the coming summer. Power for drills is supplied by an air-compressor driven by a Pelton wheel.

The *Ruth-Hope*, at Sandon, is worked by the Ruth-Hope Mining Company, with John Hanna as superintendent. Thirty men were employed underground and twelve on the surface. The methods of working are pillar and chamber and a form of overhand stoping. The hanging-wall often requires close attention, but was found to be faultlessly timbered. Square sets or stulls are used for this purpose, according to requirements. Nos. 5 and 6 levels are reached from the surface by a long crosscut tunnel which affords the only means of exit for the men employed there. This part of the workings depends for its ventilation upon a small fan connected to a line of metal pipes, and samples of air taken in the most distant part of the district showed a slight deficiency in oxygen. These features will be difficult to eliminate and the easiest solution of the problem appears to be the establishment of a communication with the workings of a neighbouring property, which is under a different ownership.

The new mill and the power plant, described in the Resident Mining Engineer's last report, have been in operation since the beginning of the year. The majority of the employees live in Sandon. The general conditions prevailing in and around the mine were good and the provisions of the "Metalliferous Mines Regulation Act" were well carried out.

The *Silversmith*, also at Sandon, is owned by the Silversmith Mines, Limited, with Oscar V. White as superintendent. During 1928 operations were limited to the driving of exploratory drifts and the sinking of an inclined blind shaft. The drifts have now reached considerable lengths and fans have to be used for ventilating purposes. The shaft is following a moderately inclined lead and has been very carefully driven and timbered. The timbering, consisting of drift and square sets, according to local requirements, was always sufficient and well placed. The general conditions prevailing in and around the mine were satisfactory. A new powder-magazine of frame construction was erected during the summer. The work gave employment to thirty-four men underground and thirteen on the surface.

The *Leadsmith*, on Cody creek, is owned by the Leadsmith Mines, Limited, and Erwin A. White is the superintendent. Five men were employed at the time of the last inspection, four underground and one on the surface. Operations were limited to the driving of prospect-drifts. These were timbered with half-sets where artificial support was required. The workings are ventilated by a small blowing-fan. Power for drills is supplied by a small compressor driven by a gasoline-engine. The living accommodation was good, as were also the general conditions prevailing in and around the mine.

The *Noble Five*, at Cody, is operated by the Noble Five Mines, Limited, with Jno. G. Shephard as superintendent and Wm. Findlay as mine foreman. Considerable work was done on this property during 1928. The height of the blind shaft has been increased by 45 feet and a second hoisting compartment was formed by demolishing the ore-chute. A double-drum, compressed-air-driven hoist has been installed and it is intended to lower the ore from the upper levels in skips. For this purpose ore-pockets have been constructed at every level and a large bin has to be erected at the bottom. The drift in which the recent strike was made has had the unexpected effect of opening an outlet for the water formerly running down the shaft and the latter is now almost dry. This fact will undoubtedly tend to lengthen the life of ropes and other hoisting appliances, and to render the use of the shaft much more agreeable for travelling purposes besides. The main crosscut tunnel is also better drained now than it was formerly. Square sets or stulls are used, according to circumstances, where timber is required. The operations consisted in stoping and drifting, while a small prospect-winze was also sunk during the year. There were twenty-four men employed underground and ten on the surface at the time of the last inspection.

The general conditions were good and the provisions of the "Metalliferous Mines Regulation Act" were well complied with. The men's living-quarters are commodious and well kept. The need of some additional fire-protection there was pointed out, a suggestion promptly acted upon by the management.

The tramway linking the mine with the concentrator was entirely rebuilt during 1928.

The *Mary Ryan*, situated on the rim of McGuigan basin, is operated by Spokane interests, with Alfred Holmquist in charge of the mine. The buildings have been erected on a small ridge, apparently escaping the snowslides for which the locality is famed. The operations were limited to the driving of two exploratory drifts in ground that did not require any timber. Seven men were employed underground and seven on the surface. The general conditions were good as far as immediate safety was concerned, but some provisions of the "Metalliferous Mines Regulation Act" had not been observed. The bunk-house and cook-house are rough buildings, leaving ample scope for improvements.

No accidents were reported from any of these mines during 1928.

In the course of these inspections I have always found the officials anxious to carry out the provisions of the "Metalliferous Mines Regulation Act" and willing to accept any suggestions tending to increase the safety of their operations. My thanks are due them for their attitude in this respect and for the friendly manner in which I was received everywhere. At all operations visited the workmen appeared to be both careful and competent.

REPORTS OF COAL-MINE INSPECTORS.

The coal-mines of the Province are situated in four Inspection Districts—namely, Vancouver Island, Northern, Nicola-Princeton, and East Kootenay Districts.

VANCOUVER ISLAND INSPECTION DISTRICT.

THOS. R. JACKSON, JAS. STRANG, AND JAS. W. JEMSON, INSPECTORS.

The Canadian Collieries (Dunsmuir), Limited, operated Nos. 4, 5, and 6 mines, Comox Colliery, and Nos. 1, 2, 3, 5, 6, 8, and 9 mines, and Vancouver slope, Wellington Extension Colliery.

The Western Fuel Corporation of Canada, Limited, operated No. 1, Reserve, and Wakesiah mines, Nanaimo Colliery.

The Granby Consolidated Mining, Smelting, and Power Company, Limited, operated No. 1 mine, Granby Colliery, Cassidy.

The East Wellington Coal Company, Limited, operated No. 1 mine, East Wellington.

Diamond Jubilee operated its No. 1 mine at Nanaimo.

Fiddick mine was operated at South Wellington.

Consumers' Coal Co., Limited, operated the Round Island mine at Nanaimo.

Little Ash mine operated at Nanaimo.

Richardson mine operated at South Wellington.

NORTHERN INSPECTION DISTRICT.

THOS. J. SHENTON, INSPECTOR.

The Telkwa Collieries, Limited, operated the Goat Creek mine.

NICOLA-PRINCETON INSPECTION DISTRICT.

JOHN G. BIGGS, INSPECTOR (HEADQUARTERS, MERRITT).

The Middlesboro Collieries, Limited, operated Nos. 2 and 3 North, No. 2 South, Nos. 2 and 4 East mines, Middlesboro Colliery, Merritt.

The Coalmont Collieries, Limited, operated Nos. 3 and 4 mines, Coalmont Colliery, Blakeburn.

The Tulameen Valley Coal Mine Company operated its No. 1 mine.

Lynden Coal Company, Limited, operated its No. 1 mine.

Normandale mine operated at Nicola.

Pleasant Valley Coal Company operated its mine at Princeton.

EAST KOOTENAY INSPECTION DISTRICT.

ROBT. STRACHAN, SENIOR INSPECTOR, AND JOHN MACDONALD AND H. E. MIARD, INSPECTORS (HEADQUARTERS, FERNIE).

The Crow's Nest Pass Coal Company, Limited, operated No. 1 East, No. 1 South, No. 2, No. 3, and No. 9 mines, Coal Creek Colliery; No. 3, No. 3 East, and No. 8 mines, Michel Colliery.

The Corbin Coals, Limited, operated Nos. 4 and 6 mines, Corbin Colliery.

VANCOUVER ISLAND INSPECTION DISTRICT.

REPORTS BY THOS. R. JACKSON AND JAS. W. JEMSON, INSPECTORS.

Western Fuel Corporation of Canada, Ltd.

Head Office—Nanaimo, B.C.

F. Perry, President, Montreal, Que.; Lieut.-Col. C. W. Villiers, Vice-President and Managing Director, Nanaimo, B.C.; P. S. Fagan, Secretary-Treasurer, Nanaimo, B.C.; John Hunt, General Manager, Nanaimo, B.C.

The above company operated during 1928 the Nanaimo Colliery, which consists of No. 1, Reserve, and Wakesiah mines, all situated in the vicinity of the city of Nanaimo.

AGGREGATE RETURNS FROM THE WESTERN FUEL CORPORATION'S MINES FOR YEAR 1928.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	400,844			
Sold for export to United States	49,304			
Sold for export to other countries				
Total sales		450,148		
Used in making coke				
Lost in washing	31,099			
Used under colliery boilers, etc.	74,186			
Total for colliery use		105,285		
		555,433		
Stocks on hand first of year	29,736			
Stocks on hand last of year	16,073			
Difference taken from stock during year		13,663		
Output of colliery for year		541,770		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

Character of Labour.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	44		36		80	
Whites—						
Miners	346				346	
Miners' helpers	3				3	
Labourers	285		108		393	
Mechanics and skilled labour	88		87		175	
Boys	48		25		73	
Japanese						
Chinese			102		102	
Indians	2				2	
Totals	816		358		1,174	

REPORT BY THOS. R. JACKSON, INSPECTOR.

NANAIMO COLLIERY.

No. 1 MINE (SOUTH SIDE).

Arthur Newbury, Manager; John Sutherland, Overman, South Side No. 1 mine; Geo. Bradshaw, Alexander Rowan, Alex. Coombs, Wm. Neave, Fred Menzies, Matt Broderick, John Marrs, and Wm. Frew.

This mine is situated at the south end of the Esplanade on the shore-line of the bay. It is the oldest working-mine in Nanaimo District and has a large submarine area extending several miles in a seaward direction.

The mine has four openings. No. 1 shaft is used for hoisting coal and the screening plant is situated at this shaft; it also serves as a downcast shaft for the ventilation of the South side workings.

The men working in the South side portion of the mine are also raised and lowered at this shaft. No. 2 shaft, which is situated about 300 feet distant from No. 1, serves as an upcast shaft for the ventilation of the South side workings as well as part of the North side workings.

The power plant of No. 1 mine consists of two 530-horse-power Babcock & Wilcox water-tube boilers, coupled with two 208-horse-power return-tubular boilers which operate at a lower pressure than the Babcock & Wilcox; the steam from the Babcock & Wilcox passing through a No. 8 Locke pressure-reducing regulator, which works very satisfactorily. The Babcock & Wilcox boilers were installed during 1925, being completed in October, and are supplied with chain-grate stokers, induced and forced draught fans. Cope's feed-water regulator and Cochrane steam-flow meter.

The boilers supply steam to the power plant, which consists of two cross-compound Ingersoll-Rand compressors, each supplying 2,500 cubic feet of air a minute, and two Robb-Armstrong Corliss-valve engines which are direct-connected to d.c. generators, also to fan, hoisting, and washery engines and mine-pump. The hoisting-engines at No. 1 and Protection shafts are steam-driven.

Electrical equipment consists of two generators driven by steam-engines. One generator is of the Westinghouse type, 250 kw., running at 150 r.p.m. and direct-coupled to a Robb-Armstrong steam-engine. These units supply power to all the electrically driven machinery above ground and underground. There are, underground, one 10-ton Westinghouse motor, three 6-ton Jeffry motors, and one 10-ton Edison motor, all of which are operated on the open overhead-trolley system; four electric hoists ranging from 30 to 140 horse-power; and a 3-stage centrifugal pump driven by a 125-horse-power motor running at 1,740 r.p.m. The power is carried into the mine by four armoured cables which enter the mine by way of the shafts; two of these are leads and two returns.

In connection with the washery plant, two centrifugal pumps of the Fairbanks-Morse type and capable of delivering 1,000 gallons of water a minute each are driven by two 40-horse-power motors. There is also a 90-horse-power sludge-pump and a 30-horse-power motor used for driving the coal-washers. Seven motors are in use at the coal wharves for raising and lowering the coal-chutes to facilitate loading scows or ships.

Underground.—Firebosses and shotlighters use the Wolf flame safety-lamp and workmen use the Edison electric safety-lamp. Operations are being conducted in the Newcastle and Douglas seams.

On the South side of the mine the Douglas seam has been worked exclusively until the latter part of this year. A slope has been put down off No. 3 level motor-road to reach the Newcastle seam, which is now being developed and will shortly contribute largely to the tonnage obtained from the South side of the mine. On the North side of the mine coal is taken from both seams. Only permitted explosives are used for blasting; shots are fired by cable and electric battery; compressed air and electricity are used as motive power for haulage and drainage purposes. Hoisting-engines at the shafts are steam-driven.

Haulage on the Main levels on the North side of the mine is done by electric locomotives of the overhead-trolley type. Heavy steel rails are laid and a copper trolley-wire carried for approximately 3 miles on No. 1 level, extending from the shaft to a point beyond the foot of Lamb's incline.

Haulage on the South side of the mine is a combination of electric motor and direct rope-haulage on the main roads and drivers and horses are employed for the purpose of getting the cars to and from the working-faces to the main haulage.

During the inspections made in the month of December the following conditions were found to prevail:—

Diagonal Slope Section.—I measured 42,350 cubic feet of air a minute passing down the Main slope; this divides into three splits—namely, No. 4 level, No. 5 North slope, and Diagonal slope split.

There was 13,200 cubic feet of air a minute passing into the latter split for the use of forty-five men and six horses. The ventilation at the working faces was, generally speaking, found to be fairly good; roadways and timbering were in good condition. I found no explosive gas and the flame safety-lamp in test showed no methane-cap.

The coal-dust is mixed with rock-dust supplied by the company and naturally produced from the seam which carries quite a percentage of rock sometimes. A dampness prevails which helps

to provide a water content in the mixture, which when taken both together fulfils the necessary requirements of the "Coal-mines Regulation Act." This slope has been more or less affected during the year by gob-fires. Great care has to be exercised and constant vigilance maintained by all the officials in the matter of extracting the pillars and providing the necessary ventilation for operating purposes without causing spontaneous heating to occur.

No. 5 North Slope Section.—This section is now retreating, the extraction of pillars being general. No explosive gas was found and the flame safety-lamp test gave no indication of a gas-cap. The ventilation at the working-faces was found to be fair and the roadway and timbering in general good condition. In No. 4 West level there was considerable evidence of roof-pressure.

The section is fairly free from coal-dust owing to a natural supply of rock-dust and water on the roadways. A general heavy dampness prevails in the section.

In this split there was 8,500 cubic feet of air a minute passing for the use of forty-two men and five horses.

This section is subject to spontaneous combustion, though, so far, it has escaped with but one heating-up, which was at once sealed off with wooden-block stoppings.

No. 3 Level District.—Extraction of pillars in the Douglas seam has ceased for the time being; all work being concentrated in the operation of the Newcastle seam, which is now being opened up by means of a 450-foot slope of easy gradient which commenced on No. 3 level. The coal is of good quality, although containing two bands of rock. It is expected to adopt the long-wall method of working the seam. The coal will be cut by machinery and it is probable that the use of some kind of conveyor and loading device will be adopted. A good strong roof overlies the seam which should make it amenable to such a system of working.

I measured 12,000 cubic feet of air a minute coming from Protection mine side and passing out the level. There were only twelve men engaged in this operation. No gas was found and the roadways and timbering were in good condition. A general wetness prevailed throughout the section.

From the face of the slope a roadway was set away to the raise for the purpose of reaching a point where a diamond-drill could be used to tap the old Newcastle workings, which were lying full of water. This was successfully accomplished and the water is now being led off through a pipe.

The mine-air sample tests in the various main return airways showed from 0.01 to 0.03 per cent. of methane. The gas committee reports, which are submitted to this office every month, show that the general conditions of the mine are consistently good and well maintained. Several minor accidents occurred, but there was no fatality for the year.

REPORT BY JAS. W. JEMSON, INSPECTOR.

NANAIMO COLLIERY.

No. 1 MINE (NORTH SIDE).

Mine Manager, A. Newbury; Overman, A. W. Courtney; T. J. Wood, T. Smith, G. Perry, G. Jardine, W. Cass, A. Bennett, D. Stobbart, F. Cope, F. Nash, G. Frater, G. Moore, J. Nichol, N. McMillan, and A. Kirkham, Firebosses.

The most of the workings of this mine are submarine areas, having an average cover of 450 feet. The workmen employed on this side of the mine are transported to and from their work by ferry operated by the coal company; the distance across the bay to Protection island is about 1¼ miles. The main intake is Protection shaft, which is also used to raise and lower the workmen. Newcastle shaft, which is situated on Newcastle island about 3 miles from No. 1 shaft, serves as an upcast for the major part of the North side workings; a ladder-way is provided in this shaft which affords another or third means of ingress or egress to No. 1 shaft. All the North side output is brought to No. 1 by electric locomotives of the overhead-trolley type. Both the Douglas and Newcastle seams are operated; the greater part of the output being machine-mined, one section being entirely machine-mined and loaded by shaker conveyors.

Practically the only development-work done during the year consists of driving a rock-slope in what is known as the Prospect, situated about 2,000 feet from No. 1 shaft bottom and lying

between No. 1 Motor level and No. 3 Motor level. A good seam of coal has been located through the rock-slope, which, it is expected, will eventually be about 10 feet thick and covering an area of 5 acres.

Near Protection shaft bottom in the Lower seam two concrete dams have been constructed, the object being to retain the North side drainage in the old south-east slope of No. 2 wall, and thus prevent the water from gravitating to the lower workings of No. 3 level. The head created by the dams causes the water to gravitate to Protection shaft, where an electrically operated centrifugal pump forces it to No. 1 Motor level, where it is discharged into ditches and finds its way to the main pumping-station at No. 1 shaft bottom.

During the course of my inspection in the month of December the following conditions prevailed:—

No. 2 Incline (Douglas Seam).—Entirely pillar-extraction. The gobs are fairly well filled with refuse and cogs; consequently the extracted coal areas soon become a solid mass and subsidence reduced to a minimum. Six thousand five hundred cubic feet of air was entering the section for the use of twelve men and two horses. No. 10 South (Douglas seam): This section is reached by a rock-drift driven from the Lower seam in No. 3 wall to the Douglas. Both hand and machine mining is practised, some of the miners using the "Woodpecker" or small percussion pick for mining. The section was in good working-order; well timbered and ventilated.

No. 5 Wall (Newcastle Seam).—This section is entirely machine-mined but loaded by hand. The future output of this section depends on the coal extending to the dip; at present the outlook is fairly favourable in that direction, as a good length of long-wall face is now exposed, enough to warrant the operators to improve the haulage to take care of the increasing output.

No. 6 Wall (Newcastle Seam).—This section is entirely machine-mined and loaded by shaker conveyors; the two principal face-lines are about 250 feet long, the roof is remarkably good, and the gob is well filled with machine cuttings (rock) and cogs. The section is generally well taken care of as regards timbering and ventilation.

Protection Pillars (Douglas Seam).—This is a small section of Protection Diagonal slope, where four men are employed.

The following are the official returns from No. 1 mine for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	212,078	.....	.....	.....
Sold for export to United States	49,304	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	261,382	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	11,724	.....	.....	.....
Used under colliery boilers, etc	45,604	.....	.....	.....
Total for colliery use	.....	57,328	.....	.....
		318,710		
Stocks on hand first of year	18,334	.....	.....	.....
Stocks on hand last of year	16,073	.....	.....	.....
Difference taken from stock during year	.....	2,261	.....	.....
Output of colliery for year	.....	316,449	.....	.....

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	30	.....	21	.....	51	.....
Whites—						
Miners	188	.....	.....	.....	188	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	210	.....	68	.....	278	.....
Mechanics and skilled labour	63	.....	47	.....	110	.....
Boys	27	.....	14	.....	41	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	53	.....	53	.....
Indians	1	.....	.....	.....	1	.....
Totals	519	.....	203	.....	722	.....

REPORT BY THOS. R. JACKSON, INSPECTOR.

RESERVE MINE.

Robert Laird, Manager; Clifford Dickinson, Overman; Ernest Kelly, Jacob Stobbart, Fred Bell, Harry Allsopp, and Harry Meikle, Firebosses.

This mine is situated in the Cranberry district, about 5 miles south of Nanaimo. The first shaft sunk reached the seam at a depth of 1,162 feet. On account of folding in the measures and heavy pitching it was decided to drive a crosscut tunnel 7 by 12 feet in section across the measures at a point 950 feet from the surface, with the result the seam was struck at a distance of 180 feet from the shaft.

The second shaft was sunk to a depth of 950 feet and a tunnel driven across the measures for a similar distance and the seam struck. A level was then driven in the coal a distance of 300 feet, connecting the two tunnels. After considerable development-work had been done from this point a new tunnel was driven across the measures from No. 1 shaft at a point 200 feet higher, penetrating the seam at a point about 200 feet distant from the shaft. This tunnel is now the main haulage of the mine.

Operations are conducted in the Douglas seam, which is very much troubled with folds or overlaps, which tend to make operations difficult. At times the seam pinches out and may be found underlapping or overlapping. The coal, which varies from 3 to 20 feet in thickness, is fairly hard, with a fairly good roof.

The quantity of sulphur produced from the seam evidently has appreciably lessened, there being fewer men affected than ever before.

The ventilation of the mine is produced by a pair of 90-inch Sirocco fans, connected to a 20- by 30-inch engine, rope-driven. These fans, running at an engine-speed of 16 r.p.m., are capable of producing 100,000 cubic feet of air a minute, against a 3-inch water-gauge.

A description of the surface plant at this mine has been given in former reports. The underground mechanical haulage is carried on by means of compressed-air winches.

During the year a considerable amount of development-work was done in various parts of the mine. In No. 8 section the new slope was continued for a distance of 1,500 feet, dipping about 40°; owing to the soft nature of the coal and heavy cover this section was subject to blowouts and had to be abandoned during the year.

In No. 2 West section two tunnels have been driven in for a distance of 1,200 feet and a considerable amount of good hard coal found. These tunnels will be continued for about 4,000 feet more and will open up all the area between Reserve mine and old No. 4 slope. In No. 9 section on the East side of the Main heading two tunnels have been driven in 1,100 feet with a view to striking the York Estate. These tunnels have about 2,000 feet to advance; but a large amount of good coal is being extracted from the area overlying the tunnels.

In No. 5 West a new roadway has been driven up into old No. 5 mine barrier from the Main heading. A considerable number of holes have been drilled through the barrier a distance of 225 feet.

The mine is inclined to draw water on the roadways and a general dampness prevails throughout the mine, which to a large extent militates against the necessity of resorting to the usual devices for rock-dusting or watering. Where necessary the material on the roadways is loaded out and fine dust employed as the inert means of combating the coal-dust trouble to be in accordance with the requirements of the "Coal-mines Regulation Act."

The analyses of the coal-dust samples submitted to this office were in keeping with the rules and regulations of the above Act.

Four fatal accidents occurred during the year at this mine. Two were due to falls of roof and two due to a sudden blowout. The blowout was rather an unusual occurrence and came as a great surprise to both workmen and officials of this mine. The section known as No. 8 slope was immediately abandoned on account of the blowout happening there. The pillars are being taken out.

The workmen of the mine availed themselves of the opportunity provided by the provisions of section 101, Rule 37, of the "Coal-mines Regulation Act." These reports were received regularly at this office and indicated the general conditions of the mine to be fairly good. Other report-books kept at the mine were examined regularly and found to be kept in compliance with the "Coal-mines Regulation Act."

The water in old No. 5 mine is now 440 feet down the shaft, leaving only 47 feet of water on the drill-holes. Old No. 4 slope was opened up during the year and a large Cameron pump installed to dewater the mine, steam being supplied by a large locomotive situated at the surface. This pump has done good work in helping to drain old Nos. 4 and 5 mines.

The drilling which has been carried out during the year for the purpose of dewatering old No. 5 mine has been very successful. Very suddenly one of the main producing drill-holes ceased delivering water and commenced to give off methane. This was immediately checked, coming through the pipe by means of the valve attachment on the pipe. This gas will be liberated in due time.

It was found that the other main pipe was only producing sufficient flow of water to only half-fill a 4-inch pipe. Methane was issuing through the other half of the pipe and was found to be slightly explosive in a test made about 1 foot from the discharge end. Some further drilling must be performed before it will be safe to tap the old No. 5 mine with a roadway.

During my last visit of inspection in December I found the following conditions to prevail therein: Ventilation generally fairly good. Timbering and roadways generally good, except Cuthill's dip, which was suffering from a roof-squeeze and requires a timberman and helper more or less of their time to keep the roadway in safe repair.

In No. 2 West split there was 3,000 cubic feet of air a minute passing for the use of twelve men and three horses. Measured 35,000 cubic feet of air a minute passing up the Main heading at a point near the shaft-bottom. This quantity of air divides into four splits. In No. 8 Slope split there were only eight men in the section, which is very well ventilated.

There was 7,000 cubic feet of air a minute passing in No. 9 East level split for the use of twenty-five men and five horses. In the Tunnel section there are only half a dozen at work pulling the remaining pillars.

No. 10 Dip section split had 6,000 cubic feet of air a minute passing for the use of fourteen men and three horses. A roadway has started from the main incline of No. 10 to connect with the return airway of the tunnel. Found no explosive gas in any of the sections and no gas-cap was seen on the Wolf flame safety-lamp on any of the tests made. The mine makes very little gas. Sample bottles and B.G.D. tests showed only from 0.02 to 0.03 per cent. of methane.

The following are the official returns from Reserve mine for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	128,250	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	128,250	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	9,827	.....	.....	.....
Used under colliery boilers, etc	19,678	.....	.....	.....
Total for colliery use	.....	29,505	.....	.....
		157,755		
Stocks on hand first of year	8,415	.....	.....	.....
Stocks on hand last of year	.....	.....	.....	.....
Difference taken from stock during year	.....	8,415	.....	.....
Output of colliery for year	.....	149,340	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance						
Whites—	8	.....	10	.....	18	.....
Miners	98	.....	.....	.....	98	.....
Miners' helpers	3	.....	.....	.....	3	.....
Labourers	51	.....	25	.....	76	.....
Mechanics and skilled labour	19	.....	28	.....	47	.....
Boys	14	.....	6	.....	20	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	38	.....	38	.....
Indians	1	.....	.....	.....	1	.....
Totals	194	.....	107	.....	301	.....

Report by Jas. W. Jemson, Inspector.

WAKESIAH COLLIERY.

W. H. Moore, Mine Manager; N. Bevis, Overman; Thos. Chapman, A. Dean, H. Carroll, and Jas. Richards, Firebosses.

This mine is situated on the Western Fuel Corporation of Canada's farm, about 2 miles from Nanaimo, and is operated in the Wellington seam, which here varies in thickness from 2 to 20 feet. Minor dislocations are common and the dip, although irregular, is moderate, except on the western side of the mine, where it varies from 20° to 60°. Mining is by the pillar-and-stall system. The mine was worked fairly steadily throughout the year, a fair output being made.

The mine is entered by two shafts 320 feet in depth, one being used as a fan-shaft or upcast, the other as the main hoisting-shaft. The coal is hoisted by a 14- by 16-inch first-motion steam-hoist, and single cage with counterbalance being used. With the exception of the shaft-bottom

pump, which is steam-operated, all other underground machinery and pumps are operated by compressed air. The shaft-bottom and stables are electrically lighted. The roof of the mine is sandy shale, often frail and demanding careful attention and timbering. The mine is naturally damp. Storage-battery electric cap-lamps are exclusively used by the workmen and Wolf safety-lamps by the mine officials for gas-testing purposes. The mine is ventilated by a 90-inch Sirocco fan, rope-driven.

During the course of my inspections very little explosive gas has been found, though several times black-damp has been reported found in the innermost workings of Lewis, where pillars are being extracted, consequently finishing that part of the mine.

The workmen at this mine availed themselves of the opportunity provided by the provisions of section 101, Rule 37, of the "Coal-mines Regulation Act" and appointed their own representatives to examine the mine. Inspections have been regular and reports sent to this office.

It is a pleasure to report that no very serious fatal accident occurred at this mine during the year.

The following are the official returns from the Wakesiah mine for the year ended March 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	60,516			
Sold for export to United States				
Sold for export to other countries				
Total sales		60,516		
Used in making coke				
Lost in washing	9,548			
Used under colliery boilers, etc	8,904			
Total for colliery use		18,452		
		78,968		
Stocks on hand first of year	2,987			
Stocks on hand last of year				
Difference taken from stock during year		2,987		
Output of colliery for year		75,981		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	6		5		11	
Whites—						
Miners	60				60	
Miners' helpers						
Labourers	24		15		39	
Mechanics and skilled labour	6		12		18	
Boys	7		5		12	
Japanese						
Chinese			11		11	
Indians						
Totals	103		48		151	

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

F. Perry, President, Montreal, Que.; Lieut.-Col. Chas. W. Villiers, General Manager, Nanaimo, B.C.; H. S. Adlington, Secretary, Montreal, Que.; P. S. Fagan, Assistant Secretary, Nanaimo, B.C.; Thos. Graham, Superintendent, Cumberland, B.C.; T. H. Williams, District Superintendent, Cumberland, B.C.

The above company operated the following mines during 1928: The Comox Colliery, Nos. 4, 5, and 6 mines, situated in the vicinity of Cumberland; the Wellington Extension Colliery, Nos. 1, 2, 3, 8, and Vancouver slope, situated at Extension; No. 5 mine, situated at South Wellington; and No. 9 mine, situated at Wellington.

The following returns show the combined output of the company's collieries during 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	417,468	.....	.....	.....
Sold for export to United States	37,267	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	454,735	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	66,547	.....	.....	.....
Used under colliery boilers, etc.	26,637	.....	.....	.....
Total for colliery use	.....	93,184	.....	.....
		547,919		
Stocks on hand first of year	20,451	.....	.....	.....
Stocks on hand last of year	11,842	.....	.....	.....
Difference taken from stock during year	.....	8,609	.....	.....
Output of colliery for year	.....	539,310	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	66	.....	33	.....	99	.....
Whites—						
Miners	447	.....	.....	.....	447	.....
Miners' helpers	37	.....	.....	.....	37	.....
Labourers	231	.....	102	.....	333	.....
Mechanics and skilled labour	139	.....	128	.....	267	.....
Boys	13	.....	31	.....	44	.....
Japanese	62	.....	.....	.....	62	.....
Chinese	180	.....	95	.....	275	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	1,175	.....	389	.....	1,564	.....

Report by Thos. R. Jackson, Inspector.

COMOX COLLIERIES.

These mines are situated in the Comox district, 13 miles from Union Bay (by road). A railway 20 miles in length, over which the output is conveyed, connects the separate mines to a shipping-point at Union Bay.

The mines worked are Nos. 4, 5, and 6. The latter is a shaft acting as a means of drainage and intake air for No. 5 mine. No. 4 mine is located at the east end of Comox lake, about 3 miles from Cumberland. No. 5 mine is about a mile away from the city. No. 6 is close to the city.

The mine ventilation of Nos. 1 and 2 slopes, of which No. 4 mine is comprised, is produced by a Sullivan reversible fan, double-inlet, having a capacity of 180,000 cubic feet of air a minute, against a 6-inch water-gauge. This fan, which is located at the return end of No. 2 parallel slope, is electrically driven by a 250-horse-power induction-motor, 2,200 volts, speed 250 r.p.m., directly connected to the fan-shaft. A 108-inch double-inlet reversible Sirocco fan is situated at the return end of No. 1 parallel slope and is in operation.

The hydro-electric plant of this company, which has been described in previous reports, has been in constant operation during 1928. Sufficient electricity is generated at this plant to supply motive power to all the collieries, the wharf at Union Bay, and for the lighting of Courtenay, Union Bay, and Cumberland.

No. 4 Mine.

Thomas Williams, Mine Superintendent; Harry Devlin, Manager; Charles Parnham, Overman; Syd. Horwood, Chas. O'Brien, A. W. Watson, Tom Shields, Watkin Williams, John Vaughan, Wm. Devoy, Robert Walker, Jack Devlin, Wm. Herd, Thomas Lewis, and Alf Jones, Firebosses.

This mine consists of two slopes with one main entrance. There is also a manway part of the way. No. 1 slope runs due north; the lower workings below No. 14 West level are practically abandoned. No. 2 slope runs N. 45° E. and all work is practically finished for a hundred yards or so above No. 15 East level and filled with water. These slopes diverge at a point about 75 feet from the main portal. The electric haulage-engine is so connected that trips can be run simultaneously on both slopes to a point where they converge to the main entrance.

The men are conveyed from the bottom and other sections of the slope in a man-trip at the end of each working-shift. A safety-car is connected to the rear end of the man-trip, which ensures the safety of the workmen while riding up the slope. As a precaution against trips breaking away on these slopes the car is now used behind all trips ascending the slopes.

Electric head-lights of the Edison storage-battery type are used by the workmen and the firebosses use the flame safety-lamps of the Wolf type for testing purposes.

In No. 1 slope electricity is used as the motive power to operate all pumps, winches, and motors. A storage-battery locomotive is employed for haulage purposes in No. 11 West level, No. 1 slope. The extraction of pillars is general throughout the mine. The thickness of the seam varies from 3 to 7 feet. The coal is good and cokes well.

Evidence of a fire was noticed on March 9th near old No. 2 incline, No. 11 West level, No. 1 slope, and stoppings were immediately built to try and seal it off. These seemed to be effective for some time, but later on it became apparent the fire had not been properly extinguished, so that it became necessary to abandon this section and to seal it off from other parts of the mine. The closing of this section has prevented any further developments in No. 11 West level beyond No. 1 incline.

A new haulage roadway has been driven from No. 6 East level to No. 5 East level in No. 2 slope. It is a great improvement for bringing the coal out of this section to the Main slope. The water in the slopes has risen to the point where it is necessary to maintain it for the future operation of the mine. The electric pump has again been installed at the bottom of No. 2 slope. Two new levels have been started in the mine during the year—No. 6 West in No. 1 slope and No. 3 East in No. 2 slope.

The following conditions were found to prevail during the inspection in December:—

Quantity of air entering the mine portals: Main tunnel quantity equals 140,000 cubic feet of air a minute and manway quantity equals 10,000 cubic feet of air a minute passing, making a total quantity of 150,000 cubic feet.

In No. 1 slope the present workings are confined to Nos. 6, 7, 9, 11, and 14 West, and East side of slope at No. 14 West level. The general conditions of the mine varied from fairly good to good. The roadways were, generally speaking, kept in good condition. Broken timbers on the roadways that showed signs of weakening too much were immediately repaired.

Timbering and spragging at the faces were maintained very well. I found no explosive gas. Measured 28,000 cubic feet of air a minute passing into No. 11 West level, which divides into two splits. The new airway from No. 7 to No. 9 is making good progress. A new airway is started from No. 7 to tap into No. 6 level. When these airways are completed it should help the ventilation materially.

North Side Split (No. 11 West).—There was 13,000 cubic feet of air a minute passing for the use of fifty men and four horses.

South Side Split (No. 11 West).—There was 15,000 cubic feet of air a minute passing for the use of sixty-eight men and six mules. Further improvements of ventilation will take place as soon as connection with roadway is made between No. 9 West level and left side of No. 1 incline off No. 11 West level.

A heavy natural dampness, with a fair amount of water, prevails throughout the various sections of this slope, causing the mine as a whole to be fairly free from coal-dust. The ventilation was fairly good.

In No. 2 slope, No. 4 Comox mine, the pillars are now extracted to about No. 10 level. The space below this point is filled with water. Above here and situated on the Main slope is the electric pump which discharges the water through a wooden line of pipe to the surface. This pump will handle all the water that is required to be pumped from the mine and maintain it at waste-working level. The damp and water conditions of this slope are similar to No. 1 slope, so that it is fairly free from coal-dust.

The analysis of mine-dust samples taken from each slope show (samples taken each month) that they comply with the provisions of the "Coal-mines Regulation Act."

During my visit of inspection in December I found the general condition of the mine to be fairly good. I found no explosive gas. The timbering and spragging was in good order. The ventilation was good generally, except at the faces on the right side of No. 5 level, where the air-current is rather slack. The management is giving this matter immediate attention for improvement.

Measured 70,000 cubic feet of air a minute passing down the slope at a point about No. 3 level. The workings are confined now to Nos. 3, 5, 6, and 9 West levels, also Nos. 5, 7, and 9 East levels.

West Side Split.—There was 14,000 cubic feet of air a minute passing for the use of forty-two men and six mules.

East Side Split.—There was 9,000 cubic feet of air a minute passing for the use of twenty-five men and four mules.

Mine-air samples taken at the fan-drift shows a methane content of from 0.15 to 0.25 per cent.

No fatality occurred in either of the slopes during the year.

Advantage was taken by the workmen, under provision of Rule 37 of section 101 of the "Coal-mines Regulation Act," to appoint their own representatives for the purpose of examining the mines. Inspections have been made monthly and the reports furnished at this office have shown conditions found were generally satisfactory.

No. 5 Mine.

T. H. Williams, Mine Superintendent; John S. Williams, Mine Manager; Jack Gillespie, Overman; Jack Davidson, J. Brown, Jas. Quinn, Alf. Davis, and Sam Jones, Firebosses.

For further description of mine, plant, etc., *see* 1926 Report of Minister of Mines.

This mine after remaining idle for about a year was reopened in May for the purpose of driving two slopes in No. 2 seam down to a greater depth. The operations were confined to this form of work for some time, but the long-wall face which had been previously worked by belt-conveyors was again restarted under that system. This later one was changed to ordinary long-wall method, with roadways 36 feet apart, and this system is still in operation.

Work has also been started in No. 1 seam, where some of the pillars are being extracted.

The production of coal from both seams amounts to 250 to 275 tons of coal a day. No. 1 seam produces from 75 to 90 tons a day. The coal is of good quality. One or two bands of rock prevail in the seam.

The balance of the tonnage is produced from the middle seam (No. 2). The undercutting of the coal is done by means of electrically driven Sullivan mining-machines. It is anticipated

that the belt-conveyor and loader will be utilized when certain developments of the mine are reached. Electricity and compressed air are used as motive power. Little air-driven winches clamped to upright iron posts are used extensively and render good service in haulage.

No blasting is done without the use of electric battery and cable. Only permitted explosives are used. Electric cap-lamps of the Edison type are used by the workmen. Firebosses use the Wolf type of flame safety-lamp for gas-testing purposes. One of the noticeable features of the development of No. 2 seam is the small amount of methane liberated.

During my last visit of inspection in December of the working parts of Nos. 1 and 2 seams I found the following conditions to prevail therein:—

Ventilation generally good. I measured 96,000 cubic feet of air a minute passing into West side of mine. No explosive gas found. Roadways in good condition generally. Timbering in good order. (Notice: The cap-rock in No. 1 seam will require special timbering attention and care.) Sections fairly free from coal-dust on account of dampness and water on some of the roadways and rock-dust on the others.

No. 1 Seam.—There were fifteen men and two mules employed in the seam, which was well ventilated.

No. 2 Seam, Right Split.—There were 13,000 cubic feet of air a minute passing for the use of twenty-six men and two mules.

No fatality or serious accident took place during the year. Mine-air samples in main return airways showed around 0.025 per cent. of methane.

No. 6 Mine.

This mine is supervised by the officials in charge of the management at No. 5 Comox mine. Practically all the water entering Nos. 5 and 6 mines is hoisted from No. 6 shaft by specially constructed tanks capable of delivering 1,200 gallons of water a minute.

During December visit of inspection I measured on the main intake roadway the quantity of 50,000 cubic feet of air a minute passing inby from the shaft.

The roadways and timbering in the mine were generally in fairly good condition and the stoppings surrounding the Main heading of old workings were in good condition.

Fireboss R. McNeil is in charge of looking after the condition of the shaft, guides, ropes, and chains, and these were found to have received the best of care and attention. There are three hoisting engineers connected with this operation, each one having to hoist water almost continually during their shift.

The following are the official returns for the year ended December 31st, 1928, and the aggregate output of all the mines of the Comox Colliery:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	235,880	.....	.....	.....
Sold for export to United States	901	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	236,781	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	24,611	.....	.....	.....
Used under colliery boilers, etc	4,049	.....	.....	.....
Total for colliery use	.....	28,660	.....	.....
		265,441		
Stocks on hand first of year	8,959	.....	.....	.....
Stocks on hand last of year	9,901	.....	.....	.....
Difference added to stock during year	.....	942	.....	.....
Output of colliery for year	.....	266,383	.....	.....

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	28	.....	14	.....	42	.....
Whites—						
Miners	122	.....	.....	.....	122	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	80	.....	47	.....	127	.....
Mechanics and skilled labour	96	.....	59	.....	155	.....
Boys	13	.....	9	.....	22	.....
Japanese—						
Miners	31	.....	.....	.....	31	.....
Miners' helpers	31	.....	.....	.....	31	.....
Chinese—						
Miners	65	.....	.....	.....	65	.....
Miners' helpers	52	.....	.....	.....	52	.....
Labourers	57	.....	30	.....	87	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	575	.....	159	.....	734	.....

REPORT BY J. W. JEMSON, INSPECTOR.

WELLINGTON EXTENSION MINES.

This division of the Canadian Collieries (Dunsmuir), Limited, mining properties comprises Nos. 1, 2, 8, and Vancouver slope, No. 5 South Wellington, and No. 9 Wellington; the latter two each form a separate section of this report. The entire output of the Extension Collieries is brought to Ladysmith over the Wellington Extension Collieries Railway, which also affords means of transportation to and from their work for the employees of the company residing at Ladysmith.

LADYSMITH.

The general shipping-point for the output of these mines is Ladysmith, where the coal is either loaded on vessels or sent to Mainland points in railway-cars by means of transfer-barges. The coal-washery is equipped with three washers, each having a computed capacity of 200 tons in twelve hours, 6-compartment jigs, and four 14- by 17-foot Mascoe tables taking care of the smaller-sized coal. Power for the washery is supplied by a Pelton wheel. Provisions are made to replace the ordinary fresh-water supply by salt water in case of abnormally cold weather and during part of the dry season. A 40-kw., 240-volt Allis-Chalmers-Bullock generator furnishes the power for lighting purposes to the washery and wharves.

EXTENSION COLLIERY.

William Roper, Manager.

The workings of this colliery are situated partly in the Cranberry and partly in the Douglas districts. Here the Wellington seam underlies an area of some 2 miles in width at its south-east end, in the vicinity of the Nanaimo river, and extending about 4 miles in a north-westerly direction. The presence of the coal was accidentally discovered in the year 1895 and rapid development followed.

All the Extension mines are in the western limb of an important anticline, the axis of which is closely followed by the Extension valley. The field is traversed by several minor folds, all running in a north-westerly direction, as do the two major faults. The latter is by far the most important, both as to continuity and displacement, its throw sometimes approaching 500 feet. At some points it has a comparatively low dip to the south-west and there assumes all the

characteristics of an overthrust. As a result of the intense folding the edges of the basin are turned up rather sharply and the highest dips are generally met in the vicinity of the outcrops.

The entire output of No. 1 and No. 2 mines is brought to the tipple through a rock tunnel, driven 14 by 7 feet in the clear on a 1-per-cent. grade, which meets No. 1 mine at a distance of three-quarters of a mile from the portal. It continues from there to No. 2 mine, a total distance of 1¼ miles. Haulage is done by electric locomotives of the overhead-trolley type. The underground employees are taken to and from their work in man-trips hauled by a 13-ton Baldwin-Westinghouse electric locomotive.

Power-house.—The boiler plant consists of four Goldie & McCulloch return-tubular boilers of 163 horse-power each. The electric power is supplied by three 250-volt d.c. generators. No. 1 is a Crocker-Wheeler of 112.5-kw. capacity, direct-coupled to a 15 by 14 Ideal engine; No. 2 is a 150-kw. direct-connected to a 14 by 14 by 32 Flemming-Harrisburg compound engine; No. 3 is a 150-kw. General Electric, direct-connected to a 16 by 16 Robb-Armstrong engine. A Black fire-supply pump 12 by 18 by 10 is maintained in the boiler-house.

Wash-house.—This is a steam-heated building, providing accommodation for more than 400 men and equipped with thirty-six spray-baths, a number of hot- and cold-water taps, and a dry-room. Separate lockers and wash-rooms are provided for the firebosses and other mine officials.

First Aid and Mine-rescue.

First-aid classes are conducted during the year; consequently there are a large number of certificated men always available at the colliery. At Extension there is a well-equipped first-aid room and a well-appointed ambulance railway-car which is kept in readiness at all times. Both first-aid and mine-rescue teams represented Extension mines at the Labour Day and indoor competitions; their work received much favourable comment and they were successful in carrying off some of the prizes.

No. 1 Mine.

William Roper, Mine Manager; Thos. Wilson, Overman; David Gordon, A. Orr, D. Copeland, Jno. Greenhorn, Jos. Wilson, and R. Houston, Firebosses.

The workings of this mine are situated in part of the field known as the "underlap" and are grouped in two independent sections, separated by a large expanse of worked-out and barren ground. The main ventilating apparatus is assisted by a 5-foot Stine fan driven by a 15-horse-power d.c. motor and used as a "booster" in the dip-workings off No. 4 East level. Owing to the heavy inflow of water during the wet season it is necessary to have two electrically driven pumps operating in the Main slope.

No. 4 East district, which was abandoned some years ago, is now the main source of production. The seam is worked on the long-wall system. The slope and incline driven off No. 4 East level have proved very successful. The incline workings have been connected with the West Incline district; the latter section is practically following the outcrop and the pillars are being extracted on the retreating system. A large recovery of top coal has been attained along with the pillar coal. The coal being so high makes the working very difficult, but operations have been carried on with satisfactory results, both as regards recovery and safety, reflecting great credit on the workmen and officials connected with the work.

The haulage equipment consists of one Ottumwa hoist, driven by a 100-horse-power d.c. motor, and three smaller hoists. Two of these take care of the No. 4 East output, the other operating on the West incline. The mine is ventilated by twin fans of the Murphy type, driven by an Allis-Chalmers-Bullock motor, and passing 60,000 cubic feet of air a minute, against a water-gauge of 0.75 inch; the booster-fan passing about 15,000 cubic feet a minute. During the December examination this mine was found to be in general good order, well timbered and ventilated. This mine is naturally damp, therefore practically free from coal-dust.

No dangerous occurrences were reported and no very serious or fatal accidents occurred during the year 1928.

No. 2 Mine.

This is the most extensive mine and comprises five widely separated districts, known as No. 2 Incline, No. 17 Incline, East Incline, Old Man's Home, No. 21 Incline, and Old Slope districts. No. 2 incline is entirely pillar-extraction; the level pillars having been extracted, operations are

being carried on at the top of the incline. This district has a separate intake supplying ventilation for eight men and two horses.

No. 17 incline is the largest producing section; here the seam is very irregular, the roof is frail, and therefore requires careful attention by the mine officials and workmen. No. 5 East level, abandoned three years ago, has since been driven ahead with satisfactory results, striking coal averaging 4½ feet in thickness. Connections have been made with No. 3 East level, which cuts off about 2,000 feet of haulage and provides a good watercourse, so that practically all drainage gravitates to a common basin and is then siphoned to the surface through a 4-inch pipe. This surface opening provides an intake for the section.

No. 21 incline, entirely pillar-extraction, is ventilated by a Stine fan installed at the top of a shallow shaft in No. 17 incline, which produces 28,000 cubic feet a minute, against a water-gauge of 1 inch.

Old Man's Home section is situated to the dip of the lower motor-road, where some pillars are being extracted; a limited number of men can be employed at one time as the water in the lower workings prevents extensive working.

Old Slope section is entirely pillar-extraction. The rise workings have been very satisfactory and a fair amount of coal recovered; the lower workings have been stopped for a few months due to an accumulation of black-damp. To overcome this condition a small booster-fan was installed along the level, and with the aid of change of seasonal temperature ventilation is almost normal at the present time. Electrically operated hoists are taking care of the output of the several sections and delivering it to the main haulage-roads, where large electric locomotives bring it to the tipple at the surface. A large electrically operated centrifugal pump having a capacity of 1,000 gallons a minute takes care of the bulk of the water made in the mine.

On October 13th an accident occurred, resulting in the death of a tracklayer named Richard Morgan, an old employee of the company.

New Vancouver Slope.

William Roper, Mine Manager; Thos. Strang, Overman; Thos. Hunter and D. McMillan, Firebosses.

The operation at this mine consists chiefly in recovering top coal and small pillars left by previous operations. The slope has been driven about 1,450 feet through heavily caved ground, likewise the levels on each side of the slope. Nos. 2, 2½, and 3 West levels have been driven 1,250 feet and are approaching a fault which separates this mine and Old No. 1 mine. No. 2 level has struck some solid coal about 3 feet in thickness, of good hard coal; this level is connected to No. 1 level by a chute, by means of which the coal is run down. The levels on the other side of the slope have made satisfactory progress, advancing towards the outcrop. The Main slope has been temporarily stopped due to the heavy inflow of water which usually prevails during the wet or winter season; this water gravitates to No. 2 mine through the caved area separating the two mines.

The haulage equipment consists of a steam-hoist about 100 horse-power, which operates on the Main slope and hauls to a gravity-incline which is 1,000 feet long, and connects with the F. Beban Lumber Company's railway, over which the product is brought to Extension. At the foot of the incline the mine-cars are dumped into the railway-cars for shipment.

When inspected in December this operation was in good working-order, well timbered and ventilated; 12,000 cubic feet of air was passing for the us of twenty men and three horses. No explosive gas has been found in the mine and all underground workmen are supplied with Edison electric cap-lamps; the officials use Wolf safety-lamps for testing purposes. This mine, in spite of the hazardous nature of the work, has been remarkably free from serious accident.

No. 6 Mine.

This mine was abandoned early in the year, the mine equipment being distributed throughout the other mines of the company.

The following are the official returns from the Extension Colliery for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	95,593	.....	.....	.....
Sold for export to United States	36,366	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	131,959	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	24,861	.....	.....	.....
Used under colliery boilers, etc.	14,888	.....	.....	.....
Total for colliery use	.....	39,749	.....	.....
		171,708		
Stocks on hand first of year	11,492	.....	.....	.....
Stocks on hand last of year	1,941	.....	.....	.....
Difference taken from stock during year	.....	9,551	.....	.....
Output of colliery for year	.....	162,157	.....	.....

Average Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	20	.....	10	.....	30	.....
Whites—						
Miners	194	.....	.....	.....	194	.....
Miners' helpers	5	.....	.....	.....	5	.....
Labourers	70	.....	24	.....	94	.....
Mechanics and skilled labour	15	.....	41	.....	56	.....
Boys	.....	.....	15	.....	15	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	6	.....	43	.....	49	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	310	.....	133	.....	443	.....

Report by J. W. Jemson, Inspector.

WELLINGTON EXTENSION No. 5 MINE, SOUTH WELLINGTON.

William Wilson, Mine Manager; William Brown, Overman; W. Wesnedge, R. Ewing, Jas. Rallison, W. Robinson, and N. McIntyre, Firebosses.

This mine, situated in the Cranberry district near the South Wellington Station of the Esquimalt & Nanaimo Railway, is operated in the Douglas seam and adjoins the old Alexandria mine, from which it is separated by a safety-pillar having a minimum breadth of 300 feet. The seam is very variable in thickness. The weak sandy-shale floor shows much more frequent irregularities than does the roof, which may be either a sandy shale or a rather coarse grit. "Pinches" and "wants" are often met with.

The shipping facilities are excellent owing to its close proximity to the Esquimalt & Nanaimo Railway, to which it is connected by a spur. The coal is sent over this road to the Canadian Collieries shipping centre at Ladysmith. The tipple is provided with a revolving dump, chain car-haul, shaker screens, picking-table, loading-boom, and a scraper conveyor for boiler-fuel.

The entire output is hauled up the Main slope by a first-motion steam-hoist with 18 by 36 cylinders. The smaller winches underground are driven by compressed air. The main pumps are electrically driven.

The mine is ventilated by a Keith 60-inch single-inlet fan having a capacity of 60,000 cubic feet a minute, against a water-gauge of 1 inch. At the time of the last inspection there was 26,000 cubic feet of air circulating for the use of fifty-one men and four horses. Small quantities of explosive gas were found during the year 1928. The mine is naturally damp, consequently there is practically no coal-dust.

The Main slope has reached the boundary-line, and is now abandoned. The coalfield now lies to the south of the Main slope, and a Diagonal slope has been driven from No. 15 North to facilitate the haulage. The drivages on the south of this Diagonal slope have been very troublesome and expensive to drive, the greater part of the levels having been driven in rock.

Steps are now being taken to reopen the old Alexandria mine from the Main slope of No. 5 mine by driving through the barrier-pillar with two drivages. As the Alexandria mine is full of water, safety precautions are being taken by drilling advance and flank bore-holes with a diamond-drill.

The following are the official returns for the Wellington Extension Mine No. 5, South Wellington, for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	45,635	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	45,635	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	12,840	.....	.....	.....
Used under colliery boilers, etc	4,802	.....	.....	.....
Total for colliery use	.....	17,642	.....	.....
		63,277		
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	.....	.....	.....	.....
Difference added to (or taken from) stock during year	.....	.....	.....	.....
Output of colliery for year	.....	63,277	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	6	.....	5	.....	11	.....
Whites—						
Miners	52	.....	.....	.....	52	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	19	.....	12	.....	31	.....
Mechanics and skilled labour	6	.....	7	.....	13	.....
Boys	.....	.....	5	.....	5	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	83	.....	29	.....	112	.....

REPORT BY J. W. JEMSON, INSPECTOR.

WELLINGTON EXTENSION No. 8 MINE, WELLINGTON.

R. Houston, Overman; William Strang and J. Morgan, Firebosses.

This mine is located on Range 1, Section 1, Cranberry district, and in close proximity to McKay's lake and Nanaimo river. No. 1 slope was abandoned during the year and all work concentrated on No. 2 slope, as the coal remaining in No. 1 will eventually be reached by the workings of No. 2 slope. The Main heading has been driven about 1,300 feet, with levels on either side, the coal being lowered to the foot of the Main slope by a gravity-incline. The West level has been driven to the outcrop, where a Keith fan has been placed and will provide ample ventilation for the mine. This opening will also provide the mine with another means of ingress and egress.

The coal-seam averages about 5 feet in thickness and is in two benches, the top bench averaging 15 inches of coal, then about 6 to 8 inches of dirt; the bottom bench is good hard coal. The bench of dirt is mined out by Siskol punchers; all the coal is hand-loaded. The roof is remarkably good, so that prop and cap-piece are generally sufficient support. The entire output is taken over the Timberlands Railway to Haslam flat, where it connects with the Canadian Collieries (Dunsmuir), Limited, Railway, about 5 miles from Ladysmith, the shipping-point.

Transportation of the employees to and from the mine from Lockner's Crossing is made by automobile or jitney over what was formerly a diamond-drill road. In the early spring the roads department did some repairs on the road which has improved it greatly.

The surface equipment consists of the following: Power-house, two return-tubular boilers, 160 horse-power each, one air-compressor, and small generating-set. The slope hoist is a double-drum steam-hoist about 100 horse-power. One Keith fan, 60-inch capacity, about 60,000 cubic feet a minute. The tipple is equipped with a link-belt shaker and loading-boom.

The mine worked fairly steadily till October, 1928; then closed down due to trade depression, and as this mine is favoured with excellent roof conditions, and being all solid work, it can stand for a considerable time without suffering much damage and be reopened at a minimum cost.

The following are the official returns from the Wellington Extension No. 8 mine for the year ended December 31st, 1928:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Sold for consumption in Canada	28,366			
Sold for export to United States				
Sold for export to other countries				
Total sales		28,366		
Used in making coke				
Lost in washing	3,755			
Used under colliery boilers, etc	2,531			
Total for colliery use		6,286		
		34,652		
Stocks on hand first of year				
Stocks on hand last of year				
Difference added to (or taken from) stock during year				
Output of colliery for year		34,652		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

Character of Labour.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	5	.....	2	.....	7	.....
Whites—						
Miners	17	.....	.....	.....	17	.....
Miners' helpers	29	.....	.....	.....	29	.....
Labourers	37	.....	.....	.....	37	.....
Mechanics and skilled labour	16	.....	10	.....	26	.....
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	20	.....	20	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	104	.....	32	.....	136	.....

REPORT BY J. W. JEMSON, INSPECTOR.

WELLINGTON EXTENSION No. 9 MINE.

Geo. O'Brien, Mine Manager; J. G. Hindmarch, Geo. Stewart, Jno. Michek, Geo. Dinsdale, and John White, Firebosses.

This mine is operated by the Canadian Collieries (Dunsmuir), Limited, and is situated about 6 miles from Nanaimo. It was formerly operated by King & Foster and known as the Island Collieries, Limited.

The seam now being worked is the well-known Wellington Upper seam and, characteristic of this seam wherever it has been worked, is very variable in thickness. The coal is of excellent quality. The method of operation is long-wall, with roads driven on 36-foot centres. To maintain height for mule-haulage in the branch roads the floor has to be brushed. The cover over the seam, which is hard conglomerate, averages about 30 feet in thickness and is badly fissured owing to the extraction of pillars in the Lower seam by former operations. The mine is naturally damp; as a result, all the year round it is free from accumulations of coal-dust.

All workmen are provided with Edison storage-battery cap-lamps and the officials with flame safety-lamps of the Wolf type for inspection purposes, and all shot-firing is done by certificated officials with single shot-firing batteries and cable.

At the present time the mine is closed down owing to the depression in the coal trade, and unfortunately is the second shut-down during the year. On March 9th the mine was closed down for an indefinite period, at which time the output was approximately 250 tons a day. On October 17th the mine was reopened, but again shut down on November 2nd and remained closed for the rest of the year. During the summer months a few men were employed installing a compressed-air line throughout the mine. A 5-inch line was installed from the surface air-receiver to a point known as the First Left Diagonal. At this point two 3-inch lines branch off the 5-inch line to the several sections, where the line is again reduced to 2 inches in all the levels and main development-places and 1 inch in all the gateways. Jack-hammers are used for drilling purposes, which proved a great improvement over the old hand-drilling system. The installation of the Canadian Ingersoll-Rand air compressor, which was under way at the end of 1927, was completed and put into operation.

Other additions to the plant are enlarging mule-barn on surface; a 10-kw. lighting plant; relaying Main slope with 35-lb. steel from the surface to main parting at the foot of the slope, a distance of 1,200 feet. It is also contemplated to extend the Esquimalt & Nanaimo Railway track down to the mine and abandon the present narrow-gauge railway from the tipple to the mine and erect a new tipple at the mine, thereby reducing surface haulage cost.

There were no serious or fatal accidents during the period of operation. At the time of the last inspection there was 16,000 cubic feet of air passing into the mine for the use of forty men and six horses. No explosive gas has been found; timbering generally good; ventilation some-

times sluggish in lower workings, but as a connection has been made with an old shaft, this will improve the ventilation generally.

The following are the official returns for Wellington Extension No. 9 for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	11,994	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	11,994	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	480	.....	.....	.....
Used under colliery boilers, etc	367	.....	.....	.....
Total for colliery use	.....	847	.....	.....
		12,841		
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	.....	.....	.....	.....
Difference added to (or taken from) stock during year	.....	.....	.....	.....
Output of colliery for year	.....	12,841	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	7	.....	2	.....	9	.....
Whites—						
Miners	62	.....	.....	.....	62	.....
Miners' helpers	3	.....	.....	.....	3	.....
Labourers	25	.....	19	.....	44	.....
Mechanics and skilled labour	6	.....	11	.....	17	.....
Boys	.....	.....	2	.....	2	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	2	.....	2	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	103	.....	36	.....	139	.....

Report by J. W. Jemson, Inspector.

FIDDICK MINE, SOUTH WELLINGTON.

R. Fiddick, Operator; James Handlen, Fireboss.

This mine is situated on the site formerly worked by the Pacific Coast Coal Company, near the South Wellington Station on the Esquimalt & Nanaimo Railway. As was anticipated at the time of opening this mine, a few thousand tons of coal could be recovered from the pillars left by the previous operators; the recovery so far has been very satisfactory and the future prospects are encouraging.

Several small slopes have been opened, and as the coal immediately adjacent to the slope is worked out a new opening is made. This is possible as the cover is very shallow and of a soft nature. The present opening, which is near the Esquimalt & Nanaimo Railway track, shows a few pillars in a north-easterly direction.

The mine is ventilated by natural means. There being several openings to the surface, no gas has been found, and the requirements of the "Coal-mines Regulation Act" are carefully observed. Edison electric cap-lamps are used by the miners and Wolf safety-lamps by the mine officials for testing purposes. All shots are fired by battery and cable under the supervision of a competent person appointed for the purpose.

The following are the official returns for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	1,805			
Sold for export to United States				
Sold for export to other countries				
Total sales		1,805		
Used in making coke				
Used under colliery boilers, etc.				
Total for colliery use				
Stocks on hand first of year				
Stocks on hand last of year				
Difference added to (or taken from) stock during year				
Output of colliery for year		1,805		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance						
Whites—						
Miners	6	5.50			6	
Miners' helpers	2				2	
Labourers			4	2.25	4	
Mechanics and skilled labour						
Boys						
Japanese						
Chinese						
Indians						
Totals	8		4		12	

Report by J. W. Jemson, Inspector.

DIAMOND JUBILEE MINE, LANTZVILLE.

Harry Shepherd, Superintendent.

This mine is situated at the entrance to Nanoose bay, on Lot 54, Alberni district, and adjoins the property of the abandoned Nanoose Wellington Collieries. The Diamond Jubilee slope is near an old slope which was driven years ago into the upper Wellington seam, which outcrops here on the shore. The slope has advanced about 350 feet and bears 10° west of south; branches are driven mostly on the west side of the slope and small long-wall faces won out. The coal-seam averages about 20 inches in thickness and is of good quality, specially suitable for domestic use. As the seam is very thin it cannot be operated profitably; therefore operations ceased some time ago.

During the shut-down a new company has been formed, which is now driving a new slope to the Lower seam, where, according to bore-hole indications, a good seam is to be found.

An air-compressor, boiler, hoist, and pumps have been installed. With this new equipment good progress should be made with the slope and the seam reached within three months. Several important changes are contemplated as regards shipping and tipple arrangements.

The following are the official returns for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	750			
Sold for export to United States				
Sold for export to other countries				
Total sales		750		
Used in making coke				
Used under colliery boilers, etc				
Total for colliery use				
Stocks on hand first of year				
Stocks on hand last of year				
Difference added to (or taken from) stock during year				
Output of colliery for year		750		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	1		1		2	
Whites—						
Miners	2				2	
Miners' helpers						
Labourers						
Mechanics and skilled labour						
Boys						
Japanese						
Chinese						
Indians						
Totals	3		1		4	

Report by Thos. R. Jackson, Inspector.

Granby Consolidated Mining, Smelting, and Power Co., Ltd.

J. T. Crabbs, President, New York City; Chas. Bocking, Vice-President, Vancouver, B.C.; H. Harvey, Secretary, New York City; H. R. Plommer, Treasurer, Vancouver, B.C.; Robert Henderson, Superintendent, Cassidy, B.C.

No. 1 MINE.

Robert Henderson, Manager; Alex. McLaughlin, Overman; Albert Radford, Matthew Meek, Tom Bullen, and James McGrath, Firebosses.

Granby Colliery No. 1 mine is situated about 9 miles in a southerly direction from Nanaimo. The main entrance to the mine is by a slope 7 by 14 feet in the clear to allow for a double track and is timbered by 12- by 14-inch framed sets, 4 feet centre to centre. A separate manway is provided for a travelling-road and it at the same time forms an intake airway. The Douglas

seam, which varies from 3 to 20 feet in thickness, is worked at this mine and the system of work adopted is pillar and stall.

The mine is ventilated by a Sirocco fan having a capacity of 150,000 cubic feet of air a minute, with a 3.5-inch water-gauge. This fan is driven by a 150-horse-power Westinghouse electric motor. The main hoist is a Vulcan 18- by 36-inch, double-drum, second-motion hoist. The mine-cars are large, having a carrying capacity of 1.75 tons of coal. No mules or horses are used in the mine. Compressed air is used underground for driving of drills, pumps, and winches. A Rand cross-compound condensing compressor, with capacity of 2,000 cubic feet of air a minute, furnishes the power. Electric power is supplied by an Allis-Chalmers 450-kw. generator, 2,300-volt, 3-phase, 60-cycle, 300 r.p.m., both direct-connected to vertical high-speed engines of the Goldie & McCulloch type. The remainder of the electric equipment is of the Westinghouse type. A Worthington fire-pump, capacity of 1,000 gallons a minute, size 18 by 10 by 12 inches, is kept in readiness for emergency.

A large house called the "change-house" is used by the miners for the purpose of changing their clothes. An attendant is in charge whose duty it is to keep the place clean, well ventilated and heated. The heat produced in the drying-room is sufficient to make the mine clothes perfectly dry and comfortable for the workmen to don before they go to work in the mine. The change-house is equipped with steel lockers, which are heated by steam-coils underneath. There are shower-baths and large lavatory, including every convenience for the workmen.

The intake air is heated by exhaust steam passing through radiators and allowed to travel down the mine, thus to some extent preventing the drying-out of the mine. Very fine fog sprays are placed about 150 feet apart on the Main slope and these operate automatically for twenty minutes out of every hour.

Farther in the mine the main roads are liberally treated with inert dust and water to such extent that the sample tests for coal-dust show an incombustible content in compliance with the requirements of the "Coal-mines Regulation Act."

Edison head-lamps are used by the employees, except in the case of officials, who use the Wolf flame safety-lamp for gas-testing purposes.

The extraction of pillars is still general. No blowouts or pushes occurred underground during the year. During the writer's inspection in the month of December the general conditions of the mine were found to be good. Roof-subsidence and floor-heaving conditions have been very efficiently dealt with by the management. This squeezing took place chiefly along the lower levels. I found no explosive gas and could not detect a gas-cap in the many tests that were made on that occasion with the aid of a Wolf flame safety-lamp.

Mine-air sample tests showed about 0.02 per cent. of methane. Several accidents of a more or less serious nature took place during the year. On December 20th a very serious accident occurred to a winch-boy while operating his winch, which resulted in his death two days later. This was a very unusual and unfortunate fatality.

The analysis of mine coal-dust samples submitted to this office were considerably better in ash content than what is specified by the "Coal-mines Regulation Act."

I measured a total quantity of 90,000 cubic feet of air a minute entering the mine, divided as follows: Main portal 58,000, manway portal 32,000. In the North side split there was 12,000 cubic feet of air a minute passing for the use of thirty-seven men. In the South side split there was 10,000 cubic feet of air a minute passing for the use of twenty-five men. Reports of mine examination by the gas committee were sent in to this office and were found to show the general conditions of the mine to be good.

The following are the official returns for the Granby Colliery for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	139,144	.....	.....	.....
Sold for export to United States	2,945	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	142,089	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	41,007	.....	.....	.....
Used under colliery boilers, etc.	9,598	.....	.....	.....
Total for colliery use	.....	50,605	.....	.....
		192,694		
Stocks on hand first of year	6,492	.....	.....	.....
Stocks on hand last of year	597	.....	.....	.....
Difference taken from stock during year	.....	5,895	.....	.....
Output of colliery for year	.....	186,799	.....	.....

Average Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	7	6.00	4	5.50	11	5.82
Whites—						
Miners	113	7.01	.....	.....	113	7.01
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	41	4.16	28	3.50	69	3.89
Mechanics and skilled labour	.....	.....	28	4.63	28	4.63
Boys	.....	.....	5	1.50	5	1.50
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	161	.....	65	.....	226	.....

Report by J. W. Jemson, Inspector.

East Wellington Coal Company.

H. G. Heisterman, President, Victoria, B.C.; P. S. Fagan, Secretary-Treasurer, Victoria, B.C.

EAST WELLINGTON COLLIERY.

William Wilson, Mine Manager; Walter Joyce, Overman; G. Grey, C. Webber, D. McMillan, and Jos. Wilson, Firebosses.

This mine was abandoned in February, 1928, as the boundary adjoining the Western Fuel Corporation of Canada property had been reached. On the other side of the mine the coal pinched out, and was not located again although considerable prospecting and diamond-drilling had been done, involving considerable expense. All mining machinery was withdrawn from the mine at the time of abandonment.

The following are the official returns for the period worked during the year 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	3,995			
Sold for export to United States				
Sold for export to other countries				
Total sales		3,995		
Used in making coke	245			
Lost in washing	208			
Used under colliery boilers, etc	909			
Total for colliery use		1,362		
		5,357		
Stocks on hand first of year				
Stocks on hand last of year				
Difference added to (or taken from) stock during year				
Output of colliery for year		5,357		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	2		3		5	
Whites—						
Miners	32				32	
Miners' helpers						
Labourers	29				29	
Mechanics and skilled labour	11				11	
Boys	2				2	
Japanese			9		9	
Chinese						
Indians						
Totals	76		12		88	

Report by Jas. W. Jemson, Inspector.

Consumers' Coal Co., Ltd.

John Arbuthnot, President, Victoria, B.C.; J. R. Green, Secretary, Victoria, B.C.; F. John, Superintendent.

ROUND ISLAND MINE.

The above company commenced prospecting operations on June 15th, 1928, by driving a slope beginning at an old shaft that had been sunk many years ago near the outcrop on the beach at the east end of Round island. This island is situated in the Cedar district and stands about half a mile off the shores of Vancouver island and about 2 miles north-west of Boat harbour, containing approximately 8 acres.

The development-work done consists chiefly in driving the slope, erecting a few cabins, installing machinery, and making a temporary boat-landing. The slope has been driven about 270 feet and dips about 12°; the coal-seam at the outcrop showed about 6 feet thick, but gradually thinned out to 2 feet at the face of the slope, where operations ceased. The roof is

good (sandstone) and a hard sandy-shale floor. It has always been doubtful whether or not operations were being carried on in the true seam; therefore to prove this two diamond-drill holes have been put down, one on the north-west and the other on the south-east corner of the island, and, it is reported, with satisfactory results. One shipment of 138 tons of coal was made by scow.

The equipment comprises one Fairbanks-Morse 7-horse-power hoist; compressor, 176 cubic feet a minute capacity, with 25-horse-power Diesel engine; fan, 2,000 cubic feet a minute capacity. All workmen used Wolf safety-lamps; blasting was carried on under the supervision of a competent person, using permitted explosives, and the "Coal-mines Regulation Act" satisfactorily observed.

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	138	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	138	.....	.....
Used in making coke	.....	.....	.....	.....
Used under colliery boilers, etc	.....	.....	.....	.....
Total for colliery use	.....	.....	.....	.....
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	.....	.....	.....	.....
Difference added to (or taken from) stock during year	.....	.....	.....	.....
Output of colliery for year	.....	138	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	1	.....	2	.....	3	.....
Whites—						
Miners	4	5.50	.....	.....	4	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	.....	.....	.....	.....	.....	.....
Mechanics and skilled labour	.....	.....	.....	.....	.....	.....
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	5	.....	2	.....	7	.....

Report by J. W. Jemson, Inspector.

LITTLE ASH MINE, WELLINGTON.

R. H. Chambers, Operator and Mine Official.

This mine is situated about a mile from Wellington and about half a mile from the present No. 9 mine of the Canadian Collieries. It was formerly known as the "Jordan mine" and operated by that name over thirty years ago, though very little mining was done.

The coal was hauled over a wooden track to Nanoose Bay, the shipping-point being near the Indian reserve. Probably lack of equipment and funds were the cause of the operation ceasing at that time. A new lease of the property was acquired by a few local miners, who commenced to clean up the place and dewater the mine in April, 1928. Satisfactory progress has been made with the development of a new slope, which is opening virgin ground.

The coal-seam varies in thickness and quality. The cover is mostly gravel, with very little hard measures; consequently in the wet season surface water is a serious hindrance. The output is hauled by trucks to Nanaimo and district, and finds a ready market as it is a good domestic coal.

The lamps used generally by the workmen are Wheat electric cap-lamps, while Wolf safety-lamps are used for testing purposes. Gas has not been found in this mine as there are numerous openings to the surface. Permitted explosives are used and all shots fired under the supervision of a competent person and the requirements of the "Coal-mines Regulation Act" are reasonably observed.

The following are the official returns for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	1,532	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	1,532	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	.....	.....	.....	.....
Used under colliery boilers, etc	.....	.....	.....	.....
Total for colliery use	.....	.....	.....	.....
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	.....	.....	.....	.....
Difference added to (or taken from) stock during year	.....	.....	.....	.....
Output of colliery for year	.....	1,532	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	1	.....	.....	.....	1	.....
Whites—						
Miners	6	5.50	.....	4.50	6	5.00
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	.....	.....	4	.....	4	.....
Mechanics and skilled labour	.....	.....	1	.....	1	.....
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	7	.....	5	.....	12	.....

Report by J. W. Jemson, Inspector.

RICHARDSON MINE, SOUTH WELLINGTON.

Richardson Brothers, Operators; George Stewart, Fireboss.

This mine adjoins the Fiddick property and is a continuation of the old workings of the Pacific Coast Coal Company. It is situated on Section 13, Range 6, in the Cranberry district, near the South Wellington Railway Station on the Esquimalt & Nanaimo Railway.

A slope has been driven under the by-road into the old workings, where some pillar coal is men have been engaged during the greater part of the year as labourers and miners, etc., under supposed to have been left. So far the coal recovery has not been very successful. Three to four

the supervision of a certificated mine official. Only permitted explosives are used and all shots fired by battery and cable. The underground workmen are supplied with Edison electric cap-lamps and with Wolf safety-lamps for testing purposes. No gas has been found in the mine, as there are several openings to the surface which ensures ample ventilation.

The following are the official returns for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	72	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	72	.....	.....
Used in making coke	.....	.....	.....	.....
Used under colliery boilers, etc	.....	.....	.....	.....
Total for colliery use	.....	.....	.....	.....
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	.....	.....	.....	.....
Difference added to (or taken from) stock during year	.....	.....	.....	.....
Output of colliery for year	.....	72	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	.....	.....	.....	.....	.....	.....
Whites—						
Miners	3	5.50	.....	.....	3	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	1	3.20	2	2.40	3	.....
Mechanics and skilled labour	.....	.....	.....	.....	.....	.....
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	4	.....	2	.....	6	.....

NORTHERN INSPECTION DISTRICT.

Report by T. J. Shenton, Inspector.

Telkwa Collieries Co., Ltd.

John J. McNeil, President, Telkwa, B.C.; George Woodland, Vice-President, Prince Rupert, B.C.; Thomas McClymont, Secretary-Treasurer, Prince Rupert, B.C.; Asa Robinson, Superintendent, Telkwa, B.C.

GOAT CREEK.

J. McNeil, General Manager; A. Robinson, Mine Foreman.

This mine was operated from the first of January to the end of April, when work was suspended until August, from which date operation was continuous to the end of the year. During the year a second shaft with ladder and platform was completed to improve the ventilation.

About the middle of November an agreement to purchase the property was made by F. Taggart, representative of a company of London, England, and it is expected that an engineer to take charge will be on the ground early in 1929. In the meantime the services of the manager, J. McNeil, and that of A. Robinson are being continued. In all of my inspections throughout the year I have found the operation to be conducted in compliance with the "Coal-mines Regulation Act." No inflammable gases so far have been encountered.

The following are the official returns from the Telkwa Colliery for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	1,668	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	1,668	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	.....	.....	.....	.....
Used under colliery boilers, etc.	.....	.....	.....	.....
Total for colliery use	.....	.....	.....	.....
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	.....	.....	.....	.....
Difference added to (or taken from) stock during year	.....	.....	.....	.....
Output of colliery for year	.....	1,668	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	1	7.65	.....	.....	1	7.65
Whites—	.....	.....	.....	.....	.....	.....
Miners	3	4.00	.....	.....	3	4.00
Miners' helpers	2	3.00	.....	.....	2	3.00
Labourers	.....	.....	.....	.....	.....	.....
Mechanics and skilled labour	.....	.....	1	4.00	1	4.00
Boys	.....	.....	.....	.....	.....	.....
Cook	.....	.....	1	3.80	1	3.80
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	6	4.28	2	3.90	8	4.18

NICOLA-PRINCETON INSPECTION DISTRICT.

Report by John G. Biggs, Inspector.

I have the honour to submit my annual report as Inspector of Mines for the Nicola-Princeton District for the year 1928.

The coal companies operating in this district during the present year were as follows: The Coalmont Collieries, Limited; Middlesboro Collieries, Limited; Lynden Coal Company, Limited; Tulameen Valley Coal Company, Limited; Normandale Collieries, Limited; and the Pleasant Valley Coal Company, Limited. Two of these are new companies which commenced operations during the year.

The Normandale Collieries, Limited, commenced work at the old Normandale property, situated in the south-east portion of the Nicola field, during the latter part of the year, where

a small staff of men has been employed under the supervision of Frank Glover. This work is entirely of a prospecting nature for the purpose of proving this portion of the basin.

Probably the most important coal-mine development that has taken place in this district for several years is that instituted by the Pleasant Valley Coal Company in the Princeton district, where preparation is being made for developing and operating on a large scale. The property is situated 1½ miles west of Princeton and is conveniently situated near the Kettle Valley Railway. Two large and well-timbered adit-levels are being driven into the side of the mountain which are expected to encounter the seam of coal at a distance of some 700 feet from the portal. The seam is exposed at the surface some distance above these rock tunnels. A road has been graded around the side of the mountain to connect the entrance to these tunnels with a large and well-equipped mine-tipple and bunkers. A large mine-yard has been graded on the river-flat below and a bridge across the river is at present being constructed which will give this property access to the railway. There is no doubt that this company will commence operations during the early part of the year 1929 and will produce a high grade of domestic coal with a low ash content, and will be in a position to meet the demand for this fuel both at the Coast and the southern interior portion of the Province. The Princeton coalfield is well able to supply this market owing to its position. The great trouble in the past has been the lack of a mine that could supply this market, which is of a variable nature. There is every possibility that this operation may lead to further industries in the Princeton district.

The operating mines have been very free from explosive gas during the present year and it has been only on very rare occasions that any trace of methane has been found. On the other hand, the coals of this area are very susceptible to spontaneous combustion and every possible precaution must be taken to avert this danger.

It would appear that a system of panels that can be dealt with individually in the case of heating gives the best protection from heating or fire, as any panel can be quickly and effectively sealed off without affecting the rest of the mine. Fortunately we have been very free from this cause of trouble at the various mines during the year, with the exception of the Coalmont Collieries. During the month of January heating was found to be taking place in the pillar operations of No. 10 East level of the No. 4 mine, and as a result it was found necessary to seal off Nos. 7, 8, 9, 10, and 11 East levels by beam stoppings, which have been found to be very effective. This practically finishes the operations on the east side of this mine and very fortunately most of the pillar area has been drawn back. During the month of March heating was found to be taking place in a blind heading off No. 1 level, which was sealed off at once. During February heating was found to be taking place in the pillar section of the No. 4 West level and which was successfully sealed off. During November heating was found to be taking place in the inside of the counter-level of the No. 3 mine, which was successfully dealt with in the same manner.

Liberal use has been made at the Coalmont Collieries during the year of the all-service gas-mask, which is found very effective for this class of work, being light, compact, and very easy to adjust. These masks are looked upon with great favour by the men employed in this class of work, and while their use is limited they are very adaptable.

Accidents.

The coal-mines in operation in this district during the present year have been very free from serious accidents, and it is gratifying to report that there has been no fatal accident in these mines during the year. Four accidents have been reported to this office during the year as required by section 71 of the "Coal-mines Regulation Act," resulting in injury to the same number of employees. Each was in nature of fractures and all occurred at the No. 4 mine of the Coalmont Collieries.

Inspection on behalf of the workmen, as provided for by General Rule 37, has been taken advantage of at the larger operations and regular inspections made by the employees during each month, and in all cases the reports of inspection were very satisfactory. However, this matter has not received the same amount of attention around the smaller properties, which I presume is owing to the limited area of these mines and the little cost of the mine committee.

I again thank the workmen and officials for their co-operation in carrying out my work as an Inspector of Mines for this district, and hope that the same will continue during the year

1929, as it is only by the co-operation on the part of the workmen and the officials that we can hope to make coal-mining safe.

Middlesboro Collieries, Ltd.

E. W. Hamber, President, Vancouver, B.C.; Thos. Sanderson, Secretary, Vancouver, B.C.; C. M. O'Brian, Treasurer, Vancouver, B.C.; Robert Fairfoull, Superintendent, Merritt, B.C.

MIDDLESBORO COLLIERY.

Robt. Fairfoull, Manager.

This colliery is situated 1 mile south of the city of Merritt and, with the exception of the Normandale operations, is the only operating colliery in the Nicola valley. The seams of coal generally outcrop to the surface on the side of the hill which rises from the valley below. The measures have a general pitch south-east and lie at a high angle of inclination. Five mines are now in operation and these are being developed by means of slopes and adit-levels from the croppings, lying at a much higher elevation than the mine-yard. As a result a gravity-plane is in use for transporting the coal from the mines to the tipple. All the work at present is being conducted on the south-east side of this property, heading towards the Coldwater river, where the measures are found to be lying in good conformation and the quality of the coal much improved. At these mines all the coal is undercut by machines and the use of explosives is greatly curtailed; this has been the means of greatly improving the grade of coal produced.

Power Plant.—There has been no change made with the power plant during the present year. It consists of four return-tubular boilers which have a capacity of 600 horse-power, providing power for a 2,300-volt alternator direct-coupled to a high-speed steam-engine, also used for the pump-station at the Coldwater river for lighting purposes around the plant and camp buildings, the tipple machinery, and No. 4 East mine hoist. A large steam-driven Canadian Rand 2-stage cross-compound air-compressor which has a capacity of 2,000 cubic feet of free air a minute is the chief source of power at present in use at these mines for operating the mine-hoists, mining-machines, and pumps. This is conveyed through 3,000 feet of pipe-line from the power-station to the mines.

Edison electric lamps are in use by all the employees underground, while Wolf-type safety-lamps are used by mine officials for inspection purposes. There have been no serious accidents at these mines during the year.

The miners have availed themselves of the opportunity provided by the "Coal-mines Regulation Act," section 101, Rule 37, and have appointed their own representatives to inspect these mines during each month, reports of which have been mailed to this office. Copies of the "Coal-mines Regulation Act" and special rules are well posted near the entrance to these mines.

No. 2 North Mine.

James Fairfoull, Overman; Leslie Dickie, Fireboss.

This mine is situated 300 feet above and 2,000 feet south of the mine-yard. It is operating in a small coal-basin by means of an adit-level and two slopes. The seam is at a high angle of inclination around the edges and gradually falls off towards the centre of this basin. The seam has an average thickness of 6 feet, which has been correlated as the No. 2 seam of this property. The area of this mine is very limited, all work at present consisting of the extraction of pillars from the slopes and adit-level, with several other openings being made to the surface. The roads are being driven about 10 feet in width and, owing to the high inclination of the seam, the coal is transported from the headings and crosscuts above to the Main levels by means of chutes, where it is loaded into the mine-cars, having a capacity of 1½ tons, and hauled from the slopes by means of compressed-air hoists and horse-haulage from the levels.

Ventilation measurements taken during my last visit of inspection showed 12,000 cubic feet of air a minute passing through this mine for the use of twenty-two men and one horse. There has been no trace of gas found in this mine, the air being well conducted around the working-faces; the brattice and stoppings were found in good order. The working-places were well

timbered and a sufficient supply of suitable timber provided for the use of the miners. The roads were also well timbered and in fairly good condition. Analyses of material taken from this mine during each month showed the same to be in conformation with the requirements of the Coal-dust Regulations.

The coal is mined by machines of the post-puncher type, and owing to the high inclination of the seam requires very careful spragging; little blasting is required.

No. 2 South Mine.

James Fairfoull, Overman; Richard Dunnigan, Fireboss.

This is a new mine opened up during the present year and is situated about 1,000 feet west of the No. 2 North mine. The seam is 10 feet thick and is almost vertical at the outcrop, where it is being developed by an adit-level and slope from the outcrop. The workings gain depth in the measures as the developments are extended, owing to the rise of the hill. The Main level has reached a distance of 400 feet from the portal. A raise has been driven at 300 feet from the entrance to the surface above for the purpose of ventilation. The slope has reached a distance of 200 feet from the entrance, and it is expected that as depth is attained by this slope the seam will follow a more normal pitch. Eight men are employed underground. I found the general conditions of this small mine to be very good, the roads being well timbered, and, being naturally damp, free from dangerous coal-dust.

The entrance to the Nos. 2 North, 3 North, and the 2 South mines are all on the same elevation, about 300 feet above the mine-tipple, and are connected by surface tracks following around the side of the hill to a large four-way surface siding situated near the upper terminal of the gravity-plane, which is 3,000 feet in length and by which the coal is lowered to the tipple. One rather interesting feature about this gravity-plane is the use of a loose-drum compressed-air hoist in the place of a drum and a friction-brake, which was necessary owing to the fact that the entrance to the No. 2 East mine is situated in the centre of this gravity-plane, and the coal production of this mine is handled by this hoist and taken over this plane to the lower mine siding.

Compressed air is the only motive power in these three mines and is transmitted through a 4-inch pipe from the large compressor plant, situated near the mine-tipple. It is also used for the operation of the various hoists, pumps, and mining-machines.

No. 2. East Mine.

William Ewart, Overman; Matthew McKibben, Fireboss.

This is a small mine opened from the outcrop on the north side of the surface incline and developed by an 18° slope driven into the side of the hill a distance of about 300 feet. The coal is found to be subject to a great deal of faulting, and practically all the work done has been of a prospective nature for the purpose of proving this portion of the coalfield and developing a mine, but it has met with little success. The coal is found to be lying very irregularly and generally at a high inclination, while the raises have been driven to the outcrop at the side of the hill and used for the purpose of ventilation. All the work at present consists of extracting pillars and, the area being small, the life of the mine is very limited. Eleven men are employed underground.

I found the general conditions of this mine to be very good, the working-faces well timbered, and a sufficient supply of suitable timber provided for the use of the miners. The roads were also well timbered and in good condition. Analyses of material taken from the roads each month show the same to be in conformation with the requirements of the Coal-dust Regulations.

No. 3 North Mine.

Alex. Allen, Overman; Garnet S. Corbett, Fireboss.

This is the largest and most important mine at present operated by the Middlesboro Collieries and is situated on the same elevation, 150 feet east of the No. 2 North mine. The measures following the same conformation, inclination, and direction of dip, but lying at a much lower elevation in this coal-basin, causes it to have a very much larger workable area than the No. 2 mine. This coal-seam, which is about 6 feet in thickness, is found to have a general pitch of about 30° and has been developed by a level driven into the side of the hill from the surface outcrop and extended a distance of 2,000 feet, when the outcrop was again reached at the opposite side of the hill. Headings were driven up from this level to the surface at a distance varying from

200 to 400 feet. The coal to the dip has been developed by an 18° slope driven a distance of about 500 feet, where it is found to approach the foot of the basin; four levels driven to the north and one to the south.

All the work above the Main level and the Upper section of this mine consists of the extraction of pillars, and owing to the high inclination of the seam the coal is conveyed from the various faces to the main haulage-level by means of chutes. The coal is all machine-mined by the post-puncher type of machine. Owing to the friable nature of the coal and the pitch careful spragging is required. Very little blasting is resorted to, the object being to produce coal as large and as clean as possible.

Ventilation measurements taken during my last visit of inspection showed 16,000 cubic feet of air a minute passing into this mine for the use of thirty-two men. The air was well conducted around the working-faces and the brattice and stoppings were found to be in good order. The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The roads were well timbered and in good condition. Analyses of material taken from this mine during each month, pursuant to the provisions of section 128, show the same to be in conformation with the requirements of the Coal-dust Regulations.

No. 4 East Mine.

William Ewart, Overman.

This is the oldest operating mine of the Middlesboro Collieries and is situated a short distance south and on the same elevation as the mine-tipple. It has been developed by a 15° slope from the surface croppings on the No. 4 seam, which attains an unusual thickness in this section of the property.

The area of the mine is very limited and all the work at present consists of the extraction of pillars above the old No. 2 level, which is situated about 300 feet from the portal of the Main slope. Five men are employed underground. I found the general conditions of the mine to be very good and free from any trace of explosive gas; the stoppings and brattice were also found to be in good order. The working-places were well timbered and a sufficient supply of suitable timber provided for the use of the miners. The roads were well timbered, in good condition, and, being naturally damp, were free from dangerous coal-dust.

The method of haulage is very simple, the coal being transported from the faces above the Main level in chutes and loaded into the mine-cars on the level, trammed by hand to a landing situated near the slope, then hauled in trips to the surface by a steam-hoist situated near the entrance to the mine.

The following are the official returns for the Middlesboro Colliery for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	42,920	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	42,920	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	.....	.....	.....	.....
Used under colliery boilers, etc	1,369	.....	.....	.....
Total for colliery use	.....	1,369	.....	.....
		44,289	.....	.....
Stocks on hand first of year	179	.....	.....	.....
Stocks on hand last of year	536	.....	.....	.....
Difference added to stock during year	.....	357	.....	.....
Output of colliery for year	.....	44,646	.....	.....

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

Character of Labour.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	7	.....	3	.....	10	.....
Whites—						
Miners	42	4.50	.....	.....	42	.....
Miners' helpers	20	4.00	.....	.....	20	.....
Labourers	18	4.00–4.50	12	4.25	30	.....
Mechanics and skilled labour	.....	.....	12	4.40–5.30	12	.....
Boys	.....	.....	6	2.50	6	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	87	.....	33	.....	120	.....

Coalmont Collieries, Ltd.

W. J. Blake-Wilson, President, Vancouver, B.C.; General J. W. Stewart, Vice-President, Vancouver, B.C.; A. H. Douglas, Secretary, Vancouver, B.C.; D. McLeod, Treasurer, Vancouver, B.C.; George Murray, Superintendent, Blakeburn, B.C.

COALMONT COLLIERY.

This is the largest and most important coal operation in the district and is situated on the main line of the Kettle Valley Railway, 170 miles east of the city of Vancouver and 12 miles west of the town of Princeton, and has been in active operation during the whole of the year. The mine-yard, tipple, and power-house are situated at the town of Coalmont and the mines located on the opposite side of the mountain, at an elevation of 1,600 feet above the railway.

Owing to the inaccessibility and the difficulty of locating a satisfactory railway-grade for transportation, an overhead tramway 3 miles in length is in use for hauling the coal from the mines to the tipple. Near the top terminal of this tramway and at the opposite side of the mountain is the town of Blakeburn, the scene of the chief operations of this company, and where the mine offices, bunk-house, dining-hall and cook-house, wash and change room, machine-shops, auxiliary steam plant, and a number of dwellings, occupied by the employees and the officials of this company, are located. This is reached by a winding mountainous road 4½ miles in length from the old Granite Creek townsite, situated near the Coalmont–Princeton highway and near the entrance of the creek into the Tulameen river. The Public Works Department has done a considerable amount of necessary and effective work on this road during the present year by relocating and grading a very fine road down the side of the mountain, which maintains a uniform grade from the mine to the valley below.

This company is at present operating the Nos. 3 and 4 mines, which have both been developed by adit-drifts driven into the side of the mountain, and all operations conducted to the dip of these Main levels and in the same seam of coal in the series. The No. 3 mine is the oldest and is situated on the same elevation and about 1,000 feet west of the top terminal of the overhead tramway, which comprises the mine-yard, from which a light railway is continued around the side of the mountain a further distance of 5,400 feet to the entrance to the No. 4 mine, which is the largest and the most important operation and the mine to which this company at present depends upon for a tonnage. These mines are separated by a large intrusive dyke which cuts through the mountain and destroys a large section of the coal area in this section of the Coalmont coalfield. The measures generally are lying at a high angle of inclination and subject to a fairly large amount of faulting, which causes the coal in sections of the mine to be of little commercial value. The seam is of unusual thickness and may be better described as a number of coal-seams intersected by small bands of rock, bone, and shale, with an aggregate thickness of about 160 feet. The operations are being conducted in the third seam of the series, which is about 12 feet

thick and overlain by an irregular friable fireclay rock about 3 feet in thickness, which disintegrates and expands when in contact with the atmosphere, causing it to be necessary to leave a section of the coal-seam to form a roof in the workings. It is often a very hard matter to maintain roads owing to the crushing of the timber, and it is the action of this rock that is the cause of the high timber costs which prevail at these mines.

During the present year a crosscut adit-drift was driven off the No. 12 West level of the No. 4 mine for the purpose of proving a section of the series in this mine, the inclination of the seam being about 20°. The foot-wall was encountered at a distance of 160 feet from the level and it was found rather a difficult matter to find a section that could be operated with success.

Power Plant.—The main power plant is situated at Coalmont and consists of three 250-horse-power cross-drum horizontal-inclined water-tube boilers fitted with forced draught and duplicate feed-pumps; feed-water heaters provide power for the operation of a 600-horse-power Corliss cross-compound condensing-engine coupled direct to a G.E. 3-phase alternator, speed 500 r.p.m., voltage 500; also a 500-kw. Westinghouse-Parsons steam-turbine generator set feeding into transformers situated near the plant, where the current is stepped up to 10,000 volts. The current is carried over high-tension lines to transformers situated near the mining operations, from which the current is distributed at 550 volts for power purposes and 110 volts for lighting.

This plant is supplemented by a small steam-power plant at the mine and consists of two Jenks return-tube boilers used for operating a steam-driven compressor which provides power for the air-hoists and the pumps of the No. 3 mine, and also heating various houses, offices, bunk-house, and wash-house, which are situated around the camp.

Owing to the expansion of the mining operations and the seams of coal lying at a high angle of inclination and all the work to the dip of the main haulage, this operation requires considerable power, which the present plant, that has been in operation for a considerable number of years, is not able to produce. As a result the company is at present making preparation for the installation of a 1,000-kw. Allis-Chalmers turbine generator set which is expected to be in operation during the early part of the year and will replace the two units at present in use.

Aerial Tramway.—Owing to the mountainous nature of this coalfield and the elevation of the mines above the railway, an aerial tramway system of transportation has been adopted for conveying the coal from the mines to the tipple. While this system of haulage has been in use for several metal-mines in the Province, this was a new and interesting method of haulage to be adopted for the transportation of coal over any such distance, and it has been operated with a fair amount of success. The great trouble is that it limits the production of the mines to the capacity of the tramway and all the material required at the mines has to be taken over the road by means of motor-trucks.

This tramway is about 15,000 feet in length, with a difference in elevation between the terminals of some 1,600 feet. It is supported by wooden towers, equipped with 1⅝-inch track strand cable on the full side and 1⅛-inch locked coil cable on the empty side. These are used as standard cables for supporting the buckets and are operated by a ⅞-inch Keystone travelling-cable from a 7-foot Fowler Grip pulley situated at the top terminal, connected by spur-gearing and belt-driven by a 75-horse-power alternator, also friction-brakes. At the lower terminal of the tipple there is a large return pulley installed on a trolley, to which a counterbalance is attached consisting of large cement blocks and used as a tension.

The buckets, each of which serves also as the body of a mine-car, have a capacity of 1 ton and are attached to the carrier-arms provided with grips and runners. The buckets are lifted from the car-frame at the top terminal by means of a compressed-air lift on to an overhead rail which connects to the tram-line; where they are properly spaced, at the rate of 1 bucket or 1 ton a minute.

These cables, which have been in operation several years, were beginning to show wear and causing considerable trouble, with the result that during the present year 5,000 feet of 1⅝-inch track strand cable has been replaced on the full side of the tramway, 5,000 feet of 1⅛-inch lock coil cable on the empty side of the tramway, also a complete running-line has been installed which comprised about 30,200 feet of ⅞-inch Keystone plough-steel cable, making a total of about 40,000 feet of new cable installed during the present year. This greatly improves the condition of the tramway and naturally facilitates the operations of these mines.

No. 3 Mine.

Harry Hopkins, John Davis, and Robert Barrass, Firebosses.

This mine is situated on the same level and 1,000 feet north of the top terminal of the overhead tramway, which constitutes the mine-yard, and has been developed by a well-timbered 8- by 12-foot adit-level, generally known as the "Wilson tunnel." The pillars have been drawn back to within close proximity to the entrance of No. 2 slope, which is about 1,600 feet from the entrance to the mine. This slope is separated from the old No. 2 mine above by a 100-foot barrier-pillar and operates the same seam of coal. All work at present is to the dip of the Main level and near the face of the No. 2 slope.

This mine was sealed off during the early part of the year 1925 owing to a mine fire and was allowed to fill with water. It was opened again during the latter part of the same year and during the last two years the principal work done has been the dewatering of the mine to the dip, cleaning out and retimbering the No. 2 slope and counter, the erection of heavy beam stoppings on each side of the slopes as the water receded for the purpose of sealing off the old disused portions of the mine, and preventing any spontaneous heating. This slope had been cleaned out and retimbered a distance of 1,600 feet to the old No. 6 level, which was the lowest working-level in this section of the mine, and at present work consists of drawing back these pillars and recovering all the coal possible.

This is a friable seam of coal about 12 feet in height. Since the lower section of the mine was dewatered it has been found a very hard matter to maintain roads owing to a general crush which is at all times taking place. This requires a large staff of timbermen to keep the roads in repair, and as a result this mine is being drawn back with as little delay as possible. Owing to the old disused roads and the gobs being loaded with this high volatile coal, this mine is at all times subject to spontaneous heating and requires very careful and diligent supervision by the mine officials.

The coal is mined by hand and, owing to the friable nature, little blasting is required. It is loaded into the mine-cars at the face of the levels and the dips by means of chutes from the headings, brought to the landings situated near the Main slope by horse-haulage, and hauled out of the slope by a compressed-air hoist to a landing situated on the Main adit-level; thence to the surface in large trips by an electric trolley-motor.

Ventilation is produced by a 5-foot "booster" fan situated near the entrance to the counter-level and belt-driven by a 30-horse-power induction-motor. During my last visit ventilation measured showed 9,800 cubic feet of air a minute passing into this mine for the use of eighteen men. The air was well conducted around the working-faces, while the brattice and stoppings were found in good order.

The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The roads were well timbered and in fairly good condition. This mine has been free from explosive gas during the year, but owing to the fluctuation of the atmosphere pressure from time to time there is a possibility of the gases from the gobs expanding into the working-places. To guard against this source of danger the miners working in the open skips are not only provided with an electric head-light, but a flame safety-lamp which is hung on a post near the face with full directions as to the use of same. The roads of this mine are naturally damp and as a result are free from dangerous coal-dust.

No. 4 Mine.

James Webster, Overman; Frank Bond, William Ross, George Walker, Thomas Vincent, Robert Murray, James Sim, James McWhirter, and John Ovington, Firebosses.

This is the largest and the most important operation of the Coalmont Collieries. This mine is situated 5,400 feet north of the entrance to the No. 3 mine and is connected to the mine-yard by a light railway built around the side of the mountain, upon which an electric trolley-motor system of haulage has been employed. This mine is entered by a 7- by 10-foot rock tunnel 1,600 feet in length, driven into the side of the mountain and cuts the No. 6 level of the mine. This has been developed by two 18° slopes 1,500 feet in length below the No. 6 level to the No. 17 East level on the right side and the No. 15 West level on the left side of the slopes. These are

operated on the panel system, the levels, headings, and slopes being driven about 10 to 12 feet in width.

There is a large intrusive dyke running north and south through this section of the Coalmont field, separating the operations of the Nos. 3 and 4 mines. It heads towards and intersects the slopes below the No. 17 East level, making operations on the East side of this mine very limited. At present all the available pillars have been drawn back and the whole of the east side of this mine sealed off by 8- by 8-inch beams. Pillar operations are at present being conducted on the Nos. 2, 7, and 12 West levels, while the No. 15 West, or the lowest West level in this mine, after being driven a distance of about 2,000 feet from the slope encountered a large upthrow fault, with the result that work was suspended at the face of this level. Owing to the length of the Main slope and to facilitate haulage two pairs of slopes are being driven to the dip of the No. 15 West level, which will open up a large section of this mine. The No. 1 slope is on a 25° pitch and has reached a distance of 600 feet; the No. 2 slope, located about 1,000 feet west, has reached a distance of around 350 feet, and while the coal-seam in this lower section of the mine maintains its usual good quality it appears to improve with depth. The overburden of the strata above greatly increases with depth and causes the lower section of this mine to be subject to "crush," and notwithstanding the fact that these roads are not driven more than 9 feet in width, that the size of the pillars has been increased, and the collars used by the miners for timbering the working-faces are from 18 to 24 inches in diameter, the evidence of crushing is so very apparent that the life of these slopes will be somewhat limited.

The No. 4 mine is operating in the same seam as No. 3 mine. The seam has an average thickness from 10 to 12 feet and a general pitch to the north-west of from 20° to 25°, with a short-grained lime rock lying a short distance above it. As a result very heavy timbering is required. Owing to the pitch of the seam, chutes are used to convey the coal to the mine-cars on the levels, where the cars are collected and hauled by horses to landings on each of the levels situated near the Main slope. Electric hoists are in use for the Main slope haulage, also in No. 1 and No. 2 slopes driven to the dip of the No. 15 West level.

Several cases of spontaneous heating were detected in the gobs during the year; in all cases the areas affected were effectively sealed off without delay.

Ventilation is produced by an 84-inch double-inlet belt-driven Sirocco reversible fan and operated by a 75-horse-power constant-speed motor situated near the entrance to the counter-slope, and during my last inspection ventilation measurements showed 36,000 cubic feet of air a minute passing into this mine for the use of sixty men. The brattice, stoppings, and doors were in good order, the air being well conducted around the working-faces, and no trace of methane found in the mine.

The working-places were well timbered and a sufficient supply of suitable timber provided for the use of the miners. The roads were well timbered and in fairly good condition. A spraying system of watering is installed on the Main slope and the levels of the mine are naturally wet, and as a result the mine is free from dangerous coal-dust.

A well-appointed doctor's office and first-aid room is maintained at this operation under the supervision of a first-aid man, who is at all times in attendance to render any services that may be required, while the doctor pays a daily visit to the mines. The mine-rescue station is equipped with five sets of Gibbs self-contained breathing apparatus, pulmotor, oxygen-pump, four sets of all-service gas-masks, which are ready at all times for any call or emergency, also a necessary supply of material for the above.

All blasting is done under the supervision of certificated officials with permitted explosives; shots are fired by electric detonators. Edison electric head-lights are in use by all the employees underground, while Wolf flame safety-lamps are in use by all the officials for inspection purposes. Copies of the "Coal-mines Regulation Act" and special rules are well posted near the entrance to these mines.

The following are the official returns for the Coalmont Colliery for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	152,385	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	152,385	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	.....	.....	.....	.....
Used under colliery boilers, etc	12,431	.....	.....	.....
Total for colliery use	.....	12,431	.....	.....
		164,816		
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	.....	.....	.....	.....
Difference added to (or taken from) stock during year	.....	.....	.....	.....
Output of colliery for year	.....	164,816	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	12	6.31	14	6.17	26	6.23
Whites—						
Miners	123	7.47	.....	.....	123	7.47
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	65	4.82	70	4.28	135	4.54
Mechanics and skilled labour	1	5.50	39	5.17	40	5.18
Boys	6	3.75	3	3.50	9	3.66
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	1	2.64	1	2.64
Indians	.....	.....	.....	.....	.....	.....
Totals	207	6.45	127	4.73	334	5.80

Tulameen Valley Coal Co.

Chas. Hunter, General Manager; T. Harvey, Accountant; J. Bennett, Mine Superintendent.

No. 1 MINE.

Andrew McKendrick, Manager; Thomas Dobie, Thomas Rowbottom, and William Foster, Firebosses.

This is a small coal operation situated west of the town of Princeton and is accessible by a wagon-road following the west bank of the Tulameen river, a distance of about 2 miles. The seam has a general pitch east of about 15° and has been developed by four adit-levels driven into the side of the hill from the surface outcrop. The No. 3 level is used for the main haulage and the upper or No. 4 level is used for the mine return, at the portal of which the mine-fan

is located. The levels follow the strike of the seam for a distance of about 1,200 feet, when they come in contact with soft and faulted ground. Work was suspended at this point while headings, driven to the raise, encountered the outcrop at a short distance, with the result that the work at present in this mine is to the dip of these adit-levels, where the mine is being developed by slopes following the full pitch of the seam.

Ventilation is produced by a 5-foot enclosed-type belt-driven fan, and during my last inspection ventilation measurements taken showed 17,000 cubic feet of air a minute passing into this mine for the use of twenty men. The air was well conducted around the working-faces, while the brattice and stoppings were in fairly good order. The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners; while the roads were well timbered, in fairly good condition, and, being naturally wet, were free from dangerous coal-dust.

Owing to the inclination of the seam the coal is conveyed from the face of the headings and crosscuts to the Main levels, where it is loaded into the mine-cars, having a capacity of 1 ton, trammed by hand to landings situated on the levels near the entrance to the haulage-slope, hauled by a small compressed-air hoist to the Main haulage-level, and hauled from there by horses to the surface, where it is dumped over a bar-screen into a bunker. From there it is hauled by means of motor-trucks a distance of a little more than half a mile to a loading-platform situated at the side of a spur off the Kettle Valley Railway.

The power plant consists of a 6-horse-power loco-type steam-boiler and is used for driving a 14 by 12 Ingersoll-Rand single-stage air-compressor, belt-driven by a 14 by 20 single-cylinder steam-engine. This power is conducted into the mine by a 4-inch air-line and is used for operating the mine-hoist, slope-pump, and the coal-cutting machines.

All the coal is mined by machines of the post-puncher type. The use of explosives is avoided as much as possible for the purpose of producing a large percentage of big coal for the domestic coal trade.

Approved Wheat electric head-lamps are in use by all the employees underground, while safety-lamps of the Wolf type are used by the officials for inspection purposes.

During the year a large steam-heated garage was erected near the mine for the use of storing the motor-trucks when not in use; also a building provided with spray, baths, lockers, and change-room was erected for the use of the employees.

During the year there have been no serious accidents reported. Copies of the "Coal-mines Regulation Act" and special rules were posted near the entrance to the mine.

The following are the official returns for the Tulameen Valley mine for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	15,694	.....	.....	.....
Sold for export to United States	340	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	16,034	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	567	.....	.....	.....
Used under colliery boilers, etc	1,287	.....	.....	.....
Total for colliery use	.....	1,854	.....	.....
		17,888	.....	.....
Stocks on hand first of year	16	.....	.....	.....
Stocks on hand last of year	14	.....	.....	.....
Difference taken from stock during year	.....	2	.....	.....
Output of colliery for year	.....	17,886	.....	.....

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

Character of Labour.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	4	7.20	4	6.50	8	6.80
Whites—						
Miners	11	6.00	.....	.....	11	6.00
Miners' helpers	13	4.50	.....	.....	13	4.50
Labourers	.....	.....	8	.....	8	4.40
Mechanics and skilled labour	2	5.00	8	5.25	10	5.20
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	30	5.50	20	5.25	50	5.20

Lynden Coal Co., Ltd.

M. C. Duvall, President, Bellingham, Wash.; Lester Ecker, Vice-President, Bellingham, Wash.; D. W. Bender, Secretary, Lynden, Wash.; S. K. Mottishaw, Superintendent, Princeton, B.C.

No. 1 MINE.

Sam. K. Mottishaw, Manager; Robert Gourlay, Frank Lester, and George Gray, Firebosses.

This company commenced mining operations during the latter part of the year 1927 from a coal-outcrop situated on Lamont creek, 10 miles from the town of Princeton, on the southern portion of the Princeton coal-basin, and has continued operations during the whole of the year. The seam of coal follows very much in line with the seam operated by the Tulameen Valley Coal Company, also the No. 1 seam of the old Princeton Coal and Land Company, having an aggregate thickness of about 24 feet and overlain by a good shale roof with a general pitch west of from 12° to 15°. The lower section of the seam is intersected with several bands of shale and fire-clay, making it of very little commercial value; as a result all the operations are confined to the upper section of the sea, the upper 2 feet being left to form a roof and making the average height of the working-places about 10 feet. With the exception of irregular nodules of pyrites found in the seam from time to time, it is practically a clean seam of coal.

Owing to the short duration of this mine the operations underground are limited and are being developed on the panel system. The Main slope, N. 45° E., follows the full pitch of the seam a distance of 600 feet from the portal, where the dip of the measures change, and as a result the main haulage takes a level course for a further distance of 600 feet to the face of the level. A panel of work 700 feet from the entrance to the mine is being blocked out to the raise. The Main headings have reached a distance of 450 feet, while a similar panel is being blocked out to the dip of the main haulage-level. The working-places are all driven from 10 to 12 feet in width and mined by coal-cutting machines of the post-puncher type for the purpose of reducing blasting to a minimum and producing as large a percentage of lump coal as possible. Compressed-air hoists are in use for haulage underground and mine-cars. Framed sets are used for timbering underground.

Ventilation is produced by a 4-foot high-speed enclosed-type fan driven direct by a Sturtevant steam-engine. During my last visit of inspection ventilation measurements taken showed 10,500 cubic feet of air a minute passing into this mine for the use of nineteen men. The brattice and stoppings were in good condition and the air well conducted to the working-faces. The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of

the workmen, while the roads were well timbered, in good condition, and, being naturally wet, were free from dangerous coal-dust.

During the year a two-story combined cook and bunk house was completed, while a wash and change house provided with shower-baths has been installed.

The power plant consists of a 5½- by 16-foot return-tubular boiler situated near the mine and is used for providing power for a single-stage air-compressor having a capacity of 516 cubic feet of free air a minute. This is the only power at present used in the mine for the operation of hoists, pumps, and mining-machines. A 7- by 12-inch steam-driven hoist situated near the entrance to the mine is used for hauling loaded mine-cars out of the slope to a surface landing, where they are dumped over a shaking screen into bunkers, from there loaded into motor-trucks and hauled to coal-chutes situated on the Kettle Valley Railway near the town of Princeton.

Edison electric safety-lamps are used by all the employees underground, while flame safety-lamps of the Wolf type are used by the officials for inspection purposes. All shots are fired by electric batteries by officials appointed for that purpose.

The following are the official returns from the Lynden Coal Company, Limited, for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	14,119	.....	.....	.....
Sold for export to United States	2,566	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	16,685	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	469	.....	.....	.....
Used under colliery boilers, etc.	1,244	.....	.....	.....
Total for colliery use	.....	1,713	.....	.....
		18,398	.....	.....
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	.....	.....	.....	.....
Difference added to (or taken from) stock during year	.....	.....	.....	.....
Output of colliery for year	.....	18,398	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	4	.....	2	.....	6	.....
Whites—						
Miners	30	.....	.....	.....	30	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	13	.....	8	.....	21	.....
Mechanics and skilled labour	.....	.....	2	.....	2	.....
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	47	.....	12	.....	59	.....

Pleasant Valley Coal Co., Ltd.

W. R. Wilson, President, Fernie, B.C.; Miss M. Duncan, Secretary-Treasurer.

This mine is situated 1½ miles west of the Princeton Railway-station, on the south bank of the Tulameen river; this affords ideal transportation facilities and is the most important coal operation that has been commenced for the purpose of exploiting the coal resources of the Princeton field for several years, and it is of special interest to see that provision is being made for operating on a large scale.

The location of the mine is about all that may be desired, being situated alongside of the railway, with an ample amount of room for the tipple, bunkers, railway and mine sidings on the river-flats; with sufficient water for power purposes. The seam of coal to be operated is exposed at the side of the hill at an elevation of about 200 feet above the mine-yard, where the measures at the side of the mountain are fairly well exposed and of unusual continuity for the district. Two levels have been driven on the same elevation as the mine-tipple, in the measures below the coal-seam, and will assure a large tonnage lying above the water-level.

During the month of July work was commenced on the construction of a large modern mine-tipple and screening plant, a road graded along the side of the hill between the tipple and the main haulage-tunnels, and provided with two tracks. In looking over the same one cannot help but be impressed with the fact that the whole is so arranged to avoid hard labour and accidents, as ample room is provided for the employees. Grading of the railway and the mine railway sidings has been completed, while the bridge across the river is in the course of construction, which will connect the mining operations with the railway and as soon as completed the railway sidings at the mine will be laid.

This mine is being developed by two well-timbered 8- by 10-foot adit-levels situated about 1,000 feet east of the tipple and cutting across the measures; these will be used for the haulage. The East drift will be used for developing the coal to the dip, while the West drift will be used for developing the coal to the west and raise operations. These will be operated in a series of panels for the purpose of protecting the operations against spontaneous heating.

A self-contained Sullivan gas-driven air-compressor provides power for the air-drills used for tunnelling, while a small gas-engine driving a force-fan, situated near the entrance to the tunnels and connected to a 9-inch air-line, provides ample ventilation at the faces of the drifts. Electric head-lamps are used by the miners, while the Wolf safety-lamp is used by the officials for inspection purposes.

This mine will be in operation during the early part of the year 1928 and will greatly increase the coal production in the Princeton district.

The following are the official returns from the Pleasant Valley Coal Company for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	20	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	20	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	.....	.....	.....	.....
Used under colliery boilers, etc.	.....	.....	.....	.....
Total for colliery use	.....	.....	.....	.....
		20		
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	50	.....	.....	.....
Difference added to stock during year	.....	50	.....	.....
Output of colliery for year	.....	70	.....	.....

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	1	6.50	1	8.00	2	.....
Whites—						
Miners	12	5.50	.....	.....	12	.....
Miners' helpers	9	4.15	.....	.....	9	.....
Labourers	.....	.....	10	4.15	10	.....
Mechanics and skilled labour	2	6.00	10	.....	12	.....
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	24	.....	21	.....	45	.....

Normandale Coal Co., Ltd.

B. Kerr, President, Toronto, Ont.; W. H. Newcombe, Director, Vancouver, B.C.; Francis Glover, Superintendent.

This mine is situated about 2 miles from the town of Nicola and in close proximity to the Nicola–Coalmont highway. It was operated during the year 1922 by the Community Coal and Coke Company, Limited, in a small way for the purpose of proving the south-east section of the Nicola basin. An adit-level was driven into the side of the hill a distance of some 300 feet on the coal-seam, which is found exposed at the surface and laying "on end."

These operations are entirely of a prospective nature for proving this section of the coalfield and are being conducted in close proximity to the basic measures. As a result this operation will to a great extent depend upon the continuity of the coal-seam, which at present is found to vary greatly in thickness. As the work is advanced the measures are expected to assume greater regularity and the mining conditions to improve with depth and distance attained from the basic rocks. This is a high-carbon coal with good coking qualities and is stated to give good results for blacksmith purposes.

The inside of the level was found to be caved and as a result the work at present consists of driving a dip slope some distance below on the coal-seam, which will be continued for the purpose of proving the same. Three men are at present employed underground.

Safety-lamps are in use by the employees underground and this mine was found to be in good condition and well timbered.

The following are the official returns from the Normandale Coal Company, Limited, for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	135	.....	.....	.....
Sold for export to United States	.....	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	135	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	.....	.....	.....	.....
Used under colliery boilers, etc	.....	.....	.....	.....
Total for colliery use	.....	.....	.....	.....
		135		
Stocks on hand first of year	.....	.....	.....	.....
Stocks on hand last of year	27	.....	.....	.....
Difference added to stock during year	.....	27	.....	.....
Output of colliery for year	.....	162	.....	.....

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

Character of Labour.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$				
Supervision and clerical assistance	1	7.00	.....	.....	1	.....
Whites—						
Miners	1	5.00	.....	.....	1	.....
Miners' helpers	2	4.00	.....	.....	2	.....
Labourers	1	4.00	.....	.....	1	.....
Mechanics and skilled labour	.....	.....	.....	.....	.....	.....
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	5	.....	.....	.....	5	.....

EAST KOOTENAY INSPECTION DISTRICT.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit the annual report for the year 1928, covering the inspection of coal-mines in the East Kootenay District as provided for by section 94 of the "Coal-mines Regulation Act."

The general inspection of the mines was made by John MacDonald, Inspector of Mines, whose report covering the conditions in and around the mines is attached.

The three collieries in operation were the same as in the last few years, and no attempt was made to reopen either the Morrissey or Hosmer Collieries, which have been closed down for several years. Two of the collieries, Coal Creek and Michel, are owned and operated by the Crow's Nest Pass Coal Company, Limited, with office in Fernie; the other, at Corbin, is owned and operated by the Corbin Coals, Limited, with offices in Spokane, Wash., and local offices at Corbin. No labour troubles occurred during the year, and the mines operated for about 90 per cent. of the available working-days.

The production of coal was 1,001,523 long tons, or an increase of 94,004 tons over the previous year, representing about 10 per cent. This is the first year since the Hosmer mines were closed that the production has exceeded the 1,000,000-ton mark, or since the year 1913.

The amount of coal used for the production of coke was a decrease from that of 1927 of 37,326 tons, or 29 per cent. The amount of coke was 23,254 tons less than in 1927, or a decrease of 28 per cent. This decrease in the use of coke is reflected both in the home and export markets, the decrease being twice as much in the export market as the home market.

ACCIDENTS.

Twenty-one accidents were reported during the year under section 71 of the "Coal-mines Regulation Act," involving death or injury to twenty-six workmen; all of these accidents came under subsection (*b*); no accidents were reported under subsection (*a*). Sixteen of these accidents, involving twenty-four workmen, occurred underground; five above ground, involving two workmen.

All of the accidents were investigated, and where inquests were held these were attended, and we are very much indebted to the Coroners for their courtesy in allowing us every opportunity to investigate them.

Haulage accounted for 9 accidents; falls of roof or coal, 6; outbursts of coal and gas, 1, involving 6 workmen; miscellaneous, 5. The occupations of the workmen covered miners, fireboss, stableman, mining engineer, hoistman, tracklayers, and drivers.

The most serious accident was the outbursts of gas and coal in No. 1 East mine, Coal Creek, which caused the loss of six miners, which occurred on August 30th. This accident, the worst experienced in the district since 1917, occurred in the No. 1 room off No. 20 room, No. 16 East Slope district, shortly before noon, filling the whole district with methane. A great amount of very fine coal-dust was also given off, and a remarkable feature was that this was forced against the ventilating-current for a long distance. The methane followed the same course, being detected as far as 2,000 feet from the seat of the outburst and against the air-current. These conditions retarded the work of rescue for some time, but later investigation showed that the workmen did not travel very far from their working-places.

While outbursts of this nature have been common in this mine for a period of over ten years, this is the first one which has caused loss of life, and probably over 200 of these have occurred. Drilling of bore-holes in advance of the working-face has been carried out in suspected areas, but unfortunately this place had not been drilled, although the adjoining place had. The method followed was to drill a hole for about 20 feet, then work the coal off, then drill another.

Since the accident and in compliance with instruction of the September 15th, "All working-places in this area at a lower elevation than the 1,000-foot contour-line as shown on the mine-plan require to be systematically drilled by advance bore-holes, such bore-holes to be kept at least 15 feet in advance of the working-face and a daily record kept of such drilling and depth."

My report of September 8th covers the recovery-work so far as it had progressed to that date, and at the end of the year the working-face of No. 1 room had not been reached, although over 1,000 cars of coal, coal-dust, and rock had been loaded out.

The other two fatal accidents occurred, one at Coal Creek and the other in Corbin. The accident at Coal Creek occurred to a tracklayer who was carrying ties underground; he stumbled and fell and the end of a tie struck him in the abdomen, causing injuries. He continued working until the end of the shift; the injuries were considered trifling at the time and the accident was not reported, but he died about a month later.

The accident at Corbin occurred to a labourer who was found beside a car used to run coal from one chute to another. Deceased was unconscious when found and died shortly after being taken to the hospital, although no wounds or bruises were visible. A post-mortem examination revealed that he died as the result of internal abdominal hæmorrhage; the presumption is that the unfortunate man had somehow been squeezed beneath the car.

The non-fatal accidents cover haulage, falls of roof and coal, and miscellaneous, several of which could have been avoided by the exercise of greater care on the part of the workmen.

Dangerous Occurrences.

Thirteen notices were received under the above section. Eleven of these referred to outbursts of gas, or gas and coal, varying from comparatively small occurrences to that of August 30th, the worst which has taken place at Coal Creek. All of these outbursts occurred in No. 1 East mine, Coal Creek. One bump was reported from No. 3 mine, Coal Creek, which was felt on the surface, damaging about 150 feet of the roadway, breaking the timbers, and causing falls of roof and sides; fortunately no person was injured. An inrush of water was reported from No. 1 East mine, Coal Creek; this was anticipated and the workmen were withdrawn previous to the occurrence.

Ventilation.

The general conditions with respect to ventilation have been maintained fairly well during the year and are dealt with in the detailed report by John MacDonald, Inspector.

Advantage was taken, as in previous years, of the facilities afforded by the Dominion Department of Mines to have analyses made of samples of mine-air, and we are very much indebted to them for these analyses, sample-bottles furnished, and mailing facilities. During the year 111 samples were taken, of which sixteen were lost either in transit or in the laboratory. Seventy-two of these were taken in Coal Creek mines, thirty-seven in Michel, and two in Corbin. A great deal of information is afforded by these analyses, by giving a correct determination of the percentage of methane in the air-currents, and also as a check on the Burrell gas-detector, which is constantly in use for checking the methane.

Regulations for Precautions against Coal-dust Danger.

The conditions with respect to this danger have been maintained very well during the year and it is important that this work should be maintained.

The principal means of dealing with the coal-dust has changed from water to non-combustible rock-dust, principally lime rock, which is secured in a fine pulverized form from the Summit Limestone Works, which also supplies a great many of the Alberta coal-mines. Tests of the roadways, roofs, and sides have been made regularly during the year as required by the "Regulations for Precautions against Coal-dust." The number of tests made in the district amounted to 1,183—922 at Coal Creek, 237 at Michel, and 24 at Corbin. Where the analyses showed these did not come up to the standard set, the place was treated and further tests made until it complied with the regulations.

Inspection on behalf of the Workmen.

This inspection on behalf of the workmen was carried out at all the collieries and is of great value to the officials as well as the workmen in maintaining safer and healthier conditions in and around the mines. One hundred and twenty-four visits of inspection were made, representing 100 at Coal Creek, twelve at Michel, and twelve at Corbin. Conditions at these inspections were found fairly good and no reports were made to this office complaining of either dangerous or unhealthy conditions.

Searches for Matches, Pipes, or Articles contrary to Section 101, Rule 9.

Searches under this rule were carried out at all the collieries and in two cases matches were found in the possession of the workmen contrary to the above rule. In both cases prosecutions followed and the parties were found guilty and fined. There were eleven prosecutions during the year, nine of these being under the special rules and two under the regulations. In every case the parties were found guilty and punished.

Haulage.

Underground haulage is either by compressed-air hoists or locomotives, self-acting inclines or horses; in some cases electric hoists are situated outside the mine and hauling-ropes led inside. No electric machinery is in use underground. Electricity purchased from the East Kootenay Power Company is increasing in use in the district and within a short time both Michel and Coal Creek will be entirely operated by this power.

Lighting.

Lighting underground is principally by the Edison electric mine safety-lamp, the Wolf safety-lamp being only used by the officials as a means of making a rapid determination of the condition of the air-currents with respect to the presence of methane. The Burrell gas-detector is in use at all the mines for determining lower percentages of methane than can be detected by the use of the Wolf safety-lamp as required by section 101, Rule 4, of the "Coal-mines Regulation Act." All the lamps and Burrell gas-detectors are cleaned and tested in well-equipped lamp-stations convenient to the mine. The old Edison mine safety electric lamp is gradually being replaced with the "F" type at both Coal Creek and Michel, having a great advantage both with respect to light in the working-places and enabling the workmen to produce cleaner coal.

Explosives.

At Michel and Corbin explosives are used to bring down the coal; no explosives are used for this purpose at Coal Creek. The use of explosives in the mines is subject to Rules 11 and 12, section 101, of the "Coal-mines Regulation Act," and these have been fairly well complied with during the year. The use of explosives for bringing down coal is attended with a certain amount of danger and it should be distinctly understood that every precaution should be taken to avoid accident.

In addition to the restrictions as laid down in Rules 11 and 12, strict attention should be paid as to the presence of methane (gas) or dust. The placing of the shot should be studied

and in no case should a second drill-hole be placed until the first shot has been blasted and the place examined. It should be remembered that it is very difficult to accurately determine the proper position of a second shot until it is known exactly what work the first shot has done. Neglect of this precaution contributes to serious accidents, as frequently breaks develop in the coal-seam or the roof, where explosive gas may accumulate and be difficult to detect. During the year only two kinds of explosives have been in use—Gelpermite for rock-work and Monobel for breaking down the coal.

Coal-cutting Machinery.

No coal was produced by coal-cutting machinery during the year.

Mine-rescue and First Aid to the Injured.

The amount of mine-rescue apparatus maintained at the collieries was the same as in the previous year and all of the same type—namely, the Gibbs. Six sets of this type are maintained at Coal Creek and Michel and five at Corbin.

The mine-rescue station maintained by the Department of Mines at Fernie maintains six sets of Gibbs mine-rescue apparatus and during the year two sets of the McCaa type have been added. The latter have given great satisfaction and we expect at an early date to have at least sufficient of the McCaa machines to equip a team.

The work of first aid to the injured has been very well maintained during the year at all the collieries and large classes have been held in the mine-rescue station here during the winter months. At Coal Creek, through an arrangement with the East Kootenay Mine Safety Association, regular training classes are held every month in the rescue-station, which should prove of greater value than the intensive training previously given in preparation for competitions.

Copies of the special rules, extract of the "Coal-mines Regulation Act," and copies of the systematic timbering rules are all kept posted convenient to the mine entrances, as well as reports of the condition of the mine with regard to dust, in good condition.

We again desire to thank the workmen and officials for their co-operation and assistance in carrying out our duties during the year, and look forward to a continuance of the same in the year we are now entering upon, as it is only through having the co-operation of both the workmen and officials that coal-mining can be made safer and healthier.

Attached is the report covering the inspections in detail by John MacDonald, Inspector, and the annual returns as required by section 66 of the "Coal-mines Regulation Act" from the collieries for 1928.

Report by John MacDonald, Inspector.

Crow's Nest Pass Coal Co., Ltd.

Head Office—Fernie, B.C.

W. R. Wilson, President, Fernie, B.C.; A. H. McNeill, Vice-President, Vancouver, B.C.; J. S. Irvine, Secretary, Fernie, B.C.; A. A. Klauer, Treasurer, Fernie, B.C.; H. P. Wilson, General Manager, Fernie, B.C.

The above company operated, during 1928, Coal Creek and Michel Collieries on the western slope of the Rocky mountains in East Kootenay Inspection District.

Coal Creek Colliery is situated at Coal Creek, about 5 miles from Fernie. Railway connection from the colliery is made with the Canadian Pacific Railway and the Great Northern Railway at Fernie, over the Morrissey, Fernie & Michel Railway.

Michel Colliery is situated on both sides of Michel creek, on the Crowsnest branch of the Canadian Pacific Railway, about 24 miles in a north-easterly direction from Fernie.

The following are the aggregate returns from the Crow's Nest Pass Coal Company's mines for the year 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	459,857	.....	48,062	.....
Sold for export to United States	220,075	.....	13,902	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	679,932	.....	61,964
Used in making coke	92,607	.....	.....	.....
Lost in washing	.....	.....	.....	.....
Used under colliery boilers, etc	48,334	.....	.....	.....
Total for colliery use	.....	140,941	.....	.....
		820,873	.....	.....
Stocks on hand first of year	202	.....	1,034	.....
Stocks on hand last of year	1,609	.....	440	.....
Difference { * added to / † taken from } stock during year	.....	*1,407	.....	†594
Output of colliery for year	.....	822,280	.....	61,370

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	39	.....	30	.....	69	.....
Whites—						
Miners	531	.....	.....	.....	531	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	42	.....	150	.....	192	.....
Mechanics and skilled labour	382	.....	185	.....	567	.....
Boys	45	.....	24	.....	69	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	1,039	.....	389	.....	1,428	.....

COAL CREEK COLLIERY.

B. Caufield, Manager; J. Taylor, Assistant Manager; E. Morrison, Safety Inspector.

This colliery is situated on both sides of Coal creek and has railway connection with the Canadian Pacific and Great Northern Railways at Fernie by means of a branch line, 5 miles in length, called the Morrissey, Fernie & Michel Railway. The mines operated during 1928 were No. 1 East, No. 1 South, No. 2, and No. 3 on the south side of the valley, the only one operating on the north side being No. 9, where maintenance-work on main roads and airways kept a small crew of repairmen busily engaged throughout the year. A general description of the method of working, system of haulage in and around the mines, and surface plant has appeared in previous Annual Reports. As the operations at this colliery have grown beyond the limit of the present power plant, it was evident that a change was necessary to cope with the ever-growing requirements of the mines.

After much deliberation and thought had been given to this matter by the executive and management of the company, it was decided to proceed with the erection of a new power-house, ground being broken in the spring, and, although serious difficulties were encountered during the excavation-work on account of wet ground, the building was finished in record time for the installation of the following machinery: Three Belliss & Morcom 2-crank, 2-stage air-compressors (size of cylinders, 33 by 19 inches; stroke, 15 inches) having a capacity of 3,000 cubic feet of free air a minute at an altitude of 4,000 feet above sea-level, and delivering same at a final gauge-pressure of 125 lb. a square inch when operating at a speed of approximately 257 r.p.m. These are vertical, enclosed, self-lubricating type of standard design arranged for motor-drive. These machines are driven by three C.G.E. 600-horse-power, 257-r.p.m., 2,200-volt, 3-phase, 60-cycle, 50° C. rise, self-starting synchronous motors. One 21- by 12- by 10- by 5½- by 16-inch stroke Pre-4, direct-connected, electrically driven 4-stage air-compressor. This machine has a piston displacement of 1,510 cubic feet of air a minute when operating at a speed of 240 r.p.m., and an actual delivered capacity of 1,208 cubic feet a minute at a discharge-pressure of 1,200 lb. a square inch at 4,000 feet altitude, and is driven by a C.G.E. 450-horse-power, 240-r.p.m., 2,200-volt, 3-phase, 60-cycle, 50° C. rise, synchronous motor.

The intake air for these four compressors passes through one common duct and is filtered by passing through a Wellman-Bibby type of air-filter. All of these machines are housed in a brick-faced concrete building having the following inside dimensions: Length, 100 feet; width, 32 feet; height, 22 feet; the power-house being equipped with a 10-ton travelling-crane having a 30-foot span for the purpose of handling the machinery and facilitating repairs.

Another very important addition to the plant was the installation of a new 11- by 7½-foot Sirocco fan on the mountain-side above No. 1 South mine for the purpose of ventilating Nos. 2 and 1 South mines. This fan is equipped with a Tex rope-drive, S.K.F. spherical roller bearings, is driven by a 300-horse-power induction-motor fitted with automatic control, and is designed to deliver 400,000 cubic feet of air a minute, under a water-gauge of 5 inches, while operating at a speed of 210 revolutions a minute. The fan buildings are fire-proof, being of concrete and steel construction throughout.

The lamp used exclusively by the workmen is the Edison electric cap safety-lamp, while Wolf safety-lamps are used by the officials and bratticemen for testing purposes, all lamps being cleaned and repaired in a well-equipped lamp-room located in a central position at the colliery. Burrell gas-detectors are provided at all the mines for the purpose of detecting lower percentages of methane than that usually found by the ordinary safety-lamp.

A large number of dwellings are provided at Coal Creek for the convenience of those who prefer living close to the mines, while there is a good train service to Fernie, where the majority of the workmen reside.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines. Following is a brief description of the conditions prevailing in the various mines during 1928:—

No. 1 East Mine.

J. Caufield, Overman; J. Duncan, J. Maltman, T. Reid, E. Rutledge, and J. Whyte, Firebosses.

This mine operates the eastern portion of No. 1 seam and is ventilated by an electrically driven 11- by 7½-foot Sirocco fan, which, running at a speed of 174 r.p.m., produced an average quantity of 170,300 cubic feet of air a minute, under a water-gauge of 3.7 inches. The ventilation is divided into four splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—23,200 cubic feet of air a minute for the use of fifty-six men and nine horses. Burrell gas-detector, 1 per cent. methane.

No. 2 Split.—16,500 cubic feet of air a minute for the use of ten men and two horses. Burrell gas-detector, 1.2 per cent. methane.

No. 3 Split.—31,200 cubic feet of air a minute for the use of twenty-four men and four horses. Safety-lamp indicated 1.9 per cent. methane.

No. 4 Split.—31,500 cubic feet of air a minute for the use of seventeen men and five horses. Safety-lamp indicated 1.4 per cent. methane.

North Return.—121,500 cubic feet of air a minute for the use of fifty-one men and eleven horses. Safety-lamp indicated 1 per cent. methane.

East side of fan-shaft, 68,000 cubic feet of air a minute; west side of fan-shaft, 112,450 cubic feet of air a minute; total return air, 180,450 cubic feet of air a minute.

Explosive gas has been found quite a number of times in this mine in the course of inspection, mostly in cavities caused by blowouts and in cavities in the roof above the timbers at the working-faces, the nature of the roof being such that it is very difficult to prevent the formation of these cavities, where gas sometimes lodges, but mostly in small quantities. Burrell readings taken regularly in the return air-currents have varied from 0.9 per cent. methane in No. 1 split to 2.4 per cent. methane in No. 3 split.

Roadways and timbering have been kept in fairly good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces. While spraying systems are still operated on many of the roadways, the use of crushed limestone-dust has been generally adopted in this mine as a means of alleviating the coal-dust hazard.

Two hundred and seventy-seven samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, the resultant analyses showing that 240 of these were in keeping with the requirements of the above regulation.

No. 1 South Mine.

F. Landers, Overman; W. Hynds, W. Stockwell, and M. Hilton, Firebosses.

This mine operates the upper and western portion of No. 1 seam and until August 5th was ventilated by an electrically driven 8- by 4-foot Keith fan, which, running at a speed of 254 r.p.m., produced an average quantity of 38,600 cubic feet of air a minute, under a water-gauge of 2.6 inches. Since the above date this mine, along with No. 2 mine, has been ventilated by an electrically driven 11- by 7½-foot Sirocco fan, which, running at a speed of 210 r.p.m., produced an average quantity of 148,250 cubic feet of air a minute, under a water-gauge of 4.2 inches.

Note.—This fan is operating as a single-inlet unit at present until such time as the main airways in Nos. 2 and 1 South mines are enlarged and repaired.

At the time of writing the ventilation in this mine is all on one split, the quantity passing at the last inspection measuring as follows:—

Main Return.—46,200 cubic feet of air a minute for the use of fifty-six men and fourteen horses. Burrell gas-detector, 0.3 per cent. methane. Explosive gas has only been found on two occasions in the course of inspection, while Burrell readings taken regularly in the return air-current have varied from 0.2 per cent. to 0.7 per cent. methane.

Roadways and timbering have been kept in fairly good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces. While spraying systems are still operated on certain roadways, by far the greater portion of this mine is now being treated regularly with crushed limestone-dust. Two hundred and thirty-seven samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, the resultant analyses showing that 198 of these were in keeping with the requirements of the above regulation.

No. 2 Mine.

C. McNay, Overman; J. Bushell, W. Clarkstone, R. Alstead, and W. Green, Firebosses.

This mine is situated on the level of the tipple and operates the upper and western portion of No. 2 seam. Until August 5th it was ventilated by an electrically driven 16- by 8-foot Wilson fan, which, running at a speed of 170 r.p.m., produced an average quantity of 53,100 cubic feet of air a minute, under a water-gauge of 5 inches. Since the above date it has been ventilated jointly with No. 1 South mine by an electrically driven 11- by 7½-foot Sirocco fan, particulars of which have already been given in the report *re* No. 1 South mine. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—40,300 cubic feet of air a minute for the use of forty-eight men and six horses. Safety-lamp indicated a slight trace of methane.

No. 2 Split.—40,000 cubic feet of air a minute for the use of fifty-two men and four horses. Safety-lamp indicated a very slight trace of methane.

Explosive gas has been found a number of times in the course of inspection, while Burrell readings taken regularly in the return air-currents have varied from 0.4 per cent. methane in No. 1 split to 1.2 per cent. in No. 2 split.

Roadways and timbering have been kept in good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces. With the exception of a few roadways, where spraying systems are still in operation, crushed limestone-dust is now used generally in this mine as a means of reducing the coal-dust hazard. Two hundred and thirty-three samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, the resultant analyses showing that 209 of these were in keeping with the requirements of the above regulation.

A great improvement has taken place in the ventilation of this mine since the ventilation was rearranged in the month of August. This has resulted in a marked increase in the quantity of air passing in every district, with a corresponding decrease in the general temperature, particularly in No. 2 split, while the methane content has been reduced from an average of 1.2 per cent. to 0.4 per cent. in the return air-currents.

No. 3 Mine.

J. Worthington, Overman; R. Phillips, W. Brown, E. Caufield, and J. Chester, Firebosses.

This mine operates the lower and eastern portion of No. 2 seam and is ventilated by an electrically driven 16- by 8-foot Wilson fan, which, running at a speed of 170 r.p.m., produced an average quantity of 63,600 cubic feet of air a minute, under a water-gauge of 5.5 inches. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—10,800 cubic feet of air a minute for the use of fourteen men and four horses. Burrell gas-detector, 1 per cent. methane.

No. 2 Split.—33,600 cubic feet of air a minute for the use of forty men and twelve horses. Burrell gas-detector, 1.9 per cent. methane.

Main Return.—60,000 cubic feet of air a minute for the use of fifty-four men and sixteen horses.

Explosive gas has only been found on one occasion in the course of inspection, while Burrell readings taken in the return air-currents have varied from 0.7 per cent. methane in No. 1 split to 1.9 per cent. in No. 2 split. Roadways and timbering have been kept in good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces.

While spraying systems are still operated on some of the roadways, the greater portion of this mine is now being treated regularly with crushed limestone-dust. Two hundred and seventy samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, 238 of these being in keeping with the standard set by the above regulation.

No. 9 Mine.

R. Fowler, Fireboss.

A small crew of men has been kept steadily at work in this mine during the year, repairing and enlarging main roads and airways. The mine is all on one split and is ventilated by a fan of the Guibal type, which, running at a speed of 50 r.p.m., produced an average quantity of 4,200 cubic feet of air a minute, under a water-gauge of 0.8 inch. The quantity of air passing at the last inspection measured as follows:—

Main Intake.—4,000 cubic feet of air a minute for the use of four men and one horse.

No explosive gas was found in the course of inspection and the percentage of methane in the return air-current has always been kept under 0.5 per cent. Roadways and timbering have been kept in good shape as far as the repair-work extends, a good supply of timber being kept on hand for the purpose.

Following are the official returns from Coal Creek Colliery for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	176,275	.....	9,073	.....
Sold for export to United States	220,075	.....	13,181	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	396,350	.....	22,254
Used in making coke	32,982	.....	.....	.....
Lost in washing	.....	.....	.....	.....
Used under colliery boilers, etc.	31,994	.....	.....	.....
Total for colliery use	.....	64,976	.....	.....
		461,326		
Stocks on hand first of year	202	.....	536	.....
Stocks on hand last of year	1,609	.....	267	.....
Difference { * added to / † taken from } stock during year	.....	*1,407	.....	†269
Output of colliery for year	.....	462,733	.....	21,985

Number of Hands employed, Daily Wages paid, etc. (Includes Fernie Coke-ovens.)

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	23	.....	14	.....	37	.....
Whites—						
Miners	291	.....	.....	.....	291	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	27	.....	72	.....	99	.....
Mechanics and skilled labour	204	.....	102	.....	306	.....
Boys	19	.....	11	.....	30	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	564	.....	199	.....	763	.....

MICHEL COLLIERY.

R. Bonar, Manager; M. McLean, Assistant Manager; J. Henney, Safety Inspector.

This colliery is situated on Michel Creek, 24 miles north-east of Fernie, and has railway connection with the Canadian Pacific Railway. A general description of the method of working, system of haulage in and around the mines, and surface plant has appeared in previous Annual Reports.

Additions to the surface plant during the year consist of the following: One electrically driven 8- by 3½-foot Jeffrey fan, designed to deliver 160,000 cubic feet of air a minute, under a water-gauge of 6 inches. This fan was installed at No. 3 East mine to ventilate No. 3 East and B mines and was put in operation in January of this year. It is driven by a 100-horse-power induction-motor, 3-phase, 2,200 volts, and is controlled by a disconnecting oil-switch and automatic compensator; the power is transmitted to the fan through a Tex rope-drive and Broadbent clutch-pulley, all bearings being connected with a force-feed oiling system.

A new double-story warehouse, 61 by 31 feet, was erected to provide suitable storage accommodation for the large stocks that must be kept on hand at all times to supply the needs of this

colliery. A new mine-rescue station, 31 by 25 by 11 feet, was built out of old No. 4 engine-room, and is fully equipped with six Gibbs machines, pulmotor, and a sufficient stock of repair parts necessary to keep the above machines in good order at all times. The station is steam-heated and provided with the necessary accommodation for the comfort of the mine-rescue teams while undergoing training.

As in previous years, the whole of the output of this colliery has come from Nos. 3 and 8 mines, the operations in No. 3 East being confined to repairing the main roads and airways.

The Edison electric cap safety-lamp is used exclusively by the workmen, while Wolf safety-lamps are used by the officials and bratticemen for testing purposes, all lamps being cleaned and repaired in a well-equipped lamp-room located in a central position at the colliery. Burrell gas-detectors are provided at all the mines for the purpose of detecting lower percentages of methane than that usually found by the ordinary safety-lamp.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines. Following is a brief description of the conditions prevailing in the various mines throughout the year:—

No. 3 Mine.

M. Littler, Overman; J. Strachan, T. Owen, R. Beard, O. Winstanley, and J. Wallbank, Firebosses; J. Jenkinson, Shotfirer.

This mine operates the No. 3 and lower No. 3 seams and is ventilated by an electrically driven 12- by 6-foot Sullivan fan, which, running at a speed of 240 r.p.m., produced an average quantity of 116,900 cubic feet of air a minute, under a water-gauge of 2.9 inches. The ventilation is divided into three splits, the quantities passing in each at the last inspection measuring as follows:—

Nos. 2 and 3 Splits.—20,100 cubic feet of air a minute for the use of sixty-one men and nine horses.

No. 4 Split.—20,400 cubic feet of air a minute for the use of twenty-four men and three horses. Burrell gas-detector, 0.8 per cent. methane.

No. 5 Split.—11,000 cubic feet of air a minute for the use of fifteen men and two horses. Safety-lamp indicated 0.4 per cent. methane.

Main Return.—110,000 cubic feet of air a minute for the use of 100 men and fourteen horses. Safety-lamp indicated a slight trace of methane.

Explosive gas has been found a number of times in the course of inspection, while the percentage of methane in the return air-currents as determined by the Burrell gas-detector varied from 0.3 per cent. methane in No. 4 split to 1.3 per cent. in No. 3 split. Roadways and timbering have been kept in fairly good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces.

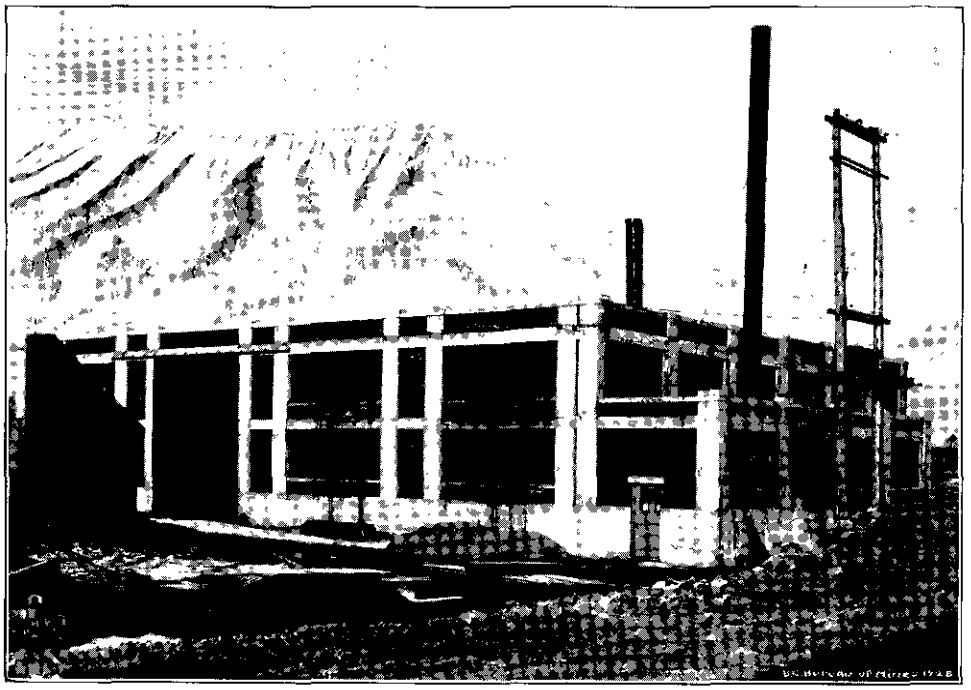
Spraying systems are in operation in some districts of this mine, while in others crushed limestone-dust is used as a medium to reduce the coal-dust hazard. One hundred and twenty-five samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but eleven of these coming up to the standard set by the above regulation.

No. B Mine.

C. Stubbs, Overman; W. Cartwright, D. James, and A. Ball, Firebosses.

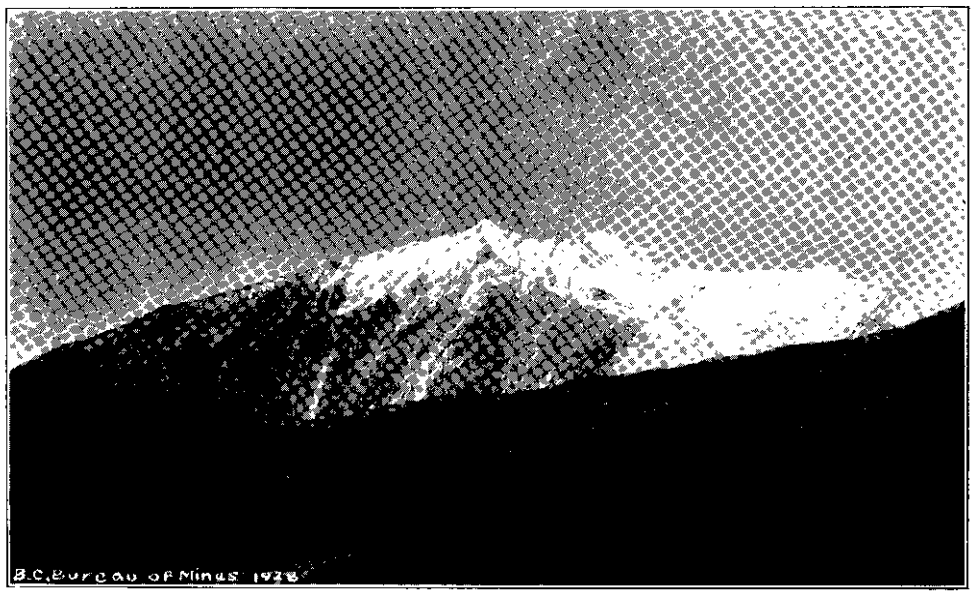
This mine is reached by a crosscut tunnel driven from the upper No. 3 seam and operates the Nos. 1, A, and B seams. It is ventilated by an electrically driven 8- by 3½-foot Jeffrey fan, which, running at a speed of 240 r.p.m., produced an average quantity of 102,000 cubic feet of air a minute, under a water-gauge of 1.9 inches. Explosive gas has been found three times in the course of inspection, while the percentage of methane in the return air-current has always been kept below 0.5 per cent. Roadways and timbering have been kept in good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces.

Spraying systems are in operation on some of the roadways, while in others crushed limestone-dust is distributed to alleviate the coal-dust hazard. Thirty-one samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but two of these coming up to the standard set by the above regulation.

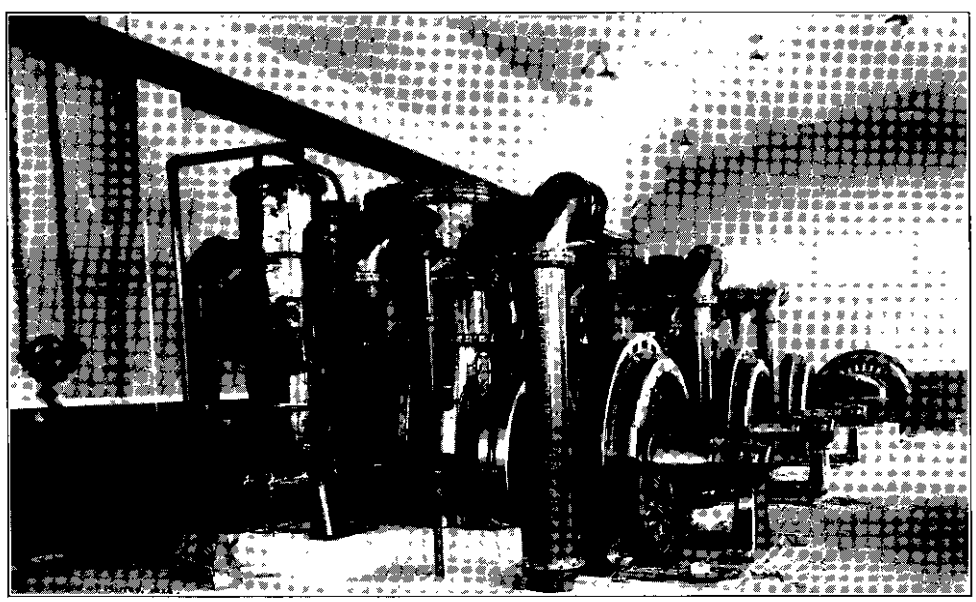


Morrissey, Fernie & Michel Rly. at Fernie, Fort Steele M.D.

Cassidy First-aid Team, Winners of McKenzie Cup, 1928.



Coal Formation at Corbin, Fort Steele M.D.



Coal Creek Colliery—Compressors, Fort Steele M.D.

No. 3 East Mine.

C. Stubbs, Overman; W. Cartwright, D. James, and A. Ball, Firebosses.

Operations in this mine during the year have been confined to repairing main roads and airways and attending to drainage. It is ventilated by an electrically driven 8- by 3½-foot Jeffrey fan, which, running at a speed of 240 r.p.m., produced an average quantity of 102,000 cubic feet of air a minute, under a water-gauge of 1.9 inches. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—30,400 cubic feet of air a minute.

No. 2 Split.—26,000 cubic feet of air a minute for the use of two men.

Main Return.—99,000 cubic feet of air a minute for the use of thirty-five men and four horses.

B Return.—20,000 cubic feet of air a minute for the use of thirty-three men and four horses.

Roadways and timbering have been kept in a fairly good state of repair, a good supply of timber being kept on hand at all times for the purpose.

No. 8 Mine.

R. Taylor, Overman; R. McFegan, A. Almond, E. Ainsworth, W. McKay, and J. Scales, Firebosses; W. Gregory, Shotfirer.

This mine operates the upper portion of No. 8 seam and is ventilated by an electrically driven 8- by 3½-foot Jeffrey fan, which, running at a speed of 240 r.p.m., produced an average quantity of 64,900 cubic feet of air a minute, under a water-gauge of 2.9 inches. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—22,400 cubic feet of air a minute for the use of fifty-six men and fourteen horses.

No. 2 Split.—15,400 cubic feet of air a minute for the use of forty men and five horses.

Main Return.—57,000 cubic feet of air a minute for the use of ninety-six men and nineteen horses.

Explosive gas was only found once in the course of inspection, while the percentage of methane in the return air-currents has been kept below 0.5 per cent. Roadways and timbering have been kept in good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces.

While spraying systems are still operated on certain roadways, by far the greater portion of this mine is treated regularly with crushed limestone-dust. One hundred and twenty-one samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were in keeping with the standard set by the above regulation.

Following are the official returns from Michel Colliery for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	283,582	.....	38,989	.....
Sold for export to United States	.....	.....	721	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	283,582	.....	39,710
Used in making coke	59,625	.....	.....	.....
Lost in washing	.....	.....	.....	.....
Used under colliery boilers, etc.	16,340	.....	.....	.....
Total for colliery use	.....	75,965	.....	.....
		359,547		
Stocks on hand first of year	.....	.....	498	.....
Stocks on hand last of year	.....	.....	173	.....
Difference taken from stock during year	.....	.....	.....	325
Output of colliery for year	.....	359,547	.....	39,385

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC. (INCLUDES COKE-OVENS.)

Character of Labour.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	16	.....	16	.....	32	.....
Whites—						
Miners	240	.....	.....	.....	240	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	15	.....	78	.....	93	.....
Mechanics and skilled labour	178	.....	83	.....	261	.....
Boys	26	.....	13	.....	39	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	475	.....	190	.....	665	.....

Corbin Coals, Ltd.

E. L. Warburton, Manager.

This colliery is situated 14 miles from McGillivray Junction on the Crowsnest branch of the Canadian Pacific Railway, to which it is connected by a branch line called the Eastern British Columbia Railway. Nos. 4 and 6 mines only were operated during the year, no work of any kind being done in No. 5.

A general description of the method of working, system of haulage in and around the mines, and surface plant has appeared in previous Annual Reports. In the early part of the year the screening and washing plant was considerably added to by the addition of a drier for drying ¼-inch coal for powdered fuel, together with the necessary conveyors, elevators, screens, etc. A new conveyor was also installed to carry the sludge from the washer to the drier, and a third Arms screen erected. At this stage the tipple was in a position to prepare 1,000 tons of coal a day when a disastrous fire occurred on July 3rd, which completely demolished the whole plant.

This fire took place about 5.30 a.m. on the above date, presumably due to overheating in the drier. It spread very rapidly to include the whole of the building, and, in spite of every effort put forth to combat it, continued to burn until the plant was a total loss. For a time it seemed as though the No. 4 mine buildings and the balance of the surface plant also would be lost, but the fire around these points was eventually controlled and the danger averted. On July 26th the directors of the company met and decided to go ahead with the building of a new plant for the preparation of the coal and work was immediately proceeded with. This was designed to consist of four sections, drying unit, screening unit, wet-washing unit, and a dry-cleaning unit, the three latter units all being under one roof but otherwise divided from each other. Except for the dry-cleaning plant, construction-work was completed in the early part of December, the tipple at this time having a capacity of 1,200 tons of coal a day. It is anticipated that the drying unit will be erected and put in operation in the early part of 1929.

That part of the plant now in use consists of a large apron conveyor to take the coal from the railway hopper and the No. 4 mine chute to two large shaking screens, where the coal is sized to over 4 inches, 4 inches to 1 inch, and under 1 inch. The under-1-inch size is passed through two Ruggles-Coles driers and is not cleaned at the present time, but when the air-cleaning plant is installed all above ¼ inch will be cleaned.

The 4-inch-to-1-inch size is washed in a double-compartment Elmore jig having the necessary settling-tank, elevators, conveyors, bins, etc., to make a complete unit. The over-1-inch size is hand-picked on an apron picking-table and all sizes after preparation are remixed and loaded into the railway-cars by means of a Manierre box-car loader. One vibrating screen was also

installed to prepare bird's-eye coal for pulverized fuel. The plant is operated entirely by electrical power and is fully equipped with fire-extinguishing apparatus. During the construction-work the mines operated full time, the coal being thoroughly hand-picked in the cars by a crew of men on each shift, although a restricted tonnage was obtained during this period.

The power-house has also been enlarged and a small 60-k.v.a. generator, belt-connected to a 75-horse-power Robb-Armstrong steam-engine, has been installed to take care of the town-lighting system and the fan at No. 6 mine.

The lamp generally used by the workmen is the Edison electric cap safety-lamp, while Wolf safety-lamps are used by the officials and bratticemen for testing purposes, all lamps being cleaned and repaired in a fairly well-equipped lamp-room located in a central position at the colliery.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines. Following is a brief description of the conditions prevailing in the various mines during the year:—

No. 4 Mine.

W. Almond, Overman; G. Elmes, H. Ferryman, and D. Waddington, Firebosses.

This mine operates the No. 4 seam and is ventilated by a single-inlet fan of the Guibal type, which, running at a speed of 90 r.p.m., produced an average quantity of 16,000 cubic feet of air a minute, under a water-gauge of 0.5 inch. At the present time this mine is all on one split, the quantity of air passing at the last inspection measuring as follows:—

A Level.—15,120 cubic feet of air a minute for the use of fourteen men and two horses.

Explosive gas has only been found on one occasion in the course of inspection, while the percentage of methane in the return air-current has always been kept below 0.5 per cent.

Roadways and timbering have been kept in fairly good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces. Five samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, only one of these coming up to the standard set by the above regulation. This mine is naturally damp and has been generally free from coal-dust at all our inspections.

No. 6 Mine.

W. Almond, Overman; W. Commons, Shiftboss; B. Parsons, B. Cheetman, and E. Rear, Firebosses.

This mine operates the No. 6 seam and is ventilated by a 4½- by 3-foot Sirocco fan, which, running at a speed of 280 r.p.m., produced an average quantity of 24,000 cubic feet of air a minute, under a water-gauge of 0.6 inch. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

A Level.—16,800 cubic feet of air a minute for the use of sixteen men and two horses.

No. 2 Level.—10,800 cubic feet of air a minute for the use of eleven men and one horse.

Explosive gas was found once in the course of inspection, while the methane content in the return air-currents has always been kept well below 0.5 per cent.

Roadways and timbering have been kept in fairly good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces.

Nineteen samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, fifteen of which were in keeping with the requirements of the above regulation. This mine is naturally damp and has been generally free from coal-dust at all our inspections.

Following are the official returns from Corbin Colliery for the year ended December 31st, 1928:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	127,691	.....	.....	.....
Sold for export to United States	19,948	.....	.....	.....
Sold for export to other countries	.....	.....	.....	.....
Total sales	.....	147,639	.....	.....
Used in making coke	.....	.....	.....	.....
Lost in washing	22,783	.....	.....	.....
Used under colliery boilers, etc.	12,116	.....	.....	.....
Total for colliery use	.....	34,899	.....	.....
		182,538		
Stocks on hand first of year	32,959	.....	.....	.....
Stocks on hand last of year	29,664	.....	.....	.....
Difference taken from stock during year	.....	3,295	.....	.....
Output of colliery for year	.....	179,243	.....	.....

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	9	.....	12	.....	21	.....
Whites—						
Miners	67	.....	.....	.....	67	.....
Miners' helpers	2	.....	.....	.....	2	.....
Drivers	11	.....	3	.....	14	.....
Labourers	22	.....	40	.....	62	.....
Mechanics and skilled labour	3	.....	23	.....	26	.....
Boys	.....	.....	1	.....	1	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	114	.....	79	.....	193	.....

GOVERNMENT MINE-RESCUE STATIONS.

Mine-rescue stations are established under authority of section 117, "Coal-mines Regulation Act," for the purpose of supplementing in case of need the colliery installations of mine-rescue apparatus, and also for the purpose of training holders of certificates of competency in the use of mine-rescue apparatus. In cases of emergency these stations are available for the use of any trained corps of mine-rescuers, duly qualified medical practitioners, or corps trained in the work of first aid to the injured, subject always to the order of an Inspector.

In several instances the rescue apparatus owned or supervised by the Government in the different districts were called for by teams dealing with underground fires. All these emergencies were dealt with by experienced teams and the work carried out in an efficient manner.

A number of calls were received during 1928 for the use of oxygen resuscitation apparatus from different hospitals and medical men. Four stations are established, as follows:—

Nanaimo.—J. D. Stewart, Instructor; serves the coal-mines in the Nanaimo area of the Vancouver Island Inspection District.

Cumberland.—John Thomson, Instructor; serves the coal-mines in the Comox area of the Vancouver Island Inspection District.

Middlesboro.—W. C. Stone, Instructor; serves the coal-mines in the Nicola-Princeton Inspection District.

Fernie.—John T. Puckey, Instructor; serves the coal-mines in the East Kootenay Inspection District.

MINE-RESCUE STATION, NANAIMO.

REPORT BY J. D. STEWART, INSTRUCTOR.

I have the honour to submit herewith my annual report as Instructor of Government Mine-rescue Station, Nanaimo, for the year ended December 31st, 1928.

There was an emergency call from the Reserve mine on July 20th, when two miners were caught by a blowout, but unfortunately both men were dead when reached.

A number of emergency calls for the oxygen resuscitation apparatus were made by medical men during the year, all of which were attended to at once.

Two mine-rescue teams maintained practice-training during most of the year and during July several teams carried out intensive practice.

In the early part of the year John Anderson, of the Vancouver Fire Department, took the full course of training and instruction in the use of the different oxygen apparatus and gas-masks at this station. On return to Vancouver he was appointed to bring the oxygen and gas-masks of the Fire Department up to date.

During the year five sets of the new McCaa two-hour oxygen apparatus was added to the equipment of this station. This is the latest type of rescue apparatus and keeps this station in line with modern requirements. The use of this apparatus was demonstrated at the first-aid and mine-rescue competitions held in Nanaimo on March 3rd and Labour Day and gave satisfactory results.

MINE-RESCUE STATION, CUMBERLAND.

REPORT BY JOHN THOMSON, INSTRUCTOR.

I have the honour to submit my annual report for the year ended December 31st, 1928, Mine-rescue Station, Cumberland.

During the year twelve employees of the Canadian Collieries (Dunsmuir), Limited, carried out a regular training with the apparatus every week.

A fire was discovered in a section of No. 4 mine, Comox Colliery, on September 17th, and an emergency call was made for the use of apparatus to assist in sealing off the fire in that portion of the mine. The men used the Paul breathing apparatus.

The equipment maintained at this station consists of five sets of the new McCaa apparatus, twelve sets of Paul oxygen apparatus, twelve sets of Burrell all-service gas-masks, twenty-five self-rescuers, one pulmotor, one H.H. inhalator, and one refilling-pump. An adequate stock of

supplies is kept on hand to maintain the above apparatus in service. In addition to above, four sets of Paul apparatus owned by the Canadian Collieries (Dunsmuir), Limited, are housed in this station.

Two teams from this district competed at the mine-rescue competition held at Nanaimo on Labour Day.

MINE-RESCUE STATION, MIDDLESBORO.

REPORT BY WILLIAM C. STONE, INSTRUCTOR.

As caretaker and instructor of the Middlesboro Mine-rescue Station, I beg to submit the following report for the year 1928:—

No practice was carried out by rescue teams at this station during the year, but individual instruction and training was given to a number of miners who are interested in this work.

The equipment at this station consists of five sets of Paul apparatus, four sets of Gibbs apparatus, six sets of the Burrell all-service gas-masks, twelve self-rescuers, pulmotor and first-aid requisites; all the above is maintained ready for use and adequate supplies are kept on hand.

The mines in the district have forwarded their rescue apparatus periodically for repairs and overhaul, in order to be ready for any emergency.

MINE-RESCUE STATION, FERNIE.

REPORT BY JOHN T. PUCKEY, INSTRUCTOR.

I have the honour to submit my annual report for the year ended December 31st, 1928.

The annual first-aid classes were started in February and the examination held in March, fifty-eight students sitting for their certificates, medallions, and labels.

In March I accompanied Inspector Miard to the *Sullivan* mine to examine the rescue equipment in use there. The equipment consisted of two all-service gas-masks and an inhalator, also an old-type pulmotor. The advisability of augmenting this equipment was pointed out to the management, with the result that there are sixteen all-service masks now at this mine, fifty spare canisters for the same, and two H.H. inhalators. A man has been detailed to maintain this equipment in good order, and regular practice by selected men is gone through twice each month in the use of the machines.

The East Kootenay Mine Safety Association has been very active this year, and as a result the three mine-rescue teams from Coal Creek Colliery have been training at this station every month since last May. The men on the team are paid $1 an hour and the practice generally lasts about three hours.

The Department placed two sets of the McCaa apparatus in this station in May. This machine has given great satisfaction to the men of the rescue teams, who feel that it is an improvement on the older type of rescue apparatus. Three more sets were ordered.

On August 30th at 11.45 a.m. I received a telephone message from Coal Creek Colliery to the effect that four men had been caught in a blowout in No. 1 East mine. Inspectors Strachan and Miard, who were at the station at that time, immediately left for the mine. At 12.15 I was notified to bring all my apparatus to Coal Creek as soon as possible, and arrived there with the equipment at 1 o'clock. I learned that two bodies had been recovered and that four men were still unaccounted for. As soon as trained men were available the rescue apparatus was rushed into the mine. Meantime three more bodies had been recovered and the apparatus was used to recover the sixth body. On reaching the mine I posted a man to check off all men entering or leaving the entrance.

The equipment at this station is the same as last year, with the addition of six "G" type electric-light head-pieces and two McCaa machines; three more being ordered. Total equipment: Six Gibbs apparatus, two McCaa apparatus, twelve all-service masks, and forty-five self-rescuers, spare parts and supplies. All the apparatus is in good working-order.

In training the teams I have used twelve tanks of oxygen and 288 lb. of Cardoxite.

Two men took a full course of mine-rescue work, but have not yet taken their examinations for certificates.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

FIRST-, SECOND-, AND THIRD-CLASS CERTIFICATES AND MINE-SURVEYING CERTIFICATES.

REPORT BY JAMES STRANG, SECRETARY TO THE BOARD.

I have the honour to submit herewith the annual report of transactions of the above Board for the year ended December 31st, 1928.

The Board of Examiners, which was formed on July 10th, 1919, at present consists of James Dickson, Chief Inspector of Mines, as Chairman; Harry Ernest Miard, member; and James Strang, member and Secretary of the Board. The meetings of the Board are held in the office of the Mines Department, Victoria. The examinations are held in accordance with the rules made by the Provincial Board of Examiners and approved by the Minister of Mines, July 10th, 1919.

In April, 1927, an amendment was made to Rule 13, allowing the candidates the use of an approved text-book at the examination.

Two examinations were held in 1928; the first was held on May 16th, 17th, and 18th, and the second on November 21st, 22nd, and 23rd.

The total number of candidates at the examinations were as follows: For First-class Certificates, 6 (3 passed and 3 failed); for Second-class Certificates, 9 (3 passed and 6 failed); for Third-class Certificates, 16 (7 passed and 9 failed); for Mine Surveyor Certificates, 5 (1 passed and 4 failed).

The following is a list of the candidates who successfully passed in the various classes:—

First-class Candidates.—John Bruce Elliott, John Johnston, and A. C. D'Altroy.

Second-class Candidates.—Robt. B. Bonar, Joseph Wilson, and Garnet S. Corbett.

Third-class Candidates.—Joseph Wilson, Steve Lazaruk, David Litherland, Allen McDonald, Henry Taylor, Albert Clare, and John Christie.

Mine Surveyor.—Percy Kneen.

The attention of mining students, who have not the opportunity of attending evening schools where the subject of mining is taught, is directed to the correspondence course in mining provided by the Department of Education. To those who intend to qualify as mine officials this course of study would be of immense advantage.

EXAMINATIONS FOR CERTIFICATES OF COMPETENCY AS COAL-MINERS.

In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act further provides that every coal-miner shall be the holder of a certificate of competency as such. By "miner" is meant any person employed undeground in any coal-mine to cut, shear, break, or loosen coal from the solid, whether by hand or machinery.

The work of the Board of Examiners in examining candidates has been carried out in all mining districts at intervals of not less than sixty days, as required by the amendment to the Act.

No certificate has been granted in any case where the candidate failed to satisfy the Board as to his general fitness, experience in a coal-mine, and a working knowledge of the English language. During 1928 examinations have been held for candidates for certificates of competency as coal-miners in the various coal-mining districts of the Province.

Three hundred and eight candidates presented themselves for examination; 269 passed and thirty-nine failed to qualify.

In addition to the above, a number of duplicate certificates were issued to coal-miners who had lost their original certificate of competency.

The Board of Examiners desires to thank the different coal-mining companies for the use of their premises for holding these examinations.

The Inspector of Mines in each district has authority, under the amendment (1919) to "Coal-mines Regulation Act," to grant, after a satisfactory examination, a provisional certificate of competency as a coal-miner to applicants which entitles the holder to follow the occupation of a coal-miner for a period not exceeding sixty days, or until the date of the next regular examination before the Board.

REGISTERED LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY AS COAL-MINE OFFICIALS.

FIRST-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT, 1897."

Name.	Date.	Name.	Date.
Shepherd, Francis H.	Mar. 5, 1881	Stockett, Thomas, Jr.	Aug. 3, 1901
Honobin, William	May 1, 1882	Cunliffe, John	Aug. 3, 1901
Little, Francis D.	May 1, 1882	Evans, Daniel	Aug. 3, 1901
Chandler, William	Dec. 21, 1883	Browitt, Benjamin	Aug. 3, 1901
Priest, Elijah	Dec. 21, 1883	McEvoy, James	Oct. 17, 1902
Randle, Joseph	Jan. 18, 1888	Wilson, A. R.	Oct. 17, 1902
Matthews, John	Jan. 8, 1889	Simister, Charles	Oct. 17, 1902
Norton, Richard Henry	Aug. 26, 1889	Budge, Thomas	Oct. 17, 1902
Kesley, John	Mar. 4, 1892	Richards, James A.	Oct. 17, 1902
Wall, William H.	May 30, 1896	McLean, Donald	Jan. 21, 1904
Wilson, David	May 30, 1896	Wright, H. B.	Jan. 21, 1904
Smith, Frank B.	May 30, 1896	Coulthard, R. W.	Jan. 21, 1904
Bradshaw, George B.	June 12, 1899	Roaf, J. Richardson	Jan. 21, 1904
Simpson, William G.	June 12, 1899	John, John	Jan. 21, 1904
Hargreaves, James	Feb. 5, 1901	Manley, H. L.	Jan. 21, 1904
Drinnan, Robert G.	Feb. 5, 1901		

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT," 1904–1911–1919.

Name.	Date.	Name.	Date.
Battey, Richard	May 27, 1913	Graham, Thomas	Nov. 9, 1907
Baxter, Andrew	June 10, 1911	Gray, James	Nov. 27, 1909
Bennett, John	Dec. 30, 1926	Henderson, Robert	Nov. 27, 1909
Biggs, J. G.	July 22, 1908	Hewlett, Howe	May 27, 1913
Bonar, Robert	Oct. 28, 1911	Higgins, Alexander	Dec. 19, 1918
Brace, Tom	May 13, 1915	Hodge, William K.	June 16, 1925
Bridge, Edward	July 22, 1908	Holden, James	May 1, 1909
Brown, David	May 21, 1914	Howden, Archibald	May 27, 1913
Brown, Robert Joyce	May 13, 1915	Howells, Nathaniel	Oct. 28, 1911
Caufield, Bernard	May 1, 1909	Hughes, John C.	May 17, 1917
Church, James A. H.	June 10, 1911	Humphries, Clifford	June 10, 1911
Cox, Richard	May 13, 1915	Hunter, Alex. B.	July 8, 1916
Crowder, James	June 10, 1911	Huntrods, Eustace S. F.	May 19, 1922
Cunningham, John Howard	May 9, 1912	Jackson, Thos. R.	Nov. 9, 1907
D'Altroy, A. C.	Dec. 20, 1928	Jaynes, Frank	May 13, 1915
Davidson, W. A.	May 1, 1909	Jemson, Jas. W.	May 27, 1913
Davies, David	June 10, 1911	Johnston, John	June 30, 1928
Davies, Stephen	Nov. 15, 1917	Kellock, George	June 10, 1911
Davies, Thos. Owen	May 21, 1914	Knox, T. K.	July 27, 1909
de Hart, J. B.	May 17, 1917	Laird, Robert	Nov. 15, 1917
Derbyshire, James	Nov. 9, 1907	Leighton, Henry	May 9, 1912
Devlin, E. H.	Dec. 30, 1926	Mackinnon, Hugh G.	May 19, 1922
Devlin, Henry	May 1, 1909	Macauley, D. A.	June 10, 1911
Dickson, James	Oct. 31, 1912	McCulloch, James	Sept. 10, 1910
Elliott, Daniel	Nov. 9, 1907	McDonald, John	Oct. 3, 1919
Elliott, John B.	June 30, 1928	McGuckie, Thomas	July 22, 1908
Emmerson, Joseph	Nov. 9, 1907	McKendrick, Andrew	May 27, 1913
Ewart, William	May 19, 1922	McLean, Michael D.	June 16, 1925
Fairfoull, Robert	June 10, 1911	McMillan, J. H.	Sept. 10, 1910
Foster, William R.	Dec. 31, 1925	McVicar, Samuel	May 1, 1909
France, Thos.	Nov. 22, 1906	Mazey, William John	Oct. 31, 1912
Fraser, Norman	Mar. 4, 1905	Miard, Henry Ernest	May 9, 1912
Freeman, H. N.	May 1, 1909	Millar, John K.	Nov. 22, 1906
Galloway, C. F. J.	July 22, 1908	Miller, Andrew Anderson	Oct. 31, 1912
Garman, Morris W.	Nov. 15, 1917	Montgomery, John W.	May 1, 1909
Gascoyne, Rowland B.	May 21, 1914	Moore, Wm. H.	May 17, 1917
Gillham, John	Jan. 5, 1925	Mordy, Thomas	Sept. 10, 1910
Glover, Francis	Oct. 31, 1912	Morrison, Edward	June 24, 1924
Graham, Charles	Nov. 14, 1905		

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT," 1904–1911–1919—*Continued.*

Name.	Date.	Name.	Date.
Mottishaw, Sam. K.	Nov. 15, 1917	Stewart, R. T.	Sept. 10, 1910
Murray, George	June 21, 1921	Strachan, Robert	Mar. 4, 1905
Newbury, Arthur	June 21, 1920	Strang, James	June 10, 1911
O'Brien, George	May 21, 1914	Taylor, James	May 16, 1918
Ovington, John	May 27, 1913	Thomas, J. D.	Sept. 10, 1910
Peacock, Frank David	Oct. 28, 1911	Thorne, B. L.	Sept. 10, 1910
Penman, Hugh	May 21, 1914	Touhey, James	May 21, 1914
Phelan, Arthur	May 27, 1913	Vincent, Thomas C.	June 24, 1924
Powell, J. W.	June 10, 1911	Walker, William	May 16, 1918
Quinn, John Graham	July 8, 1916	Wallbank, J.	Sept. 10, 1910
Ramsay, Peter Millar	May 16, 1918	Warburton, Ernest Leonard	July 8, 1916
Roper, William	May 13, 1915	Wark, Samuel David	Oct. 3, 1919
Russell, John	May 21, 1914	Wesnedge, William	Dec. 19, 1918
Scott, Thomas Wright	Dec. 22, 1921	Whittaker, John	Dec. 19, 1918
Shanks, John	May 1, 1909	Williams, Jahn Samuel	Dec. 19, 1918
Shenton, T. J.	Sept. 10, 1910	Williams, Thos. B.	May 17, 1917
Shone, Samuel	May 1, 1909	Williams, Thos. H.	Nov. 22, 1906
Smith, A. E.	Oct. 28, 1911	Wilson, Ridgeway R.	Nov. 15, 1917
Smith, Joseph	July 22, 1908	Wilson, Thos. M.	Dec. 23, 1927
Smith, Thos. Edwin	Dec. 19, 1918	Wilson, William	May 16, 1918
Spicer, J. E.	Oct. 28, 1911	Wylie, John	July 22, 1908
Spruston, T. A.	Nov. 27, 1909	Yates, Frank	Dec. 31, 1925
Stevens, L. C.	Nov. 27, 1909		

SECOND-CLASS CERTIFICATES OF SERVICE.

Name.	Date.	No.	Name.	Date.	No.
Lee, John S.	Mar. 4, 1905	B 9	Walker, David	Mar. 4, 1905	B 14
Millar, J. K.	Mar. 4, 1905	B 10	Powell, William Baden	Mar. 4, 1905	B 16
McCliment, John	Mar. 4, 1905	B 11	Bryden, Alexander	Mar. 4, 1905	B 18
Hunt, John	Mar. 4, 1905	B 13			

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

Name.	Date.	No.	Name.	Date.	No.
Adamson, Robert	Sept. 10, 1910	B 120	Brown, James L.	Oct. 28, 1911	B 136
Allan, Alex. McDiarmid	May 27, 1913	B 167	Brown, John C.	Oct. 23, 1906	B 39
Almond, Walter	Nov. 15, 1917	B 213	Brown, John Todd	May 9, 1912	B 150
Alstead, Robert	June 24, 1924	B 257	Brown, R. J.	Oct. 28, 1911	B 134
Archibald, William	Nov. 22, 1922	B 250	Brown, Robert	May 21, 1914	B 183
Ball, Benjamin	June 21, 1920	B 235	Brown, Robert Sneddon	May 13, 1915	B 196
Barclay, Andrew	July 29, 1905	B 25	Brown, William Gold	Dec. 19, 1918	B 228
Barlow, Benjamin Robt.	Dec. 19, 1918	B 229	Brownrigg, John H.	May 17, 1917	B 124
Bastian, Albert	Nov. 21, 1923	B 256	Bushell, J. P.	May 1, 1909	B 81
Baybutt, Thomas	July 8, 1916	B 206	Carroll, Henry	July 22, 1908	B 62
Bell, John	May 17, 1917	B 212	Caufield, Bernard	Oct. 23, 1906	B 30
Beveridge, William	June 21, 1920	B 233	Caufield, John	July 8, 1916	B 199
Bevis, Nathaniel	Sept. 10, 1910	B 123	Cawthorne, L.	May 1, 1909	B 93
Biggs, John	May 1, 1909	B 94	Challinor, Jno. Thomas	May 27, 1913	B 169
Biggs, John G.	Nov. 2, 1907	B 40	Challoner, Jno. Arthur	May 21, 1914	B 178
Blair, James	May 13, 1915	B 197	Chapman, Wm.	June 10, 1927	B 268
Bonar, Robt. B.	June 30, 1928	B 270	Churchill, James	July 22, 1908	B 65
Brace, Tom	Nov. 27, 1909	B 96	Clark, Robt.	June 21, 1921	B 242
Bridge, Edward	Oct. 23, 1906	B 33	Clarkstone, Wm. W.	May 21, 1914	B 180
Brown, David	Sept. 10, 1910	B 108	Commons, Wm.	Sept. 10, 1910	B 115
Brown, George	Dec. 19, 1918	B 225			

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Corbett, Garner S.	June 30, 1928	B 272	Jones, Samuel	May 16, 1918	B 221
Coupland, George	May 16, 1918	B 217	Jones, William T.	July 22, 1908	B 66
Courtney, A. W.	Oct. 28, 1911	B 138	Jordon, Thos.	Nov. 27, 1909	B 104
Cox, Richard	May 9, 1912	B 143	Joyce, Walter	May 27, 1913	B 168
Crawford, David	May 1, 1909	B 88	Kirkwood, John R.	Oct. 31, 1912	B 160
Cunliffe, Thomas	May 1, 1909	B 78	Knowles, James E.	Oct. 28, 1911	B 137
Dando, John	May 27, 1913	B 164	Laird, Robert	May 17, 1917	B 210
Daniels, David	Nov. 2, 1907	B 53	Lander, Frank	May 13, 1915	B 195
Derbyshire, James	Oct. 23, 1906	B 32	Lane, Joseph	May 9, 1912	B 142
Davidson, Hugh	May 27, 1913	B 165	Lee, Robert John	Sept. 10, 1910	B 110
Davies, Stephen	Sept. 10, 1910	B 113	Littler, Jas.	June 10, 1927	B 266
Dennis, Fred. W.	May 21, 1914	B 174	Littler, Matthew	Oct. 31, 1912	B 157
Devlin, Ernest H.	May 21, 1914	B 179	Luck, George	June 10, 1911	B 128
Dewar, Alexander	Oct. 31, 1912	B 162	Manifold, Albert	May 9, 1912	B 145
Dickenson, Clifford	May 13, 1915	B 189	Marsh, John	Nov. 15, 1917	B 216
Dunsmuir, John	Nov. 14, 1905	B 26	Mason, Joseph	May 13, 1915	B 193
Duncan, James	Nov. 21, 1923	B 255	Massey, H.	Nov. 27, 1909	B 99
Dykes, J. W.	May 1, 1909	B 77	Mather, Thomas	June 10, 1911	B 127
Eccleston, Wm.	May 1, 1909	B 87	Matusky, A.	May 1, 1909	B 91
Fairfoull, James	May 21, 1914	B 186	Mayer, Ralph Waldo	May 9, 1912	B 144
Fairfoull, R.	May 1, 1909	B 83	Mazay, W. J.	Nov. 27, 1909	B 101
Finlayson, James	July 29, 1905	B 21	Menzies, Fred	Dec. 22, 1921	B 244
Ford, Allan	May 27, 1913	B 171	Merryfield, William	July 22, 1908	B 61
Foster, W. R.	Nov. 27, 1909	B 102	Miard, Hy. E.	Sept. 10, 1910	B 107
France, Thos.	May 14, 1905	B 27	Michek, John	May 17, 1917	B 188
Francis, David M.	May 21, 1914	B 182	Middleton, Robert	July 22, 1908	B 72
Francis, Enoch	May 1, 1909	B 86	Mitchell, Henry	July 8, 1916	B 201
Francis, James	July 22, 1908	B 63	Monks, James	Nov. 2, 1907	B 55
Frater, George	July 8, 1916	B 204	Moore, Wm. H.	May 21, 1914	B 173
Freeman, Henry N.	Nov. 2, 1907	B 45	Morgan, John	Nov. 2, 1907	B 43
Frew, Wm. M.	June 10, 1927	B 269	Morgan, William	Dec. 19, 1918	B 224
Garbett, Richard	Oct. 31, 1912	B 161	Morgan, Daniel	Nov. 21, 1923	B 254
Garman, Morris Wilbur	Oct. 31, 1912	B 155	Morris, John	July 22, 1908	B 67
Gilham, John	June 21, 1920	B 237	Morrison, Edward	Nov. 21, 1923	B 253
Gillespie, Hugh	July 29, 1905	B 24	Morton, Robert W.	July 22, 1908	B 59
Gillespie, John	Oct. 23, 1906	B 36	Mottishaw, S. K.	Oct. 28, 1911	B 135
Gould, Alfred	May 13, 1915	B 190	Murray, George	Oct. 3, 1919	B 232
Gourlay, Robert	Dec. 19, 1918	B 227	Musgrave, J.	May 1, 1909	B 90
Graham, Chas.	Mar. 4, 1905	B 1	Myers, Peter	May 9, 1912	B 149
Gray, David	May 1, 1909	B 76	MacKinnon, Hugh G.	Dec. 22, 1921	B 243
Gray, George	July 8, 1916	B 207	McKay, Walter	June 30, 1926	B 262
Greenwell, Archibald	May 16, 1918	B 220	McLaughlin, Alex	May 13, 1915	B 191
Hamilton, Robert N.	May 21, 1914	B 175	McDonald, J. A.	Oct. 28, 1911	B 133
Hastings, Andrew P.	Dec. 19, 1918	B 223	McDonald, John	May 27, 1913	B 172
Henderson, Robert	July 22, 1908	B 60	McFegan, W.	Nov. 31, 1909	B 106
Hodge, William K.	Jan. 5, 1925	B 259	McFegan, Robert	May 18, 1922	B 246
Holliday, William	Dec. 19, 1918	B 230	McGarry, Martin	Oct. 31, 1912	B 156
Horrocks, Abner G.	June 10, 1911	B 130	McGuckie, Thomas M.	Oct. 23, 1906	B 35
Houston, Robert	June 16, 1925	B 260	McKelvie, J.	May 1, 1909	B 92
Howells, Nathaniel	Nov. 27, 1909	B 97	McKendrick, And.	Sept. 10, 1910	B 112
Hudson, George	Sept. 10, 1910	B 121	McLean, Michael D.	June 21, 1920	B 234
Hughes, John C.	Sept. 10, 1910	B 109	McMillan, D.	June 10, 1911	B 125
Hutton, Isaac	May 21, 1914	B 185	McNay, Carmichael	May 9, 1912	B 151
Hutton, John	May 9, 1912	B 154	McPherson, James E.	July 22, 1908	B 73
Hynds, William	Dec. 14, 1920	B 240	McWhirter, James	June 30, 1926	B 263
Hynds, John	May 18, 1922	B 247	Neen, Joseph	June 10, 1911	B 129
Jackson, Thos. R.	Mar. 4, 1905	B 5	Newbury, Arthur	May 21, 1914	B 184
James, David	Nov. 2, 1907	B 58	Newton, Wm.	Sept. 10, 1910	B 116
Jarrett, Fred	May 1, 1909	B 84	Nicholl, Joseph O.	Dec. 31, 1925	B 261
Jaynes, Frank	Sept. 10, 1910	B 111	O'Brien, Charles	May 9, 1912	B 148
John, Francis	July 8, 1916	B 200	O'Brien, George	May 1, 1909	B 82
John, Howell	Sept. 10, 1910	B 122	Osborne, Hugh	Dec. 14, 1920	B 239
Johnson, Moses	May 1, 1909	B 75	Ovington, John	Nov. 2, 1907	B 52
Johnston, John	June 10, 1927	B 267	Park, William	June 21, 1920	B 238

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Parkinson, T.	May 1, 1909	B 80	Stubbs, Clement	May 18, 1922	B 245
Parnham, Charles	Nov. 2, 1907	B 49	Sutherland, John	May 16, 1918	B 218
Quinn, James	May 21, 1914	B 181	Taylor, James	May 13, 1915	B 194
Quinn, John	May 9, 1912	B 146	Taylor, Robt.	Dec. 30, 1926	B 265
Ramsay, Peter Millar	May 17, 1917	B 209	Taylor, Thomas	July 8, 1916	B 203
Rankin, Geo.	Nov. 27, 1909	B 103	Thomas, J. B.	Nov. 27, 1909	B 105
Raynes, M. T.	Oct. 28, 1911	B 139	Thomas, Joseph D.	Oct. 23, 1906	B 38
Reid, Wm.	Oct. 28, 1911	B 132	Thomas, Daniel W.	Nov. 22, 1922	B 249
Renny, James	Oct. 28, 1911	B 140	Thompson, Joseph	Sept. 10, 1910	B 114
Richards, Thomas	Nov. 2, 1907	B 57	Touhey, James	May 9, 1912	B 147
Richards, Samuel	May 9, 1912	B 152	Touhey, William	July 8, 1916	B 205
Rigby, John	July 29, 1905	B 29	Tonge, Thomas	July 22, 1908	B 71
Roberts, Ebenezer	Sept. 10, 1910	B 117	Tully, Thomas	Nov. 15, 1917	B 214
Robinson, William	July 22, 1908	B 69	Vanhulle, Peter	Nov. 2, 1907	B 54
Rogers, George	May 1, 1909	B 79	Virgo, John	May 1, 1909	B 89
Roper, William	May 9, 1912	B 141	Walker, William	May 13, 1915	B 192
Rowbottom, Thomas	May 16, 1918	B 222	Warburton, Ernest L.	May 27, 1913	B 170
Russell, John	Nov. 2, 1907	B 47	Watson, Adam G.	Nov. 14, 1905	B 28
Rutherford, Jasper	May 16, 1918	B 219	Watson, Arthur W.	May 17, 1917	B 211
Scarpino, Francis	Dec. 19, 1918	B 226	Webster, James S.	June 24, 1924	B 258
Scott, Thomas Wright	June 21, 1921	B 241	Wesnedge, William	Nov. 27, 1909	B 98
Shanks, David	Oct. 31, 1912	B 159	White, John	Nov. 2, 1907	B 48
Shaw, Thomas John	May 27, 1913	B 166	Whitehouse, William	Oct. 31, 1912	B 163
Smith, John	Oct. 3, 1919	B 231	Williams, John Samuel	Nov. 15, 1917	B 215
Smart, Robert K.	Nov. 22, 1922	B 248	Williams, Watkin	Sept. 10, 1910	B 118
Somerville, Alex.	Mar. 4, 1905	B 4	Wilson, Joseph	June 30, 1928	B 271
Spruston, Robert Lecce	July 8, 1916	B 202	Wilson, Robinson	May 21, 1914	B 177
Spruston, Thos. A.	Nov. 2, 1907	B 46	Wilson, Thomas	July 22, 1908	B 74
Stafford, Matthew	June 10, 1911	B 131	Wilson, William	July 22, 1908	B 70
Stewart, J. M.	May 1, 1909	B 95	Wood, Thos. James	May 21, 1914	B 176
Stobbart, Jacob	May 9, 1912	B 153	Worthington, Joseph	May 1, 1909	B 85
Stockwell, William	Nov. 2, 1907	B 56	Yates, Frank	Nov. 22, 1922	B 251
Strang, Thomas	Oct. 31, 1912	B 158			

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

Name.	Date.	No.	Name.	Date.	No.
Adamson, Robert	May 1, 1909	C 323	Barrass, Robt.	June 30, 1926	C 795
Adamson, Wm.	Dec. 22, 1921	C 721	Bastian, Albert	May 30, 1923	C 750
Ainsworth, Edward	May 16, 1918	C 674	Bate, Horace	Dec. 30, 1926	C 802
Allan, Alexander	Oct. 28, 1911	C 430	Bateman, Joseph William	Oct. 28, 1913	C 551
Almond, Alex	Oct. 1, 1907	C 252	Bauld, Wm.	June 10, 1911	C 422
Almond, Walter	July 22, 1908	C 286	Baxter, Robert	Oct. 28, 1911	C 450
Alstead, Robt.	June 21, 1921	C 719	Baybutt, Thomas	May 27, 1913	C 548
Anderson, John	Oct. 28, 1911	C 437	Beard, Henry C.	May 30, 1923	C 751
Anderson, Peter Blane	Nov. 15, 1917	C 660	Beeton, D. H.	May 1, 1909	C 338
Anderson, Robt.	Oct. 14, 1914	C 599	Bell, Fred	May 27, 1913	C 514
Angell, William	May 21, 1914	C 591	Bell, John	May 9, 1912	C 477
Arbuckle, John	May 13, 1915	C 622	Bennett, Andrew M.	Nov. 15, 1917	C 661
Archibald, Geo.	May 21, 1914	C 569	Bennett, John	Oct. 14, 1914	C 597
Archibald, Thomas	Oct. 28, 1911	C 454	Bennie, John	June 10, 1911	C 411
Ball, Alfred	May 17, 1917	C 635	Beveridge, Wm.	June 10, 1911	C 396
Bann, Thomas	Oct. 31, 1912	C 494	Biggs, John	Mar. 4, 1905	C 210
Baggaley, J.	July 22, 1908	C 300	Biggs, Thomas	Oct. 28, 1911	C 449
Bain, James	May 27, 1913	C 546	Birchell, Richard	Oct. 1, 1907	C 266
Bainbridge, James	Nov. 21, 1922	C 744	Blair, James	Oct. 31, 1912	C 502
Ball, Benjamin	May 21, 1914	C 583	Blas, Emil	June 24, 1924	C 774
Barker, Robert	June 10, 1911	C 415	Blewett, Ernest	July 22, 1908	C 298
Barlow, B. R.	May 1, 1909	C 337	Blinkhorn, Thomas	Dec. 19, 1918	C 681
Barr, Samuel	June 10, 1927	C 809	Bond, Frank	June 30, 1926	C 797

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Bradley, William	July 22, 1908	C 291	Corbett, Garnet S.	Dec. 23, 1927	C 812
Bradley, Wilfred	May 17, 1922	C 733	Coulthard, James	June 10, 1911	C 407
Bridge, Edward	July 29, 1905	C 223	Crawford, David	Mar. 4, 1905	C 208
Briscoe, F.	July 22, 1908	C 309	Cunningham, G. F.	Nov. 11, 1905	C 229
Broderick, Matthew	Jan. 21, 1913	C 525	Cunliffe, Thos.	Oct. 1, 1907	C 265
Brown, Arthur A.	Oct. 14, 1914	C 596	Dabb, Owen	May 21, 1914	C 578
Brown, David	Nov. 1, 1909	C 348	Dando, John	May 9, 1912	C 465
Brown, George	July 8, 1916	C 626	Davey, George	June 21, 1921	C 718
Brown, George A.	Dec. 14, 1920	C 706	Davidson, Hugh	May 9, 1919	C 464
Brown, James	Sept. 10, 1910	C 364	Davies, Alfred	Oct. 3, 1912	C 691
Brown, James	June 10, 1911	C 412	Davies, Evan Thomas	May 9, 1912	C 463
Brown, James	July 8, 1916	C 625	Davies, John H. C.	May 17, 1922	C 729
Brown, Jas. Millie	May 13, 1915	C 615	Davis, John David	May 16, 1918	C 669
Brown, John	Sept. 10, 1910	C 392	Davis, William	May 1, 1909	C 339
Brown, Robert	Oct. 28, 1911	C 451	Dean, Andrew	Dec. 19, 1918	C 688
Brown, Robert D.	June 10, 1911	C 423	Dean, Joseph	May 13, 1915	C 611
Brown, Robert S.	June 10, 1911	C 408	Derbyshire, A.	June 10, 1911	C 401
Brown, Wm. A.	May 21, 1914	C 576	Dewar, Alex.	Sept. 10, 1910	C 369
Brown, William Gold	July 8, 1916	C 629	Devlin, Edward	Oct. 23, 1906	C 241
Bruce, Preston	Dec. 14, 1920	C 712	Devlin, Ernest Henry	May 27, 1913	C 538
Bullen, Thomas	Sept. 10, 1910	C 379	Devlin, John	Oct. 3, 1919	C 693
Bushell, Jas. P.	Oct. 1, 1907	C 264	Devoy, William	May 17, 1917	C 638
Bysouth, Thomas	May 16, 1918	C 673	Dickenson, Clifford	May 27, 1917	C 532
Cairns, Andrew	June 10, 1911	C 420	Dickie, Leslie	Nov. 20, 1923	C 762
Cairns, Robert	May 27, 1913	C 539	Dingsdale, Geo.	Oct. 28, 1911	C 459
Caldwell, Daniel	May 17, 1917	C 639	Dobie, Thomas	Dec. 22, 1921	C 726
Caldwell, Peter	June 21, 1921	C 715	Doherty, J. J.	May 1, 1909	C 340
Calverly, Joseph	Sept. 10, 1910	C 375	Doney, John	Mar. 4, 1905	C 211
Camamile, Hollis	Oct. 28, 1911	C 443	Donnachie, John	June 10, 1911	C 425
Campbell, Samuel	Nov. 15, 1917	C 662	Doodson, Robert	Oct. 28, 1911	C 455
Campbell, Andrew	Nov. 27, 1917	C 651	Dorrance, Orlin William	Jan. 21, 1913	C 517
Carroll, George	Nov. 21, 1922	C 746	Douglas, D. B.	Oct. 23, 1906	C 235
Carr, Peter	Oct. 31, 1912	C 497	Dow, And. Y.	May 21, 1914	C 587
Carson, George	Mar. 17, 1917	C 663	Drybrough, Robert	June 21, 1920	C 701
Cartwright, Wm. H.	June 24, 1924	C 768	Dunn, Wm.	Oct. 14, 1914	C 606
Cass, Wm.	Dec. 30, 1926	C 800	Dunnigan, Richard	June 21, 1921	C 716
Catchpole, Charles	July 29, 1905	C 227	Dykes, Isaac	June 10, 1911	C 409
Caufield, Edward	May 16, 1918	C 670	Dykes, Joseph W.	Oct. 1, 1907	C 248
Caufield, John	May 1, 1909	C 321	Eccleston, Thomas	May 17, 1917	C 482
Challoner, Arthur	Oct. 28, 1911	C 433	Eccleston, John I.	May 30, 1923	C 757
Chambers, Ralph H.	Dec. 14, 1920	C 709	Edwards, John	May 27, 1913	C 542
Chapman, Wm.	Dec. 22, 1921	C 720	Elliott, John	May 27, 1913	C 541
Chapman, John	May 30, 1923	C 753	Elliott, John B.	Dec. 23, 1927	C 811
Chapman, Thomas H.	Jan. 5, 1925	C 779	Elmes, George	Oct. 31, 1912	C 511
Charnock, John	Nov. 15, 1917	C 653	Evans, D.	July 22, 1908	C 284
Cheetham, Ben	July 22, 1908	C 311	Ewing, Robert	May 13, 1915	C 608
Chester, John	Oct. 28, 1911	C 440	Fairfoull, James	Oct. 28, 1911	C 453
Christie, John	Dec. 20, 1928	C 820	Farrow, John William	Dec. 19, 1918	C 683
Clare, Albert	Dec. 20, 1928	C 819	Ferryman, Henry	June 21, 1920	C 697
Clark, Lewis	June 10, 1911	C 405	Fitzpatrick, T. J.	Oct. 2, 1911	C 452
Clark, Walter Pattison	May 9, 1912	C 480	Flockart, David	Jan. 21, 1913	C 531
Clarkson, Robert	June 21, 1920	C 696	Ford, Allen	Oct. 28, 1911	C 445
Clarkstone, Wm. W.	Oct. 28, 1911	C 431	Fowler, Robert	Oct. 31, 1912	C 495
Clarkstone, Hugh	May 17, 1922	C 736	Francis, David Morgan	Oct. 28, 1913	C 558
Cleaves, Walter	May 9, 1912	C 475	Francis, James	Oct. 1, 1907	C 250
Clifford, William	July 22, 1908	C 313	Frater, George	May 13, 1915	C 616
Cloke, Chas. E.	June 16, 1925	C 782	Freeman, H. N.	Nov. 14, 1905	C 230
Coates, Frank	June 16, 1925	C 789	Frew, William M.	May 30, 1923	C 752
Colgrove, Charles Henry	Dec. 19, 1918	C 679	Frew, Andrew	Nov. 27, 1909	C 360
Commons, William	July 22, 1908	C 304	Frodsham, Vincent	July 22, 1908	C 282
Coupland, David	June 21, 1921	C 713	Furbow, John	Jan. 21, 1913	C 528
Cooke, Joseph	Mar. 4, 1905	C 209	Gabriel, Ernest P.	May 17, 1922	C 739
Coomb, Alexander	May 27, 1913	C 533	Garbett, Richard	Sept. 10, 1910	C 377
Cooper, John Andrew	Dec. 19, 1918	C 689	Gascoyne, Rowland B.	Jan. 21, 1913	C 513
Cope, Frank	Oct. 28, 1913	C 549	Geater, Jas. Gordon	May 21, 1914	C 573

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Name.	Date.	No.
Gemmell, James	Oct. 31, 1912	C 505
Gillham, John	May 13, 1915	C 623
Gillies, William	May 16, 1918	C 668
Glenn, James	Oct. 28, 1911	C 435
Gordon, Davis John	May 9, 1912	C 474
Gourley, Robert	May 9, 1912	C 470
Gray, George	May 9, 1912	C 467
Gregory, William	May 30, 1923	C 756
Gregson, John B.	Dec. 31, 1925	C 790
Green, William	Nov. 15, 1917	C 659
Greenhorn, John	May 21, 1914	C 575
Groat, Ed. Murray	Nov. 20, 1923	C 764
Griffiths, Edward	Oct. 31, 1914	C 508
Gunniss, Matthew	May 9, 1912	C 460
Haile, Joseph G.	May 17, 1922	C 731
Hallinan, William	May 1, 1909	C 343
Hall, Joseph	May 17, 1922	C 742
Halsall, J.	July 22, 1908	C 307
Hamilton, John	Oct. 28, 1911	C 444
Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550
Hampton, Samuel	Nov. 15, 1917	C 650
Hancock, Arthur	Nov. 15, 1917	C 656
Hardy, Edward	June 21, 1920	C 694
Hartley, Thomas	Oct. 31, 1912	C 510
Hart, Daniel M.	May 17, 1922	C 730
Harwood, Fred	Sept. 10, 1910	C 384
Harvey, Thomas	May 9, 1912	C 466
Harvie, George	Sept. 10, 1910	C 378
Heaps, Robert	Sept. 10, 1910	C 373
Hemer, Herbert	Oct. 14, 1914	C 595
Henney, Jonathan	June 10, 1911	C 424
Hendry, James	May 9, 1912	C 471
Herd, William	Dec. 19, 1918	C 682
Heyes, Edward	May 1, 1909	C 320
Hilton, Mathias	Dec. 19, 1918	C 677
Hilton, R. G.	Sept. 10, 1910	C 376
Hindmarsh, John G.	June 30, 1926	C 799
Hindmarsh, Peter	May 30, 1923	C 755
Hodson, R. H.	Mar. 4, 1905	C 216
Hodge, William K.	Nov. 20, 1923	C 761
Holdsworth, William	May 16, 1918	C 671
Holliday, William	July 8, 1916	C 634
Hopkins, Harry	Dec. 31, 1925	C 791
Horbury, Joseph W.	June 10, 1911	C 406
Horrocks, A. G.	May 1, 1909	C 324
Horwood, S.	July 22, 1908	C 312
Houston, Robert	July 8, 1916	C 631
Howells, Nathaniel	May 1, 1909	C 316
Hunter, Peter M.	June 30, 1926	C 798
Hunter, Thomas	June 16, 1925	C 786
Hutchison, Ben	Nov. 14, 1905	C 232
Hutchison, Fred	Nov. 27, 1909	C 358
Hynd, John	Dec. 14, 1920	C 707
Hynds, William	July 8, 1916	C 632
Ireson, John	Oct. 31, 1912	C 507
Irvine, David	June 10, 1911	C 413
Jack, John	May 21, 1914	C 582
Jackson, Harry	June 24, 1924	C 776
James, Thos.	May 21, 1914	C 588
Jardine, Geo. Edward	Jan. 21, 1913	C 521
Jarrett, Fred. J.	Oct. 1, 1907	C 256
Jaynes, Frank	July 22, 1908	C 277
Jemson, J. W.	Mar. 4, 1905	C 205
Jenkins, John	Sept. 10, 1910	C 390
Jenkinson, Jonathan	Dec. 23, 1927	C 813
John, Howel	July 22, 1908	C 305
Johnson, Moses	Oct. 1, 1907	C 258
Johnston, Fred	Dec. 30, 1926	C 803
Johnston, Robert	May 9, 1912	C 479
Jones, Alf. Geo.	May 21, 1914	C 584
Jones, Samuel	May 27, 1913	C 518
Jones, William C.	Jan. 21, 1913	C 556
Jones, William Ernest	Oct. 28, 1913	C 221
Jones, W. T.	Mar. 4, 1905	C 544
Joyce, Walter	Nov. 27, 1909	C 361
Judge, Peter	Sept. 10, 1910	C 391
Keenan, Wm. James	June 10, 1911	C 426
Kelly, Ernest	May 17, 1917	C 646
Kemp, Wm.	Oct. 14, 1914	C 594
Kingham, Alfred	Oct. 28, 1913	C 559
Kirkeberg, H. S.	Nov. 27, 1909	C 350
Klejko, Steve	Dec. 14, 1920	C 703
Lane, Joseph	Oct. 1, 1907	C 254
Lavin, Joseph	June 21, 1920	C 700
Lazaruk, Steve	June 30, 1928	C 815
Leeman, T.	May 1, 1909	C 345
Lester, Frank	May 17, 1922	C 734
Lewis, Benj. J.	Sept. 10, 1910	C 386
Leynard, Paul	May 17, 1917	C 637
Liddle, John	July 29, 1905	C 228
Lindsay, William	May 17, 1917	C 642
Linn, George Y.	May 17, 1922	C 737
Litherland, David	June 30, 1928	C 816
Littler, James	June 30, 1926	C 792
Littler, John	June 10, 1911	C 410
Littler, Matthew	June 10, 1911	C 417
Littler, Robert	June 10, 1911	C 418
Livingstone, Alex	Oct. 28, 1911	C 436
Loxton, George	June 10, 1911	C 428
Loxton, John	June 10, 1911	C 416
Lloyd, Thomas	May 17, 1922	C 740
Luck, George	May 1, 1909	C 318
Lynch, Stewart	Oct. 28, 1911	C 432
Mackie, John	June 10, 1911	C 421
Makin, J. Wm.	Sept. 10, 1910	C 385
Malone, John	May 21, 1914	C 585
Maltman, James	Oct. 31, 1912	C 501
Mansfield, A.	May 1, 1909	C 336
Marrs, John	May 17, 1917	C 640
Marsh, Daniel Parks	May 27, 1913	C 543
Marsh, John	Oct. 1, 1907	C 270
Martin, James	June 10, 1911	C 398
Mason, Joseph	July 22, 1908	C 297
Massey, Henry	May 1, 1909	C 317
Mather, Thomas	July 22, 1908	C 293
Matusky, Andrew	Oct. 1, 1907	C 259
Mawson, J. T.	Nov. 27, 1909	C 359
Maxwell, Geo.	May 21, 1914	C 571
McAlpine, John	Mar. 4, 1905	C 217
McArthur, John Malcolm	May 17, 1917	C 648
McArthur, Robert	Dec. 22, 1921	C 723
McBroom, Al.	July 2, 1908	C 287
McCourt, John	Oct. 14, 1914	C 605
McCourt, Thos.	Dec. 30, 1926	C 805
McCulloch, James	May 1, 1909	C 315
McDonald, Allen	June 30, 1928	C 817
McDonald, John	Oct. 28, 1911	C 448
McFagen, Alexander	May 9, 1912	C 490

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Name.	Date.	No.	Name.	Date.	No.
McFegan, Robert	June 21, 1920	C 698	O'Brien, Charles	Nov. 27, 1909	C 349
McFegan, W.	May 1, 1909	C 319	Odgers, Eli	Jan. 21, 1913	C 523
McGarry, Martin	May 1, 1909	C 326	Orr, Alexander	Oct. 28, 1911	C 434
McGrath, James	July 8, 1916	C 630	Osborne, Hugh	Oct. 28, 1913	C 555
McGuckie, Jno. M.	May 21, 1914	C 562	Oswald, Geo. L.	Sept. 10, 1910	C 370
McGuckie, Thomas	July 29, 1905	C 226	Owen, Thomas	May 1, 1909	C 347
McGuire, Thomas	Oct. 28, 1913	C 553	Park, William	Dec. 19, 1918	C 684
McIntyre, Neil	May 21, 1914	C 574	Parks, Alexander	Jan. 21, 1913	C 519
McKay, Walter	Nov. 20, 1923	C 763	Parker, L.	May 1, 1909	C 341
McKelvie, J.	July 22, 1908	C 285	Parkinson, James Wm.	Nov. 15, 1917	C 655
McKenzie, Peter	June 10, 1911	C 427	Parkinson, T.	July 22, 1908	C 289
McKibben, Matthew	May 21, 1914	C 580	Parkinson, Thomas	June 24, 1924	C 769
McKinley, John	Oct. 28, 1914	C 442	Parrott, Jas. E.	May 21, 1914	C 590
McLaren, John	May 30, 1923	C 754	Parson, Herbert	May 13, 1915	C 621
McLaughlin, James	May 9, 1912	C 485	Parsons, Albert	June 10, 1927	C 808
McLachlan, Alex	June 10, 1912	C 419	Pearson, Jonathan	May 9, 1912	C 473
McLean, M. D.	Sept. 10, 1910	C 389	Penman, Hugh	Oct. 28, 1913	C 552
McLellan, William	Mar. 4, 1905	C 219	Perry, Geo. Harewood	May 17, 1917	C 643
McLeod, James	July 22, 1908	C 296	Phillips, Richard S.	May 17, 1917	C 620
McLeod, John	May 13, 1915	C 609	Phillips, James	Nov. 21, 1922	C 749
McMeakin, James	May 13, 1915	C 612	Pickup, A.	July 22, 1908	C 310
McMillan, D.	Sept. 10, 1910	C 363	Picton, W.	May 1, 1909	C 333
McMillan, Edward	Oct. 31, 1912	C 493	Plank, Samuel	Nov. 14, 1905	C 233
McMillan, Neil	Nov. 15, 1917	C 654	Pollock, John	May 30, 1923	C 760
McNay, Carmichael	July 22, 1908	C 306	Poole, Samuel	May 27, 1913	C 536
McNeill, Adam L.	July 22, 1908	C 281	Price, Walter	Sept. 10, 1910	C 371
McNeill, Robert	Sept. 10, 1910	C 387	Puckey, John Thomas	Dec. 19, 1918	C 687
McWhirter, Archibald	June 30, 1926	C 794	Quayle, Alex. B.	Jan. 5, 1925	C 778
Meek, Matthew	May 9, 1912	C 484	Quinn, James	Oct. 28, 1911	C 441
Meikle, Harry Alexander	July 8, 1916	C 627	Quinn, John	Oct. 28, 1911	C 429
Menzies, Frederick	Dec. 14, 1920	C 704	Radford, Albert	May 21, 1914	C 579
Merrifield, George	Oct. 23, 1906	C 239	Rallison, R.	July 22, 1908	C 279
Merrifield, William	Oct. 23, 1906	C 236	Rallison, James	May 30, 1923	C 759
Michek, John	May 21, 1914	C 563	Rankin, George	July 22, 1908	C 275
Miles, John	June 10, 1911	C 414	Rankin, Wm. Shaw	May 9, 1912	C 489
Mitchell, Charles	May 1, 1909	C 322	Raynor, Fred	Oct. 1, 1907	C 257
Mitchell, Henry	Sept. 10, 1910	C 366	Rear, Albert E.	June 10, 1927	C 807
Monks, James	Nov. 14, 1905	C 234	Reid, Robert	Sept. 10, 1910	C 383
Moore, George	Oct. 23, 1906	C 242	Reid, Thos.	May 21, 1914	C 592
Moore, John	May 1, 1909	C 335	Reid, Wm.	June 10, 1911	C 403
Moreland, Thomas	July 22, 1908	C 299	Reilly, Thomas	July 22, 1908	C 303
Morgan, John	July 29, 1905	C 224	Renney, Jas.	Nov. 27, 1909	C 354
Morgan, William	May 17, 1917	C 636	Richards, James	Nov. 1, 1907	C 249
Morgan, Cornelius	Dec. 22, 1921	C 725	Richards, Samuel	Oct. 23, 1906	C 244
Morgan, John	June 24, 1924	C 773	Richardson, J. H.	Oct. 28, 1911	C 458
Morris, David	May 9, 1912	C 472	Rigby, John	July 29, 1905	C 225
Mottishaw, Samuel K.	Oct. 23, 1906	C 237	Roberts, Arthur	June 24, 1924	C 772
Murdock, Jno. Y.	May 21, 1914	C 564	Roberts, Ebenezer	May 1, 1909	C 327
Murray, Robt.	June 30, 1926	C 796	Robinson, Michael	May 1, 1909	C 332
Myers, Peter	Oct. 28, 1911	C 446	Robinson, Asa	June 16, 1925	C 787
Nanson, T. H.	July 22, 1908	C 280	Robson, James	June 16, 1925	C 788
Nash, George William	May 17, 1917	C 565	Robson, Thomas	May 21, 1914	C 566
Nash, George F.	Dec. 22, 1921	C 727	Rogers, Ellis	May 13, 1915	C 624
Nee, Wm. R.	Dec. 22, 1921	C 724	Roper, William	July 22, 1908	C 274
Neen, Joseph	Nov. 27, 1909	C 352	Ross, William	June 21, 1920	C 702
Nelson, Horatio	Oct. 1, 1907	C 263	Rowan, Alexander	Oct. 31, 1912	C 500
Neilson, William	May 9, 1912	C 481	Rowan, John	Oct. 14, 1914	C 602
Newman, John	Oct. 14, 1914	C 603	Rowbottom, Thomas	Oct. 31, 1914	C 492
Nicholson, James	May 9, 1912	C 469	Royle, Edward	Oct. 31, 1912	C 506
Nimmo, James	May 9, 1912	C 461	Russell, Robert	Nov. 27, 1909	C 351
Norris, Joshua	Oct. 28, 1913	C 557	Rutherford, Jasper	May 17, 1917	C 644
Nuttall, Wm.	June 16, 1925	C 780	Rutledge, Edwin	July 22, 1908	C 302
Oakes, Robert	Oct. 31, 1912	C 498	Scales, Joseph	May 17, 1922	C 738

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Name.	Date.	No.
Scott, Henry	July 22, 1908	C 294
Saunders, Eustace L.	Jan. 21, 1913	C 520
Scarpino, Francis	May 17, 1917	C 649
Seddon, James	Oct. 3, 1919	C 692
Shanks, David	Sept. 10, 1910	C 372
Sharp, James	May 1, 1909	C 325
Sharpe, Henry	June 16, 1925	C 783
Sharples, J. T.	Sept. 10, 1910	C 380
Shea, Thomas J.	Dec. 22, 1921	C 722
Shearer, L.	May 1, 1909	C 330
Shields, Thomas	May 16, 1918	C 667
Shipley, John W.	Oct. 28, 1911	C 456
Shooter, Joseph	Oct. 1, 1907	C 261
Shortman, J.	May 1, 1909	C 331
Simister, J. H.	Nov. 27, 1909	C 353
Simister, W.	May 1, 1909	C 334
Sim, James	Dec. 14, 1920	C 711
Simms, Hubert Allan	Jan. 21, 1913	C 526
Sinclair, William	Jan. 21, 1913	C 527
Skelton, Thos.	May 1, 1909	C 344
Slee, Thomas	June 30, 1926	C 793
Smith, A. E.	Sept. 10, 1910	C 367
Smellie, John	May 29, 1923	C 755
Smith, John Watterson	May 16, 1918	C 665
Smith, Joseph	Mar. 4, 1905	C 207
Smith, Richard Beveridge	Oct. 28, 1913	C 561
Smith, Thomas	Dec. 30, 1926	C 804
Smith, Thos. J.	Oct. 1, 1907	C 271
Smith, Thomas	May 9, 1912	C 486
Smith, Thomas	Dec. 14, 1920	C 705
Snow, Aubrey	June 15, 1918	C 675
Sopwith, Reginald Scott	Jan. 21, 1913	C 512
*Sparks, Edward	Oct. 1, 1907	C 255
Spencer, G.	May 1, 1909	C 329
Spruston, R. L.	Nov. 27, 1909	C 355
Spruston, Thomas A.	Mar. 4, 1905	C 206
Stafford, M.	Sept. 10, 1910	C 382
Starr, Wallace	May 9, 1912	C 488
Staton, Edward	May 21, 1914	C 581
Steele, Walter	Oct. 28, 1911	C 439
Stewart, George	May 27, 1913	C 534
Stewart, James M.	Oct. 23, 1906	C 240
Stewart, James B.	June 16, 1925	C 785
Stewart, John	Dec. 30, 1926	C 801
Stobbart, David	June 16, 1925	C 781
Stockwell, William	Oct. 23, 1906	C 238
Stone, Wm. C.	June 21, 1921	C 714
Strachan, John	Oct. 14, 1914	C 604
Strang, James	May 13, 1915	C 614
Strang, Thomas	June 10, 1911	C 400
Strang, Wm.	June 10, 1911	C 395
Strang, William L.	Jan. 5, 1925	C 777
Sutherland, John	May 27, 1913	C 545
Sweeney, John	May 17, 1922	C 735
Taylor, Charles M.	Mar. 4, 1905	C 213
Taylor, Henry	Dec. 20, 1928	C 818
Taylor, Hugh	Jan. 21, 1913	C 530
Taylor, James	May 21, 1914	C 567
Taylor, Jonathan	Dec. 19, 1918	C 680
Taylor, J. T.	Oct. 28, 1911	C 447
Taylor, Leroy	Sept. 10, 1910	C 381
Taylor, Robert	June 21, 1920	C 695
Taylor, Thomas	May 21, 1914	C 577
Tennant, Joseph	June 24, 1924	C 770
Thacker, Geo.	May 27, 1913	C 537
Thomas, Thomas	Sept. 10, 1910	C 365
Thomas, John B.	Nov. 14, 1905	C 231
Thomas, Joseph	Mar. 4, 1905	C 220
Thomas, Warriett	Oct. 1, 1907	C 273
Thomason, Charles	Nov. 15, 1917	C 657
Thompson, Charles	June 24, 1924	C 765
Thompson, Thomas	Oct. 1, 1917	C 267
Thompson, John	Oct. 31, 1912	C 509
Thompson, Joseph	Oct. 1, 1907	C 269
Thomson, Duncan	Mar. 4, 1905	C 218
Tolley, John	Dec. 19, 1918	C 678
Touhey, William	May 27, 1913	C 547
Travis, Joseph	June 21, 1920	C 699
Tully, Thomas	May 9, 1912	C 468
Tune, Elijah	May 9, 1912	C 476
Unsworth, John	June 16, 1925	C 784
Vardy, Robt.	May 21, 1914	C 570
Vaughan, John Henry	Oct. 28, 1913	C 560
Vincent, Thomas C.	Nov. 21, 1922	C 745
Waddington, D. M.	June 10, 1927	C 806
Walker, George	July 8, 1916	C 633
Walker, Jas. Alexander	Oct. 31, 1912	C 496
Walker, Robert C.	May 17, 1922	C 728
Walker, Wm.	May 21, 1914	C 586
Wallace, Fred	Oct. 1, 1907	C 260
Walls, John	Dec. 14, 1920	C 710
Warburton, Ernest L.	June 10, 1911	C 399
Ward, Ernest Hedley	May 17, 1917	C 641
Wardrop, James	Oct. 31, 1912	C 504
Watson, Adam G.	Mar. 4, 1905	C 212
Watson, Arthur W.	May 27, 1913	C 535
Watson, George	July 22, 1908	C 288
Watson, Joseph	Jan. 21, 1913	C 515
Watson, William	Oct. 22, 1906	C 246
Watson, William	May 17, 1917	C 645
Watson, John	May 17, 1922	C 743
Weaver, William	Nov. 17, 1922	C 748
Webb, Herbert	Oct. 28, 1911	C 457
Webster, James Stewart	Dec. 19, 1918	C 685
Weeks, John	Mar. 4, 1905	C 214
West, James Gloag	May 16, 1918	C 676
Whalley, William	Dec. 19, 1918	C 686
White, James	Oct. 31, 1912	C 499
White, John	Oct. 22, 1906	C 245
Wilkinson, Edward	Oct. 28, 1911	C 438
Williams, John Sam.	June 10, 1911	C 404
Williams, Watkin	June 22, 1908	C 301
Wilson, Joseph	June 24, 1924	C 767
Wilson, Joseph	June 30, 1928	C 814
Wilson, Robinson	June 10, 1911	C 397
Wilson, Thomas M.	Oct. 1, 1907	C 272
Wilson, William	Oct. 1, 1907	C 262
Wilson, William	May 17, 1917	C 674
Winstanley, Robert	Nov. 21, 1922	C 747
Winstanley, Oliver	May 17, 1922	C 741
Winstanley, H.	July 22, 1908	C 283
Wintle, Thomas A.	July 29, 1905	C 222
Witherington, George	Oct. 28, 1913	C 554
Wood, Thos. James	Oct. 31, 1912	C 491
Worthington, J.	July 22, 1908	C 295
Wright, John	May 21, 1914	C 593
Wright, Robert	May 21, 1914	C 589
Wright, William	Jan. 21, 1913	C 522
Yates, Frank	May 17, 1922	C 732
Yeowart, Hudson	June 24, 1924	C 771
Young, Alexander	May 16, 1918	C 666

* C 314 issued in lieu of C 255 destroyed by Fernie fire.

COAL-MINE OFFICIALS.

Third-class Certificates issued under "Coal-mines Regulation Act Further Amendment Act, 1904," sec. 38, subsec. (2), in exchange for Certificates issued under the "Coal-mines Regulation Act Amendment Act, 1901."

Name.	Date.	No.	Name.	Date.	No.
Adam, Robert	Oct. 12, 1904	C 42	Lanfear, Herbert	Jan. 27, 1905	C 63
Addison, Thos.	Dec. 10, 1904	C 52	Lewis, Thos.	Oct. 11, 1904	C 35
Aitken, James	Oct. 24, 1904	C 44	Marsden, John	May 3, 1904	C 21
Allsop, Harry	Oct. 11, 1904	C 34	Miard, Harry E.	Mar. 3, 1905	C 76
Ashman, Jabez	Feb. 5, 1907	C 131	Middleton, Robt.	Feb. 11, 1905	C 71
Auchinvole, Alex	Mar. 29, 1905	C 89	Miller, Thos. K.	Feb. 21, 1905	C 74
Barclay, Andrew	April 27, 1904	C 19	McKenzie, John R.	Oct. 12, 1904	C 40
Barclay, James	April 27, 1904	C 20	McKinnon, Arch'd	April 3, 1905	C 102
Barclay, John	April 17, 1905	C 111	McMillan, Peter	Mar. 29, 1905	C 94
Bickle, Thos.	Oct. 11, 1904	C 37	McMurtrie, John	Mar. 29, 1905	C 96
Bowie, James	May 13, 1905	C 116	Moore, Wm. H.	June 17, 1905	C 119
Briscoe, Edward	Oct. 10, 1906	C 129	Morris, John	Dec. 27, 1904	C 57
Campbell, Dan	Mar. 29, 1905	C 93	Myles, Walter	April 3, 1905	C 100
Carr, Jos. E.	Oct. 11, 1904	C 36	Nash, Isaac	June 1, 1904	C 120
Carroll, Harry	Mar. 29, 1905	C 98	Neave, Wm.	Oct. 12, 1904	C 43
Clarkson, Alexander	April 27, 1904	C 18	Nelson, James	April 27, 1904	C 16
Collishaw, John	Feb. 7, 1905	C 68	Nimmo, Richard E.	April 18, 1911	C 133
Comb, John	Mar. 23, 1904	C 2	O'Brien, Geo.	Feb. 6, 1905	C 66
Courtney, A. W.	Nov. 2, 1904	C 45	Pearse, Thomas W. H.	April 14, 1916	C 138
Crawford, Frank	April 6, 1904	C 7	Power, John	Sept. 8, 1920	C 142
Daniels, David	April 27, 1904	C 12	Price, Jas.	Nov. 8, 1904	C 50
Davidson, David	April 3, 1905	C 106	Rafter, Wm.	Mar. 29, 1905	C 95
Davidson, John	Mar. 29, 1905	C 87	Reid, James	Mar. 23, 1904	C 1
Dobbie, John	Nov. 27, 1905	C 126	Richards, Thos.	April 27, 1904	C 14
Dudley, James	Mar. 22, 1905	C 114	Roughead, George	Jan. 30, 1907	C 130
Duncan, Thomas	Aug. 29, 1906	C 128	Ryan, John	Dec. 28, 1904	C 59
Dunlap, Henry	Nov. 21, 1904	C 51	Sanders, John W.	April 3, 1905	C 107
Dunn, Geo.	Dec. 19, 1904	C 56	Shenton, Thos. J.	July 25, 1904	C 30
Dunsmuir, John	Mar. 29, 1905	C 90	Shepherd, Henry	June 13, 1904	C 26
Eccleston, Wm.	Mar. 15, 1905	C 80	Smith, Geo.	Mar. 29, 1905	C 84
Fagan, David	April 6, 1905	C 109	Somerville, Alex.	Mar. 24, 1904	C 3
Farquharson, John	April 27, 1904	C 17	Stauss, Chas. F.	Feb. 9, 1905	C 69
Findlayson, James	June 6, 1904	C 25	Steele, Jas.	Mar. 29, 1905	C 92
Fulton, Hugh T.	April 3, 1905	C 105	Steele, John	June 4, 1913	C 4
Gibson, Edward	May 30, 1905	C 118	Stewart, Duncan H.	Mar. 28, 1904	C 137
Gilchrist, Wm.	Mar. 29, 1905	C 85	Stewart, John	April 3, 1904	C 104
Gillespie, Hugh	April 6, 1904	C 8	Stewart, Daniel W.	May 16, 1904	C 23
Gillespie, John	April 6, 1904	C 5	Stoddart, Jacob	Feb. 21, 1905	C 73
Gould, Alfred	April 17, 1906	C 112	Strachan, Robt.	April 27, 1904	C 15
Green, Francis	Oct. 11, 1904	C 38	Strang, James	April 27, 1904	C 10
Handlen, Jas.	June 16, 1904	C 122	Sullivan, John	July 4, 1916	C 139
Harmison, Wm.	Feb. 3, 1905	C 65	Summers, Joseph	May 17, 1920	C 141
Hescott, John	Jan. 16, 1905	C 62	Thomas, John	Mar. 29, 1905	C 97
Hoggan, Wm.	June 6, 1911	C 134	Vass, Robt.	Dec. 12, 1904	C 53
John, David	Nov. 8, 1904	C 49	Vater, Charles	April 6, 1904	C 66
*John, Evan	July 25, 1916	C 140	Webber, Chas.	Sept. 13, 1904	C 32
Johnson, Geo.	May 9, 1904	C 124	Whiting, Geo.	May 29, 1905	C 117
Johnson, Wm. R.	Mar. 1, 1905	C 75	Wilson, Austin	Feb. 7, 1905	C 67
Jones, Evan	April 30, 1913	C 136	Wilson, Thos.	April 27, 1904	C 11
Lander, Frank	Jan. 9, 1905	C 61	Woodburn, Moses	Mar. 29, 1905	C 83

MINE SURVEYOR CERTIFICATES ISSUED UNDER THE "COAL-MINES REGULATION ACT AMENDMENT ACT, 1919."

Name.	Date.	No.	Name.	Date.	No.
Anderson, Harry C.	May 19, 1922	59	Lymn, Albert Crompton	Oct. 3, 1919	17
Baile, Wynne Jeffreys	Oct. 3, 1919	16	MacDonald, John	May 19, 1922	46
Bonar, Robert B.	Dec. 30, 1926	64	McKenzie, Frank	June 10, 1927	66
Bowerman, Everard S.	Dec. 14, 1920	39	Miard, Harry Ernest	Oct. 3, 1919	2
Boyce, Joseph Patrick	Oct. 3, 1919	5	McCulloch, Robert	Oct. 3, 1919	6
Caufield, Bernard	May 19, 1922	54	Owen, Wm. Arthur	Oct. 3, 1919	10
Corbett, Garnett S.	May 19, 1922	49	Priest, Elijah	May 19, 1922	53
Cox, Richard	May 19, 1922	57	Rafter, Wm.	May 19, 1922	51
Crosscombe, James S.	May 31, 1923	60	Reger, Frederick Wm.	Oct. 3, 1919	7
Daniell, Geo. W. B.	Oct. 3, 1919	29	Richards, Chas. Clifton	Oct. 3, 1919	19
Davis, Gerald D.	Oct. 3, 1919	28	Ridley, James	Oct. 3, 1919	18
Delaney, James	Oct. 3, 1919	21	Roaf, Jos. R.	Oct. 3, 1919	14
Dickson, James	Oct. 3, 1919	3	Richards, James A.	Oct. 3, 1919	15
Drewry, Wm. Stewart	May 19, 1922	56	Scott, Thos. Wright	Oct. 3, 1919	4
Edwards, Jas.	June 10, 1927	65	Strachan, Robert	June 21, 1920	36
Freeman, Harry N.	May 19, 1922	47	Spruston, Thos. A.	May 19, 1922	52
Garman, Maurice W.	Oct. 3, 1919	11	Strachan, Robert	May 19, 1922	45
Gregory, P. W.	Nov. 17, 1919	32	Sandland, Joseph	May 31, 1923	61
Graham, Charles	May 19, 1922	50	Stewart, R. T.	Nov. 17, 1923	62
George, Frank J.	May 19, 1922	48	Townsend, Neville F.	Nov. 17, 1919	31
Hargreaves, James	Nov. 29, 1920	33	Vallance, Wm. Dixon	Oct. 3, 1919	8
Hepburn, James T.	Dec. 14, 1920	37	Verkirk, Lucas	June 21, 1921	42
Holdsworth, William	Oct. 3, 1919	9	Waddington, Geo. W.	June 21, 1920	35
Hughes, Edward	Dec. 14. 1920	38	Wark, Samuel David	Oct. 3, 1919	20
Hunter, George	Oct. 3, 1919	30	White, Harold	Oct. 3, 1919	25
Howden, Archibald	May 19, 1922	55	Wilson, R. Robinson	Oct. 3, 1919	12
Jackson, Thos. R.	May 19, 1922	43	Wilson, Arthur Rupert	Oct. 3, 1919	13
King, Alfred Geo.	Oct. 3, 1919	27	Wilson, Chas. Jas.	Oct. 3, 1919	22
Kneen, Percy	Dec. 20, 1928	67	Wilson, Hartley Paul	Oct. 3, 1919	24
Lancaster, Peter	Oct. 3, 1919	23	Wilton, Douglas D.	May 19, 1922	59
Lauderbach, Wilfrid P.	June 16, 1925	63	Wilkie, Octavius B. N.	Oct. 3, 1919	26
Lindoe, Luke	June 21, 1921	41	Wright, Austin	Dec. 14. 1920	40

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

Mine and Date.	Occupation of Defendant.	Offence charged.	Judgment.
Crow's Nest Pass Coal Co., Ltd.—			
Coal Creek Colliery, February 14th.	Miner	Riding on underground haulage without permission	$5 and costs.
Coal Creek Colliery, February 14th.	Hoistman	Riding on underground haulage without permission	$5 and costs.
Coal Creek Colliery, March 12th	Miner	Failing to secure working-place	$5 and costs.
Coal Creek Colliery, March 12th	Miner	Failing to secure working-place	$7.50 and costs.
Coal Creek Colliery, May 1st	Miner	Matches in possession underground	$5 and costs.
Coal Creek Colliery, June 28th	Miner	Subjecting himself to unnecessary danger	$10 and costs.
Coal Creek Colliery, August 8th	Miner	Riding on underground haulage without permission	$5 and costs.
Michel Colliery, August 16th	Hoistman	Allowing another person to operate his hoist	$10 and costs.
Michel Colliery, August 16th	Rope-rider	Allowing unauthorized person to ride on trip	Costs only.
Michel Colliery, August 16th	Miner	Riding on cars underground without permission	Costs only.
Michel Colliery, December 17th	Miner	Matches underground	$5 and costs.

METALLIFEROUS MINES SHIPPING IN 1928.

NORTH-WESTERN DISTRICT (No. 1).

ATLIN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
Engineer	Atlin	Engineer Gold Mines, Ltd., Engineer	Gold, silver.

SKEENA MINING DIVISION.

Black Wolf	Maroon mountain	Black Wolf Mining Co., 6125 Arcade Bldg., Seattle	Gold, silver, lead.
Western Copper	Khutze inlet	Detroit Western Mining Co., 804 Standard Bank Bldg., Vancouver	Gold, copper, silver.

NASS RIVER MINING DIVISION.

Bonanza		Granby Cons. M.S. & P. Co., Anyox	Gold.
Golskeish	Anyox	Granby Cons. M.S. & P. Co., Anyox	Gold, silver.
Hidden Creek	Anyox	Granby Cons. M.S. & P. Co., Anyox	Copper, silver, gold.
Toric	Alice arm	Toric Mines, Ltd., 707 Credit Foncier Bldg., Vancouver	Silver, lead.

PORTLAND CANAL MINING DIVISION.

Outsider	Portland canal	Granby Cons. M.S. & P. Co., Anyox	Copper, gold.
Premier	Cascade river	Premier Gold Mines, Ltd., Premier	Gold, silver.

NORTH-EASTERN DISTRICT (No. 2).

OMINECA MINING DIVISION.

Diadem	Usk	Canadian-American Cons. M. Co., Vancouver	Silver, copper.
Duthie	Hudson Bay mountain	Duthie Mines, Ltd., Smithers	Silver, lead, gold.
Maple	Glen mountain	Geo. R. Hodgins, Hazelton	Silver, lead.
Mohawk	4-Mile mountain	Mohawk Mining Co., Ltd., Vancouver	Silver, lead, zinc.
Silver Cup	9-Mile mountain	Duke Mining Co., Vancouver	Silver, lead, zinc.
Sunset	Topley	Heenan & Matheson, Topley	Silver, lead.
Victoria	Rocher Déboulé mountain	Aurimont Mines, Ltd., Vancouver	Gold, cobalt, arsenic.

CENTRAL DISTRICT (No. 3).

LILLOOET MINING DIVISION.

Pioneer	Cadwallader creek	Pioneer Gold Mines of B.C., Ltd., Vancouver	Gold.

VERNON MINING DIVISION.

Ophir	North arm, Okanagan lake	Ophir Mining Co., Seattle	Gold, silver, lead, copper.

CENTRAL DISTRICT (No. 3)—*Continued.*

KAMLOOPS MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
Iron Mask	Kamloops	Continental Copper Co., Kamloops	Gold, copper, silver.

NICOLA MINING DIVISION.

Thelma	Swakum mountain	Thelma Mines, Ltd., Vancouver	Silver, lead, zinc.
Verona		S. F. Greene	Silver, zinc, lead.

SOUTHERN DISTRICT (No. 4).

GREENWOOD MINING DIVISION.

Beaver	Wallace mountain	Beaver Silver Mines, Ltd., Victoria	Silver, lead.
Bell	Beaverdell	McIntosh & Lee, Beaverdell	Silver, gold, lead, zinc.
Bounty	Beaverdell	O. B. Stanhope, Beaverdell	Silver, lead.
Brooklyn and Stemwinder		A. B. Fenwick, Greenwood	Gold, copper, silver.
Crescent	Greenwood	R. C. Swords, Vancouver	Silver, lead, zinc.
D.A.	Greenwood	J.R. Mines, Ltd., Vancouver	Gold, silver, lead.
Duncan	Wallace mountain	T. T. Henderson *et al.*, Beaverdell	Silver, lead.
Elkhorn	Greenwood	Geo. White *et al.*, Greenwood	Gold, silver.
Gold Drop	Greenwood	Louis Bosshart, Greenwood	Gold, silver, lead.
Highland Lass	Beaverdell	Highland Lass, Ltd., Kelowna	Gold, silver, zinc, lead.
Ohio	Rhone	Ohio Syndicate, Greenwood	Silver, lead.
Providence	Greenwood	Loomis-Wilson Syndicate, Greenwood	Silver, gold, lead.
Sally	Beaverdell	Sally Mines, Ltd., Box 220, Penticton	Silver, gold, lead, zinc.
Wellington	Beaverdell	Wellington Syndicate, Greenwood	Silver, gold, lead, zinc.

GRAND FORKS MINING DIVISION.

Lightning Peak	Lightning peak	Lightning Peak Mining Co., Trail	Silver, lead, zinc.

OSOYOOS MINING DIVISION.

Horn Silver	Osoyoos	Big Horn Mines, Ltd., Vancouver	Gold, silver, lead.
Nickel Plate	Hedley	Hedley Gold Mining Co., Hedley	Gold, silver, arsenic.

SIMILKAMEEN MINING DIVISION.

Copper Mountain	Allenby	Granby Cons. M.S. & P. Co., Allenby	Copper, silver, gold.

EASTERN DISTRICT (No. 5).

WINDERMERE MINING DIVISION.

Paradise	Windermere	Victoria Syndicate, Ltd., Kaslo	Silver, zinc, lead.
Pretty Girl	Windermere	North Kootenay Mines, Ltd., Vancouver	Silver, copper.
Mineral King	Windermere	J. C. Pullen	Silver, lead, zinc.
White Cat	Invermere	Galena Ghat Mines, Ltd., Stetler, Alta.	Silver, lead.

TRAIL CREEK MINING DIVISION.

Midnight	Rossland	Martin Dally, Rossland	Gold, silver.
Rossland properties	Rossland	Cons. M. & S. Co. of Canada, Ltd., Trail	Gold, copper, silver.

EASTERN DISTRICT (No. 5)—*Continued.*

FORT STEELE MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
Copper King	Bull River	D. H. Wells	Silver, gold, copper.
St. Eugene	Moyie	Consolidated M. & S. Co., Moyie	Silver, gold, zinc, lead.
Sullivan	Kimberley	Consolidated M. & S. Co., Kimberley	Silver, lead, zinc.

AINSWORTH MINING DIVISION.

Banker and Maestro	Ainsworth	H. Giegerich, Kaslo	Silver, lead, zinc.
Berengaria	Deanshaven	Berengaria Mining Co., Ltd., Riondel	Silver, lead, zinc.
Cork-Province	Zwicky	Cork-Province Mines, Ltd., Kaslo	Silver, lead, zinc.
Daybreak	Zwicky	Daybreak Mining Co., Portland, Ore.	Silver, lead, zinc.
Davys' Mill	Kaslo creek	M. S. Davys, Kaslo	Gold, silver, zinc, lead.
Jackson	Retallack	Silver Basin Mines, Ltd., Kaslo	Silver, lead.
Revenue	Sturgis creek	Sturgis Creek Mines, Ltd., Calgary, Alta.	Silver, lead, zinc.
Silver Bear	Kaslo	M. S. Davys, Kaslo	Silver, zinc, lead.
Spokane-Trinket	Ainsworth	H. Giegerich, Kaslo	Silver, lead, zinc.
Tiger	Ainsworth	T. B. Hansen, Spokane	Silver, lead, zinc.
White Eagle	Poplar	Keene Mt. G. & S. Mines, Ltd., Calgary	Silver, lead, zinc.
Whitewater	Whitewater	Whitewater Mines, Ltd., Kaslo	Silver, gold, zinc, lead.

SLOCAN MINING DIVISION.

Alamo	Alamo	Cons. Queen Bess Mines Co., Alamo	Silver, zinc, lead.
Bosun	Sandon	Rosebery-Surprise Mining Co., New Denver	Silver, lead, zinc.
Bosun	Sandon	W. S. Ellis, New Denver	Silver, lead, zinc.
Buffalo	Silverton	Fred McDonnell, Silverton	Silver, zinc, lead.
Canadian	Sandon	Joe Brandon, Silverton	Silver, lead, zinc.
Carnation	Sandon	Victoria Syndicate, Ltd., Kaslo	Silver, gold, zinc, lead.
Eagle	Three Forks	Oscar Edstrom, New Denver	Silver.
Echo	Silverton	G. Purt, Silverton	Silver, lead, zinc.
Elkhorn	Alamo	Geo. T. Gormley, Three Forks	Silver, lead, zinc.
Galena Farm	Silverton	W. S. Sheeler, Silverton	Silver, gold, zinc, lead.
Hewitt	Silverton	Victoria Syndicate, Ltd., Kaslo	Silver, zinc, lead.
Ivanhoe		J. Franchin and G. D. Serra	Silver, lead, zinc.
Lucky Jim	Zincton	Lucky Jim Lead & Zinc Co., Spokane	Silver, lead, zinc.
Lucky Thought	Silverton	Fred McDonnell, Silverton	Silver, zinc, lead.
Mammoth	Silverton	A. Shilland, New Denver	Silver, lead, zinc.
McAllister	Three Forks	W. H. North, Alamo	Silver.
Molly Hughes	New Denver	F. O. Berg, Spokane	Silver, zinc, lead.
Monitor	Three Forks	Rosebery-Surprise Mining Co., New Denver	Silver, gold, lead, zinc.
Monitor	Three Forks	G. T. Gormley, Alamo	Silver, gold, zinc, lead.
Mt. Chief	Alamo	J. Cechelero, New Denver	Silver, zinc, lead.
Noble Five	Cody	Paul Lincoln, Sandon	Silver, zinc, lead.
Queen Bess	Alamo	Cunningham Mines, Ltd., Sandon	Silver, lead, zinc.
Ruth-Hope	Sandon	Ruth-Hope Mines, Ltd., Kaslo	Silver, lead, zinc.
Silversmith	Sandon	Silversmith Mines, Ltd., Box 1772, Spokane	Silver, lead, zinc.
Standard	Sandon	Western Exploration Co., Spokane	Silver, zinc, lead.
Van Rol	Silverton	——, Sandon	Silver, zinc, lead.
Victor	Three Forks	Geo. Petty, Sandon	Silver, gold, lead, zinc.
Wonderful	Sandon	Cons. Queen Bess Co., Sandon	Silver, gold, zinc, lead.
Yakima	Sandon	Gus Erickson	Silver, zinc, lead.

SLOCAN CITY MINING DIVISION.

Anna	Springer creek	K. E. Zimmerman, Slocan	Silver, lead, zinc.
Dayton	Slocan City	E. A. Palmquist, Slocan	Silver.
Hope No. 2	Lemon creek	Piedmont Mines, Ltd., Regina	Silver, zinc, lead.
Meteor	Springer creek	J. Cullinane, Rossland	Silver, gold.
Two Friends and Black Prince	Slocan City	Empire Mining Co., Ltd., Vancouver	Silver, zinc.
Westmont	10-Mile creek	R. F. Ainslie, Silverton	Silver, zinc, lead.

EASTERN DISTRICT (No. 5)—*Continued.*

TROUT LAKE MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
True Fissure	Ferguson	Godfrey Birtsch, Rimby, Alta	Silver, zinc, lead.

LARDEAU MINING DIVISION.

Marquis and Gilbert	Poplar	Keene Mt. G. & S. Mines, Ltd., Calgary, Alta	Gold, silver.

REVELSTOKE MINING DIVISION.

Snowflake	Albert Canyon	Snowflake Mining Co., Ltd., Vancouver	Silver, lead, zinc.

NELSON MINING DIVISION.

Arlington	Erie	L. Matassa, Erie	Gold, silver, zinc, lead.
Catherine	Nelson	Nels Bystrum, Nelson	Gold, silver, lead.
Euphrates	Nelson	Euphrates Mining Co., Ltd., Nelson	Gold.
Goodenough	Ymir	Yankee Girl, Ltd., Nelson	Gold, silver, zinc, lead.
Golden Age	Nelson	Golden Age Mining Co., Ltd., Nelson	Gold.
Hunter V	Ymir	Consolidated M. & S. Co., Trail	Gold, silver.
Kootenay Belle	Salmo	F. M. Black, Kelowna	Gold, silver.
Queen	Salmo	E. Stayner, Spokane	Gold, silver, lead.
Second Relief	Erie	Second Relief Mining Co., Ltd., Erie	Gold, silver.
Wynndell	Wynndell	J. W. Rutledge, Cranbrook	Silver, copper.

WESTERN DISTRICT (No. 6).

VANCOUVER MINING DIVISION.

Britannia	Britannia Beach	Britannia M. & S. Co., Ltd., Britannia Beach	Copper, silver, gold.

NANAIMO MINING DIVISION.

Malaspina	Lund	Malaspina Mines, Ltd., Victoria	Silver, copper.
Romana	Goat Island	Romana Copper Mines, Ltd., Vancouver	Copper, silver.

LIST OF CROWN-GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1928.

NORTH-WESTERN DISTRICT (No. 1).

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Atlin—			
Observer	James Stokes and Clarence Roswell Fraser; Oct. 18	4369	20.44
Pilot	James Stokes and Clarence Roswell Fraser; Oct. 18	4367	43.61
Princess Pat	James Stokes and Clarence Roswell Fraser; Oct. 18	4366	48.11
R.A.F.	James Stokes and Clarence Roswell Fraser; Oct. 18	4368	49.95
Nass River—			
Blue Jay	Laura Allen; Nov. 29	4338	46.77
Polar Bear	Laura Allen; Nov. 29	4339	46.77
Silver Cord No. 2	Kitsault-Eagle Silver Mines, Ltd.; Feb. 24	1391	31.82
Portland Canal—			
Albert	Ralph Emerson Lundvall; July 11	4761	38.06
Bill	W. T. Shatford, Jonathan Rogers, Stewart Cameron, and Arthur H. McCallum; May 21	1841	50.33
Black Bear	Ralph Emerson Lundvall, Daniel Donald, Malcolm Julius Woods, and Norman A. McLean; July 10	4755	49.80
Black Bear No. 1	Ditto	4757	37.47
Black Bear	Ore Mountain Mining Co., Ltd.; Oct. 2	4809	41.43
Blue Jay Fraction	Charles Larsen (Estate of Wm. Hamilton); Jan. 11	4426	26.97
Bulldog	Silver Ledge Mining Co., Ltd.; March 13	4596	43.91
Bulldog No. 1	Silver Ledge Mining Co., Ltd.; March 13	4597	50.22
Bulldog No. 2	Silver Ledge Mining Co., Ltd.; March 13	4598	46.86
Bulldog No. 3	Silver Ledge Mining Co., Ltd.; March 13	4599	30.55
Carrie	Ralph Emerson Lundvall, Daniel Donald, Malcolm Julius Woods, and Norman A. McLean; July 10	4758	48.04
Castle Hill	Ditto	4759	41.74
Copper Head	Ray Vance McCarley; Jan. 11	1832	39.53
Daisy	Walter Shatford, Arthur H. McCallum, Stewart Cameron, and Jonathan Rogers; May 21	4594	51.58
Daisy No. 2	Ditto	4595	13.37
Diamond	Adanac Mines Co. of Alaska; May 17	4825	24.10
Dix	Vancouver Mines, Ltd.; May 17	4911	44.78
Ellen	Ralph Emerson Lundvall, Daniel Donald, Malcolm Julius Woods, and Norman Angus McLean; July 10	4754	49.95
Ena	Adanac Mines Co. of Alaska; May 17	3528	10.68
Fillier	Walter Shatford, Arthur H. McCallum, Stewart Cameron, and Jonathan Rogers; May 21	1842	44.17
Galena	John Ronan and Jessie Kilpatrick Jamieson; Jan. 11	4615	51.65
Galena Fraction	John Ronan and Jessie Kilpatrick Jamieson; Jan. 11	4617	29.78
Galena No. 1	Fred. Rene Coudert and Jessie Kilpatrick Jamieson; Jan. 11	4616	50.87
Gargoyle Fraction	Frederick Jancowski *et al.*; Sept. 6	1866	46.14
Gem of the Mountains	Porter-Idaho Mining Co.; Aug. 29	4735	40.69
Gem of the Mountains Fraction	Porter-Idaho Mining Co.; Aug. 29	4736	8.80
Gold Hill No. 1	Ore Mountain Mining Co., Ltd.; Oct. 4	4812	51.46
Gringo Fraction	Argenta Mines, Ltd.; March 14	3427	34.98
Hill Fraction	Ore Mountain Mining Co., Ltd.; Oct. 4	4819	37.41
Honest John	Frederick Jancowski *et al.*; Sept. 6	1860	19.64
Hope No. 1 Fraction	Vancouver Mines, Ltd.; May 17	4900	51.65
Hope No. 2 Fraction	Vancouver Mines, Ltd.; May 17	4901	47.90
Hope No. 5	Vancouver Mines, Ltd.; May 17	4899	28.40
Hope No. 6 Fraction	Vancouver Mines, Ltd.; May 17	4902	51.40
Josephine	Ray Vance McCarley; Jan. 11	1833	51.14
Lakeshore	Ore Mountain Mining Co.; Oct. 4	4808	50.86
Lead Coil	Ore Mountain Mining Co.; Oct. 4	4811	51.59

NORTH-WESTERN DISTRICT (No. 1)—*Continued.*

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Portland Canal—*Contd.*			
Lead Coil No. 2	Ore Mountain Mining Co.; Oct. 4	4813	51.65
Lucille	Porter-Idaho Mining Co.; Aug. 29	4729	39.56
Nettie L.	Porter-Idaho Mining Co.; Aug. 29	4730	41.59
Never Sweat	Porter-Idaho Mining Co.; Oct. 29	4733	34.40
Never Sweat Fraction	Porter-Idaho Mining Co.; Aug. 29	4738	6.97
New Strike	Daniel Donald; June 9	4751	51.09
Noonday Fraction	Vancouver Mines, Ltd.; May 17	4910	19.48
Noonday No. 2	Vancouver Mines, Ltd.; May 17	4909	30.74
Noonday No. 3	Vancouver Mines, Ltd.; May 17	4908	13.20
Noonday No. 4	Vancouver Mines, Ltd.; May 17	4906	44.51
Noonday No. 5	Vancouver Mines, Ltd.; May 17	4905	50.93
Noonday No. 6 Fraction	Vancouver Mines, Ltd.; May 17	4904	34.21
Noonday No. 7	Vancouver Mines, Ltd.; May 17	4903	51.65
Ore Fraction	Ore Mountain Mining Co.; Oct. 4	4814	51.61
Ore Hill	Ore Mountain Mining Co.; Oct. 4	4815	39.81
Ore Hill No. 2	Ore Mountain Mining Co.; Oct. 4	4816	35.21
Ore Hill No. 3	Ore Mountain Mining Co.; Oct. 4	4817	51.65
Ore Hill No. 4	Ore Mountain Mining Co.; Oct. 4	4818	51.65
Ore Mountain No. 5	Ore Mountain Mining Co.; Oct. 4	4820	51.65
Ore Hill No. 6	Ore Mountain Mining Co.; Oct. 4	4821	48.44
Ouija	Adanac Mines Co. of Alaska; May 17	4826	44.09
Pershing	Ruby Silver Mines, Ltd.; Oct. 18	4762	51.65
Pershing No. 1	Ruby Silver Mines, Ltd.; Oct. 18	4763	51.65
Pit Fraction	Premier Gold Mining Co., Ltd.; Aug. 29	4767	0.09
Prickly Heat	Porter-Idaho Mining Co.; Aug. 29	4734	39.23
Prickly Heat Fraction	Porter-Idaho Mining Co.; Aug. 29	4737	8.63
Prince George	Percy Waite Baldwin; June 8	4752	33.62
Prosperity	Frederick Richard Jancowski; Sept. 6	1858	20.81
Prosperity Fraction	Frederick Richard Jancowski; Sept. 6	1859	3.85
Ruby	Ruby Silver Mines, Ltd; Oct. 18	4764	50.71
Ruth	Ralph Emerson Lundvall, Daniel Donald, Malcolm Julius Woods, and Norman A. McLean; July 10	4753	37.69
Safe Key No. 2 Fraction	Silverbell Mining Co., Ltd.; June 13	4772	23.06
Shough	Ray Vance McCarley; Jan. 11	1829	40.07
Shough No. 2	Ray Vance McCarley; Jan. 11	1830	25.62
Silver Band	Ore Mountain Mining Co.; Oct. 2	4810	51.65
Silver Bell Fraction	Silverbell Mining Co., Ltd.; June 13	4771	42.34
Silver Bank No. 1	Silverbell Mining Co., Ltd.; June 13	4742	49.28
Silver Bank No. 2	Silverbell Mining Co., Ltd.; June 13	4743	49.28
Silver Bank No. 3	Silverbell Mining Co., Ltd.; June 13	4745	46.90
Silver Bank No. 4	Silverbell Mining Co., Ltd.; June 13	4744	30.75
Silver Bell No. 1	Silverbell Mining Co., Ltd.; June 13	4773	51.65
Silver Bell No. 2	Silverbell Mining Co., Ltd.; June 13	4774	49.24
Silver Bell No. 3	Silverbell Mining Co., Ltd.; June 13	4775	44.82
Silver Dollar	Adanac Mines Co. of Alaska; May 17	4822	51.48
S.D.	Stewart Central Mines, Ltd.; Jan. 31	4560	49.12
S.D. No. 1	Stewart Central Mines, Ltd.; Jan. 31	4561	50.52
S.D. No. 2	Stewart Central Mines, Ltd.; Jan. 31	4562	51.65
S.D. No. 3	Stewart Central Mines, Ltd.; Jan. 31	4563	50.25
S.N. Fraction	Silverbell Mining Co.; June 13	4770	21.10
Silver Night	Silverbell Mining Co.; June 13	4768	51.47
Silver Night No. 2	Silverbell Mining Co.; June 13	4769	51.65
Silver View	Ray Vance McCarley; Jan. 11	1831	35.39
Slide	Porter-Idaho Mining Co.; Aug. 29	4728	43.46
Snow	Adanac Mines Co. of Alaska; May 17	4824	24.10
Star	Ruby Mines, Ltd.; Oct. 18	4765	32.25
Stirling	Ruby Silver Mines, Ltd.; Oct. 18	4766	44.54
Sunday	Porter-Idaho Mining Co.; Aug. 29	4731	46.08
Tea Pot Dome	Frederick Richard Jancowski; Sept. 6	1857	34.23
Valley	Adanac Mines Co. of Alaska; May 17	4823	21.90
Vancouver Fraction	Vancouver Mines, Ltd.; May 17	4907	2.31
Vivian	Ralph Emerson Lundvall, Daniel Donald, Malcolm Julius Woods, and Norman A. McLean; July 10	4756	51.51
W. Fraction	Ditto	4760	29.73

NORTH-EASTERN DISTRICT (No. 2).

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Cariboo—			
Avonlea	A. McClelland; Jan. 13	9602	51.57
Blighty	J. H. Blair and Frederick James Tregillus; Nov. 17	9569	46.41
General Currie	J. H. Blair and Frederick J. Tregillus; Nov. 17	9570	47.80
Portland	Eustace J. Kingley; Jan. 13	9941	51.65
Tipperary	John Henry Blair; Nov. 17	9561	46.22
Warspite	John Henry Blair and Frederick James Tregillus; Nov. 17	9560	51.54
Omineca—			
Cobalt	Duthie Mines, Ltd.; Aug. 2	2939	43.90
Henderson Fraction	Duthie Mines, Ltd.; Aug. 2	2932	44.60
Muriel	Duthie Mines, Ltd.; Aug. 2	2940	46.37
Oriental	Chung King Ho.; Feb. 1	1073	29.31
Oriental No. 1	Chung King Ho.; Feb. 1	1074	34.53
Oriental No. 2	Chung King Ho.; Feb. 1	1075	34.63
Oriental No. 3	Chung King Ho.; Feb. 1	1076	39.31
Oriental No. 4	Chung King Ho.; Feb. 1	1077	39.13
Oriental No. 5	Chung King Ho.; Feb. 1	1078	38.24
Raven	Duthie Mines, Ltd.; Aug. 2	2937	51.63
Raven Fraction	Duthie Mines, Ltd.; Aug. 2	2936	4.12
White Swan	Duthie Mines, Ltd.; Aug. 2	2938	43.96

CENTRAL DISTRICT (No. 3).

Kamloops—			
Copper Jack	A. Beckman; June 27	2557	35.92
Klondyke	A. Beckman; June 27	2556	42.06
Nippon	A. Beckman; June 27	2553	17.89
Peacock	A. Beckman; June 27	2558	34.10
Prince of Wales	A. Beckman; June 27	2559	38.54
Tunnel Fraction	A. Beckman; June 27	2560	20.54
Vernon—			
Jumbo	Dorothy Saunders; March 23	4882	50.66
Pine	Harold Saunders; March 23	4883	42.39
Yale—			
Gisby	Stephen Gisby and Sydney Gisby; Feb. 11	1078	51.65
Gisby Fraction	Stephen Gisby and Sydney Gisby; Feb. 11	1105	35.91
Laura	Stephen Gisby and Sydney Gisby; Feb. 11	1080	46.88
Mary Ann	Stephen Gisby and Sydney Gisby; Feb. 11	1081	51.65
Mary Ann Fraction	Stephen Gisby and Sydney Gisby; Feb. 11	1106	9.68
Salmon River	Stephen Gisby and Sydney Gisby; Feb. 11	1077	51.65

SOUTHERN DISTRICT (No. 4).

Greenwood—			
Acme Fraction	Joseph Pringle; Sept. 6	1089	49.01
Osoyoos—			
Copper King	Lewis Victor Newton, John W. S. Logie, executors of the Estate of Richard Wearne Northey, and Alfred Hagelberg; Aug. 3	3065s	48.27
Similkameen—			
Anaconda	Charles Bonnevier; Aug. 22	400	49.95
Copper Queen	Alfred Hagelberg; Oct. 15	3066s	51.12
Red Star	Gustav Pouwels; Aug. 27	399	51.65

EASTERN DISTRICT (No. 5).

Windermere—			
Big Chief	D. M. L. McKay; Jan. 5	12766	51.65
Columbia	D. M. L. McKay; Jan. 5	12764	51.60
Colum Chief Fraction	Everard M. Davis; Jan. 5	11423	10.99
First Effort	D. M. L. McKay; Jan. 5	11426	51.65

EASTERN DISTRICT (No. 5)—*Continued.*

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Windermere—*Continued.*			
Lead Queen	Dorothy M. Louise McKay; Jan. 5	12763	44.73
Lead King	Francis May Simonds; Jan. 5	11422	43.92
Lucky Chief Fraction	Albert Filmore Hyde; Jan. 5	11424	15.87
Lucky Strike	Dorothy M. L. McKay; Jan. 5	11425	51.65
Fort Steele—			
Abney	Consolidated Mining and Smelting Co.; Sept. 27	13582	51.65
Ahoy	Consolidated Mining and Smelting Co.; Sept. 27	13560	51.65
Air	Consolidated Mining and Smelting Co.; Sept. 27	13559	51.65
Alpine	Consolidated Mining and Smelting Co.; Sept. 27	13538	51.65
Archean	Consolidated Mining and Smelting Co.; Jan. 24	13540	51.65
Axe	Consolidated Mining and Smelting Co.; Jan. 24	13213	51.65
Bee	Consolidated Mining and Smelting Co.; Sept. 27	13586	5.65
Beltian	Consolidated Mining and Smelting Co.; Sept. 27	13555	51.65
Bin	Consolidated Mining and Smelting Co.; Sept. 27	13587	51.65
Burgess	Consolidated Mining and Smelting Co.; Sept. 27	13581	51.65
Cambrian	Consolidated Mining and Smelting Co.; Sept. 27	13558	51.65
Camel	Consolidated Mining and Smelting Co.; Jan. 24	13535	51.65
Central Fraction	Russell Hoadley Bennett; May 14	13797	29.86
Closin Fraction	Russell Hoadley Bennett; May 12	13795	41.08
Cretaceous	Consolidated Mining and Smelting Co.; Sept. 27	13563	51.65
Crocodile	*Consolidated Mining and Smelting Co.; Jan. 24*	13531	51.65
Dephole	Russell Hoadley Bennett; May 12	13775	49.76
Devonian	Consolidated Mining and Smelting Co.; Sept. 27	13557	51.65
Dolphin	Consolidated Mining and Smelting Co.; Jan. 24	13527	51.65
Doug	Consolidated Mining and Smelting Co.; Sept. 27	13580	51.65
Eau	Russell Hoadley Bennett; May 14	13796	51.30
Elephant	Consolidated Mining and Smelting Co.; Jan. 24	13536	51.65
Eocene	Consolidated Mining and Smelting Co.; Jan. 24	13530	51.65
Flange	Consolidated Mining and Smelting Co.; Jan. 24	13219	51.65
Frog	Consolidated Mining and Smelting Co.; Jan. 24	13210	51.53
Galton	Consolidated Mining and Smelting Co.; Sept. 27	13579	51.65
Gear	Consolidated Mining and Smelting Co.; Jan. 24	13223	51.65
Giraffe	Consolidated Mining and Smelting Co.; Sept. 27	13545	51.65
Graph	Consolidated Mining and Smelting Co.; Sept. 27	13543	51.65
Hell	Consolidated Mining and Smelting Co.; Sept. 27	13588	51.65
Hilside	Consolidated Mining and Smelting Co.; May 12	13776	46.97
Hippo	Consolidated Mining and Smelting Co.; Sept. 27	13544	51.65
Hub	Consolidated Mining and Smelting Co.; Jan. 24	13218	51.65
Huronian	Consolidated Mining and Smelting Co.; Jan. 24	13541	51.65
Jurassic	Consolidated Mining and Smelting Co.; Sept. 27	13561	51.65
Kimberley	Russell Hoadley Bennett; May 12	13794	44.58
Level	Consolidated Mining and Smelting Co.; Sept. 27	13552	51.65
Lillian	Russell Hoadley Bennett; May 12	13443	50.80
Margery	Russell Hoadley Bennett; May 12	13444	51.65
Mastadon	Consolidated Mining and Smelting Co.; Jan. 24	13537	51.65
Miocene	Consolidated Mining and Smelting Co.; Jan. 24	13529	51.65
Miriam	Russell Hoadley Bennett; Jan. 12	13445	51.65
Ozalid	Consolidated Mining and Smelting Co.; Sept. 27	13547	51.65
Panta	Consolidated Mining and Smelting Co.; Sept. 27	13554	51.65
Paper	Consolidated Mining and Smelting Co.; Sept. 27	13548	51.65
Pelton	Consolidated Mining and Smelting Co.; Jan. 24	13216	51.65
Permian	Consolidated Mining and Smelting Co.; Jan. 24	13539	51.65
Phosphate	Consolidated Mining and Smelting Co.; Sept. 27	13546	51.65
Pick	Consolidated Mining and Smelting Co.; Jan. 24	13212	51.65
Plug	Consolidated Mining and Smelting Co.; Jan. 24	13214	51.65
Rhino	Consolidated Mining and Smelting Co.; Jan. 24	13534	51.65
Rust	Consolidated Mining and Smelting Co.; Jan. 24	13217	51.65
Scraper	Consolidated Mining and Smelting Co.; Jan. 24	13220	51.65
Shark	Consolidated Mining and Smelting Co.; Jan. 24	13528	51.65
Silurian	Consolidated Mining and Smelting Co.; Sept. 27	13556	51.65
Sioux Fraction	Russell Hoadley Bennett; May 12	13442	21.42
Spark	Consolidated Mining and Smelting Co.; Jan. 24	13211	51.65
Telfer	Consolidated Mining and Smelting Co.; Sept. 27	13553	51.65
Tiffie	Consolidated Mining and Smelting Co.; Jan. 24	13221	51.65

EASTERN DISTRICT (No. 5)—*Continued.*

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Fort Steele—*Continued.*			
Toller	Consolidated Mining and Smelting Co.; Jan. 24	13226	51.65
Tortoise	Consolidated Mining and Smelting Co.; Jan. 24	13533	51.65
Triassic	Consolidated Mining and Smelting Co.; Sept. 27	13562	51.65
Turtle	Consolidated Mining and Smelting Co.; Jan. 24	13532	51.65
Valve	Consolidated Mining and Smelting Co.; Jan. 24	13222	51.65
Wheel	Consolidated Mining and Smelting Co.; Jan. 24	13215	51.65
Yahk	Consolidated Mining and Smelting Co.; Sept. 27	13542	51.65
Nelson—			
Alan Fraction	Howard Mines, Ltd.; Dec. 6	12545	11.82
Contact	Howard Mines, Ltd.; Dec. 6	12542	44.67
Glencoe	Howard Mines, Ltd.; Dec. 6	12539	31.76
Howard	Howard Mines, Ltd.; Dec. 6	12540	47.16
Jeremy Fraction	Howard Mines, Ltd.; Dec. 6	12544	8.03
Lochiel	Howard Mines, Ltd.; Dec. 6	12543	51.16
Niagara	Charles Plummer Hill; July 30	12535	51.60
Paddy	Howard Mines, Ltd.; Dec. 6	12538	51.65
Prince Charlie	Howard Mines, Ltd.; Dec. 6	12541	28.77

WESTERN DISTRICT (No. 6).

Nanaimo—			
Aladdin	Rudolph Kurtzhals; May 10	166	51.09
Better Ole	Otto Kurtzhals; May 10	164	51.65
Old Bill	Rudolph Kurtzhals; May 8	163	51.65
Trio	Alexander Kurtzhals; May 8	165	40.71
New Westminster—			
Climax	William Henry Wooley; Jan. 20	5576	36.29
Ivanhoe	William Henry Wooley; June 20	5573	51.55
Viking	William Henry Wooley; June 20	3177	34.11
Vimy	William Henry Wooley; June 20	5575	42.71

NOTE.—The following corrections should be made in the list of Crown Grants for 1927 issued in the 1927 Annual Report:—

Bobcat, Lot 9719, should be in the Nelson Mining Division.
Dawson Fraction, Lot 13374, should read Darwin Fraction.
Erasmus, Lot 13372, should read Uranus.
Face, Lot 13280, should read Fence.
Gain, Lot 13235, should read Game.
Sunny, Lot 13279, should read Surrey.
Good Hope: Grantee is George Hilton Scott.
John D.: Grantee is Sarah F. Dunlop and W. H. Laird.

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British Columbia. *Bureau of Mines.*

Annual Report of the Minister of Mines for the year ended 31st December, 1928, being an account of mining operations for gold, coal, etc., in the Province. John D. Galloway, Provincial Mineralogist. 540 pp., plates, maps, 1928.

Victoria, Government Printing Office, 1929.

Author.

Galloway, John D. *(Provincial Mineralogist.)*

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