ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1931

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1932.

To His Honour J. W. FORDHAM JOHNSON,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mineral Industry of the Province for the year 1931 is herewith respectfully submitted.

W. A. McKENZIE,
Minister of Mines.

Minister of Mines' Office,
March, 1932.

To the Honourable W. A. McKenzie,
Minister of Mines.

SIR,—I have the honour to submit herewith my Annual Report on the Mineral Industry of the Province for the year ended December 31st, 1931.

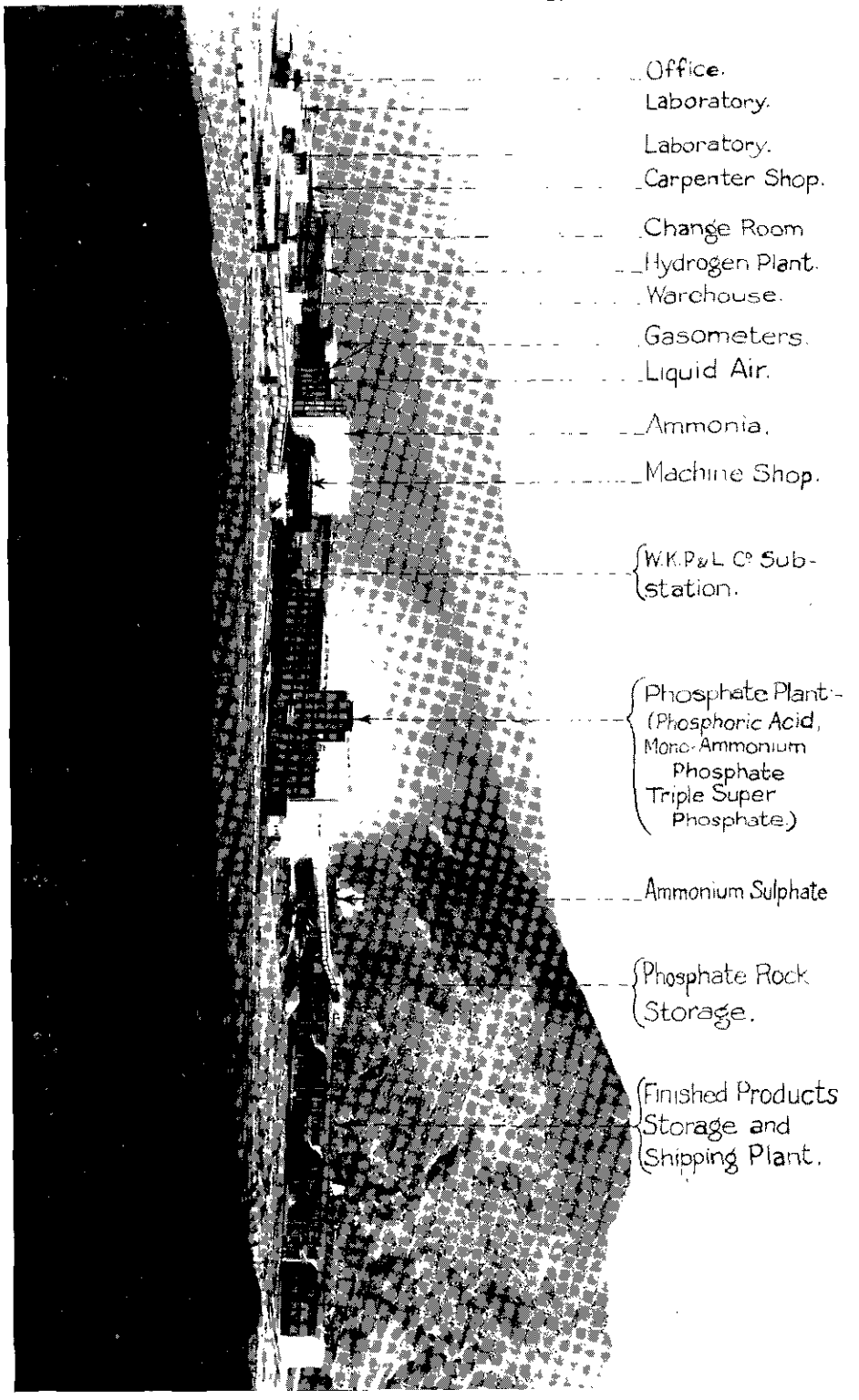
The statistical tables give the total mineral production of the Province to date and show by Districts and Divisions the output of the various metals and minerals for the year 1931 and comparative figures for previous years.

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 the inspection of mines in British Columbia.

I have the honour to be,
Sir,
Your obedient servant,

JOHN D. GALLOWAY,
Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,
March, 1932.



Consolidated Mining and Smelting Co. of Canada, Ltd.—Fertilizer Plant at Trail, B.C.

STATISTICAL REVIEW OF THE MINERAL INDUSTRY OF BRITISH COLUMBIA IN 1931.

By John D. Galloway, Provincial Mineralogist.

GENERAL SUMMARY.

The gross value of the mineral production of British Columbia in 1931 was $34,883,181, a decrease of $20,508,812, or 37 per cent., as compared with the figure of $55,391,993 in 1930. This heavy decline in value was mainly caused by much lower metal prices and lowered outputs of metals.

In recent years the major portion of the mineral production of the Province has been in silver, copper, lead, and zinc, and the demoralized condition of the markets for these metals during 1931 caused a decline in the value of the output of these four metals of over $18,000,000. Other branches of the mineral industry therefore only declined comparatively slightly. Placer gold showed a substantial increase and a gain was also made in miscellaneous metals and minerals, but the major branches of the industry all showed decreased outputs. For some years past the coal production of the Province has been valued at $5 per long ton. A careful review of sales prices of the operators shows that a price of $4.50 per ton is more representative and accordingly has been used this year. This accounts for a part of the drop in the total gross value of mineral production.

The final figure of $34,883,181 is somewhat lower than the estimated figure in the Preliminary Report issued in December, 1931. In the last two months of the year further curtailment in metal production took place and the lowered price used for valuing coal also reduced the final figure.

Considering the state of world business and the unprecedentedly low prices of metals in 1931, it is not surprising that metallic production declined as it did. It is satisfactory, however, that the major operations were continued and only remarkably efficient operation prevented a complete shut-down.

The following table shows the decline in production of the principal components of the mineral industry of the Province:—

Class.	Dollars Decline in 1931 Output from 1930.	Percentage Decline.
Gold (placer and lode)	164,925	4.75
Silver	2,059,756	47.90
Base metals (copper, lead, and zinc)	16,015,384	48.20
Coal	1,751,495	18.57
Structural materials	539,268	13.18
Miscellaneous metals and minerals (increase)	22,016	2.76

The tonnage of metalliferous ore mined in the Province was 5,549,103, as compared with 6,803,846 tons in 1930, a decrease of 18.45 per cent. The average gross value of the ore mined was $4.06 a ton, as compared with $6.04 a ton in 1930. This shows the effect of much lower metal prices and emphasizes the low operating costs being achieved by the large low-grade mines of the Province.

For the purpose of the statistical tables in this Annual 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 1931 valued at $22,827,565 (including placer gold). This is followed by coal, with an output valued at $7,684,155; and structural materials and miscellaneous metals and minerals, totalling together $4,371,561.

By value, the various products of the mineral industry produced in 1931 are ranked in the following order: Coal, lead, copper, zinc, structural materials, gold, silver, miscellaneous metals and minerals.

Lode-gold production, valued at $3,018,894, shows a slight decline from the figure in 1930 notwithstanding much increased activity in this form of mining. The lessened output was mainly due to the shutting-down of the *Copper Mountain* mine, a lowered output from *Premier* owing to slightly lower-grade ore, and the closing of the *Nickel Plate* mine, a former consistent gold-producer. These decreases were offset in part by a much larger output from the *Pioneer* and increases from the *Union* and *Reno* mines.

Placer-mining had a very busy and successful year. Production amounted to $291,992, a considerable increase over the $152,235 recorded in 1930. Furthermore, the work carried out in 1931 indicates that placer-gold production will increase in future years. This form of mining is beginning to attract widespread attention as the undoubted possibilities and large rewards in sight are better realized. "Sniping" by individuals with pan, rocker, and small sluice provided a living for many men who otherwise would have been a charge on the community.

The silver-output was 7,524,320 oz., valued at $2,247,514, being much below the record figure of 11,289,171 oz. produced in 1930. Most of the small silver-lead-zinc mines of the Province were closed in 1930. *Sullivan*, *Premier*, and *Prosperity*, however, all made large outputs that year, enabling a high record production to be made. *Prosperity* was closed early in 1931 and *Sullivan* and *Premier* were forced to curtail to some extent, these factors thereby largely causing the marked decline in the 1931 production.

Lead and zinc output from the Province for some years has been mainly from the *Sullivan* mine of the Consolidated Company and in 1931 it was almost entirely from this mine. Due to the desire of this company to assist in world stabilization of these metals, output has been gradually lessened throughout the year. The output of lead was 248,783,508 lb., a decrease of 22 per cent. as compared with 1930. A zinc production of 205,071,247 lb. is a decline of 17.9 per cent. from the figures for the preceding year.

The copper-output for 1931 was 63,194,299 lb., as compared with 90,421,545 lb. in 1930. *Copper Mountain* mine of the Granby Company did not produce this year, and in addition curtailment was in force at the *Britannia*, these factors largely accounting for the decreased output. *Hidden Creek* mine of the Granby Company made a larger output than in 1930, but the total production of this company shows a large decrease due to the non-operation of the *Copper Mountain* mine.

The coal-output for the year was 1,707,590 long tons, as compared with 1,887,130 tons in 1930, a decline of 9.5 per cent. The rate of decline in coal-output which has been in progress since 1928 is slowing up, and it would seem that British Columbia collieries are not continuing to lose business to imported fuels as fast as formerly.

By districts, the Crowsnest produced only slightly less coal than last year, Nicola-Princeton almost the same amount, and the major portion of the decline was in the Vancouver Island district. Crowsnest has benefited by the Dominion Government subvention on coal moving east and has gained industrial business in Winnipeg, offsetting some lowered consumption in its normal British Columbia market. Nicola-Princeton has gained business in the Vancouver City market at the expense of Alberta and Vancouver Island coal, offsetting decreased railway business. The decline from Vancouver island in part reflects the lowered general business of the Coast district and the steady competition from fuel-oil.

Many factors are now aiding coal, the full effect of which have not yet materialized. The Dominion Government subventions and bonuses, the campaign by the British Columbia Government, the British Columbia Coal Committee and the operators, to show that British Columbia coal is the safest and most efficient fuel, are all assisting and the public is beginning to realize that if there is anything in the "Buy Home Products" campaign, then British Columbia coal should get a hearty reception. The discount on Canadian money is helping the sale of more British Columbia coal in the United States, as it largely offsets the duty.

There is still much to be done, however, as it should be remembered that the coal industry was in a heavy depression when all else was booming a few years ago, and since then it has gone back a long way. The coal industry still requires every effort if it is to be brought back to the prosperous condition it enjoyed many years ago.

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

	1928.	1929.	1930.	1931.
Vancouver Island mines .....tons, 2,240 lb.	1,277,533	1,120,805	988,805	831,925
Nicola-Princeton mines ..... „	245,978	242,236	208,060	211,844
Crowsnest mines ..... „	1,001,523	886,706	689,236	661,426
Northern District ..... „	1,668	1,505	1,029	2,395
Total quantity of coal mined	2,526,702	2,251,252	1,887,130	1,707,590

Complete coal production statistics will be found in the Report of the Chief Inspector of Mines.

The production of structural materials for the year was $3,553,300, a decline of $639,268 as compared with 1930. This is a comparatively small decrease and shows that building and construction-work was fairly well maintained during the year. In 1930 several large projects were under way which caused the output of structural materials for that year to be a high all-time record. The 1931 output equalled the five-year average, which is a satisfactory showing.

An output of miscellaneous metals and minerals valued at $818,161 was made in 1931, compared with $796,145 in the preceding year. The increase was due to a substantial output of bismuth and a greater production of sulphur in sulphuric acid, largely offset by declines in other products.

While there has been a marked decline in the money value of the mineral industry of the Province in 1931, it should be noted that, if valued at 1930 prices, the 1931 output would be worth approximately $44,400,000. The industry therefore operated at approximately 80 per cent. of the quantity rate in 1930, a very creditable effort considering world conditions and the necessity of marketing silver and base metals in world markets.

As a result of the closing of mines, curtailment of production, and the conceiving of every possible economy much unemployment has resulted. However, it is fortunate that these economies were possible and carried through, or the result would have been the closing of still more mines, with still greater unemployment.

The foregoing statistical outline shows that during 1931 a general decline has taken place in the production end of the mineral industry of the Province. This was to be expected, but compared to mining elsewhere and other industries in the Province, it must be considered that the record is fairly satisfactory. Complete details of mineral production will be found in the statistical tables following this section.

METAL PRICES.

The continued fall in metal prices that commenced three years ago continued in 1931 and new low records were made. The following table shows the average yearly prices for silver, copper, lead, and zinc. For 1931 the figures are corrected for Canadian funds at par by applying the average exchange prevailing during the last three months of the year.

AVERAGE METAL-MARKET PRICES FOR 1929, 1930, AND 1931.

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.
1929	* 52.093	* 18.107	* 5.0504	6.833	* 5.3858	6.512
1930	* 38.154	* 12.982	* 3.9273	5.517	* 3.5999	4.556
1931	* 28.700	* 8.116	* 2.7101	4.243	* 2.554	3.640

* Prices used in compiling total metal valuations in 1929, 1930, and 1931 Annual Reports.

Copper is apparently in the worst position of all metals with large stocks of refined copper on hand and consumption much below normal. When prices will move upward is dependent on greatly increased consumption, which in turn can only be caused by a radical improvement in world business. Curtailment of production is assisting, but greater consumption is the only cure for the present unsatisfactory price-level.

METALLURGICAL FEATURES OF THE YEAR.

Very little mill construction was carried out in British Columbia during 1931. Plans and construction were under way to increase the *Pioneer* mill to 300 tons a day, or three times the present size. This will be completed in 1932. Construction of a 100-ton mill on the *Lorne* mine was well advanced by the end of the year. The *Big Missouri* mill, which was nearly completed in 1930, was finished in January and test-milling carried on until the fall, when it was closed down.

The main construction-work of the year was that of the Consolidated Mining and Smelting Company of Canada in completing the fertilizer plant at Trail and the hydro-electric power plant at Corra Linn, on the Kootenay river. Regarding these plants the following excerpts from the company's annual report for 1931 are of interest:—

"*The Fertilizer Group.*

"*Sulphuric-acid Plants.*—The three 110-ton units were completed, the last going into operation in October; each unit started without the slightest hitch and each proved capable of easily producing its rated capacity at the estimated cost. These plants all obtain their sulphur-dioxide gas as a by-product from the zinc concentrates roasted in the concentrate-burning furnaces. This sulphur dioxide is the constituent of smelter-smoke which produces injury. Its recovery is not only very desirable, but was one of the conditions of the Joint International Commission's recommendations. This condition has been fulfilled by these plants, which, together with the 35-ton unit already installed, are capable of making about 375 tons of 100 per cent. sulphuric acid per day.

"*The Hydrogen Plant.*—The cell plant taken as a whole is very satisfactory. It consists of three series of electrolytic cells, each using 6,500 kilowatts. In order to find out the best type of cell to use, the three most promising types were installed—namely, Knowles, the best English cell; Fauser, the best Italian; and Penchranz, the Swiss cell. In addition to these a few Stewart 'new Canadian' cells were installed. The first two mentioned have successfully passed all the tests; the third, while still not quite up to specification, can deliver its full quota of hydrogen; the Canadian cells are in the testing stage.

"The electrical equipment of this plant consists of two sets of Brown Boveri Mercury Arc Rectifiers and one General Electric set. The Brown-Boveri sets, while able to carry the load, have had too many back-fires and have not yet been accepted. The Swiss company has engineers here who are trying to overcome this annoyance with good promise of success. The General Electric Company machine was not satisfactory and is being replaced by that company. In the meantime the General Electric machine was replaced by an idle set of Brown Boveri rectifiers from the zinc plant. The hydrogen plant produced full rated capacity for a thirty-day test.

"*The Ammonia Plant.*—The plant locally known as the ammonia plant comprises the nitrogen plant, the gas-mixing plants, the compressors, and the ammonia synthesis and liquefaction plants. Nitrogen is recovered from the air by two Claude liquefaction and fractional distillation plants, each capable of producing 44 tons of nitrogen daily. While some difficulties were experienced with these plants at first, one has passed all the tests and has been accepted, and the second is only waiting for a test run.

"Ammonia is made by mixing one volume of nitrogen gas recovered from the air with three volumes of hydrogen gas recovered from water, compressing the mixed gases through six-stage compressors to about 4,000 lb. per square inch, and cycling this gas through a heated catalyst, where about 18 per cent. of the gas is converted into anhydrous ammonia. This is separated out by condensation and sufficient gas mixture added to each cycle to replace the ammonia extracted. The particular process used is the Fauser process, licensed from the Montecatini Company in Italy.

"The Trail ammonia plant, though comparatively small in total output, contains the largest units throughout and is probably the most efficient and up-to-date ammonia plant in existence to-day. It has passed all the required tests and has been accepted. Production started in September, and costs, while coming down rapidly, did not reach the estimates until January.

"*The Ammonium Sulphate Plant.*—This plant went into operation in September. In this plant sulphuric acid is neutralized with ammonia, making crystalline ammonium sulphate. No radical changes were necessary and costs are coming down steadily. The estimated costs should be realized whenever this plant is run to capacity.

"The phosphoric acid and phosphate plants are being built under contract. These comprise three plant units to manufacture phosphoric acid and three units to neutralize the phosphoric acid produced with either ammonia or phosphate rock. These plants have not proved up to specifications and have not been accepted, although they are being operated. Estimates have not been realized to date in these plants.

"The tonnages produced during 1931 were:—

	Tons.
Ammonia	2,227
Triple superphosphate	14,694
Mono-ammonium phosphate	3,877
Ammonium sulphate	6,484

"*The Mechanical Department.*—This department carried through its construction programme practically on time, and, on the whole, well within the estimates. The entire fertilizer plant, including the acid plants, or about $9,000,000 worth of construction, in the main new to Canada, was completed within fourteen months. The 90 per cent. designed and built by the company's own engineers required no important changes; this part is also operating satisfactorily, with estimated costs and capacities either obtained or within sight.

"It became evident that if the Prairie farmers were to be able to buy attachments for their seed-drills to successfully use chemical fertilizers, your company would have to make them. An attachment was designed. Late in the summer orders were given to make 2,000 to 3,000 for 1932 seeding. A complete plant was designed and machinery, dies, and material ordered and assembled. By working twenty-four hours a day these attachments will be available.

"*Power.*—The Corra Linn development and installation, referred to in last year's statements, proceeded satisfactorily during the year, under the able control of L. A. Campbell, vice-president and general manager of the power company. The first unit went on the line February 23rd, 1932, and the second on March 1st. The third will go on about March 15th. Each unit is of 19,000 horse-power. The plant is a complete success and removes any possibility of shortage of power for the metallurgical operations of your company."

Improvements in smelting and refining and the notable metallurgical advance by reason of the slag-fuming plant are referred to in the following statement from the Consolidated Company's report:—

"*The Lead-smelting Plant.*—The greatest advance for the year has undoubtedly been made in the lead-smelting plant through the operation of the slag-fuming plant and the changes made possible in the blast-furnace practice, because clean slags were no longer the objective of the metallurgists. The present practice is to smelt the ore with less coke and consequently a less reducing atmosphere. This speeds up the furnaces and almost eliminates furnace troubles. The furnace-speed in 1929 was 270 tons of charge, against 336 tons in 1931, for the standard furnaces and 504 tons for the new large furnace.

"Although only 307,000 tons of ore were smelted instead of 312,000 tons in 1930, the cost per ton of ore was much lower than in any previous year, but, owing to the fact that a much larger tonnage of zinc-plant rejects and other low-grade material was smelted, the smelting cost per pound of lead remained the same as in 1930. The lead production was 138,772 tons, as against 151,370 tons in 1930.

"The following figures will serve to demonstrate the great importance of the fuming-plant operations: Of the 101,000 tons of zinc produced, 18,900 tons were recovered by the fuming plant; in other words, the zinc production was increased 23 per cent. Production costs dropped steadily from the commencement, and in the last few months of the year this additional zinc did not cost any more than the cheapest zinc produced and far less than any estimates ever given.

In 1931 there were 3,400 tons of additional lead recovered at a cost of only 0.33 cent per pound; this was sold at 2.31 cents per pound, making a gain of $134,640.

"Owing to the fact that more zinc-plant rejects could be smelted, there were an additional 2,400 tons of lead made at a cost of 1.25 cents per pound or a profit of $50,880, and a further $51,000 worth of gold and silver also from zinc-plant rejects. This plant sold $120,000 worth of steam to other departments, replacing steam costing considerably more than that amount.

"The fuming plant has produced and can continue to produce 23 per cent. more zinc and 4 per cent. more lead from the same ore than was formerly possible. This metal will be produced for about $144,000 per year less than the cost of an equivalent tonnage of the cheapest metal direct from *Sullivan* ore. The profit on the excess lead and silver produced in 1931, at the very low prices prevailing, was $236,520. There were 24,700 tons of additional metal from this furnace, consequently each 1-cent rise in the price of lead and zinc would add $494,000 per year.

"From the above it will be seen that the fuming plant has added 23 per cent. to the *Sullivan* zinc-ore reserves and 4 per cent. to the *Sullivan* lead-ore reserves.

"*The Zinc Plant.*—Production costs in this plant were maintained at the 1930 level in spite of a 10-per-cent. drop in production. The important features of the year in this plant were the completion of adapting the roasting plant to do all the roasting by the Trail concentrate-burning process, and improvements in the costs of the zinc-oxide leaching plant. Patents were obtained on the concentrate-burning process in Canada and the United States and applied for in the principal countries of the world.

"*The Lead and Silver Refineries.*—These plants made a new low record on costs, these being 4 per cent. below 1930, the previous low record, in spite of a lower production."

Very remarkable results were obtained at the *Britannia* mill in lowering milling costs by the end of the year to 20 cents a ton. At the *Sullivan* mine of the Consolidated Company and Anyox mill of the Granby Consolidated Mining and Smelting Company, further refinements and economies in milling practice were also obtained.

DEVELOPMENT AND PROSPECTING.

General mining development was considerably slowed down during 1931. The large operating companies curtailed development operations except on gold properties, and scouting was less vigorously prosecuted. Development-work at the operating mines was at a minimum consistent with sound practice. It is, however, noteworthy that the advancement of the 4,100 haulage-tunnel level is being proceeded with at the *Britannia* mine. This was started in the spring of this year and will mean an extension of some 10,000 feet, from which ore-transfer raises will be driven to the mine-workings. The quiet confidence thus shown in the future is most encouraging.

The smaller stock companies confined their efforts mainly to gold properties and several useful enterprises were under way. One factor favouring development at the present time is the much lower costs of doing work. Not only are supplies cheaper, but wages are lower and very favourable contracts can be let. It is a suitable time to develop favourable prospects, as the outlook is that costs may rise again. There is also much idle capital that might be put to work on legitimate speculation.

Despite the low price of base metals and the indefinite outlook for the future, some development of base-metal properties was carried out. In the Slocan district, leasers were active at a number of former operating mines and some shipments of high-grade crude ore were made.

Of the results attained from development during the year, the most outstanding has been that on the *Pioneer* mine, which is steadily proving additional ore reserves of good-grade gold ore.

Another promising development of the year is the *Whitewater* group in the Taku area, now under option to Noah Timmins. The values are in gold in a number of silicified zones with slight sulphide mineralization. Surface work and diamond-drilling were carried out until late in the fall, when the camp was closed for the winter. An extended campaign is planned for 1932.

The success attending the *Pioneer* mine in the Lillooet Division attracted attention to this section. One result was the taking-over of the *Lorne* by the Bralorne Syndicae, Limited. Steady development was carried out and the construction of a 100-ton mill commenced. Other gold

prospects in the area have been optioned and various operations are under way. Numerous small gold properties were explored in various parts of the Province, with satisfactory results in some instances.

Many prospectors were out in the hills in many parts of the Province during 1931 and many new discoveries have been reported. Only time and development will show what importance these have. Placer prospectors were numerous, particularly in the old placer camps. Most of these were men endeavouring to make a grub-stake by "sniping" and many of them were successful. A decided impetus has been given to placer-mining which should result in increased output in future years.

PROFITS OF MINING COMPANIES.

The following table shows the dividends declared by companies engaged in the mineral industry in the Province during 1930 and 1931:—

Company.	1930.	1931.
The Consolidated Mining and Smelting Co. of Canada, Ltd.	$6,519,219	$2,748,421
Premier Gold Mining Co., Ltd.	1,203,281	601,828
Howe Sound Co.*	1,984,152	1,149,572
Granby Consolidated M.S. & P. Co., Ltd.	2,362,341	674,955
Bell	1,000	4,800
Crow's Nest Pass Coal Co., Ltd.	.....	186,354
Pioneer Gold Mines of B.C., Ltd.	.....	155,223
Highland Lass, Ltd.	.....	3,081
Others	457,659	276,195
Totals	$12,527,652	$5,800,429

The Consolidated Company, besides paying the above cash dividend, declared stock dividends totalling two shares for each twenty shares of stock held.

The dividend total for 1931 is greater than would have been expected, and it is probable that the actual profits for the year were less than the dividends paid. In some instances surpluses from other years were used to maintain dividends.

* 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.

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 concentrates 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 $20.671834 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. In the last three months of 1931 considerable fluctuations in metal prices were caused by many countries going off the gold standard. Although Canada is technically still on the gold standard, Canadian money depreciated considerably in terms of United States money and appreciated in terms of English money. At a conference of mineral statisticians called by the Dominion Bureau of Statistics, the following procedure was agreed upon:—

(*a.*) Gold to be valued as usual in Canadian funds, without addition of any premium, as it is considered standard money rather than a commodity.

(*b.*) Silver and copper to be valued at the average New York price, with the last three months of the year adjusted to Canadian funds at the average exchange rate.

(*c.*) Lead and zinc to be valued at the London prices, with similar adjustment for exchange in the last three months of the year.

(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.

Since 1918 the coal production of the Province has been valued at $5 per long ton. Although prices on coal vary within wide limits for different grades and kinds, a check-up of the actual sales prices of the operators shows that a price of $4.50 a ton more closely represents the actual value. Accordingly, this price has been used in this Annual Report. In making comparisons with former years the decline in value is accentuated by this lowered price.

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

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

STATISTICAL TABLES.

TABLE I.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1931.

Gold, placer	$78,880,941
Gold, lode	143,886,905
Silver	104,682,561
Copper	271,160,891
Lead	170,360,055
Zinc	93,009,710
Coal and coke	337,977,843
Structural materials	66,092,133
Miscellaneous minerals, etc	6,679,989
Total	$1,272,731,028

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1931 (INCLUSIVE).

1852 to 1895 (inclusive)	$94,547,241	1915	$29,447,508
1896	7,507,956	1916	42,290,462
1897	10,455,268	1917	37,010,892
1898	10,906,861	1918	41,782,474
1899	12,393,131	1919	33,296,313
1900	16,344,751	1920	35,543,084
1901	20,086,780	1921	28,066,641
1902	17,486,550	1922	35,158,843
1903	17,495,954	1923	41,304,320
1904	18,977,359	1924	48,704,604
1905	22,461,325	1925	61,492,242
1906	24,980,546	1926	67,188,842
1907	25,882,560	1927	60,729,358
1908	23,851,277	1928	65,372,583
1909	24,443,025	1929	68,245,443
1910	26,377,066	1930	55,391,993
1911	23,499,072	1931	34,883,181
1912	32,440,800		
1913	30,296,398	Total	$1,272,731,028
1914	26,388,825		

TABLE III.—QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1929, 1930, AND 1931.

Description.	1929.		1930.		1931.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer ..... oz.	6,983	$118,711	8,955	$152,235	17,176	$291,992
Gold, lode ..... oz.	145,339	3,004,419	160,778	3,323,576	146,039	3,018,894
Silver ..... oz.	9,918,800	5,256,270	11,289,171	4,307,270	7,524,320	2,247,514
Copper ..... lb.	101,483,857	18,375,682	90,421,545	11,738,525	63,194,299	5,289,363
Lead ..... lb.	302,346,268	15,269,696	319,199,752	12,535,931	248,783,508	6,742,282
Zinc ..... lb.	172,096,841	9,268,792	250,287,306	9,010,093	205,071,247	5,237,520
Coal ..... tons, 2,240 lb.	2,251,252	11,256,260	1,887,130	9,435,650	1,707,590	7,684,155
Structural materials		3,921,768		4,092,568		3,553,300
Miscellaneous metals and minerals		1,773,845		796,145		818,161
Totals		$68,245,443		$55,391,993		$34,883,181

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

Names.	Divisions.			Districts.		
	1929.	1930.	1931.	1929.	1930.	1931.
	$	$	$	$	$	$
North-western District (No. 1)				10,399,015	7,752,006	5,594,130
Atlin, Stikine, and Liard	$53,612	$58,871	$177,220			
Nass River	6,901,925	4,130,233	3,101,811			
Portland Canal	3,391,066	3,502,678	2,233,739			
Skeena, Queen Charlotte, and Bella Coola	52,412	60,224	81,360			
North-eastern District (No. 2)				315,013	185,540	165,662
Cariboo and Quesnel	88,659	125,563	141,010			
Omineca and Peace River	226,354	59,977	24,652			
Central District (No. 3)				727,089	1,105,913	1,072,034
Nicola and Vernon	298,689	341,966	166,605			
Yale, Ashcroft, and Kamloops	292,046	328,142	292,604			
Lillooet and Clinton	136,354	435,805	612,825			
Southern District (No. 4)				6,166,711	3,900,183	1,593,272
Grand Forks, Greenwood, and Osoyoos	872,978	889,300	747,648			
Similkameen	5,293,733	3,010,883	845,624			
Eastern District (No. 5)				33,119,358	27,627,947	17,054,049
Fort Steele	31,596,722	25,582,617	16,644,950			
Windermere and Golden	27,056	904,041	8,900			
Ainsworth	337,318	26,931	33,647			
Slocan and Slocan City	1,029,734	128,371	35,286			
Nelson and Arrow Lake	102,392	256,387	283,115			
Trail Creek	5,475	699,253	8,490			
Revelstoke, Trout Lake, and Lardeau	20,661	30,347	39,661			
Western District (No. 6)				17,518,257	14,820,404	9,404,034
Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria (Vancouver Island)	7,867,462	7,127,594	5,475,619			
Vancouver and New Westminster (Mainland)	9,650,795	7,692,810	3,928,415			
Totals	68,245,443	55,391,993	34,883,181	68,245,443	55,391,993	34,883,181

TABLE V.—Yield of Placer Gold to Date.

1858	$705,000	1877	$1,608,182	1896	$544,026	1915	$770,000
1859	1,615,070	1878	1,275,204	1897	513,520	1916	580,500
1860	2,228,543	1879	1,290,058	1898	643,346	1917	496,000
1861	2,666,118	1880	1,013,827	1899	1,344,900	1918	320,000
1862	2,656,903	1881	1,046,737	1900	1,278,724	1919	286,500
1863	3,913,563	1882	954,085	1901	970,100	1920	221,600
1864	3,735,850	1883	794,252	1902	1,073,140	1921	233,200
1865	3,491,205	1884	736,165	1903	1,060,420	1922	364,800
1866	2,662,106	1885	713,738	1904	1,115,300	1923	420,000
1867	2,480,868	1886	903,651	1905	969,300	1924	420,750
1868	3,372,972	1887	693,709	1906	948,400	1925	280,092
1869	1,774,978	1888	616,731	1907	828,000	1926	355,503
1870	1,336,956	1889	588,923	1908	647,000	1927	156,247
1871	1,799,440	1890	490,435	1909	477,000	1928	143,208
1872	1,610,972	1891	429,811	1910	540,000	1929	118,711
1873	1,305,749	1892	399,526	1911	426,000	1930	152,235
1874	1,844,618	1893	356,131	1912	555,500	1931	291,992
1875	2,474,004	1894	405,516	1913	510,000		
1876	1,786,648	1895	481,683	1914	565,000		
					Total		$78,880,941

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	1,941,328	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	4,933,102	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	1,321,483	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	44,396,846	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	46,460,305	7,094,489	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
1929	145,339	3,004,419	9,918,800	5,256,270	101,483,857	18,375,682	302,346,268	15,269,696	172,096,841	9,268,792	51,174,859
1930	160,778	3,323,576	11,289,171	4,307,270	90,421,545	11,738,525	319,199,752	12,535,931	250,287,306	9,010,093	40,915,395
1931	146,039	3,018,894	7,524,320	2,247,514	63,194,299	5,289,363	248,783,508	6,742,282	205,071,247	5,237,520	22,535,573
Totals	6,971,767	143,886,905	179,000,177	104,682,561	1,723,162,669	271,160,891	3,372,195,599	170,360,055	1,714,639,401	93,009,710	783,100,122

TABLE VII.—PRODUCTION IN DETAIL OF THE

DISTRICTS AND DIVISIONS.	YEAR.	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
				$		$		$
North-western District (No. 1)								
Atlin	1930		3,141	53,397				
	1931		**8,384**	**142,528**				
Stikine	1930							
	1931		**11**	**187**				
Liard	1930		322	5,474				
	1931		**440**	**7,480**				
Nass River	1930	1,512,182			3,207	66,295	256,205	97,752
	1931	**1,577,700**			**3,381**	**69,891**	**272,131**	**81,285**
Portland Canal	1930	278,651			87,492	1,808,620	4,185,851	1,597,070
	1931	**271,320**			**80,883**	**1,672,000**	**1,751,894**	**523,291**
Skeena	1930		33	561				
	1931	**587**	**96**	**1,632**	**411**	**8,496**	**188**	**56**
Queen Charlotte	1930		19	323				
	1931		**27**	**459**				
Bella Coola	1930							
	1931							
North-eastern District (No. 2)								
Cariboo	1930		2,499	42,483				
	1931		**3,748**	**63,716**				
Quesnel	1930		2,187	37,179				
	1931		**2,698**	**45,880**				
Omineca	1930	3,096	147	2,499	95	1,964	71,342	27,220
	1931		**214**	**3,638**				
Peace River	1930		147	2,499				
	1931		**121**	**2,057**				
Central District (No. 3)								
Nicola	1930	17,001			3,295	68,114	73,743	28,136
	1931	**940**			**288**	**5,954**	**10,498**	**3,136**
Vernon	1930		16	272				
	1931		**18**	**306**				
Yale	1930	75	1	17	398	8,227	116	44
	1931	**52**	**22**	**374**	**168**	**3,473**	**21**	**6**
Ashcroft	1930							
	1931		**162**	**2,754**				
Kamloops	1930	21	50	850			5	2
	1931		**130**	**2,210**				
Lillooet	1930	36,540			18,067	373,478		
	1931	**32,369**	**100**	**1,700**	**28,153**	**581,974**		
Clinton	1930		83	1,411				
	1931		**141**	**2,397**				
Southern District (No. 4)								
Grand Forks	1930	36,916			9,488	196,134	356,291	135,939
	1931	**56,764**	**5**	**85**	**16,572**	**342,574**	**572,096**	**170,885**
Greenwood	1930	3,338			79	1,633	650,261	248,101
	1931	**3,145**	**6**	**102**	**170**	**3,514**	**514,971**	**153,822**
Osoyoos	1930	39,714			11,136	230,202	203	77
	1931							
Similkameen	1930	703,652	76	1,292	4,276	88,393	115,941	44,236
	1931	**70**	**262**	**4,454**	**3**	**62**	**4,817**	**1,439**
Eastern District (No. 5)								
Fort Steele	*1930	1,923,767	7	119			5,154,685	1,966,719
	1931	**1,621,718**	**181**	**3,077**			**4,206,128**	**1,256,370**
Windermere	1930							
	1931							
Golden	1930	75,117			4	83	64,657	24,669
	1931							
Ainsworth	1930	103			2	41	3,310	1,263
	1931	**12**			**14**	**289**	**254**	**76**
Slocan	1930	7,900			30	620	137,686	52,533
	1931	**2,612**			**14**	**289**	**49,454**	**14,772**
Slocan City	1930	2					237	90
	1931							
Nelson	1930	12,253	2	34	9,995	206,615	10,418	3,975
	1931	**13,155**	**80**	**1,482**	**10,383**	**214,636**	**4,477**	**1,337**
Arrow Lake	1930							
	1931		**2**	**34**				
Trail Creek	†1930	88			134	2,770	96	37
	1931	**113**	**1**	**17**	**216**	**4,465**	**710**	**212**
Revelstoke	1930	24	211	3,587			1,153	440
	1931		**272**	**4,624**				
Trout Lake	1930		11	187				
	1931							
Lardeau	1930	13			1	21	609	232
	1931							
Western District (No. 6)								
Nanaimo	1930							
	1931	**52**			**19**	**393**	**136**	**41**
Alberni	1930							
	1931							
Clayoquot	1930	1			17	351	17	6
	1931		**16**	**272**				
Quatsino	1930							
	1931		**1**	**17**				
Victoria	1930		3	51				
	1931		**8**	**136**				
New Westminster	1930							
	1931		**24**	**408**				
Vancouver	1930	1,920,905			13,062	270,015	206,345	78,729
	1931	**1,968,484**			**5,364**	**110,884**	**136,547**	**40,786**
Totals	1930	6,803,846	8,955	152,235	160,778	3,323,576	11,289,171	4,307,270
	1931	**5,549,103**	**17,176**	**291,992**	**146,039**	**3,018,894**	**7,524,320**	**2,247,514**

* Includes some production from Sullivan mine in 1929; zinc concentrates not treated until 1930.
† Production from slags and residues at Trail plant, which cannot be credited to individual mines.

METALLIFEROUS MINES FOR 1930 AND 1931.

COPPER.		LEAD.		ZINC.		TOTALS FOR DIVISIONS.		TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1930.	1931.	1931.
	$		$		$	$	$	$
.....	.....	.....	.....	.....	.....	.....	.....	5,494,999
.....	.....	.....	.....	.....	.....	53,397	.....	.....
.....	.....	.....	.....	.....	.....	.....	142,528	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	187	.....
.....	.....	.....	.....	.....	.....	5,474	.....	.....
.....	.....	.....	.....	.....	.....	.....	7,480	.....
30,551,423	3,966,186	.....	.....	.....	.....	4,130,233	.....	.....
35,235,910	2,949,246	.....	.....	.....	.....	.....	3,100,422	.....
50,649	6,575	2,302,170	90,413	.....	.....	3,502,678	.....	.....
3,671	307	1,404,416	38,061	3,116	80	.....	2,233,739	.....
.....	.....	.....	.....	.....	.....	561	.....	.....
.....	.....	.....	.....	.....	.....	.....	10,184	.....
.....	.....	.....	.....	.....	.....	323	.....	.....
.....	.....	.....	.....	.....	.....	.....	459	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	115,277
.....	.....	.....	.....	.....	.....	42,483	.....	.....
.....	.....	.....	.....	.....	.....	.....	63,716	.....
.....	.....	.....	.....	.....	.....	37,179	.....	.....
.....	.....	.....	.....	.....	.....	.....	45,866	.....
.....	.....	237,354	9,322	173,388	6,242	47,247	.....	.....
.....	.....	.....	.....	.....	.....	.....	3,638	.....
.....	.....	.....	.....	.....	.....	2,499	.....	.....
.....	.....	.....	.....	.....	.....	.....	2,057	.....
.....	.....	.....	.....	.....	.....	.....	.....	607,434
30,035	3,899	576,667	22,647	.....	.....	122,796	.....	.....
5,609	469	87,527	2,372	12,080	308	.....	12,240	.....
.....	.....	.....	.....	.....	.....	272	.....	.....
.....	.....	.....	.....	.....	.....	.....	308	.....
.....	.....	.....	.....	.....	.....	8,288	.....	.....
.....	.....	.....	.....	.....	.....	.....	3,853	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	2,754	.....
1,200	156	.....	.....	.....	.....	1,008	.....	.....
.....	.....	.....	.....	.....	.....	.....	2,210	.....
.....	.....	.....	.....	.....	.....	373,478	.....	.....
.....	.....	.....	.....	.....	.....	.....	583,674	.....
.....	.....	.....	.....	.....	.....	1,411	.....	.....
.....	.....	.....	.....	.....	.....	.....	2,397	.....
.....	.....	.....	.....	.....	.....	.....	.....	700,959
.....	.....	42,701	1,677	.....	.....	333,750	.....	.....
.....	.....	61,301	1,661	93,538	2,389	.....	517,594	.....
.....	.....	276,193	10,847	.....	.....	260,581	.....	.....
.....	.....	290,139	7,863	420,284	10,734	.....	176,035	.....
3,773	490	664	26	.....	.....	230,795	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
15,489,798	2,010,885	79,400	3,118	.....	.....	2,147,924	.....	.....
.....	.....	45,469	1,232	5,602	143	.....	7,330	.....
.....	.....	.....	.....	.....	.....	.....	.....	13,412,489
.....	.....	301,844,470	11,854,338	218,984,983	7,883,240	21,704,416	.....	.....
.....	.....	246,228,200	6,673,031	204,252,068	5,216,598	.....	13,149,076	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	12,115,425	475,809	11,186,792	402,713	903,274	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	72,257	2,838	15,859	571	4,713	.....	.....
.....	.....	4,190	114	1,844	47	.....	526	.....
.....	.....	1,200,584	47,150	774,818	27,893	128,196	.....	.....
.....	.....	492,650	13,351	269,150	6,874	.....	35,286	.....
.....	.....	127	5	.....	.....	95	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	111,294	4,371	.....	.....	214,995	.....	.....
.....	.....	17,259	468	13,565	346	.....	218,249	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	34	.....
.....	.....	.....	.....	19,151,466	689,434	692,241	.....	.....
.....	.....	.....	.....	.....	.....	.....	4,894	.....
.....	.....	25,866	1,016	.....	.....	5,043	.....	.....
.....	.....	.....	.....	.....	.....	.....	4,624	.....
.....	.....	.....	.....	.....	.....	187	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	6,198	243	.....	.....	496	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	2,496,407
.....	.....	.....	.....	.....	.....	.....	.....	.....
5,085	426	.....	.....	.....	.....	.....	860	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
21	3	.....	.....	.....	.....	360	.....	.....
.....	.....	.....	.....	.....	.....	.....	272	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	17	.....
.....	.....	.....	.....	.....	.....	51	.....	.....
.....	.....	.....	.....	.....	.....	.....	136	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	408	.....
44,294,646	5,750,331	308,887	12,111	.....	.....	6,111,186	.....	.....
27,944,024	2,338,915	152,957	4,128	.....	.....	.....	2,494,714	.....
90,421,545	11,738,525	319,199,752	12,535,931	250,287,306	9,010,093	41,067,630	.....	.....
63,194,298	5,289,363	248,783,508	6,742,282	205,071,247	5,287,520	.....	22,827,565	22,827,565

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

	Tons (2,240 lb.)	Value.		Tons (2,240 lb.)	Value.
1836–1885	3,029,011	$9,468,557	1909	2,006,476	$7,022,666
1886	326,636	979,908	1910	2,800,046	9,800,161
1887	413,360	1,240,080	1911	2,193,062	7,675,717
1888	489,301	1,467,903	1912	2,628,804	9,200,814
1889	579,830	1,739,490	1913	2,137,483	7,481,190
1890	678,140	2,034,420	1914	1,810,967	6,338,385
1891	1,029,097	3,087,291	1915	1,611,129	5,638,952
1892	826,335	2,479,005	1916	2,084,093	7,294,325
1893	978,294	2,934,882	1917	2,149,975	7,524,913
1894	1,012,953	3,038,859	1918	2,302,245	11,511,225
1895	939,654	2,818,962	1919	2,267,541	11,337,705
1896	896,222	2,688,666	1920	2,595,125	12,975,625
1897	882,854	2,648,562	1921	2,483,995	12,419,975
1898	1,135,865	3,407,595	1922	2,511,843	12,559,215
1899	1,306,324	3,918,972	1923	2,453,223	12,266,115
1900	1,439,595	4,318,785	1924	1,939,526	9,697,630
1901	1,460,331	4,380,993	1925	2,328,522	11,642,610
1902	1,397,394	4,192,182	1926	2,330,036	11,650,180
1903	1,168,194	3,504,582	1927	2,453,827	12,269,135
1904	1,253,628	3,760,884	1928	2,526,702	12,633,510
1905	1,384,312	4,152,936	1929	2,251,252	11,256,260
1906	1,517,303	4,551,909	1930	1,887,130	9,435,650
1907	1,800,067	6,300,235	1931	1,707,590	7,684,155
1908	1,677,849	5,872,472			
			Totals	79,083,141	$312,304,243

* 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.

	Tons (2,240 lb.)	Value.		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, 1930 and 1931.

Description.	1930.		1931.	
	Quantity.	Value.	Quantity.	Value.
Coal used in making coke, long tons	200,989	$1,002,684	168,722	$924,279
Coke made in bee-hive ovens, long tons	65,810	$558,801	65,410	$548,550
Coke made in by-product ovens, long tons	28,458	298,004	24,751	236,537
Coke made in gas plants, long tons	40,811	232,917	37,359	210,470
Total coke made, long tons	135,079	$1,089,722	127,520	$995,557
Gas produced	.....	1,547,092	.....	1,541,454
Tar produced	.....	65,770	.....	66,506
Other by-products	.....	11,935	.....	32,603
Total production value of coke industry	.....	$2,714,519	.....	$2,636,120

TABLE XI.—PRODUCTION IN DETAIL OF STRUCTURAL MATERIALS, 1931.

District and Division.	Cement.	Lime and Lime-stone.	Building-stone.	Riprap and Crushed Rock.	Sand and Gravel.	Pottery and Tile.	Clay.	Fire-brick.	Face, Paving, and Sewer Brick.	Red Brick.	Totals, Divisions.	Totals, Districts.
	$	$	$	$	$	$	$	$	$	$	$	$
North-western District (No. 1)												97,742
Atlin, Liard, and Stikine				11,250	15,775						27,025	
Nass River												
Portland Canal												
Skeena and Queen Charlotte				11,626	18,593						30,219	
Bella Coola		37,511		150	2,837						40,498	
North-eastern District (No. 2)												37,337
Cariboo and Quesnel					26,070		2,818			270	29,158	
Omineca and Peace River					6,679					1,500	8,179	
Central District (No. 3)												150,486
Nicola and Vernon			4,400		13,318	230				6,160	24,108	
Yale, Ashcroft, and Kamloops				16,845	89,039						105,884	
Lillooet and Clinton					20,494						20,494	
Southern District (No. 4)												43,150
Grand Forks and Greenwood					16,365					† 10,000	26,365	
Osoyoos					7,150						7,150	
Similkameen					9,635						9,635	
Eastern District (No. 5)												211,786
Fort Steele			5,000	30,798	30,302						66,100	
Windermere and Golden					8,900						8,900	
Ainsworth			6,253	6,400	20,468						33,121	
Slocan and Slocan City												
Nelson		1,250	7,492		56,090						64,832	
Trail Creek					3,796						3,796	
Revelstoke				600	34,437						35,037	
Western District (No. 6)												3,012,799
Nanaimo and Alberni		245,660	163,634	140	30,721					28,767	468,922	
Victoria and Quatsino	1,044,851	31,489		28,103	97,680	13,048			401	33,492	1,249,064	
Vancouver	127,698		42,040	147,531	172,572	10,000					499,841	
New Westminster				115,908	280,243	182,016	7,366	99,672	56,018	53,749	794,972	
Totals	1,172,549	315,910	228,819	369,351	961,164	205,294	10,184	99,672	56,419	*133,938	3,553,300	3,553,300

* Includes $3,500 sand-lime brick, estimated. † Estimated.

TABLE XII.—PRODUCTION IN DETAIL OF MISCELLANEOUS METALS AND MINERALS, 1931.

District and Division.	Bentonite.	Bismuth.	Cadmium.	Diatomite.	Flux (Lime and Quartz).	Gypsite.	Gypsum.	Iron (Bog).	Platinum.	Selenium.	Shale.	Soda.	Sulphur Content of Pyrite and Sulphuric Acid manufactured.	Talc.	Division.	District.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
North-western District (No. 1)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,389
Atlin, Liard, and Stikine	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nass River	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,389	.....	.....	.....	.....	1,389	.....
Portland Canal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Skeena and Queen Charlotte	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bella Coola	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
North-eastern District (No. 2)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,270
Cariboo and Quesnel	.....	.....	.....	2,270	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,270	.....
Omineca and Peace River	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Central District (No. 3)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	184,163
Nicola and Vernon	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Yale, Ashcroft, and Kamloops	.....	.....	.....	.....	.....	1,600	175,343	.....	.....	.....	.....	960	.....	.....	177,903	.....
Lillooet and Clinton	.....	.....	.....	.....	.....	1,328	.....	.....	.....	.....	.....	4,932	.....	.....	6,260	.....
Southern District (No. 4)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25,816
Grand Forks and Greenwood	.....	.....	.....	.....	18,687	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,687	.....
Osoyoos	.....	.....	.....	.....	1,817	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,817	.....
Similkameen	3,529	.....	.....	.....	.....	.....	.....	.....	1,783	.....	.....	.....	.....	.....	5,312	.....
Eastern District (No. 5)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	453,357
Fort Steele	.....	154,118	180,958	.....	.....	.....	.....	.....	.....	.....	.....	.....	118,281	.....	453,357	.....
Windermere and Golden	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ainsworth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Slocan and Slocan City	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nelson and Arrow Lake	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Trail Creek	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Revelstoke	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Western District (No. 6)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	151,166
Nanaimo	.....	.....	.....	.....	7,086	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,086	.....
Victoria and Quatsino	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,000	.....	.....	600	5,600	.....
Vancouver	.....	.....	.....	.....	.....	.....	.....	1,000	.....	.....	.....	.....	137,480	.....	138,480	.....
New Westminster	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	3,529	154,118	180,958	2,270	27,590	2,928	175,343	1,000	1,783	1,389	5,000	5,892	255,761	600	818,161	818,161

TABLE XIII.

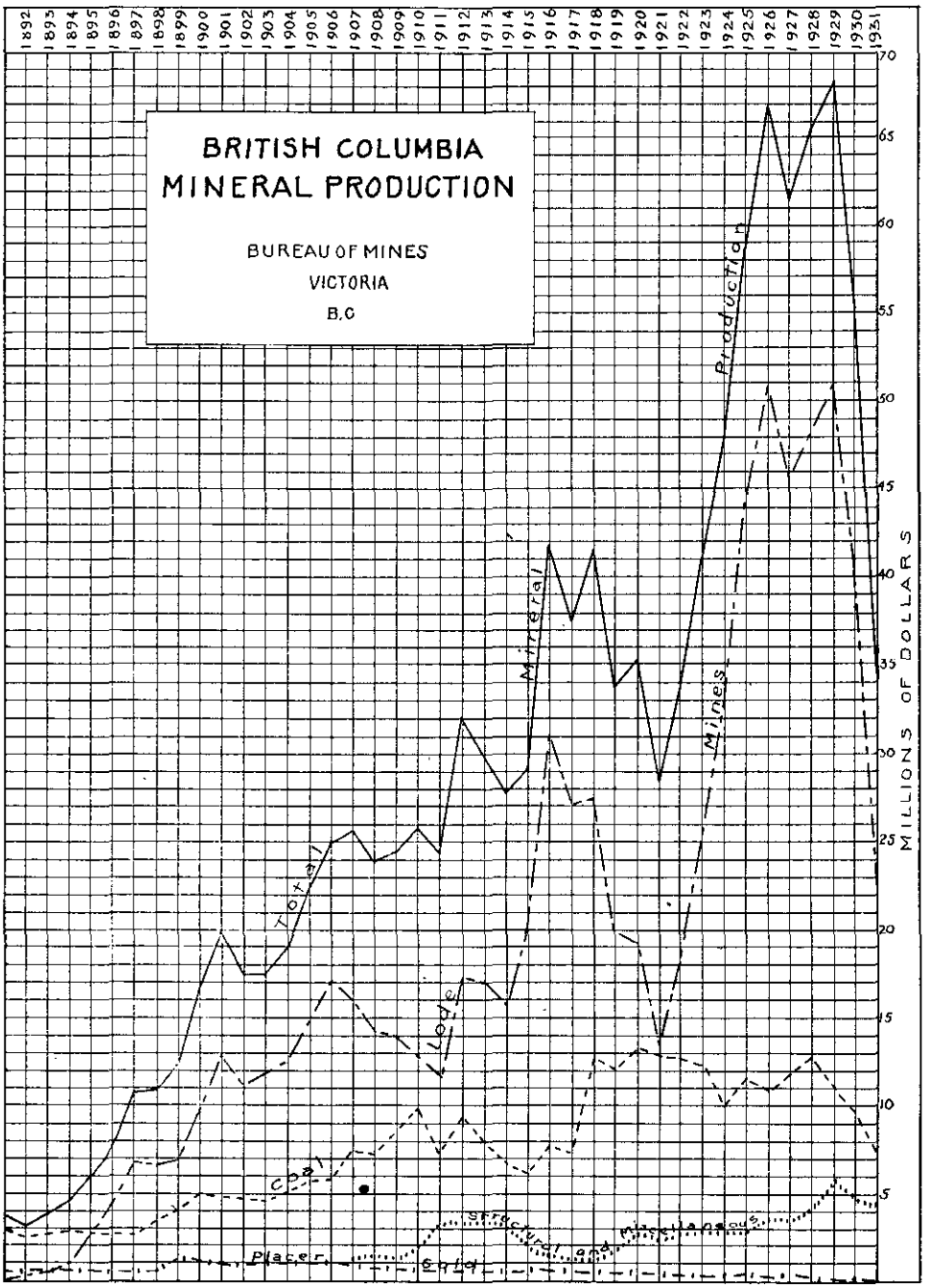

BRITISH COLUMBIA
MINERAL PRODUCTION
BUREAU OF MINES
VICTORIA
B.C
1892 1893 1894 1895 1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931
70 65 60 55 50 45 40 35 30 25 20 15 10 5
MILLIONS OF DOLLARS
Production
Mineral
Mines
Total
Lode
Coal
Placer
Structural materials
Miscellaneous

TABLE XIV.

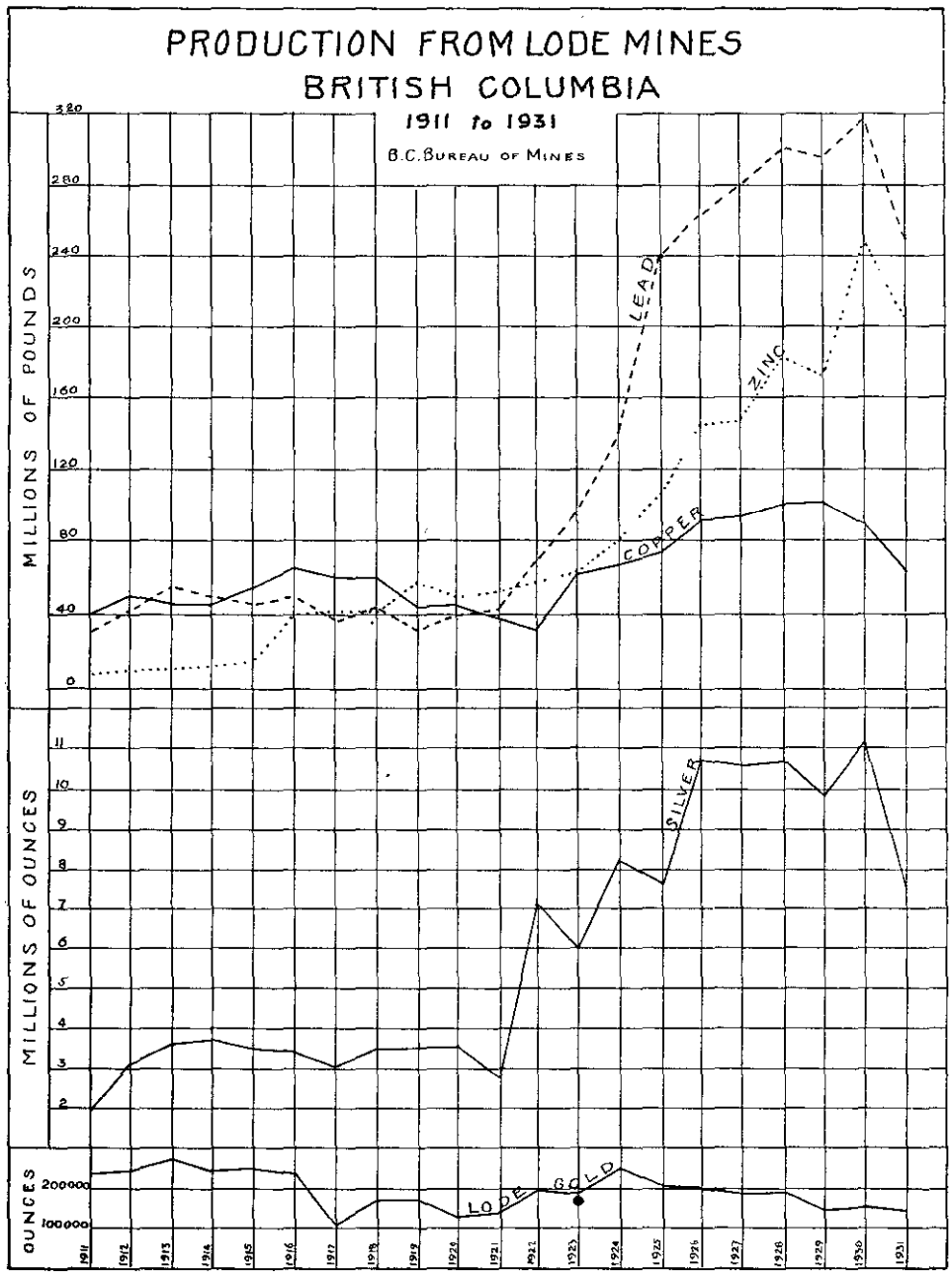

PRODUCTION FROM LODE MINES
BRITISH COLUMBIA
1911 to 1931
B.C. Bureau of Mines
MILLIONS OF POUNDS
320
280
240
200
160
120
80
40
0
LEAD
ZINC
COPPER
MILLIONS OF OUNCES
11
10
9
8
7
6
5
4
3
2
SILVER
OUNCES
200000
100000
LODE GOLD
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931

TABLE XV.—MEN EMPLOYED IN THE MINERAL INDUSTRY OF BRITISH COLUMBIA, 1931.

District.	Placer-mining.	Lode-mining.			In Concentrators.	In Smelters.	Coal-mining.			Structural Materials.		Miscellaneous.	Total.
		Under.	Above.	Total.			Under.	Above.	Total.	Quarries.	Plants.		
No. 1	187	548	267	815	111	339	.....	.....	.....	18	6	13	1,489
No. 2	273	9	10	19	.....	.....	9	2	11	5	6	2	316
No. 3	98	76	63	139	18	.....	75	30	105	48	13	6	427
No. 4	48	77	47	124	9	.....	297	146	443	8	2	2	636
No. 5	59	457	272	729	279	2,818	909	302	1,211	37	3	70	5,206
No. 6	23	296	175	471	164	.....	1,667	645	2,312	344	496	287	4,097
Totals	688	1,463	834	2,297	581	3,157	2,957	1,125	4,082	460	526	380	12,171

TABLE XVI.—TONNAGE, NUMBER OF MINES, AND NET VALUE OF LODE MINERALS, 1931.

District.	Tonnage.	No. of Shipping Mines, 1931.	No. of Mines shipping over 100 Tons.	Net Value of Lode Minerals produced.
No. 1	1,849,607	7	7	$2,385,329
No. 2	.....	....	....	.....
No. 3	33,361	4	2	593,536
No. 4	59,979	10	5	645,639
No. 5	1,637,610	21	7	4,329,670
No. 6	1,968,546	2	1	1,559,757
Totals	5,549,103	44	22	$9,513,931

METALLIFEROUS MINES SHIPPING IN 1931.

NORTH-WESTERN DISTRICT (No. 1).

Mine or Group.	Mining Division.	Locality.	Owner or Agent and Address.	Character of Ore.
Hidden Creek	Nass River	Anyox	Granby Cons. M.S. & P. Co., Vancouver	Copper, silver, gold.
Bonanza	Nass River	Anyox	Ditto	Copper, silver, gold.
Big Missouri	Portland Canal	Stewart	Cons. M. & S. Co. of Canada, Ltd., Trail	Gold, silver, zinc, lead.
Porter-Idaho	Portland Canal	Glacier creek	Porter-Idaho Mining Co., Ltd., Premier	Silver, gold, lead.
Premier	Portland Canal	Cascade river	Premier Gold Mining Co., Ltd., Premier	Gold, silver, lead.
Prosperity	Portland Canal	Marmot river	Ditto	Silver, gold, lead.
Surf Point	Skeena	Porcher island	J. B. Woodworth, Agt., Vancouver	Gold, silver.

CENTRAL DISTRICT (No. 3).

Pioneer	Lillooet	Cadwallader ck	Pioneer Gold Mines of B.C., Ltd., Vancouver	Gold, silver.
Planet	Nicola	Stump lake	Planet Mines & Reduction Co. of Nicola, Ltd., Vancouver	Silver, gold, copper, lead, zinc.
Aurum	Yale	Verona	Aurum Mines, Ltd., Vancouver	Gold, silver.
Dawson	Yale	Verona	Dawson Gold Mines, Ltd., Vancouver	Gold, silver.

Southern District (No. 4).

Mine or Group.	Mining Division.	Locality.	Owner or Agent and Address.	Character of Ore.
Bell	Greenwood	Beaverdell	Bell Mines, Ltd., Creston	Silver, gold, lead.
Butcher Boy	Greenwood	Carmi	James Kerr, Carmi	Gold, silver, zinc.
Gold Drop	Greenwood	Greenwood	Fritz and McArthur, Midway	Gold, silver.
Highland Lass	Greenwood	Beaverdell	Highland Lass, Ltd., Kelowna	Silver, gold, lead, zinc.
Sally	Greenwood	Beaverdell	Sally Mines, Ltd., Penticton	Silver, gold, lead, zinc.
Wellington	Greenwood	Beaverdell	Beaverdell-Wellington Syndicate, Ltd., Greenwood	Silver, gold, zinc, lead.
Union	Grand Forks	Granby river	James F. McCarthy, Grand Forks	Gold, silver, lead, zinc.
Waterloo	Grand Forks	Edgewood	Waterloo Gold Mines, Ltd., Penticton	Gold, silver, lead, zinc.
Copper Basin	Similkameen	Whipsaw creek	Copper Basin Mines, Ltd., Vancouver	Silver, gold, copper.
Mary E.	Similkameen	Treasure mtn.	W. B. Dornberg, Vancouver	Silver, lead, zinc.

Eastern District (No. 5).

Sullivan	Fort Steele	Kimberley	Cons. M. & S. Co. of Canada, Ltd., Trail	Silver, lead, zinc.
Davenport, or Flint	Ainsworth	Dago creek	James A. Carter, Kaslo	Silver, lead, zinc.
Little Daisy	Ainsworth	8-Mile creek	Henry Aylwin, New Denver	Gold.
Grey Copper	Slocan	Sandon	Joe Miciewic, Sandon	Silver, gold, lead, zinc.
Ivanhoe	Slocan	Sandon	Clyde B. White, Agt., New Denver	Silver, lead, zinc.
Leadsmith	Slocan	Sandon	Leadsmith Mines, Ltd., Spokane	Silver, lead, zinc.
Ruth-Hope	Slocan	Sandon	Ruth-Hope Mining Co., Vancouver	Silver, gold, lead, zinc.
Silversmith	Slocan	Sandon	A. K. Olson and O. J. Olson, Sandon	Silver, gold, lead, zinc.
Standard	Slocan	Sandon	Western Exploration Co., Silverton	Silver, gold, lead, zinc.
Catherine	Nelson	Nelson	Godfrey Birtsch, Nelson	Gold, silver, lead, zinc.
Clubine	Nelson	Erie	Clubine Comstock Gold Mines, Spokane	Gold, silver.
Gold King	Nelson	Nelson	A. R. McGregor, Crawford Bay	Gold, silver.
Golden Age	Nelson	Nelson	Golden Age Mining Co., Nelson	Gold, silver.
Euphrates	Nelson	Nelson	Euphrates Mining Co., Nelson	Gold, silver.
Perrier	Nelson	Nelson	British American Explorers Syndicate, Nelson	Gold, silver, lead, zinc.
Reno	Nelson	Sheep creek	Reno Gold Mines, Ltd., Nelson	Gold, silver, lead, zinc.
Second Relief	Nelson	Erie	Relief-Arlington Mines, Ltd., Erie	Gold, silver.
Ymir-Wilcox	Nelson	Ymir	F. A. Hibbard, Ymir	Gold, silver, lead, zinc.
I.X.L.	Trail Creek	Rossland	I.X.L. Syndicate, Rossland	Gold, silver.
Midnight	Trail Creek	Rossland	Midnight Mining Syndicate	Gold, silver.
Snowdrop	Trail Creek	Rossland	Harry Leferve, Rossland	Gold, silver.

Western District (No. 6).

Britannia	Vancouver	Britannia Beach	Britannia M. & S. Co., Britannia Beach	Copper, gold, silver, lead.
Lasqueti	Nanaimo	Lasqueti island	Lasco Development Co., Ltd., Vancouver	Gold, silver, copper.

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.*

GEO. O'BRIEN, *District Inspector*, Nanaimo.
T. R. JACKSON, *District Inspector*, Nanaimo.
ROBERT STRACHAN, *District Inspector*, Fernie.
JOHN MCDONALD, *District Inspector*, Fernie.
JOHN G. BIGGS, *District Inspector*, Merritt.
CHAS. GRAHAM, *Dist. Inspector*, Prince Rupert.
JAS. STRANG, *Inspector and Examiner*, Victoria.
H. E. MIARD, *Inspector and Examiner*, Fernie.

Resident Mining Engineers.

J. T. MANDY, No. 1 District, Prince Rupert.
DOUGLAS LAY, No. 2 District, Hazelton.
P. B. FREELAND, No. 3 District, Penticton. / No. 4 District, Penticton.
B. T. O'GRADY, No. 5 District, Nelson.
A. M. RICHMOND, Assistant Resident Engineer, No. 5 District, Nelson.
GEO. A. CLOTHIER, No. 6 District, Vancouver.

Descriptions of the functions of the Department of Mines and its various branches have been printed in previous Annual Reports and are not repeated in this report. No changes occurred during 1931 in personnel or functions of the Department. This Annual Report has been condensed as much as was practicable in order to economize on expenditure. In so far as possible, material printed in previous Annual Reports has not been reprinted, but it is believed that the main information desired by the public is contained herein. Any information not included which is available in any branch of the Department will be furnished to those writing for it.

In June, 1931, A. M. Richmond, Assistant Resident Engineer, No. 5 District, with headquarters at Nelson, was transferred to Victoria for the purpose of commencing a survey of non-metallic minerals of the Province. This survey, embracing field examination of deposits, and a study of markets both in the Province and without, is proceeding. A series of mimeographed bulletins on each particular mineral will be issued. No. 1 of this series, "Barite in British Columbia," has been issued and is available for those interested. Others will be issued in the near future.

ASSAY OFFICE.

REPORT BY D. E. WHITTAKER, PROVINCIAL ASSAYER.

During the year 1931 there were made by the staff in the Government Assay Office 3,869 assays or quantitative determinations and 525 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	$268.00
Fees for assaying	44.57
Fees for assayers' examinations	150.00
Total cash receipts	$462.57

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

Attorney-General's Department	$483.00
Agricultural Department	5,265.00
Board of Health	640.00
Treasury Department	15.00
Forest Branch	410.00
Other departments	145.00
	$6,958.00
Value of work done outside of Mines Department work	$7,420.57

The value of gold melted during the year 1931 was $399 in 10 lots, as compared with $810 in 8 lots in 1930.

FREE DETERMINATIONS.

In addition to the above quantitative work, about 2,250 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.

A meeting of the Board of Examiners was held on May 22nd and December 7th, 1931. Four candidates applied for examination on May 22nd and three passed the examination on that date. One candidate applied for examination on December 7th and passed the examination on that date. The Board recommended that certificates be issued to the above-mentioned four candidates.

In accordance with the recommendation of the Board, certificates have been duly issued by the Honourable the Minister of Mines to the four following successful candidates: D. S. Brake, J. S. Schofield, M. Trewhella, and I. Wetherup.

A list of licensed assayers up to date was given in the 1930 Annual Report.

GOLD COMMISSIONERS AND MINING RECORDERS.

The following list shows the Gold Commissioners and Mining Recorders of the Province, revised to April, 1932:—

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Deputy Recorder.
Atlin	Atlin	W. W. Wright	W. W. Wright	J. G. Garrett.
Sub-office	Telegraph Creek			H. W. Dodd.
Sub-office	Haines (U.S.)		(Com. for taking Affidavits)	B. A. Barnett.
Sub-office	Squaw Creek via Atlin			Mrs. F. Muncaster.
Sub-office	Tulsequah			H. L. Fraser.
Sub-office	Juneau (U.S.)		(Com. for taking Affidavits)	Harold E. Brown.
Stikine	Telegraph Creek	H. W. Dodd	H. W. Dodd	
Sub-office	Boundary via Telegraph Creek			W. R. Overend.
Liard	Telegraph Creek	H. W. Dodd	H. W. Dodd	A. J. Marion.
Sub-office	Porter Landing			L. F. Murphy.
Sub-office	McDame Creek			F. W. Beatton.
Sub-office	Fort St. John			J. S. Clark.
Sub-office	Fort Nelson			
Skeena	Prince Rupert	N. A. Watt	N. A. Watt	Chas. E. Moore.
Sub-office	Kitimat			O. T. Sundal.
Sub-office	Terrace			J. P. Scarlett.
Sub-office	Stewart (Portland Canal)			Percy Gadsden.
Sub-office	Kimsquit			
Nass River	Anyox	N. A. Watt	E. Ross Oatman	Mrs. L. Cummings.
Sub-office	Alice Arm			
Portland Canal	Stewart	N. A. Watt (at Prince Rupert)	J. P. Scarlett	

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Deputy Recorder.
Bella Coola	Prince Rupert	N. A. Watt	N. A. Watt	
Sub-office	Bella Coola			C. A. Brynildsen.
Sub-office	Bella Bella			
Sub-office	Ocean Falls			Geo. H. Hill.
Sub-office	Kimsquit			Percy Gadsden.
Queen Charlotte	Queen Charlotte	N. A. Watt	G. A. Charter, M.D.	
Sub-office	Jedway			W. T. Reavley.
Sub-office	Masset			J. C. S. Dunn, M.D.
Sub-office	Lockeport			Jas. S. Edkins.
Omineca	Smithers	H. B. Campbell	H. B. Campbell	
Sub-office	Fort Grahame			H. Ravenal, Act'g.
Sub-office	Bella Coola			C. A. Brynildsen.
Sub-office	Finlay Forks			A. MacKinnon.
Sub-office	Fort St. James			Alec. Kynoch.
Sub-office	Manson Creek			W. B. Steele.
Sub-office	Telkwa			T. J. Thorp.
Sub-office	Prince George			Geo. Milburn.
Sub-office	Hudson Hope			F. F. Monteith.
Sub-office	Kimsquit			Percy Gadsden.
Sub-office	Fort St. John			F. W. Beatton.
Sub-office	Whitewater (Finlay River)			John Melnyk.
Sub-office	Cedarvale			John Thompson.
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	Takla Landing			Mrs. Wilhemina Aiken.
Sub-office	McConnell Creek			H. K. Henry.
Peace River	Fort St. John	S. H. Hoskins (at Smithers)	F. W. Beatton	
Sub-office	Prince George			G. Milburn.
Sub-office	Finlay Forks			
Sub-office	Hudson Hope			F. F. Monteith.
Sub-office	Pouce Coupe			M. S. Morrell.
Cariboo	Barkerville	R. F. Ure	R. F. Ure	
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			R. F. Ure.
Clinton	Clinton	R. J. A. Dorrell	R. J. A. Dorrell	
Sub-office	Williams Lake			L. C. Maclure.
Sub-office	Haylmore via Bralorne			W. Haylmore.
Lillooet	Lillooet	L. J. Price	L. J. Price	R. W. Melton.
Sub-office	Haylmore via Bralorne			W. Haylmore.
Kamloops	Kamloops	E. Fisher	E. Fisher	
Sub-office	Chu Chua			George Fennell.
Sub-office	Vavenby			H. Finley.
Sub-office	Salmon Arm			A. P. Suckling.
Ashcroft	Ashcroft	E. Fisher (at Kam.)	R. G. Cowper	
Sub-office	Lytton			A. Dryden.
Nicola	Merritt	E. Fisher (at Kam.)	A. G. Freeze	
Yale	Hope	E. Fisher (at Kam.)	C. A. W. Lethbridge	J. W. Chadwick.
Similkameen	Princeton	L. A. Dodd	L. A. Dodd	
Sub-office	Hedley			R. E. Baxter.
Vernon	Vernon	R. M. McGusty	R. M. McGusty	J. G. Simms.
Sub-office	Kelowna			C. W. Dickson.
Greenwood	Greenwood	Chas. Nichols	Chas. Nichols	
Sub-office	Rock Creek			S. A. H. Brew.
Sub-office	Beaverdell			T. W. Clarke.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Deputy Recorder.
Grand Forks	Grand Forks	E. Harrison	E. Harrison	
Osoyoos	Penticton	W. R. Dewdney	W. R. Dewdney	
Sub-office	Keremeos			L. S. Coleman.
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	A. A. Robertson	J. E. Kennedy	
Sub-office	Fernie			S. B. Hamilton.
Ainsworth	Kaslo	Ronald Hewat	A. W. Anderson	
Sub-office	Howser			J. F. Thompson.
Sub-office	Trout Lake			H. Macpherson.
Sub-office	Poplar			Arthur G. Johnston.
Slocan	New Denver	Ronald Hewat (at Kaslo)	Frank Broughton	
Sub-office	Sandon			W. J. Parham.
Slocan City	Slocan	Ronald Hewat	T. McNeish	
Nelson	Nelson	J. Cartmel	J. Cartmel	
Sub-office	Creston			R. H. Hassard.
Sub-office	Ymir			Wm. Clark.
Sub-office	Salmo			M. C. Donaldson.
Arrow Lake	Nakusp	J. Cartmel (at Nelson)	Walter Scott	
Revelstoke	Revelstoke	Wynfield Maxwell	W. Maxwell	
Lardeau	Beaton	Wynfield Maxwell (at Revelstoke)	H. J. Gunterman	Mrs. H. J. Gunterman.
Sub-office	Trout Lake			H. Macpherson.
Trail Creek	Rossland	W. H. Reid	W. H. Reid	
Nanaimo	Nanaimo	C. L. Munroe	C. L. Munroe	
Sub-office	Ladysmith			J. A. Knight.
Sub-office	Alert Bay			Ernest H. Robinson.
Sub-office	Vananda			Leonard Raper.
Sub-office	Granite Bay			Henry Twidle.
Sub-office	Powell River			A. C. Sutton.
Alberni	Alberni	W. H. Boothroyd	W. H. Boothroyd	
Clayoquot	Clayoquot	W. H. Boothroyd (at Alberni)	W. T. Dawley	
Quatsino	Quatsino	Ditto	Ed. Evenson	
Victoria	Victoria	R. J. Steenson	R. J. Steenson	
New Westminster	New Westminster	A. P. Grant	A. B. Gray	
Sub-office	Harrison Lake			L. A. Agassiz.
Sub-office	Chilliwack			Chas. J. Whittaker.
Vancouver	Vancouver	John Mahony	R. A. Burgoyne	

GOLD COMMISSIONERS' AND MINING RECORDERS' OFFICE STATISTICS, 1931.

Districts and Divisions.	Free Miners' Certificates.			Lode-mining.					Placer-mining.				Revenue.		Total.	
	Individual.	Company.	Special.	Mineral Claims recorded.	Certificates of Work.	Bills of Sale, etc.	Certificates of Improvements.	Leases of Re-verted Crown-granted Mineral Claims.	Placer Claims recorded.	Placer Leases granted (Bench, Creek, and Dredging).	Certificates of Work, Placer Claims and Leases.	Bills of Sale, etc.	Free Miners' Certificates.	General.	Mining Divisions.	Districts.
North-western District (No. 1)																**$24,335.15**
Atlin	331	5	6	226	310	49	11		5	14	254	20	$2,104.00	$7,345.45	$9,449.45	
Stikine	125			6	68	15					4		605.00	732.50	1,337.50	
Liard	33	3	1						8	7	50	14	330.00	2,299.00	2,629.00	
Nass River	100	2	2	50	228	39	5						836.25	814.05	1,650.30	
Portland Canal	219	6	1	272	643	44	32					4	1,638.75	3,207.65	4,846.40	
Skeena	302	2		99	127	6	1		11	1	1		1,454.25	2,440.75	3,895.00	
Queen Charlotte	68	1		19	20				23	23		2	277.50	135.50	413.00	
Bella Coola	18				2	7							84.25	30.25	114.50	
North-eastern District (No. 2)																**39,692.70**
Cariboo	576	6	3	155	151	55	11		39	93	97	80	3,086.25	12,167.10	15,253.35	
Quesnel	465	2	1	27	43	4			2	92	128	106	1,446.50	8,614.02	10,060.52	
Omineca	626	12	1	275	1,010	49	18		66	39	42	218	4,465.00	9,856.33	14,321.33	
Peace River										1	1			57.50	57.50	
Central District (No. 3)																**27,339.95**
Nicola	120			67	108	26	3			5		10	437.00	1,033.75	1,470.75	
Vernon	402	3	1	63	49	7			8	3	5	8	1,809.25	771.50	2,580.75	
Yale	228	6		128	379	68			16	8	10	11	1,438.75	2,538.60	3,977.35	
Ashcroft	102	1		102	59	17			4	7	4	13	541.25	1,014.10	1,555.35	
Kamloops	503	4	1	256	260	10		1	7	15	53	11	2,448.00	3,362.05	5,810.05	
Lillooet	240	6	3	316	327	78	21	14	12	15	61	30	1,714.75	8,474.70	10,189.45	
Clinton	90	1	2	64	76	13	2	1	14	25	1	23	439.00	1,317.25	1,756.25	
Southern District (No. 4)																**9,795.55**
Grand Forks	59			33	75	7		3					275.00	376.95	651.95	
Greenwood	175	1		75	152	40	1	16	9	18	1	19	773.50	2,236.90	3,010.40	
Osoyoos	116	2		23	47	3		4					722.50	304.50	1,027.00	
Similkameen	177	2		68	247	22	3	4	13	25	47	78	1,128.50	3,977.70	5,106.20	
Eastern District (No. 5)																**21,227.50**
Fort Steele	176	6		52	120	6			8	13	10	34	1,386.00	2,464.50	3,850.50	
Windermere	65			28	81	23			2	2		15	405.25	644.00	1,049.25	
Golden	103	4	2	33	56	28			2	1			977.75	863.75	1,841.50	
Ainsworth	146	4		65	179	18	1	3	6	1			967.75	935.20	1,902.95	
Slocan	69	4		11	113	30	13						773.85	786.00	1,559.85	
Slocan City	47			39	74	8	4						232.25	425.65	657.90	
Nelson	387	11	1	191	359	36	10	11	15		4		2,663.50	1,946.30	4,609.80	
Arrow Lake	47			10	26				90			49	214.75	445.50	660.25	
Trail Creek	93	2		4	33	2							632.25	102.40	734.65	
Revelstoke	158	4		95	116	10		16	4	13	8	14	1,084.00	1,950.00	3,034.00	
Trout Lake*	6				10								18.25	25.25	43.50	
Lardeau	72	3		69	195	8			1				594.00	689.35	1,283.35	
Western District (No. 6)																**22,373.30**
Nanaimo	116			152	150	34	6	5		1			538.75	1,232.00	1,770.75	
Alberni	53	1	2	23	26	7		2	1				357.25	184.70	541.95	
Clayoquot	12			25	17	8					1		53.75	225.50	279.25	
Quatsino	43			6	72	2							211.75	225.00	436.75	
Victoria	380	18	2	39	38	8		2	2	7		2	3,138.75	726.35	3,865.10	
New Westminster	162	2		90	79	27							641.25	654.95	1,296.20	
Vancouver	1,740	77	11	43	99	31	1						13,777.75	405.55	14,183.30	
Totals	8,950	201	40	3,299	6,224	845	143	82	368	479	782	761	$56,724.10	$88,040.05	$144,764.15	**$144,764.15**

* Up to and including April 15th, 1931, when Trout Lake Mining Division became part of Lardeau Mining Division.

REPORTS OF RESIDENT MINING ENGINEERS.

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

REPORT BY JOSEPH T. MANDY, RESIDENT MINING ENGINEER (HEADQUARTERS, PRINCE RUPERT).

INTRODUCTION.

The geological, topographical, and other general features of this area are described in detail in former reports, more especially in the Annual Reports for the years 1929 and 1930, to which those interested are referred. The lode-gold deposits of the district are described in Bulletin No. 1, 1932, issued by the Department of Mines. In the 1929 Annual Report a list of publications dealing with the district between the years 1927 and 1929 will be found. The following is a list of the recent publications:—

Name of Author.	Publication.	Year.
J. T. Mandy	Minister of Mines' Annual Report	1929
A. F. Buddington and Theodore Chapin	Geology and Mineral Deposits of South-eastern Alaska. Bull. 800, U.S. Geological Survey	1929
J. T. Mandy	Bulletin No. 2, Placer-mining. B.C. Dept. of Mines	1930
Herbert Carmichael	Bulletin No. 2, Placer-mining. B.C. Dept. of Mines	1930
J. T. Mandy	Six Months' Summary. B.C. Dept. of Mines	1930
J. T. Mandy	Bulletin No. 3, Preliminary Review. B.C. Dept. of Mines	1930
J. T. Mandy	Minister of Mines' Annual Report	1930
J. T. Mandy	Bulletin No. 1, Placer-mining. B.C. Dept. of Mines	1931
J. T. Mandy	Six Months' Summary. B.C. Dept. of Mines	1931
J. T. Mandy	Preliminary Report, 1931. B.C. Dept. of Mines	1931
Geol. Sur. of Canada Staff	Econ. Geol. Series No. 7, Prospecting in Canada. Dept. of Mines, Geol. Sur. of Canada	1930
F. A. Kerr	River Navigation & the Prospector. Can. Min. Journal, Feb. 7th, 1930	1930
F. A. Kerr	The Significance of Recent Discoveries in Northwestern British Columbia. Can. Min. Journal, March 7th, 1930	1930
F. A. Kerr	Prospecting in Northwestern British Columbia. Can. Min. Journal, April 11th, 1930	1930
F. A. Kerr	Taku River District. Geol. Sur. of Canada, Summary Rep., 1929, Part A	1930
F. A. Kerr	Preliminary Report on Iskut River Area. Geol. Surv. of Canada, Summary Rep., 1929, Part A	1930
F. A. Kerr	Defining the Mineral Zones of Northern British Columbia. Transactions, C.I.M. & M.	1931
G. Hanson	Mining in the Portland Canal Area. The Stewart News, Dec. 11th, 1931	1931
G. Hanson	Bowser River Area and North Part of Portland Canal Area, B.C.	1931
G. E. Moran	Hydraulic Operations on Otter Creek, Atlin. B.C. Miner, Nov., 1931	1931
J. T. Mandy	Bulletin No. 1, 1932. B.C. Dept. of Mines	1932

GENERAL SUMMARY.

The period of continued metal price and market depression prevailing during 1931 has been remarkably well withstood by the mining industry of the district. The producing mines, Premier Gold Mining Company, Limited, and Granby Consolidated Mining, Smelting, and Power Company, have operated continuously, and reinforced their position in the face of these conditions by the introduction of economies and increased efficiency in every department. Production costs have been cut to a remarkable degree, and these undertakings have been brought to a creditable position amongst the world's most efficient and economically conducted mining operations. A stimulating feature in coping with the adverse conditions prevailing during 1931 has been the whole-hearted co-operation of all members of the working forces of the producing mines to meet the exigency of the situation with a maximum of employment and a minimum of wage

reduction. The direct result of this courageous concentration of purpose has been the achievement of a remarkable standard of efficiency and low-cost operation. The greatest credit is due all branches of the working staff of these companies for this achievement. This fortitude, efficiency, and success in the face of severe handicap is also reflected in stimulation and encouragement to all branches of the mining industry throughout the district, and portends much activity and prosperity for the industry in this district when conditions return to normal.

Production by the Premier and Granby Companies was curtailed proportionate to the scope of economical operation. Directly resultant from this is a decrease in copper, gold, and silver quantity output. Output value is also adversely affected by continued low metal prices. In this respect silver production has been particularly affected. A large proportion of the potential metal wealth of this district is locked in its silver resources, and marked expansion of the mining industry in the district is largely dependent on the restoration and stability of the price of this metal, together with that of lead and zinc, with which the white metal is generally associated. Silver output and value from the *Premier* operation necessarily show a marked decline in 1931 as compared with 1930. Production from *Prosperity* and *Porter-Idaho*, which had reached an important figure, ceased with the closing of these properties early in the year on account of sustained low silver prices.

Gold production from lode-mining shows a slight decrease, due to curtailment of production from the major operations and a slightly lower grade of ore mined from *Premier*. Potential gold resources of the district are, however, becoming increasingly apparent, and a decided interest in the discovery of new gold-mines and potential gold areas is being displayed. Attention is also being directed to possibilities for profitable gold production from properties with small-tonnage potentialities which in the aggregate can become important. A tendency to a more conservative and correct measure of these potentialities and their exploration, financing, and development in accordance with this measure is becoming more apparent. Generally, the future holds promise of sustained gold production with a gradual enlargement of the field in this phase of the mining industry in the district. As a general industrial stabilizer and antidote for depression, no effort should be neglected to bring this phase of the mining industry to fruition. In Bulletin No. 1, 1932, a special lode-gold bulletin issued by the Department of Mines, details regarding this phase of the industry in District No. 1 are elaborated.

Placer-gold activities have shown a decided increase, with a resultant significant increase of gold production from this source. Sound and technically efficient methods of placer-ground appraisal, exploration, and development are being applied, new potential placer areas are receiving attention, and prospecting is gradually spreading into the extensive virgin potential placer-gold areas of the district. A healthy expansion and increasing gold-output from placer operations can be looked to in the future. These conditions are reflected in the placer-gold output from the Atlin area, which for 1931 is more than double that recorded for 1930 and holds sound promise of still greater expansion. Details regarding this phase of the industry are elaborated in Bulletin No. 1, 1931, to which those interested are referred. Additional information, particularly regarding the McDame Creek area, Liard Division, is contained in this Annual Report.

Development, although curtailed on many of the smaller operations, has been actively prosecuted on many properties by both individuals, small companies, and large organizations, and has resulted in the indication of possible additional producing mines for the future.

Prospecting, although also somewhat curtailed in comparison with preceding years, has been gratifyingly efficient and active throughout the district, and has resulted in several important discoveries of gold and base-metal ores.

Transportation facilities have been continuously improved and new areas made accessible to the prospector and brought within the scope of mining operations.

Important advances have been made in geological knowledge of the ore-deposits of the district that will be of great assistance in the discovery and development of these deposits and accelerate possible production.

The remarkable fortitude and actual progress of the mining industry in the North-western District in the face of the exceptionally adverse conditions prevailing during 1931 and the courageous and co-operative spirit of those connected with the industry in bucking the tide of adversity with active and constructive attack is not only an important, heartening, and stabilizing factor in the general welfare of the country, but augurs a very bright future.

Production.

The following list gives the production from lode mines in No. 1 District during 1931:—

Name.	Ore.	Gold.	Silver.	Copper.	Lead.	Zinc.
Nass River Mining Division—	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.
Bonanza	96,984	431	37,047	4,086,719	.....	.....
Hidden Creek	1,480,716	2,950	235,084	31,149,191	.....	.....
Portland Canal Mining Division—						
Big Missouri	25,559	1,424	547	.....	2,576	3,116
Porter-Idaho	902	46	77,156	.....	72,169	.....
Premier	242,317	79,302	1,508,369	3,671	1,176,516	.....
Prosperity	2,502	111	165,822	.....	153,155	.....
Skeena Mining Division—						
Surf Point*	587	411	188	.....	.....	.....
Totals	1,849,567	84,675	2,024,213	35,239,581	1,404,416	3,116

* Includes 67 oz. gold and 26 oz. silver not included in 1930 production figures.

The placer-gold output from No. 1 District for 1931 was 8,958 oz., valued at $152,286, as compared with $59,755 in 1930.

Development.

Development operations have been continued uninterruptedly at the *Premier* mine by the Premier Gold Mining Company. Some exploration by diamond-drilling was also carried out by this company in the late fall on the *Salmon Gold* property, Portland Canal Division. *Prosperity* and *Porter-Idaho* operations closed early in the year. Granby Consolidated has carried on energetic exploration of the *Hidden Creek* and *Bonanza* deposits, Nass River Division. The Consolidated Mining and Smelting Company has continued active exploration of the *Big Missouri* property, Portland Canal Division, and its placer holdings on Boulder creek, Atlin. About the middle of July the N. A. Timmins Corporation, of Montreal, commenced an active campaign of diamond-drilling exploration on the *Whitewater* and other groups in the Taku River area. In the same area the Alaska Juneau Gold Mining Company commenced surface exploration of the *Silver Bird*, *Golden Star*, and *Mineral Mountain* groups. Active exploration and development of the *Atlin Ruffner* property, Atlin Division, by Buffalo interests has continued throughout the year. Exploratory operations on the *Georgia River* property were resumed by Georgia River Gold Mines, Limited, in the late fall and continued to the middle of November. On the *George Enterprise* further prospecting was carried out during the summer months. On the *Southeaster*, Graham island, exploration has been carried on by the Kitsault Eagle Silver Mines, Limited. Exploration and development was also carried out on several other properties, including the *Western Copper*, *Hunter*, and Argentine Syndicate.

During the year, operations were suspended at the *Prosperity* and *Porter-Idaho* properties and development was stopped on the *Surf Point* and *Tidewater Molybdenum* properties. Development of the *B.C. Silver* was stopped and a thorough sampling of the workings carried out.

Exceptional activity has been displayed in placer operations and excellent results have been achieved. Several individual operations are meeting with encouraging results on Douglas creek, Skeena Division. On the Barrington river the Barrington Company has completed the installation of a dredge. Keystone-drilling has been carried out on the Stikine River bars below Telegraph creek and at the mouth of Deese creek, Dease Lake area. Encouraging prospecting results in the McDame Creek area portends increased activity in this promising section during the 1932 season. The Atlin section has been especially active and exceptionally promising results, culminating in the doubling of the placer-gold output for 1931 as compared with that for 1930, have been achieved. These activities have been reported in detail in Bulletin No. 1, 1931, especially devoted to placer-mining in British Columbia. For particulars of operation and placer-mining opportunities readers are referred to this report.

Prospecting.

Although, on account of conditions contingent on the depression and the consequent difficulty faced by prospectors to raise the necessary "grub-stake," there has been a general decline in prospecting, claim recording, and assessment-work, this phase of the industry has been quite

active throughout the district. In silver and base-metal areas, however, it has lagged somewhat. To offset this there has been a decided increase and intensification in the search for both lode- and placer-gold deposits. Several parties have undertaken lengthy reconnaissance expeditions into unknown territory for the purpose of selecting likely areas for future detailed prospecting. Notable amongst these have been the prospecting of the section between Hastings arm and Stewart by S. W. Barclay, of Anyox, and the reconnaissance by J. Nedeau and Homer Ficklin, Telegraph Creek, of the country between Dease lake and the headwaters of the Yukon river. Parties also penetrated to the upper reaches of the Barrington river, Stikine Division, where likely placer and lode ground has been selected for further prospecting. The promising placer- and lode-gold area of the Dease river and McDame creek has also aroused the interest of prospectors. The Ealue Lake area in the Stikine Division has also been further prospected by J. G. Hope and associates. The Taku River area has received more detailed prospecting during the year than heretofore, with encouraging results.

New Discoveries.

Important discoveries of gold-bearing ores have been made in the Taku River area, and increased activity may materialize in this section as a result during the 1932 season. In the Portland Canal Division important discoveries of silver-lead ore have been made in the American Creek area on the *Virginia K.* group by the Excelsior Syndicate and on the *Northern* group by the Northwestern Aerial Prospectors, Limited. In the Glacier Creek area further interesting discoveries of silver-lead-zinc ore have been made on the *Kenneth* group by the Argentine Syndicate. In the Unuk River section some prospecting was carried out by T. McQuillan, of Ketchikan, and encouraging indications of gold-bearing ore found. Interesting discoveries of silver-lead ore in the British Columbia area contiguous to the headwaters of the Leduc river are reported by Wendell Dawson and W. Fromholz, prospecting out from Ketchikan. A new departure in prospecting in this district initiated by this party is worthy of note. This consisted in the periodic dropping from an aeroplane of supplies contained in specially designed bags packed with cork. The plan is reported to have worked well, and with a few minor changes, such as the addition of a small parachute to the supply-packages, should give perfect results. Towards the close of the year J. Pederson reported a new discovery of gold-bearing veins in the batholithic rocks of the Khutze Inlet-Swanson Bay-Aaltanhash Inlet area of the Skeena Division. Further discoveries have been made by prospectors during the course of their assessments on properties in the Skeena, Nass, Portland Canal, Stikine, and Atlin Divisions, and are mentioned in the body of this report.

Transportation.

Substantial assistance has been rendered by the Department of Mines and the Department of Public Works in the construction and reconditioning of mining and prospecting roads and trails in every section of every Division where such work has seemed warranted. Information has also been gathered regarding new promising areas that may warrant opening up by future trail or road construction. In this way new promising territory is being gradually made accessible to the prospector and brought within the scope of mining operations.

The facility and efficiency of aeroplane transportation was available for the first time in the district through the enterprise of the Northern B.C. Airways, of Prince Rupert, which established an air-base at that port equipped for initial operations with a one-passenger Moth machine piloted by D. Murphy. It is understood that increased flying facility is planned for 1932 by the Canadian Airways, Limited, which plans a service based at Telegraph Creek and Atlin.

Geological Survey.

Geological work has been carried out by the Geological Survey of Canada in the Salmon River and American Creek areas, Portland Canal Division, by George Hanson and assistants. An authorized preliminary account of this work is published in the December 11th edition of the Stewart *News*. *See also* Geological Survey of Canada Summary Report, 1931, Part A.

The Resident Engineer desires to express his thanks to the prospectors and operators of the district for the many courtesies, kind assistance, and co-operation extended during the conduct of his work.

BELLA COOLA MINING DIVISION.

This Division has been comparatively inactive. The *Nifty* group, which was explored by the Consolidated Company in the 1930 season, has reverted to the original staker, W. C. Merkel, Hagensborg.

Beale's Limestone-quarry. Limestone production from this property on Cunningham island, Gunboat passage, has actively continued. Work was also commenced in the opening-up of the extensive limestone-deposit on King island, Burke channel, at which locality extensive operations are contemplated. During the year 6,914 tons of limestone was shipped from the Cunningham Island deposit to Pacific Mills, Limited, at Ocean Falls, for use in the pulp and paper plant.

Hebrew. This is an old Crown-granted claim comprised of Lot 9, Block 1, Range 3, Coast District. The property is situated on the west shore of the head of the North arm of Neekas cove, Ellerslie channel. The history of this claim dates back to the late sixties and reference to the property is made in "Mineral Resources of B.C.," published by the City of Vancouver in 1889, in which high values in gold and silver are mentioned. Mention of the occurrence is also made in the 1887 Report of the Geological Survey of Canada.

During 1931 a lease on the property was obtained by W. A. Robbins, of Victoria. Around the mouth of Neekas river a wide belt of intercalated limestone and schist (altered sediments) of probably Triassic age occupies a low-lying area of the topography in the vicinity of the coast-line and represents a pendant or inclusion in the granodiorite batholith. The altered sediments strike east-west and dip steeply south, with main joint-planes striking north-south. Granitic rocks outcrop at intervals and in places the pendant rocks are decidedly hybrid in appearance, indicating that the pendant is not of any great thickness above the batholith.

The mineral-deposit consists of lenticular masses of pyrrhotite and pyrite with some zinc-blende and a little chalcopyrite, occurring along lines of schistosity and also planes of jointing. In places alteration products of epidote and garnetite occur and the wall-rocks are locally slightly impregnated with iron sulphides. The mineral occurrence has marked characteristics of contact-metamorphic origin. About 6 feet above high-tide mark and about 40 feet from the shore at the mouth of Neekas river a tunnel has been driven for about 30 feet west and exposes some small lenses of pyrrhotite and pyrite, some zinc-blende and chalcopyrite, over widths of 12 to 18 inches. No outcrops of importance were observed on the hill-slope to the west of and above the tunnel, and in a traverse for 2,000 feet on either side of the tunnel-outcrop no occurrence of mineral or workings were found. Selected samples of the ore exposed in the tunnel assayed as follows:—

(1.) Massive pyrrhotite and pyrite with some zinc-blende: Gold, 0.02 oz. per ton; silver, 0.4 oz. per ton; copper, trace.

(2.) Schistose wall-rock with garnetite and epidote and veinlets and impregnations of pyrite: Gold, 0.04 oz. per ton; silver, 0.28 oz. per ton; copper, trace.

The occurrence has not the aspects of commercial importance.

QUEEN CHARLOTTE MINING DIVISION.

Moresby Island Section.

Further assessments were carried out on several old groups of copper-bearing claims on the east side of Moresby island. Some prospecting was also carried out on the west coast of Moresby island by S. K. Larson, of Prince Rupert, who reports the discovery of a vein carrying encouraging gold values. Inquiries regarding the magnetite-deposits of this section portend further investigation of these deposits in the near future.

Skidegate-Southeaster. Underground and surface exploration of this gold property by the Kitsault Eagle Silver Mines, Limited, was continued. The old workings have been pumped out and exploration by crosscutting and drifting for the vertical extension of the ore-shoot developed on the 50-foot level carried out. Surface-trenching about 60 feet south of the "Indian" shaft has exposed the shear-zone for a width of 20 feet, showing fair mineralization in places and good definition. Fifty feet south of this a crosscut tunnel for 28 feet on the west bank of the creek shows sheared, pyritized rock with quartz and calcite veinlets in the face. This tunnel is probably on the hanging-wall side of the zone. Extensive trenching through heavy overburden north-westerly of the main shaft

exposes good widths of quartz carrying some mineralization and an occasional patch of high-grade ore showing specks of "mustard" gold. These exposures, together with two tunnels, 40 feet and 120 feet long, situated 580 feet and 680 feet northerly of the main shaft, give a fairly definitely proved continuity of the zone of about 1,200 feet.

Towards the close of the year encouraging gold values and vein-widths were reported to have been encountered for the first time on the 100-foot level of the main shaft, in a crosscut to the east from the main workings. The exploration of this showing is being continued with a view to determining its possible correlation with the ore-shoot developed between the surface and the 50-foot level. In view of the structural conditions indicated in this deposit, it is suggested that diamond-drilling from surface and also from the underground workings would be productive of valuable information regarding continuity and possible values, on the results from which further underground exploration could be efficiently based.

Placer-mining.

A detailed account of this phase of mining carried on in this Division will be found in Bulletin No. 1, 1931, "Placer-mining in British Columbia."

SKEENA MINING DIVISION.

Western Copper Venture. On this group of forty-seven Crown-granted claims, situated in the Khutze River area, the incline shaft was dewatered and continued for 16 feet and a crosscut for 138 feet driven to the canyon. This now forms a convenient means of access to the east side of the canyon. On the 350-foot level the sub-level was continued a further 16 feet towards west and shows 24 inches of high-grade ore in the face. Some work was also carried out on a small showing on the *Fanny* claim. Operations were in charge of E. G. Davidson with a crew of twelve men and closed on August 31st. For a detailed description of this deposit and the workings readers are referred to Bulletin No. 1, 1932. The *Hunter* group is also described in this bulletin.

Rowe. This property of three claims is owned by C. O. Rowe, of Prince Rupert. It is situated on the west slope of Noble mountain, Pitt island, about 40 miles south of Prince Rupert. The property is described in the 1930 Annual Report. During 1931 further stripping and open-cutting was carried out by the owner. It is suggested that constructive information regarding this deposit could be derived by intensifying on the further opening-up of those sections of the vein in which streaks of sulphides are exposed, in order to determine whether these sulphides occur in shoots of any commercial extent and whether they carry commercial gold values. A limited amount of open-cutting in these localities may be productive of valuable information.

Gibson Girl. This property of four claims is owned by Frank Cole and George Keys, of Prince Rupert. The claims are situated on Gibson island, at the head of Grenville channel, about 27 miles south of Prince Rupert. The ore occurrence is described in detail in the 1929 and 1930 Annual Reports. During 1931 the owner, in carrying out his assessment-work, has made further discoveries of copper-lead-zinc ore, and still further extended the continuity of the zone along its strike. Lateral open-cutting to the east of the main exposures has also uncovered further lead-zinc-copper mineralization, indicating a possible lateral extension to the known zone-width. This property is recommended to examining engineers as a possible potential small-tonnage base-metal producer, with low-cost operation.

Copper Coin. This group, owned by Duncan Kennedy and associates, of Prince Rupert, is situated about 1½ miles southerly of the *Surf Point*, on the westerly side of Porcher island. The showings are at altitude 150 feet and about 1,500 feet from the head of a small bay. The property is described in the 1930 Annual Report and it is also referred to in Bulletin No. 1, 1932. During 1931 stripping, open-cutting, and general prospecting has been carried out and continued to the end of the year. During the course of this work an additional showing has been uncovered carrying sparse pyrite and chalcopyrite mineralization in a quartzose gangue, and assaying: Gold, 0.06 oz. per ton; silver, 0.12 oz. per ton; copper, 0.4 per cent. As is pointed out in the reports referred to, it would seem the ore occurrence on this property warrants diamond-drilling to ascertain a possible increase in gold values in the shear-zone as, and if, it passes from the schist in which it outcrops to the underlying quartz diorite.

Surf Point. On this property, owned by the N. A. Timmins Corporation, a winze 20 feet deep was sunk off the second drift south in No. 1 tunnel and work carried on in four raises from No. 1 and No. 3 tunnels, and three scow-loads of ore were shipped to Anyox. Operations were suspended in April, and late in the fall the property was examined by Alphonse Paré, of the N. A. Timmins Corporation, with a view to determining possible future development. This property is described in former reports and referred to in Bulletin No. 1, 1932.

Eddy Pass. This group, adjoining the *Surf Point*, is owned by Frank Patterson, of Prince Rupert. The showings are described in the 1930 Annual Report and referred to in Bulletin No. 1, 1932. During 1931 further stripping on the main showing westerly of a lamprophyre dyke has resulted in the location of the extension of the vein carrying good pyrite mineralization. This property is recommended to examining engineers as a possible small-tonnage, selective-mining gold-ore producer.

Further prospecting has also been carried out on the *Drumharvey* and *Englestone* groups in the Tucks Inlet area, and some prospectors have also been active in the area contiguous to the *Prince Rupert highway, and Kildala arm, Khutzeymateen, Kumealon, Baker, Aaltanhash, and* Khutze Inlet areas.

Kitsumgallum Lake Section.

This section is described in former reports, and in the 1930 Annual Report detailed descriptions of the more recent developments on various properties are described. During 1931 work was continued in driving the tunnel on the *Motherlode* on Maroon mountain; stripping and further prospecting was also carried out on *Black Wolf*, *Hawk*, *Bear*, and *Cub*, and on the *Black Wolf* group a new vein carrying good gold values is reported to have been discovered. These properties are described in Bulletin No. 1, 1932. A consolidation of these properties is recommended to examining engineers as worthy of further exploration from the aspect of a possible small-tonnage gold-producing operation. On the *Scenic* and *Log Cabin*, situated on the divide between Maroon mountain and the Skeena valley, further work was carried out by the owner.

The former *Juneau* and *Treadwell* claims, contiguous to Kitsumgallum lake, have been restaked as the *Maloya* and *Lake Shore* by Joe Felber, who plans further active prospecting of this ground. Samples submitted by the owner of an altered andesitic rock carrying some bornite in a shear about 2 feet wide assayed: Gold, 0.24 oz. per ton; silver, 0.6 oz. per ton. The gold value in this type of rock is interesting and indicates that further exploration is warranted. This property is referred to in Bulletin No. 1, 1932.

Placer-mining.

Placer operations by individuals on Douglas creek have been quite active, and on the *Nightwine* ground some rich spots have been encountered, with a general return of wages. Besides the three original operations on this creek reported in Bulletin No. 1, 1931, "Placer-mining in British Columbia," five additional outfits have commenced prospecting operations. A recovery of about $750 in gold is estimated from the small individual workings on this creek. In this section the attention of individual prospectors is also directed to gold possibilities in Wesach (Hall) creek, Clear creek, and Maroon creek.

Lakelse Section.

This section is described in detail in the 1930 Annual Report. During 1931 a few prospectors have carried on further investigation of the Williams Creek area and prospecting of the Thornhill Mountain occurrences has continued. Properties in the localities are described in detail in the 1929 and 1930 Annual Reports and the Thornhill Mountain properties are referred to in Bulletin No. 1, 1932.

NASS RIVER MINING DIVISION.

Observatory Inlet Section.

Granby C.M.S. & P. Co. During 1931 continuous operations have been carried on, though subjected to necessary curtailment of production to meet the prevailing adverse aspects of the copper market. During 1931, 35,235,910 lb. of copper was produced from the *Hidden Creek* and *Bonanza* deposits from 1,577,700 tons of ore. To cope with the depressed copper prices, economies have been worked out and applied to every

phase of the operation. Remarkably creditable results have been achieved by the management and staff in this respect, and the per pound production cost of copper has been persistently lowered throughout the year. This achievement places this operation amongst the most efficiently conducted mining operations in the world to-day. Copper production has been sustained at the most economical point of operation and compares favourably with the 1930 output.

In the *Hidden Creek* mine, exploration and development has been energetically continued and some lateral extensions of the known replacement ore-bodies have been picked up. Diamond-drilling from the lower and minus 885 levels for depth-continuity of the known ore-carrying structure along the greenstone-argillite contact has been continued.

At the *Bonanza* further westerly extension of the ore-zone with good-grade ore has been developed on the south side of Bonanza creek. The easterly limits of the workings on this side of the creek, although showing sudden diminution of grade, also indicate the presence of faulting disturbance, beyond which the zone may possibly be picked up by diamond-drilling exploration. On the north side of Bonanza creek the incline shaft has been completed to 680 feet, with levels at 300 and 650 feet. Mining has been concentrated on the 650-foot level along the westerly dip of the zone, and encouraging results, with development of good-grade ore, have been encountered. Northerly continuity is affected by a fault striking about north-south, of possible appreciable dimensions. Extension of the zone beyond this fault will be explored for by diamond-drilling. Operations at *Bonanza* are on the basis of one shift with a daily production of about 300 tons and a crew of about forty men employed.

Deadwood and Quartz.—On this group, adjoining the *Hidden Creek* mine-workings on the north, the owner, W. Hanna, of Anyox, has carried out some further stripping, and by prospecting has picked up an extension of copper mineralization along the creek north of the cabin.

On the *Black Bear*, adjoining the *Bonanza* on the south-east, the owner, S. W. Barclay, of Anyox, has done some stripping and prospected new ground higher up the hill towards the granite-contact.

On the *Sunrise*, *Homestake*, *Homestake Fraction*, and *Starlight Fraction*, situated between the *Bonanza* and *Hidden Creek* holdings of the Granby Company, the owner, Thos. McRostie, of Anyox, has carried out some shaft-sinking and stripping. Stripping has been accomplished by means of ground-sluicing with water from a small creek. Showings carrying some bornite ore have been uncovered. Some dip-needle prospecting was also carried out, but this method did not prove successful.

Alice Arm Section.

Tidewater-Molybdenum Mines, Ltd.

This property is described in detail in the 1930 Annual Report. During 1931 operations were continued by the Dalhousie Mining Company, Limited, but were suspended on April 23rd. Work had been concentrated in the new lower tunnel on drifting and raising, with some drifting carried out in the upper tunnel. In the lower tunnel a fair grade of molybdenite ore over widths of from 0.5 to 5.5 feet was encountered for 160 feet from the end of the crosscut, with about 125 feet of backs at this point. A further 170 feet of drifting showed good quartz-widths, but very sparse mineralization, with backs of about 160 feet at the face. In the raise for 50 feet from the easterly end of the lower tunnel a width of 10 feet of quartz is exposed, carrying sparse molybdenite mineralization. Projected for another 48 feet, this raise should come out about 30 feet west of the crosscut, and should it come into commercial-grade ore as exposed in the upper tunnel there would be a commercial-grade back of 40 feet between the two levels and of about 120 feet to surface.

It would seem that the condition of mineralization exposed in the lower tunnel can be correlated with relative conditions in the upper tunnel, indicating an ore-shoot horizon about 125 feet thick, pitching south-west at an angle of about 30°, with a maximum possible pitch-length of about 800 feet It is indicated that molybdenite mineralization occupies a parallel horizon above the underlying granitic rocks.

Kitsault River Section.

Esperanza Mines, Ltd.

This property is described in the 1925, 1928, 1929, and 1930 Annual Reports. Some financing was arranged for the carrying-out of further work during 1931. For this purpose a 36/42-horse-power semi-Diesel Petter engine, belt-connected with a 2 by 120 Gardner Denver compressor, was installed and suitably housed near the portal of No. 9 tunnel.

Mining was concentrated on the driving of No. 9 tunnel crosscut. In all, about thirty days were devoted to actual mining and the tunnel extended from 310 feet to 388 feet, an advance of 78 feet. The objective of this tunnel is the intersecting of a quartz vein higher up the hill. Installation of the equipment and the crosscutting have been efficiently carried out under the supervision of W. F. MacGowan.

Contrary to some impressions and notwithstanding an occasional high gold assay procured from some sections of the workings, the indicated commercial possibilities of this property lie solely in its potentiality as a possible small-tonnage, mainly silver-producing, proposition, dependent on careful, systematic, and economical operation and a sufficient silver price. As was stressed in the 1929 Annual Report, this indicated limited possibility has yet to be definitely determined. Before embarking on haphazard exploration a systematic surveying and methodical sampling of the veins and contiguous wall-rock in the entire underground workings and surface showings, together with the plotting of this data and the correlation of structure such as slips, rolls, and dykes that affect the mineral-carrying structure, should be carried out. This would form a basis for the inauguration of exploration and development in the most likely area and its intelligent prosecution if warranted by what is indicated.

Combine. This claim adjoins the *Red Point* on the north and is owned by Miles Donald, of Alice Arm. The mineral occurrence is described in the 1930 Annual Report. During 1931 another vein showing encouraging mineralization has been discovered. The old tunnel has also been cleaned out, exposing the vein with a width of about 10 feet carrying good copper, lead, and silver values, with about $1.20 in gold. This property is recommended to examining engineers.

Vanguard. This property, owned by M. Peterson, of Alice Arm, is described in the 1928, 1929, and 1930 Annual Reports. Further work carried out and not yet reported consists of 10 feet of crosscutting in the zone from the end of the north drift of No. 2 tunnel (lower tunnel), which is reported to average about 1½ per cent. copper. The south crosscut in the zone has also been extended about 9 feet beyond the 4 feet previously reported, and is estimated by the owner to carry about 1½ per cent. copper. A sample taken by an examining engineer in 1928 across 8 feet in the trench near the cabin assayed: Gold, $21.60; silver, 0.9 oz. per ton; copper, 0.23 per cent. In the upper tunnel the north drift crosscut has been driven for 7 feet and is reported to continue in ore of a good copper tenor.

On the *Vanguard Extension* the owner, M. Peterson, of Alice Arm, has done 4 feet of tunnelling and some open-cutting.

Lucky Strike. This property consists of seven claims and is owned by John Hauber and partner, of Alice Arm. It is situated on the west side of the upper Kitsault valley, between elevation 3,500 and 4,900 feet. The several showings exposed on the claims are described in the 1929 and 1930 Annual Reports. During 1931 a new vein 3 inches to 2 feet wide, mineralized with stibnite and mispickel, has been discovered. Two samples submitted by the owner from this discovery, mineralized with mispickel, some stibnite, and pyrite in a quartzose gangue, assayed:—

(1.) Gold, 0.1 oz. per ton; silver, 6 oz. per ton; arsenic, 13.1 per cent.

(2.) Gold, 0.36 oz. per ton; silver, 6 oz. per ton; arsenic, 8.3 per cent.

This new showing has been explored by a shaft 7 feet deep. Further exploration was also carried out on several other veins by two shallow shafts and seven open-cuts. The "spar vein" on the *Silver Crown* was also explored by four open-cuts and the *Lucky Strike* vein was traced an additional 10 feet.

Moose. This property, owned by J. Strombeck and associates, of Alice Arm, is described in the 1918, 1920, 1929, and 1930 Annual Reports. During 1931 further prospecting was carried out and a promising showing in a replacement zone carrying silver, lead, and copper mineralization with interesting gold values discovered. J. Strombeck is continuing exploration-work during the winter months.

Highland, Tyee, and Last Chance. These groups are situated on the east side of the upper Kitsault River valley and are owned by Archie McPhail and associates, of Alice Arm. The showings are described in the 1930 Annual Report. During 1931 exploration was continued and with assistance from the Department of Mines the trail extended towards the summit. On the *Tyee* a tunnel was started 200 feet below the long cut. Unfortunately, this was in broken ground and it caved. Continuity of the ore-zone with encouraging mineralization was also extended by open-cuts above and below the long cut described in the

1930 Annual Report. These groups are recommended to examining engineers as offering a consolidation of territory warranting extensive exploration with a view to developing a possible appreciable tonnage of mill-grade silver ore.

Summit. This group is owned by A. Davidson and O. Evindsen, of Alice Arm, and is situated on the north slope of the ridge to Clearwater creek, upper Kitsault valley. The showings are described in the 1930 Annual Report. During 1931 stripping was carried out on the ridge above the cabin and also from the extension of the long cut above the main tunnel, resulting in the exposure of stringers carrying galena similar to those described in the 1930 Report.

General prospecting and exploration has also been carried out on several other groups in the Kitsault Valley area. In the Silver Basin area on East creek, towards the Kinskuch Lake section, G. Pearson and associates have been prospecting some encouraging copper-showings. To facilitate the prospecting of this section the trail was extended by the Department of Mines.

On the *La Rose No. 3* and *La Rose Fraction*, situated on Haystack mountain, the owner, J. Calvin, of Prince Rupert, has carried out some stripping and open-cutting.

On the *Wildcat* the owner, A. Davidson, of Alice Arm, has energetically continued exploration by stripping and tunnelling and is continuing tunnelling during the winter.

Illiance River Section.

Three Mile. This property is owned by John Hauber, of Alice Arm, and is situated about 3 miles up the Illiance river. The ore occurrence is described in the 1930 Annual Report. Further prospecting and stripping by ground-sluicing was carried out during 1931 and two quartzose brecciated zones, 15 to 20 feet wide, were exposed. These are mineralized with pyrite, markasite, sparse galena, and light-coloured zinc-blende. Representative samples from these zones submitted by the owner assayed:—

(1.) Gold, 0.02 oz. per ton; silver, 2 oz. per ton.

(2.) Gold, trace; silver, 0.6 oz. per ton; lead, 1.6 per cent.; zinc, 2.8 per cent.

Titrite. This property, owned by John Hauber, of Alice Arm, is situated in the upper Illiance River area and is described in the 1930 Annual Report. During the 1931 season further prospecting was carried out by stripping and open-cutting. A sample from a brecciated vein 4 feet wide, mineralized with pyrite, assayed: Gold, *nil;* silver, *nil.* A sample from another quartzose brecciated vein, sparsely mineralized with pyrite and a few specks of galena, assayed: Gold, trace; silver, 1.6 oz. per ton. From another lead in this area the owner claims to have obtained assays up to $2.20 in gold. Although, as pointed out in the 1930 Report, this area does not show promise of commercial gold-ore deposits, the vein from which the latter values were obtained would be worth some further prospecting.

Billy Mack. This property consists of six claims located on the southerly slope of McGrath mountain, adjoining the *Standard* group on the south. The property is owned by James Peacock, Tony Calfa, and associates, of Alice Arm. The cabin is situated at altitude 1,925 feet on the main McGrath Mountain trail.

The country-rock of the area consists of calcareous argillite, with a general northerly strike. At altitude 1,900 feet a brecciated and banded vein 15 feet wide outcrops for 250 feet along a bluff on the south side of the creek, striking east-west and dipping 30° south. Mineralization of this vein consists of sparse streaks of zinc-blende and some pyrite in a brecciated quartz-argillite gangue, which is best developed along about a 4-foot width of the foot-wall side.

An altitude 1,850 feet and southerly of the creek a 7- by 10-foot open-cut exposes a similar brecciated vein 4 feet wide, mineralized with some zinc-blende and pyrite. The attitude of this vein is not clear, but the formation strikes northerly and dips 45° south. A grab sample from the dump of this showing assayed: Gold, *nil;* silver, *nil;* zinc, 4 per cent.

At altitude 1,780 feet in the creek-bottom and about 400 feet northerly of the above-mentioned cut a tunnel has been driven about 50 feet on a banded and brecciated vein about 8 feet wide in shattered argillite. This vein strikes N. 40° E. (mag.) and dips 55° north. Fair zinc-blende mineralization with some pyrite in calcite stringers and lenses, and a marked development of graphite, features the vein, which appears to be a replacement along a defined shear-zone. Not much mineralization is evident in the tunnel, which may possibly be heading northerly of the main structure and consequently should be turned west or to the left. During the 1931 season this tunnel was continued and encouraging mineralization of a zinc tenor is reported to have been again encountered.

Beverley. This group is situated at elevation 750 feet and about 1,800 feet from the sea-shore, on the west slope of Table mountain in the Illiance River area, and is owned by L. B. Reynolds, Alice Arm. It is reached by a branch trail from the main Government telegraph-trail. The property is being prospected by several open-cuts and two crosscut tunnels. The main tunnel, 217 feet in length, is being driven with the objective of crosscutting a shear-zone in sandstone and argillite carrying quartz stringers mineralized with chalcopyrite, pyrite, and some zinc-blende. During the 1931 season the tunnel was advanced 55 feet and it is estimated that a further 12 feet of crosscutting should reach the objective and determine further possibilities of the vein. It is planned to continue this work during the winter.

PORTLAND CANAL MINING DIVISION.

Portland Canal Section.

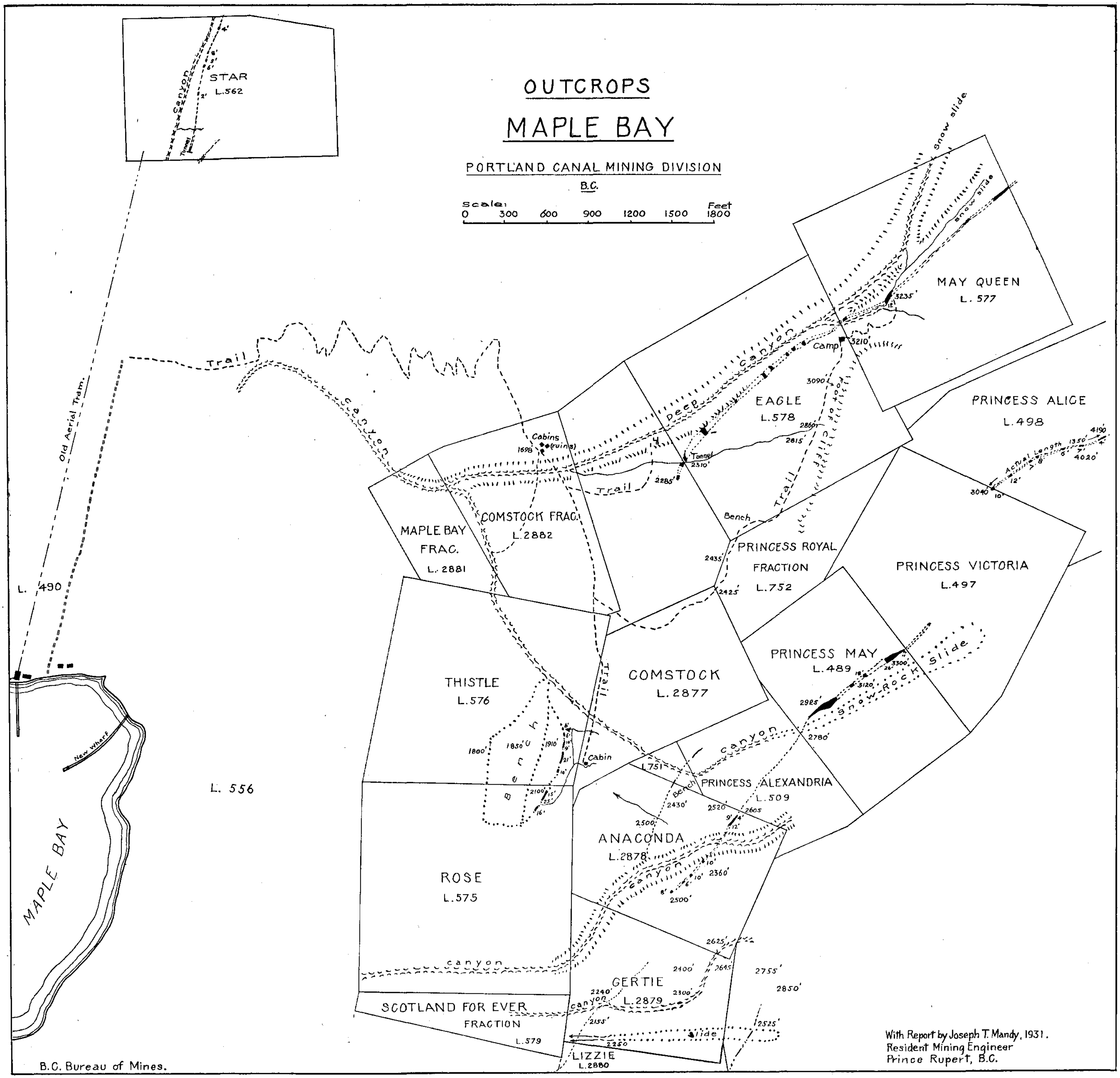
Eagle, Princess Alexander, Blue Bell, Comstock, and Star. These groups comprise a consolidated block of twenty-three Crown-granted mineral claims, situated on the east side of Portland canal, on the slopes to Maple bay and about 30 miles south of Stewart. The area lies about 9 miles due west of Anyox. The *Eagle*, *Princess Alexander*, and *Blue Bell* groups, with the *Star* claim, comprising sixteen claims in all, are owned by W. Noble and associates, of Stewart. The *Comstock* group of seven adjoining claims is owned by the estate of Helen Flewin and C. B. Flewin. L. S. Davidson, of Stewart, is authorized agent for the owners of the different groups.

The *Eagle* group, located by W. Noble in 1902, was first bonded to the Brown Alaska Company, which was developing the adjoining *Outsider* group and shipping the ore to a smelter operating at Hadley, Alaska. In 1910 the property was again bonded to the Sir Donald Mann interests and a small amount of work done. In 1912 the property was bonded to the Granby Consolidated Mining, Smelting, and Power Company, which carried out considerable superficial exploration and also extensive diamond-drilling over a period of years, but on account of extraneous circumstances returned the property to the original owners. No work has been done on the property since that time. From the *Star* claim the Granby Company shipped an appreciable tonnage of copper ore to its smelter at Anyox.

The ore occurrence consists of quartz veins and replacements of appreciable width and continuity, well mineralized with chalcopyrite in shoots of appreciable length. The veins outcrop in silicified argillite and sometimes altered andesite near the contact of an intrusive dioritic rock. The contact condition is well exemplified in the canyon area, the east side of which is silicified argillite with spurs and dykes of diorite. It is on this side of the canyon that the known ore-bodies on the main groups occur. The west side is mainly diorite with inclusion segments of silicified ferruginous argillite. The canyon practically follows the contact up to the head, the bluffs of which, forming the divide between Maple bay and Observatory inlet, are diorite. At the old tunnel, elevation 2,310 feet, near the south-west boundary of the *Eagle* claim, the contact is well indicated, with the *Eagle* vein forming a quartz replacement along the contact. The mode of occurrence is similar to that of the contact-replacement ore-bodies of the *Hidden Creek* deposits at Anyox, with the difference that the Maple Bay ore-bodies, or that constituting the *Eagle* vein at least, appear to be replacements along defined fracture-zones. In places bands of barren or sparsely mineralized silicified argillite occur as horses in the quartz of the veins. In some of the showings it is possible that copper mineralization also occurs along the contact of isolated and aligned inclusion segments of the altered argillite, as well as along the main contact. This condition may be found to exist in the deposits on the *Anaconda* and *Princess May* claims, lying to the east of the *Eagle* vein. With these conditions, spur-veins and isolated as well as aligned swellings along the main mineralized fracture-zones may be expected to occur and, with the development, additional ore-bodies that do not outcrop may be discovered.

The main showing is what may be termed the *Eagle* vein, which outcrops at intervals contiguous to and in the canyon, throughout the length of the *Eagle* and *May Queen* claims, a distance of about 3,000 feet, from elevation 2,285 feet to about 3,500 feet, striking north-east and dipping 60° to 80° east. Along this distance widths of from 5 to 35 feet, showing chalcopyrite mineralization assaying from 1 to 6 per cent. copper across appreciable widths, are exposed.

With the exception of the short tunnel referred to, some stripping, and a small amount of open-cutting, no work has been carried out on this vein. Several holes were diamond-drilled


OUTCROPS
MAPLE BAY
PORTLAND CANAL MINING DIVISION
B.C.
Scale:
0 300 600 900 1200 1500 1800
Feet
STAR
L.562
canyon
Tunnel
Old Aerial Tram.
Trail
canyon
Deep Canyon
Camp
3210'
3235'
MAY QUEEN
L. 577
snow slide
EAGLE
L.578
Cabins
(ruins)
1698
Tunnel
2310'
2285'
3090'
2860'
2815'
Foot of Cliff
Trail
Bench
PRINCESS ALICE
L.498
Actual Length
4190
1350'
4020'
3040
MAPLE BAY
FRAC.
L. 2881
COMSTOCK FRAC.
L.2882
PRINCESS ROYAL
FRACTION
L.752
2435'
2425'
PRINCESS VICTORIA
L.497
L. 490
THISTLE
L.576
Bench
1800'
1850'
1910
2100'
Cabin
COMSTOCK
L.2877
PRINCESS MAY
L.489
2925'
3120'
3300'
2780'
Snow Rock Slide
canyon
L.751
PRINCESS ALEXANDRIA
L.509
Bench
2430'
2520'
2605
2500'
ANACONDA
L.2878
canyon
2360'
2500'
L. 556
New Wharf
MAPLE BAY
ROSE
L.575
canyon
2625'
2645
2400'
2755'
2850'
GERTIE
L.2879
2240
2300'
canyon
2155'
SCOTLAND FOR EVER
FRACTION
L.579
2250
slide
2525'
LIZZIE
L.2880
B.C. Bureau of Mines.
With Report by Joseph T. Mandy, 1931.
Resident Mining Engineer
Prince Rupert, B.C.

by the Granby Company on the *Eagle* vein between elevation 2,150 feet and 3,100 feet along a horizontal distance of about 900 feet. In the upper hole 18 feet of ore was encountered, with a back of 65 feet, assaying: Gold, 0.001 oz. per ton; silver, 0.14 oz. per ton; copper, 2.19 per cent. Another hole at elevation 2,975 feet encountered 14.5 feet of ore, with a back of 310 feet, assaying 2.66 per cent. copper. In the third hole, at elevation 2,820 feet, 17 feet of ore assaying 1.24 per cent. copper was encountered, with a back of 320 feet; and in the fourth, 22.5 feet of ore assaying 0.82 per cent. copper, with a back of 375 feet. In a hole drilled at elevation 2,525 feet a mineralized width of 20 feet was encountered assaying 0.22 per cent. copper, and at elevation 2,350 feet another hole encountered only traces of copper and quartz stringers. In this drilling it may be computed that in the central part of this vein, drilled by the first four holes mentioned, 522,000 tons of probable ore assaying 1.71 per cent. copper, with an additional possible tonnage of 590,000 assaying 1.4 per cent. copper, is indicated. In the depth projection of the *Eagle* vein outcrop northerly of the upper hole between elevations 3,235 feet and 3,650 feet along a horizontal distance of 1,250 feet, an appreciable possible tonnage of commercial-grade ore is also indicated.

On the *Comstock* claim five holes were diamond-drilled by the Granby Company and in two holes some fair-grade ore was encountered over narrow widths. One hole drilled on the *Anaconda* claim encountered a narrow width of 2.56 per cent. copper ore.

The surface showings on these groups are described in detail in the 1918 and 1921 Annual Reports. The property is conveniently situated to seaboard, with a topography that would be conducive to very economical operation. The showing on the main or *Eagle* vein, which seems to occupy a defined replaced fracture-zone along an igneous contact, is worthy of extensive exploration. The properties are recommended to the attention of examining engineers.

Georgia River Section.

Georgia River Gold Mines, Ltd. The mineral occurrence and details of operation have been described in former Annual Reports and more recently in those for the years 1928, 1929, and 1930. A detailed description of the more recent workings is also given in Bulletin No. 1, 1932.

Pedro Georgia. This property, owned by Mike Koras, Nick Nickolas, and associates, of Stewart, is situated on the south side of Georgia river, about 5 miles from the Portland canal. The showings are described in the 1928 Annual Report. During 1931 work was concentrated on driving a crosscut tunnel to intersect the lower vein, from which the owners claim to have had encouraging assays in gold on surface. This tunnel is now in about 30 feet and it is estimated that about 20 feet further crosscutting will reach the objective.

Montrose. This property of four claims is owned by J. S. Lydden, of Stewart, and is located about 3½ miles up Georgia river, on the north side. The cabin is situated about 3,000 feet from the main Georgia River trail at about altitude 1,800 feet. The showings consist of quartz veins 2 to 30 inches in width, in quartz diorite, mineralized with chalcopyrite and pyrrhotite. In places massive chalcopyrite occupies the whole vein-filling. Although a high copper content is evident in the ore, the gold and silver values are low. During 1931 further stripping was carried out and a cabin erected at the workings.

Monday. This group is situated about 6 miles up Bulldog creek and is owned by Dan McDonald, of Stewart. Considerable open-cutting, stripping, and general prospecting has been carried out on showings carrying zinc-lead-pyrite mineralization, from which some encouraging values in gold are reported. Further energetic prospecting was continued during the 1931 season and with assistance from the Department of Mines the trail was reconditioned.

Marmot River Section.

Prosperity and Porter-Idaho. These properties are described in former Annual Reports and more recently in that for the year 1930. During 1931, due to the continued low price of silver, the Premier Gold Mining Company suspended operations on these properties early in April. During this period a total of 3,404 tons of ore was shipped, from which 242,978 oz. of silver was recovered. Precautions to prevent caving of the workings have been taken and a watchman is on the ground.

Marmot Engineer Syndicate.

This group is situated about 5 miles up the South fork of the Marmot river and about 7 miles from the beach. The claims are located immediately east of the Coast Range batholith contact and are owned by the Marmot Engineer Syndicate, of Stewart. The showings are described in the 1926, 1927, and 1930 Annual Reports. During 1931 George Bunn repaired the cabin, which had been damaged by a snow-slide during the winter. A drift-tunnel was also started from the cut on the lower showing, in which some copper mineralization is exposed.

BEAR RIVER SECTION.

Argentine Syndicate.

This syndicate, composed of Clay Porter, L. Legg, and H. Gibson, of Stewart, continued active and efficient exploration of the *Kenneth* group during the season under the direction of Clay Porter. Work was concentrated on the driving of "D" crosscut tunnel, at altitude 3,650 feet, to intersect the "B" vein outcropping in the creek about 600 feet south-west of the cabin. This had advanced 112 feet and intersected about 10 feet of good-grade silver-lead-zinc ore with some ruby silver, in a lime replacement gangue on the hanging-wall side of the shear-zone. A selected sample of this material assayed: Gold, 0.04 oz. per ton; silver, 111 oz. per ton; lead, 19 per cent.; zinc, 12 per cent. Next to this on the foot-wall is about 9 feet of mill-grade ore with finely disseminated galena-sphalerite ore, in brecciated argillite. A sample of this material assayed: Gold, 0.02 oz. per ton; silver, 18.5 oz. per ton; lead, 4 per cent.; zinc, 3 per cent. Some open-cutting was also done on the continuation of this vein in the canyon several hundred feet north-easterly of "D" tunnel, and very encouraging mineralization reported to have been encountered.

About 350 feet south-westerly of the canyon a new zone about 10 feet wide, well mineralized with pyrrhotite, mispickel, zinc-blende, galena, and stibnite, is reported to have been discovered. A smaller, well-mineralized vein, 12 to 18 inches wide, has also been discovered.

Further details of this property are contained in the 1930 Annual Report. It is decidedly worthy of intensive exploration. It is conveniently situated to transportation facilities and is characterized by favourable features for economical mining. The property is recommended to examining engineers as a possible appreciable-tonnage mill-grade proposition, with some shipping-grade ore of silver-lead-zinc tenor.

Palmey.

This property is owned by W. R. Tooth and associates, of Stewart, and is situated on the west side of the Bear River valley adjoining the *Dalhousie*. The ore occurrence is described in the 1930 Annual Report. During 1931 open-cutting of the quartzose replacement zone described in the 1930 Report was carried out and encouraging mineralization of zinc-blende and galena uncovered. With assistance from the Department of Mines, the old *International* trunk trail was also reconditioned and continued to this property.

Little Wonder.

This property consists of eighteen claims owned by H. Hunter and Paul Suppelsa, of Stewart, and is situated just north of Bitter creek, on the south side of Blackcurrant creek, on the west slope of the range to Bear river and about 9 miles from the town of Stewart. The property adjoins the *Ore Mountain* claims on the north and is reached by the Bear River road to Bear lake, from where the *Ore Mountain* trunk trail is followed for about 3 miles to the property. There is a good cabin at elevation 3,800 feet.

The locality of the property is contiguous to the contact of the Triassic Bitter Creek formation with the overlying Bear River formation where these series are cut by a broad belt of probably late Jurassic quartz-porphyry and and quartz-diorite dykes which strike through the country in a north-westerly direction from the upper Glacier Creek area. The rocks constituting the property consist of argillites and quartzites, with probably some andesitic tuffs and flows, intruded by numerous quartz porphyry, feldspar porphyry, dioritic, felsitic, and rhyolitic dykes.

The mineral occurrence consists of quartzose fracture-zones mineralized with galena, sphalerite, pyrite, and some tetrahedrite, occurring in sheared and silicified argillite close to the contact of intrusive acidic dykes. Pyritized quartz-replacement zones in feldspar porphyry, mineralized with pyrite, some galena, sphalerite, and chalcopyrite, also occur. These showings have been explored by several open-cuts and short tunnels, the majority of the work being on *Little Wonder No. 3* and *No. 4* claims. The main zone of the first-described type outcrops

along the creek-bed and can be traced for several hundred feet up the creek-trough from elevation 3,800 feet to elevation 4,050 feet, where it is covered by the slide-overburden of the upper creek-basin. The zone strikes N. 50° W. (mag.) and dips 45° west. The lower cut, at elevation 3,800 feet and about 400 feet southerly of the cabin, exposes a width of 6.5 feet of quartzose brecciated vein with fair mineralization of pyrite, sphalerite, galena, and chalcopyrite. On the foot-wall a width of about 14 inches is well mineralized. The hanging-wall of this exposure is pyritized silicified feldspar porphyry, with some galena. On the foot-wall is an acidic dyke 12 feet wide overlying sheared graphitic and ferruginous argillite with calcite and quartz stringers and some mineralization. An open-cut and tunnel has been started in the argillite of the foot-wall to crosscut the whole zone. Directly across the creek, on the east side, a branch vein 14 inches wide, striking north-south (mag.) and dipping 70° west, has been exposed in two places. This outcrops in sheared argillite on the contact of a quartz-porphyry dyke, and is well mineralized for 3 inches on the foot-wall with zinc-blende, galena, and pyrite.

At altitude 3,950 feet a short tunnel has been excavated on a pyritized quartz-replacement shear striking N. 60° W. and dipping 70° west, in the feldspar porphyry of the hanging-wall of the main zone. At altitude 4,000 feet a deep open-cut exposes a width of 10 feet of silicified pyritized porphyry with some galena and chalcopyrite, on the foot-wall of which is 24 inches of brecciated argillite. A sample across 4 feet of cross-fracturing of the hanging-wall assayed: Gold, trace; silver, trace. This showing is probably the southerly extension of the main creek zone.

At altitude 4,210 feet some extensive stripping and open-cutting has exposed a wide zone of pyritized and silicified feldspar porphyry with some galena and sphalerite, striking N. 80° W. (mag.) and dipping 70° west. A width of 12 feet of this zone is uncovered, with the width still undelimited on the foot-wall. The owners report gold values of $2 to $4 from this showing.

At altitude 3,850 feet, on the slope to the Bear river and about 2,000 feet southerly of the cabin, several open-cuts have been excavated on a wide pyritized quartz-replacement zone in feldspar porphyry with some calcite stringers. The formation here appears to strike about N. 60° W., with cross-fracturing striking N. 60° E. These pyritized quartz-replacement zones in intrusive porphyry occurring on this property have a likely appearance for gold values and would be worth a thorough sampling to ascertain the presence or otherwise of this possibility.

In the same area Fred Young and H. Unwin, of Stewart, carried out additional work on the *Ore Mountain* group. With assistance from the Department of Mines the trunk trail to this area was reconditioned during the season.

Lucky Date. This group of six claims is owned by W. Younkin and O. McFadden, of Stewart, and is situated near the head of the North fork of Bitter creek, about 7 miles by trail from the Bitter Creek bridge. The mineral occurrence is described in the 1930 Annual Report. During the 1931 season the owners continued driving the crosscut to intersect the vein outcropping in the ravine. At about 55 feet from the portal the vein is reported to have been broken into, showing encouraging values in gold. Additional discoveries are also reported to have been uncovered on the property during the season's work, and with assistance from the Department of Mines the trail was reconditioned and continued.

L.L. and H. This group, originally owned by the Bitter Creek Mines, Limited, has been restaked by J. S. Harkley, of Stewart, who has carried out exploration during the summer and intends continuing during the winter. The property is situated at an elevation of 3,425 to 4,000 feet in Harkley gulch, near the head of Bitter creek, about 7 miles east of the Bear River road, and is described in detail in the 1929 and former Annual Reports. It is recommended to examining engineers.

George Enterprise Mining Co., Ltd. This company was incorporated in 1928 for the purpose of acquiring the *Enterprise* group of claims, situated near the head of the Bear River valley, on the north side, about 23 miles from Stewart. Subsequently the *Heather* group on the south side of the valley was also acquired. The showings have been described in detail in the 1928 and 1929 Annual Reports. During 1931 exploration was continued with a gang of four men. A shear-structure with encouraging chalcopyrite mineralization across about 6 feet, with a well-mineralized parallel stringer, is reported to have been encountered westerly of the upper workings.

American Creek Section.

On the *Keystone*, *Morning Jubilee*, *Vancouver*, and *Ibex* groups the owner, Samuel Deschamps, of Stewart, has carried out further prospecting and trail work. The *Morning Jubilee* tunnel has been extended a further 15 feet, but nothing of commercial importance has so far been exposed and indications are not encouraging. On the *Ibex No. 6* open-cutting was carried out on a quartzose replacement shear-zone 20 feet wide, showing some very sparse specks of chalcopyrite, galena, and zinc-blende. A sample across 14 feet of this zone exposed in the main cut assayed: Gold, trace; silver, trace.

Excelsior Prospecting Syndicate.

This syndicate was formed in 1929 for the purpose of exploring the *B.L.K.*, *Bryant*, *Dundee*, and *Virginia K.* groups, situated towards the head of American creek, about 17 miles from the Bear River road. The showings on the *Bryant* and *Dundee* groups were described in the 1930 Annual Report, together with some notes on the geology of the area. During the 1931 season the necessary assessment-work was carried out on the *B.L.K.*, *Bryant*, and *Dundee* groups. Prospecting and additional exploration was concentrated on the *Virginia K.* group, resulting in the discovery of important silver-lead-zinc ore-bodies. This group is situated at about altitude 4,000 feet on the east side of American creek and about 300 feet above the creek-bottom. The early snowfall prohibited examination of these showings, but from the description of an engineer who has examined them the newly discovered ore-bodies are of possible importance and warrant extensive exploration. In an authorized report on the area by G. Hanson, of the Geological Survey of Canada, published in the December 11th issue of the Stewart *News*, the following description of this showing is given: "Two open-cuts 1,500 feet apart expose 20-foot mineral-zones, in each case having a hanging-wall of quartz-feldspar porphyry and a foot-wall of calcareous argillite. The area between the open-cuts is entirely covered with talus, but the open-cuts expose conditions so nearly identical that it is likely that they are on the same mineral body. The zone is about 20 feet wide and is a replacement of black calcareous sediments. It consists of black cherty streaks of argillaceous limestone and numerous oxidized bands of sulphides. The deposit is so oxidized that it is difficult to obtain samples of unaltered primary vein-matter, but pyrite, galena, and sphalerite can be distinguished. According to the owners the deposit carries high values in silver."

Since this examination several cuts have been excavated along the presumed surface continuity of the zone. The following information and list of samples is kindly supplied by C. M. Bryant, president of the Excelsior Syndicate:—

Description.	Gold.	Silver.	Copper.	Lead.
No. 1 cut—	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Across 3½ feet on hanging-wall	0.16	326.40	.....	55.12
Across next 3 feet	0.12	317.66	0.50	13.60
Across balance of 15-foot vein	Trace	12.00	.....	16.16
No. 2 cut—				
50 feet below No. 1 cut, across 10 feet to foot-wall	Trace	1.48	.....	1.04
Across 4 feet on hanging-wall	0.02	52.60	.....	9.67
No. 3 cut—				
Surface sample 500 feet below No. 1 cut	Trace	7.80	.....	5.25
No. 4 cut—				
1,000 feet south-west of No. 1 cut, across 15 feet on surface	Trace	2.32	.....	2.24
15 feet below, across 15 feet	Trace	4.96	.....	6.14

No. 1 cut is at about 700 feet higher altitude above No. 4 cut and about 1,000 feet north-east on the slope of the hill.

No 2 vein is situated on *Virginia K. No. 5* claim, is about 12 feet wide, and can be traced up the mountain-side for a distance of 450 feet, striking in a south-easterly direction. No. 1 and No. 2 veins may intersect farther up the slope. Samples from this vein assayed as follows:—

Across 5 feet: Gold, 0.30 oz. per ton; silver, 264.60 oz. per ton; lead, 40.04 per cent.

Across 12 feet: Gold, 0.28 oz. per ton; silver, 44.40 oz. per ton; lead, 8.01 per cent.

No. 3 vein is situated at an altitude of some 4,400 feet on *Virginia K. No. 3* claim. It is about 2.5 feet wide, strikes north-west, and dips steeply to the south.

A sample across the 2.5 feet assayed: Gold, 0.06 oz. per ton; silver, 129.48 oz. per ton; lead, 49.12 per cent.

There is another lead on the *Virginia K. No. 3* situated about 700 feet east of open-cut No. 4 on the No. 1 lead, high up on the mountain-side, striking north-east and dipping to the north. This vein is composed of chalcopyrite in a quartz gangue. On *Virginia K. No. 1* claim, at altitude 3,800 feet, a defined vein about 10 feet wide of galena in a lime gangue is exposed, striking east and west, and can be traced for a distance of about 700 feet to the west. At the beginning of the season the trail was extended into this area by the Department of Mines and the section is now accessible to pack-horses.

North-western Aerial Prospectors, Ltd.

This company controls a group of fifteen claims situated about 4 miles north of American Creek glacier, on the west side of American creek and about 17 miles from the end of the Bear River road. During the season, with assistance from the Department of Mines, the trail was extended into this area, which can now be reached with pack-horses. The main showing on the *Moonlight* claim is described in the 1930 Annual Report. Owing to an early fall of snow a planned examination of this property could not be undertaken. The owners, however, report that during the 1931 season about 80 feet of further stripping was done on this showing. This proved that the ore on the hanging-wall of the zone continues for about 1 foot in width and that the foot-wall is mineralized with high-grade stringers. The probable extension of the vein was also uncovered about 400 feet north of this working. A vein exposed in three outcrops over a distance of 500 feet, and reported to average about 18 feet in width, and a parallel vein about 10 feet wide 100 feet north, are reported to have been discovered on the *Northern No. 7* claim. These veins are reported to be well mineralized with galena and sphalerite.

The following list of assays taken from the new workings during the 1931 season have been kindly supplied by the company management:—

Description.	Au.	Ag.	Lead.	Zinc.
Moonlight claim—	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Width, 1 foot	0.06	15.78	Trace	0.9
Width, 1 foot	0.04	59.96	13.2	0.8
Width, 0.5 foot	Trace	139.44	10.4	2.1
No. 7 Northern claim—				
Width, 10 feet (hanging-wall)	0.10	6.18	1.1	4.2
Width, 2 feet	Trace	6.20	19.8	.....
Hand specimens	0.20	10.82	7.2	18.2

Several other claims have been actively prospected in this area during the season.

Salmon River Section.

High Ore Gold Mining Co., Ltd.

This property consists of seven claims and three fractions, four claims and three fractions of which are Crown-granted, situated beyond the head of Fish creek, on the Salmon River slope close to the International boundary, about 2 miles south of the *Premier* mine. The property is reached by the Salmon River road to Fish creek, Alaska, from where a good trail for about 4½ miles leads to the property camp-site at altitude 3,575 feet, just across the boundary.

The mineral occurrence consists of an extensive zone of pyritized and silicified tuffs and greenstones, intruded in places by diorite-porphyry and lamprophyre dykes. The formation strikes generally N. 20° E. and dips 70° west, and the pyritized area seems to follow a structure, not well defined, striking N. 30° E. across the formation. Several open-cuts and two short tunnels have been excavated on the main or northerly zone along a distance of about 700 feet between elevations 3,700 and 4,000 feet on the east and west sides of Boundary creek. These expose a width of about 75 feet of pyritized and silicified greenstone, bounded on the south-west by a belt of pyritized, calcareous tuff. To the west of this is a mixed area of coarse purple breccias and some pyritized calcareous tuff, with intruding dioritic and lamprophyre dykes. The work carried out has been for the purpose of exploring and tracing the siliceous replacement

sections of these tuff and greenstone beds and has been intelligently carried out. The rocks of the area represent a series of pyritized flow, tuff, and breccia beds of the Bear River series, which in places have defined contacts and in other places merge one into the other.

Whereas these pyritized zones are extensive, any commercial aspect possessed by them is entirely relative to the gold content. Small gold values of around 80 cents per ton are claimed by the owners from the surface exposures.

Premier Gold Mining Co., Ltd.

Operations have been continuously conducted at this mine, although curtailed to six days a week actual mining. Mucking is carried out on Sundays with an auxiliary compressor installed on No. 4 level to operate the hoist. Milling equipment has been continuously improved and about 500 tons of ore per day have been handled. In the mine sixteen drills were operating towards the close of the year. Of these, four to five are employed on stoping and breaking ore and the rest on development. About 120 men are employed in the mining operations. Some new ore-bodies lateral to the main zone have been discovered between No. 2 and No. 3 levels, including a promising offshoot lateral to 4 H stope. During the year every effort has been made to effect economies and reduce costs in every department of operation and creditable results have been achieved without having to resort to a reduction in wages and staff. This property is referred to in Bulletin No. 1, 1932.

B.C. Silver Mines, Ltd.

Mining development on this property was suspended in April and a thorough sampling of the workings carried out. The results of operations during the year are outlined in the following statement by C. A. Banks, president of the company, given out at the annual meeting: "Development was concentrated on the North group of claims, on which 420 feet of drifting, 209 feet of crosscutting, 304 feet of raising, and 64 feet of side-swiping was done, making a total of 997 feet of underground working. This work was all performed on previously known ore-zones, to confirm previous estimates and prepare the property for production. Before shutting down the property about the middle of May last the ore-exposures were resampled. The results of this resampling confirmed previous estimates as to the values of the ore to be expected from stoping operations. A number of test-holes drilled into the walls of the workings showed, in some cases, greater widths of ore than those considered in previous estimates. No. 651 raise, on the B-2 zone, exposed high-grade ore for a distance of 50 feet, to 50 feet above No. 6 level, the average value of samples from the raise being considerably above that obtained from the sampling on No. 6 level drift. At about 50 feet above No. 6 level a sub-drift was driven for about 130 feet in a north-easterly direction. The shut-down of the property prevented this sub-level from being connected with No. 5 level above, but work in this section confirmed the occurrence of good stoping-ground. Raises and a sub-level drift above the No. 3 level on 'C' ore-zone failed to locate high-grade ore, such as that shipped some years ago, but confirmed the occurrence of a wide well-mineralized zone from which profitable production may be expected. Estimates of probable ore, or ore that may reasonably be expected to be mined from the ore-shoots disclosed to date, remain as previously reported, though, as stated above, greater widths have been demonstrated in several sections. Preliminary surveys were made to locate a suitable mill-site, and water-supply measurements were carried on through last winter, which showed that a supply for mill and plant operations was available."

This property is described in former reports and more recently in those for the years 1929 and 1930, and in Bulletin No. 1, 1932.

Big Missouri.

This property and the ore occurrence is described in detail in former Annual Reports and more recently in the report for 1930 and in Bulletin No. 1, 1932.

During 1931 exploratory mining and test-milling was continued until about the middle of September, with a crew of sixty-five men employed. Mining for this procedure was conducted by crosscuts, drifts, and wide stope-sills breast-stoped to a height of about 16 feet. Mill-runs from material resultant from this work were carefully tabulated to correspond with the mine localities from which the material came and checked against muck, drill, and face samples.

About the middle of September this mill-sampling work was suspended to resume further diamond-drilling for the purpose of exploring for possible continuity of sections of possible commercial-grade ore indicated. A crew of ten men, with one diamond-drill operating two eight-hour shifts, was employed on this work, which was suspended, it is understood, on account of difficulties of winter transportation at about the close of the year. Although it is understood that no operation of definite commercial aspects is indicated as yet, it is encouraging to note

that no possibility that may lead to the development of either a large-tonnage low-grade or a medium-tonnage medium-grade gold-producer is being overlooked.

Unicorn Mining Co., Ltd. This property is described in former reports and more recently in the 1930 Annual Report and Bulletin No. 1, 1932. During 1931 operations commenced on March 26th and were planned to continue until the end of November. A new and substantial snow-shed was constructed, and to October 30th No. 3 tunnel had been extended a further 90 feet, with a 30-foot crosscut to the west in the porphyry, about 51 feet from the tunnel-face. Some small spots of native gold have been encountered in quartz stringers, with generally intervening low-grade gold values. Operations are in charge of John Hovland, with one miner employed.

Salmon Gold. This property is described in the 1930 Annual Report and is also referred to in Bulletin No. 1, 1932. During 1931 the property was optioned by the Premier Gold Mining Company in the late fall. Exploration by means of twelve short diamond-drill holes with a portable equipment and some surface stripping was carried out. Operations were suspended at the freeze-up.

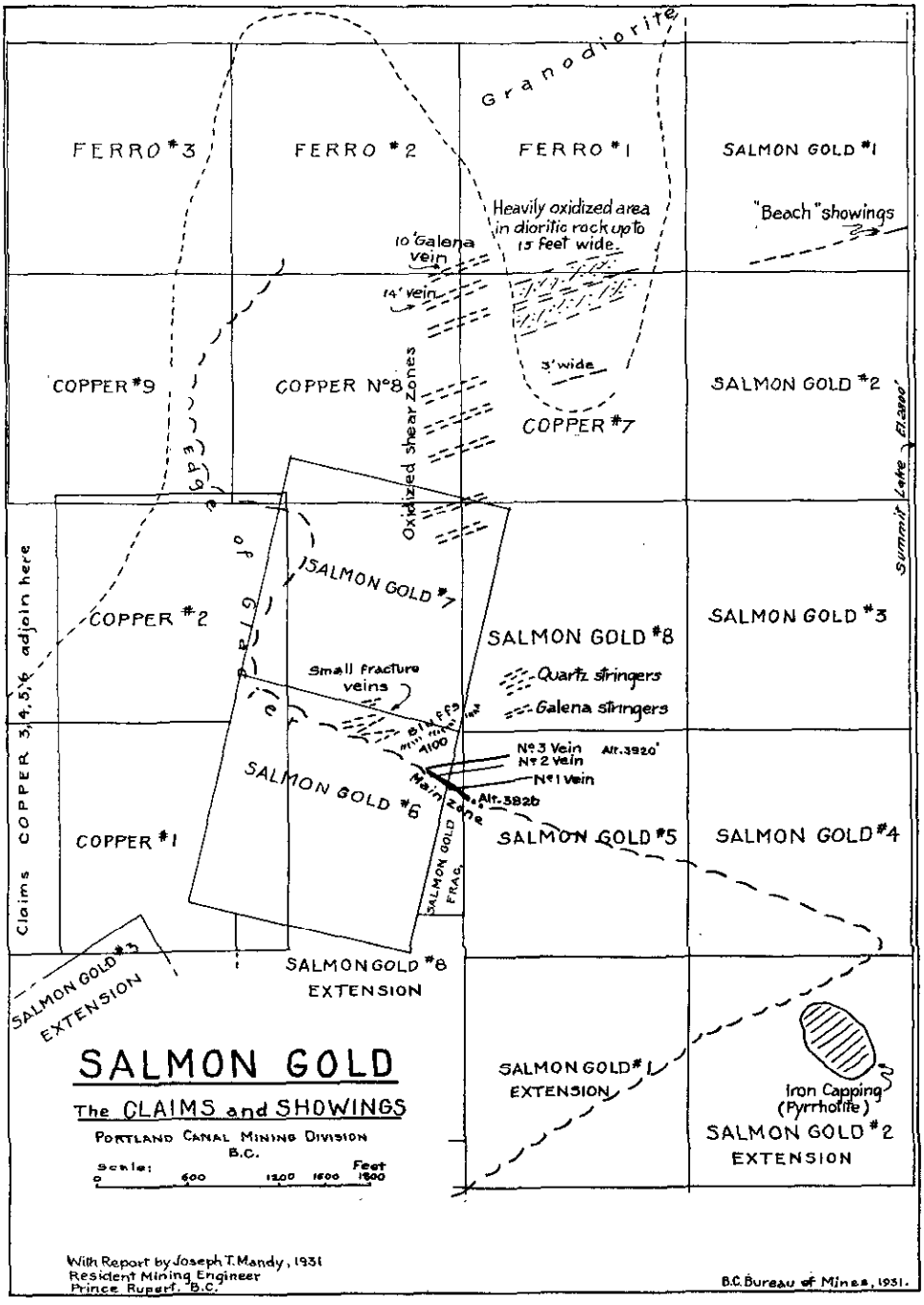
Some further work was also carried out on the *Troy* group by the owner, Charles Lake, of Stewart, and on other properties. General prospecting also resulted late in the season in a reported interesting discovery by J. Haahti, of Stewart, in the area lying east of Summit lake.

Edna May, Mineral Lode, and New Alaska. These claims were staked during 1931 in the area of the headwaters of the Leduc river by Wendell Dawson and W. Fromholz, of Ketchikan, Alaska. The Leduc river forms a north branch of the Chickamin river about 11 miles above its mouth at Behm canal, Alaska. The mouth of the Chickamin river at Behm canal is about 80 miles north-westerly of the entrance to Portland canal and about 42 miles north-easterly of the town of Ketchikan, Alaska. The area is accessible by launch from Ketchikan to the mouth of the Chickamin river, a distance of 65 miles, and thence by flat-bottomed river-boat equipped with outboard motor, and then overland.

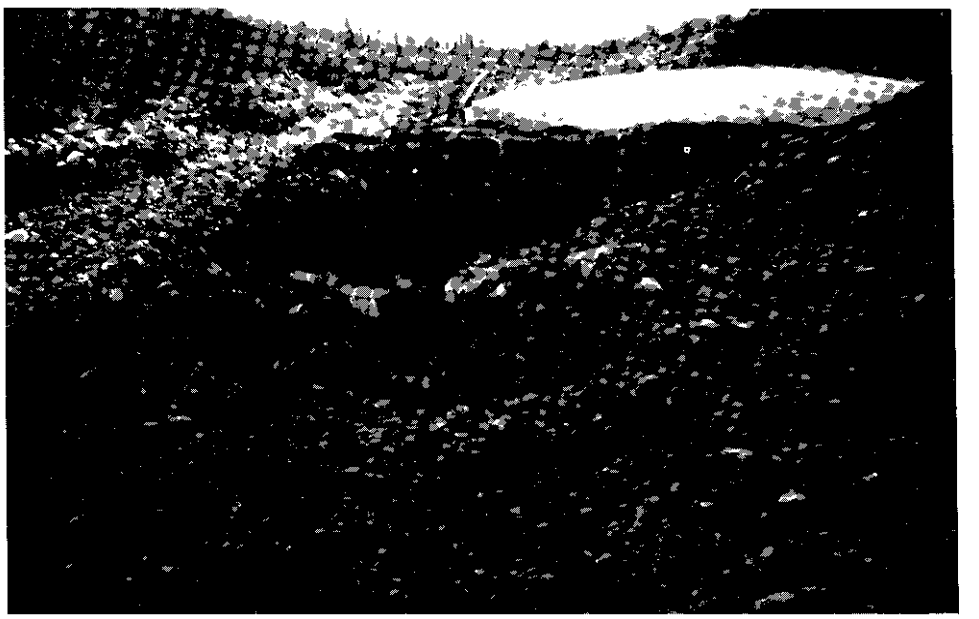
From information supplied by Wendell Dawson, boats of fair size could be used without difficulty to navigate the Chickamin river up to the confluence with the Leduc river, which is about 10 miles from tide-water. The Leduc river is reported to flow at a rate of 10 to 12 miles an hour, converging in places to one channel and at others splitting into several small channels. With the aid of lining it is reported possible to use a small river-boat on the Leduc river to a point about 10 miles below the boundary, which would be about 27 miles from tide-water. In the journey of Dawson and Fromholz four days is reported to have been required to navigate the Leduc river from its confluence with the Chickamin river to a point about 15 miles below the boundary, a distance of about 12 miles. From this point on, a trail was brushed out along the valley to the foot of the Leduc glacier and the range ascended. The International boundary crosses the Leduc river about 27 miles above its confluence with the Chickamin river and about 37 miles from tide-water at the Behm canal. It is interesting to note that previous to undertaking this journey these prospectors carried out an aerial reconnaissance and dropped supplies from the aeroplane at a selected spot in Alaskan territory near the head of the river. Additional supplies were subsequently dropped at intervals after the men had gone in and established their camp. These supplies were contained in specially constructed bags packed with cork, and after having been dropped from heights of from 50 to 200 feet were reported to have been recovered without having sustained any great material damage. It is, however, concluded that the addition of a small parachute to the packages would be an improvement.

The eastern contact of the Coast Range batholith strikes across the Leduc River trough in British Columbia territory, about 2 miles from the boundary. The immediate contact area is reported to be featured by many pegmatite dykes, and much float of chalcopyrite, pyrite, molybdenite, and galena occurring in the river-bottom, together with some small stringers of galena and copper ores. East of the contact the rocks are reported to consist of mainly argillite, slate, schist, porphyries, and volcanics, with red "iron-stained" areas that are evident for long distances.

The *New Alaska*, *Mineral Lode*, and *Edna May* claims have been located in an area from 3 to 5 miles easterly of the International boundary. The following particulars regarding the showings have been supplied by Wendell Dawson, one of the stakers: On the *Edna May* claim a quartz vein occurring in a series of lenses 2 to 8 feet wide is naturally exposed at intervals for a length of at least 1,500 feet over a vertical distance of about 1,500 feet, with both ends covered by ice. The vein strikes about north-south, dips 75° east, and is well mineralized with

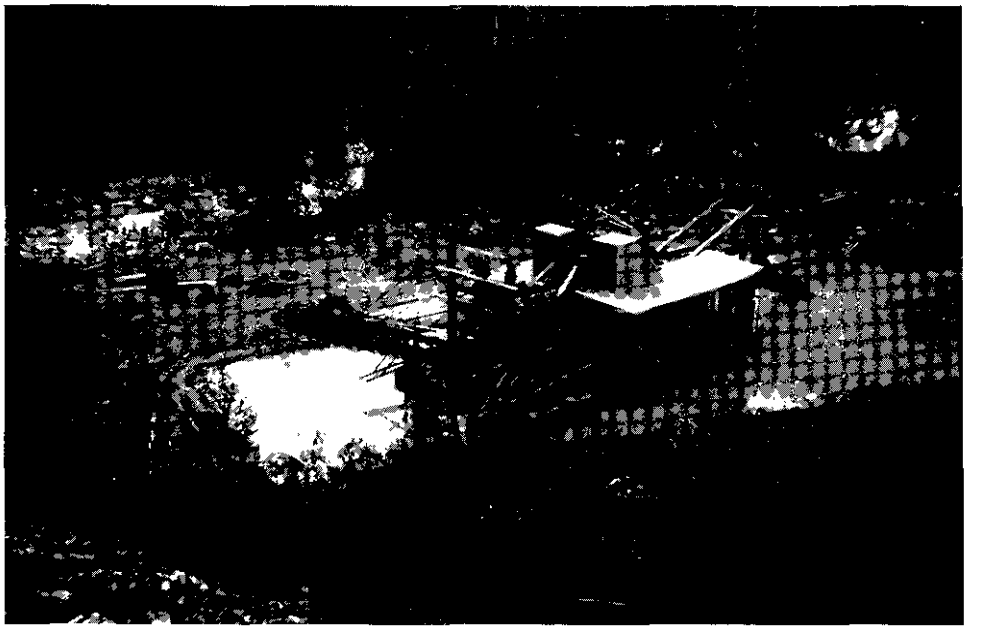

Granodiorite
FERRO #3
FERRO #2
FERRO #1
SALMON GOLD #1
"Beach" showings
Heavily oxidized area in dioritic rock up to 15 feet wide.
10' Galena vein
14' vein
3' wide
COPPER #9
COPPER No 8
COPPER #7
SALMON GOLD #2
Oxidized shear Zones
Summit Lake
Claims COPPER 3, 4, 5, 6 adjoin here
COPPER #2
15 SALMON GOLD #7
SALMON GOLD #8
SALMON GOLD #3
Small fracture veins
Quartz stringers
Galena stringers
No 3 Vein
No 2 vein
No 1 Vein
Alt. 3920'
Alt. 3826
Main Zone
SALMON GOLD #6
COPPER #1
SALMON GOLD #5
SALMON GOLD #4
SALMON GOLD FRAC.
SALMON GOLD #3 EXTENSION
SALMON GOLD #8 EXTENSION
SALMON GOLD
The CLAIMS and SHOWINGS
PORTLAND CANAL MINING DIVISION
B.C.
Scale:
0 600 1200 1800 Feet
SALMON GOLD #1 EXTENSION
Iron Capping (Pyrrhotite)
SALMON GOLD #2 EXTENSION
With Report by Joseph T. Mandy, 1931
Resident Mining Engineer
Prince Rupert, B.C.
B.C. Bureau of Mines, 1931.

McDame Creek, near Centreville—Panning for Gold.



Cassiar Hydraulic Mines, Ltd.—Workings on Dease Creek.

Khutze River—Topography on East Fork.



Barrington Co., Ltd.—Gold-dredge on Barrington Creek, Stikine River.

pyrite and galena. In some of the accessible lenses massive ore is exposed. Considerable float varying from a few pounds to over a ton in weight occur below inaccessible sections of the higher elevations and indicate strong mineralization of cube and fine-granular galena. About 800 feet east of this a quartz vein of similar size, attitude, and character, but with less intense mineralization, is reported to occur. About 800 feet west of the main vein two quartz veins similar to that on the east side, with many small mineralized stringers, are reported to occur. The country-rock is described as "porphyry," which is also said to be impregnated with metallic sulphides, particularly near to the hanging-wall. On the *New Alaska* the ore occurrence is southerly of the *Edna May* and is traced for about 1,200 feet, showing similar characteristics to those described on the *Edna May*. Assay results of samples from these two claims are submitted by Wendell Dawson as follows:—

Description.	Gold.	Silver.	Copper.
	$ per Ton.	Oz. per Ton.	Per Cent.
Sample No. 1	0.83	11.40	73.7
Sample No. 2	Trace	3.40	34.5
Sample No. 3	1.45	7.90	*
Sample No. 4	0.41	6.60	16.5
Sample No. 5	0.41	13.58	48.8
Sample No. 6	0.20	4.79	.....

* Not assayed.

On the *Mineral Lode* claim, situated south-westerly of the *Edna May*, a vein 5 feet wide mineralized with chalcopyrite, with mineralization extending for 15 to 20 feet into the wall-rock, is reported to occur in a belt of schist and slate. The zone is described as striking north-east and dipping vertically and is traced for about half a mile over an elevation range of about 1,500 feet. Surface exposures are reported to be heavily oxidized, making efficient sampling impossible. Assays on grab samples from float are submitted by Wendell Dawson as follows:—

Description.	Gold.	Silver.	Copper.
	$ per Ton.	Oz. per Ton.	Per Cent.
Sample No. 1	0.62	8.80	*
Sample No. 2	0.41	0.40	*
Sample No. 3	0.20	Trace	*
Sample No. 4	Trace	5.00	21.6
Sample No. 5	Trace	2.40	*

* Not assayed.

The owners have requested an examination of these deposits and the area in general by the Resident Engineer. When the necessary time is available this will be undertaken.

Unuk River Section.

Prospecting of the main Unuk River area in British Columbia territory beyond the International boundary was carried out by T. McQuillan and partner, of Ketchikan. Some samples of vein material and silicified pyritized rock submitted showed values of 0.08 to 0.40 oz. gold per ton. A detailed description of this section compiled from all available former reports is contained in the 1930 Annual Report. In the spring of 1931, at the invitation of the Ketchikan Chamber of Commerce and other Ketchikan public organizations, a trip was made to Ketchikan in order to discuss the inauguration of possible transportation facilities into this promising section. As a result of these discussions, resolutions recommending the undertaking of trail-construction were formulated by these organizations and forwarded to the necessary Alaskan and United States authorities. It is hoped that as a result of these representations trail-construction will be undertaken on the Alaskan side of the Panhandle boundary, which will permit the continuation of these facilities into the promising mineralized area in British Columbia territory.

STIKINE MINING DIVISION.

Drapich. This group is described in the 1930 Annual Report. The property is situated on the west bank of the Stikine river, about a quarter of a mile southerly of Jackson's Landing, and is owned by S. Barrington and associates, of Wrangell. During 1931 a tunnel was started in a narrow segment of limestone between two converging granitic contacts at elevation 525 feet above the river and about 25 feet directly below the main ore-showing in the cut. The tunnel was driven for 60 feet, bearing N. 62° W. (mag.), and after passing through about 15 feet of chalcopyrite-garnetite ore encountered granite at 47 feet, and continuing along a N. 43° W. (mag.) direction for a further 26 feet remained in granite to the face. At elevation 650 feet No. 2 tunnel was driven in garnetized limestone for 33 feet in a N. 75° W. (mag.) direction, where it also entered granite. Some additional open-cutting and stripping was also carried out. This work has indicated that this contact-metamorphic copper-ore deposit occurs in very restricted segments of limestone in the form of small remnant inclusions in granite.

Lucky Strike. These claims are situated on the right bank of the Stikine river, about 2 miles below Jackson's Landing, and are owned by the S. Barrington interests, of Wrangell. Active prospecting of the narrow quartz veins occurring in argillite, argillaceous sandstone, and quartzite, close to the batholith-contact, was carried out during the 1931 season. Some isolated specks of native gold have been encountered in these veins. The chief mineral-showings at present discovered are at altitude 1,140 feet, and 1,575 feet above sea-level. (The Stikine river at this point is about 400 feet above sea-level.) The showings are about from ¾ to 1 mile from the river, with the mountain sloping to the river-bank at an angle of about 25°.

The area embraced by the claims lies about 2 miles northerly of the main batholith-contact. Some quartz stringers, veins, and small lenticular quartz-masses outcrop in the quartzite. Many of the quartz veins, stringers, and lenses are generally barren of any accessory mineralization. On the two occurrences being explored a sparse mineralization of sphalerite, pyrite, pyrrhotite, and some galena occurs. In the upper showing some specks of free gold have been found associated with these accessory minerals and particularly with galena.

The showing at altitude 1,575 feet, on which some exploration has been conducted, consists of a brecciated fracture-zone striking N. 60° W. (mag.) and dipping 30° north. An open-cut on this exposes a width of about 4 feet of crushed material, in which are some fragments of quartz, some of which contain specks of galena. The foot-wall of the zone is not as yet clearly exposed on the floor of the cut. At the mouth of the open-cut this zone is intersected by a parallel fracture 10 inches in width, dipping 70° south. At the point of junction the fracture-zone steepens to an average 50° dip, giving the aspects of being dragged and faulted by the smaller fracture.

The smaller fault-fracture contains isolated fragments of quartz from a few inches to about 14 inches long, in some of which a sparse mineralization of zinc-blende, galena, pyrrhotite, and occasional specks of native gold occurs. For about 2 feet from surface the small fracture at the open-cut is filled with surface detritus. A sample across 2 inches of this assayed: Gold, 1.8 oz. per ton; silver, 0.4 oz. per ton. These values cannot be taken as offering a criterion of values to be expected in solid portions of the vein at greater depth. It is quite possible, on the contrary, that gold may have resulted from a concentration in the fracture of fine eluvial gold emanating from the erosion of veins occurring at higher altitude and coming to rest in this fracture, which may have functioned as a natural riffle. A sample of yellow gouge on the hanging-wall of the slip in the cut assayed: Gold, *nil;* silver, *nil.* A sample across 8 inches of brecciated material in a small cut above the tunnel assayed: Gold, 0.2 oz. per ton; silver, 0.2 oz. per ton.

At altitude 1,140 feet a quartz vein 24 inches wide, sparsely mineralized with sphalerite, pyrrhotite, chalcopyrite, and pyrite, has been traced for about 200 feet, showing good definition at points of exposure. A sample of this assayed: Gold, trace; silver, trace.

The ground embraced by these claims warrants further prospecting for gold-bearing quartz veins. On the upper showing it is suggested that a short drift-tunnel be started from the open-cut at the point of junction of the two fractures and run on a bearing of N. 20° W. (mag.). This will rapidly gain depth below the surface outcrop and enable some criterion to be formed of the possible gold contents of both structures. Systematic sampling should accompany this work.

The area generally should also be systematically prospected for other vein occurrences, particularly for those associated with some defined structure that may afford a better chance for continuity than would otherwise be the case in this type of formation and mineral occurrence. The occurrence is referred to in Bulletin No. 1, 1932.

Peach and Apricot. These claims on Devils Elbow mountain are owned by Peter Hamlin and are described in the 1930 Annual Report. During 1931 stripping and open-cutting was continued and about 100 feet westerly of the main cuts a width of 8 feet of chiefly sphalerite mineralization was exposed along the strike of the zone.

Jackson. This group is described in the 1929 and 1930 Annual Reports. The property is owned by Frank Jackson and associates, of Jackson's Landing, and is situated on the south side of the Chutine river, about 4 miles from the mouth of the river. During 1931 a log cabin was constructed at altitude 3,475 feet and some additional open-cutting carried out. A cut 6 feet deep on the main zone on the *Frank J.* claim, at altitude 3,625 feet and about 600 feet west of the camp, exposes 6 feet of sheared and oxidized material carrying fair mineralization of sphalerite, galena, and chalcopyrite in the unoxidized sections. This zone strikes N. 80° W. (mag.) and dips 80° north; it is well defined and well mineralized. Closely spaced trenching and open-cutting should be undertaken to trace the continuity of this zone.

Further stripping and open-cutting has been carried out on a series of six north-westerly and east-west striking veins outcropping along the 50° hill-slope to Conover creek, between altitude 3,350 feet and 3,950 feet. Four of these occur on the *Walter J.* claim, starting about 200 feet north-easterly of the cabin, where at altitude 3,475 feet a quartz vein 12 inches in width with some chalcopyrite is exposed. Fifty feet north of this a small cut exposes a similar parallel quartz vein 40 inches in width. About 200 feet north-easterly of this an open-cut has been excavated on a quartzose replacement-zone 6 feet in width mineralized with pyrite. In the outcrop above the cut the zone is mineralized with sphalerite, galena, and chalcopyrite. This zone strikes N. 45° W. and dips 80° south; 50 feet southerly of it is a parallel quartz vein 30 inches in width mineralized with chalcopyrite and sphalerite. At altitude 3,325 and about 700 feet north-east of these showings a quartz vein 18 inches in width mineralized with sphalerite, galena, and chalcopyrite has been exposed just above the trail. These showings are worth further exploration and should be traced by closely spaced trenches both up and down the mountain-slope.

At altitude 3,700 feet about 600 feet south-west of the cabin an open-cut on the *Frank J.* claim exposes a decomposed quartz vein 3.5 feet in width mineralized, in unoxidized parts, with pyrite, chalcopyrite, and sphalerite. This vein strikes east-west (mag.) and dips 60° south. This vein should also be traced by closely spaced trenches. With the assistance of the Department of Mines a good trail has been completed into this area.

Lady Jane. This group consists of seven claims and is owned by Frank Taylor and associates, of Vancouver. The claims are situated at around altitude 4,000 feet on the south side of the Chutine river and adjoin the *Jackson* group on the west. The property is reached by the newly constructed trail from near the mouth of the Chutine river, a distance of about 5 miles.

The rocks comprising the locality are altered volcanics in places impregnated with pyrite, which lie at a distance of about 4 miles easterly of the Coast Range batholith-contact. The main showing is located on the boundary between the *Lady Jane* and the *Lady Jane No. 2* claims. It consists of a silicified and brecciated fracture-zone about 6 feet wide in a fine-grained quartzose greenstone. Quartz seams and veinlets course through the zone, which in places is also completely replaced by quartz. Fracture and shearing structure is not intense and the quartz replacement gradually fades into the adjoining wall-rock. Whereas the hanging-wall shows some definition, the foot-wall is not defined. Mineralization is generally sparse and consists of pyrite with some chalcopyrite, zinc-blende, and galena. Some siderite or ankerite is noticeable in the gangue in small seams and veinlets.

The zone strikes N. 10° W. (mag.) and dips 60° west. It has been opened up by one open-cut and one small pit about 100 feet apart. Two smaller cuts have also been excavated about 75 feet northerly of these, but show nothing definite. In the lower or main cut at altitude 3,950 feet the described characteristics of the zone are exposed. A sample across 6 feet of the face of this cut, representing the general tenor exposed, assayed: Gold, trace; silver, 0.6 oz. per ton; copper, trace; lead, trace; zinc, 1.2 per cent. Some float and a small showing has

also been located on the *Amy J. No. 2*, about 2,000 feet north-easterly of the cuts. No work has been done in this locality. The showings occur on the hillside sloping 50° to Conover creek.

Although no commercial values are indicated in the present showings by the limited amount of work done, it is possible that further surface exploration may disclose some commercial indications that may warrant further work. The zone warrants further prospecting by surface-trenching and open-cutting for the purpose of tracing it and determining the possible existence of commercial mineralization. This should be carried out both above and below the present exposures. At present there is no evidence to enable any correlation to be made between these showings and those on the *Jackson* group adjoining to the east.

Klapan. On this group of ten claims owned by J. G. Hope and associates, of Telegraph Creek, and situated on the north side of the Ealue lake, about 62 miles east of Telegraph creek, some promising showings of good-grade copper ore with encouraging continuity are reported to have been exposed by stripping, several open-cuts, and a tunnel 21 feet long. Mineralization consists of chalcopyrite, pyrite, and pyrrhotite in a country-rock of dolomitic limestone cut by felsite and feldspar-porphyry dykes. Assays of the sulphides submitted by the owners show $2.60 in gold and 12.25 per cent. copper.

Upper Chutine River.—Some general reconnaissance prospecting was carried out by Einar Hagen and partners and John Harkins and partners, who penetrated to the headwaters of Barrington river. Promising placer-gold and likely lode areas are reported to have been located. Both these outfits have taken in supplies for from one to two years and plan intensive further prospecting in this area.

PLACER-MINING.

Barrington. This ground is situated on the Barrington river, about 12 miles by wagon-road from the Stikine river. The ground is described in former reports and more recently in Bulletin No. 1, 1931, "Placer-mining in British Columbia." During 1931 the Barrington interests have successfully completed the installation of a Risdon, New Zealand type, 1,500 cubic yards per day rated capacity dredge. Construction was commenced on June 15th and the machinery turned over on September 10th. A crew of from fourteen to twenty-five men was employed, with B. J. O'Reilly as superintendent and W. M. Withers as dredgemaster. Everything is now ready for digging at the opening of the 1932 season.

The camp is at elevation 850 feet, about 300 feet higher elevation than the Stikine river. It is estimated that the dredge will dig from 800 to 1,000 cubic yards of gravel a day in this character of ground. The bucket-line consists of thirty-eight buckets of 3¼ cubic feet capacity (24 by 18 inches opening and 28 inches deep), with reinforced manganese-steel lips, spaced 18 inches on the straight of the ladder and about 24 inches on the slack. The buckets dump into a belt-connected revolving trommel screening to ⅜ and ⅝ inch. The undersize goes to grid-tables, duplicated on each side of the dredge, of about 165 square feet on each side. The oversize from the trommel goes to the dump-stacker. The winch is the original Risdon type, with positive clutch, installed on the lower deck, with cable-gear calculated for a 3,000-lb. lift. Power is supplied by a 100-horse-power Fairbanks-Morse Diesel engine. Light is supplied by a 3-kw., 26-ampere, 115-volt Fairbanks-Morse dynamo. The boat is 76 feet long with beam of 35 feet. It is estimated the equipment can dig to a depth of 35 feet below water-level. Construction has been carried out with a crew of fourteen to twenty-five men. Transportation equipment consists of a light Ford truck and a Holt tractor with trailer. The installation is estimated to have cost about $80,000.

It is estimated that approximately 700,000 cubic yards of ground containing from 35 cents to $1.65 in gold per yard (about $500,000) is indicated and that operating costs of the dredge will amount to about 20 cents a cubic yard. The tentative plan of operation to commence in the 1932 season calls for three 8-hour shifts, with a crew on each shift consisting of one winch-man (digger), one engineer, and one deck-hand, the whole operation involving a total crew of from fifteen to twenty men. It is expected that some trouble from boulders will arise, but if this is not excessive a limited profitable outcome from the venture should be realized.

Stikine River Bars.—Some very efficient Keystone-drill exploration of the Stikine River bars was carried out by Jack Steele, of Wrangell. On Carpenter's bar about 247 feet was drilled in six holes, showing values of 3 to 8 cents per cubic yard. On Millar's bar about 100 feet was drilled in three holes, showing values of 5 to 7½ cents per cubic yard. During the 1932 season it is planned to drill Buck's bar.

LIARD MINING DIVISION.

Keystone. This group of eight claims on Thibert creek, below Berry creek, is owned by Homer Ficklin, of Porter Landing. Open-cutting and stripping has exposed a zone of quartz stringers in quartz porphyry, in which the owner reports gold values up to $5.50 across a width of 40 feet. During the winter it is planned to drive a crosscut 20 feet long to intersect the vein vertically below the surface showings. A group of claims is also being prospected by Homer Ficklin on Deloire creek.

The Thibert Creek area is referred to in Bulletin No. 1, 1932, "Lode-gold Deposits," issued by the Department of Mines.

McDame Creek. In the McDame Creek area some superficial prospecting of the many possible gold-bearing quartz veins has also been carried out and encouraging results reported that will be followed up by more intensive prospecting during the 1932 season. This interior area, and particularly that relative to the Cassiar and other batholithic satellites, is referred to in Bulletin No. 1, 1932. It is especially recommended to lode-gold prospectors as a virgin area that appears to be very promising for the occurrence of lode-gold ore-deposits.

PLACER-MINING.

Four hundred and forty ounces of placer gold, valued at $7,480, has been recovered during the 1931 season from the Liard Mining Division.

DEASE CREEK.

Cassiar Hydraulic Mines, Ltd. This company, which is hydraulicking on Dease creek, has recovered 138 oz. of gold. Work has been carried on with a crew of seventeen men working three 8-hour shifts. In the early part of the season difficulties with the new ditch retarded operations and resulted in the loss of the best water period for the hydraulicking operations. Towards the close of the season low water-pressure and an awkward set-up of the monitor prevented a thorough clean-up of bed-rock. The ground being worked consists of the high-bench old channel of Dease creek on the right bank of the present creek. This is composed of bedded layers of fine gravel, clay, coarse gravel, sand, and clay, overlain by glacial boulder-clay, the whole constituting a cross-section about 120 feet in thickness, the top being at about altitude 2,700 feet and about 200 feet above the present creek-bed. The Dease Creek gravel-deposits are described in detail by W. A. Johnston in Summary Report, 1925, Part A, Geological Survey of Canada, and are ascribed to partial pre- and inter-glacial origin.

At the workings of the Cassiar Hydraulic Mines, Limited, commodious camps have been constructed and an excellent vegetable-garden cultivated, produce from which is stored in a well-constructed root-house. Electric light is supplied by a Model K, 110-volt, d.c., 2-kw. Kohler plant. There is also a small sawmill on the ground. Seven gold-saving boxes, each 12 feet in length, with an 8-inch grade, are installed from the pit, and six similar tailings-boxes with a grade of from 10 to 12 inches to the box. From the penstock to bed-rock there is a head of 300 feet, and 250 feet to the monitor. The ditch is designed for 3,000 miners' inches of water, which is available at freshet-time. By September the water-supply drops to about 1,500 inches. Operating costs are estimated at about 9 cents per cubic yard of gravel moved. Gold values in the ground are not definitely known and the operation is based on the results obtained in old-timers' workings. Further details regarding this operation are contained in the 1929 and 1930 Annual Reports.

Dease Creek Mines Corporation. The head office of this company is at 908 Republic Building, Seattle. Operations in the upper section of Dease creek are described in the 1928, 1929, and 1930 Annual Reports. During 1931 drilling has been carried out on the old channel towards the mouth of Dease creek with a No. 3 Keystone drill and a crew of four men under the supervision of C. J. Leeds. On the *Warren* lease a hole drilled 160 feet to bed-rock is reported to have shown values of 46.75 cents per cubic yard. From another hole drilled 112 feet on the east rim without reaching bed-rock, values of 28 cents per cubic yard are reported. On the *Blue Bell* lease a hole had advanced 116 feet and up to the time of examination was reported to have returned gold values of 18 cents per cubic yard. The material passed through in this drilling is bedded sand, clay, fine and coarse gravel, similar to that described in the cut of the Cassiar Hydraulic Company.

About 6 miles up Dease creek, and above the Cassiar Hydraulic operation, Pete Jorgensen is running an open-cut to reach bed-rock. About 6 oz. of gold has been taken out in the preparatory work. Above this operation G. M. Johnson is running a bed-rock open-cut at the lower end of his lease. He claims to be on the edge of ground showing about 30 cents to the pan and will start shovelling in the 1932 season.

Thibert Creek.

L. Holensee, shovelling below Berry creek, on Thibert creek, took out about 20 oz. of gold in six weeks. The Gibson Hydraulic Association on Mosquito creek has continued preparatory work, taking out about 10 oz. of gold. Further drilling of this ground is planned for the coming season.

Gold Pan Creek.

A. M. Vickery has operated his ground on Gold Pan creek more intensively and has taken out about 91 oz. of gold. L. Holensee, "sniping" in this area, recovered about 20 oz. Ben Cambron has been stripping his ground on Gold Pan creek by ground-sluicing and recovered about 46 oz. of gold. Percy Peacock, Faulkner, and Costerman, working on Turnagain river, completed a ditch 1,500 feet long in preparation for early operations in the 1932 season. Chas. Wheatley, prospecting in the Gold Pan Creek area for likely ground to operate, recovered some nice coarse gold and will return in the 1932 season.

McDame Creek.

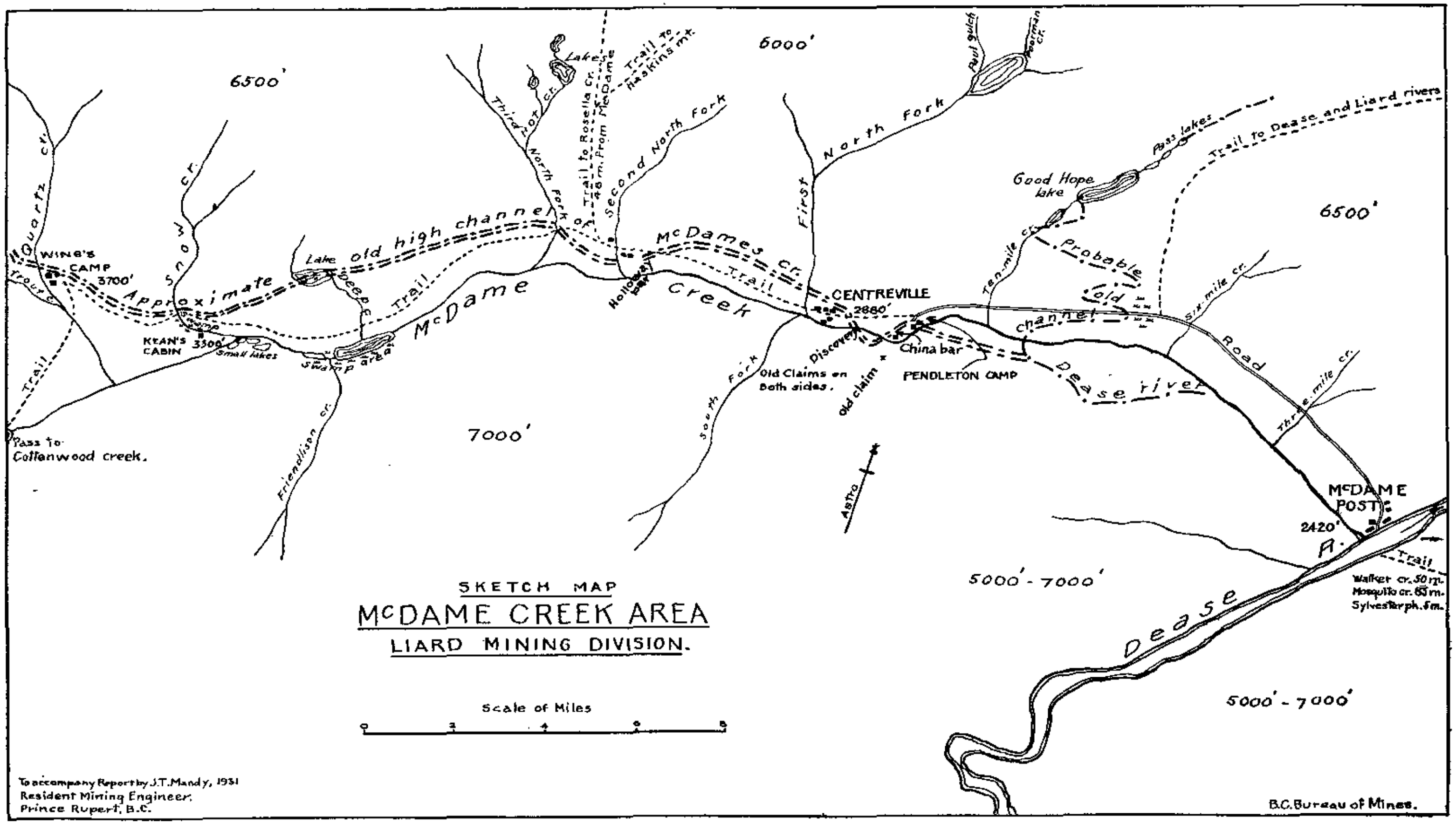
This area is attracting increased attention. Since the days of the "old-timers" only haphazard and spasmodic operations have been attempted, and the promising potentialities of the extensive virgin ground, probably suitable for appreciable hydraulicking operations, have never been probed. It is significant that the richest shallow ground ever worked by the "old-timers" in the Liard Division occurred on McDame creek. In view of the increasing interest and latent placer possibilities of this area, a detailed examination of the area was undertaken by the Resident Engineer, and the following special report prepared:—

Placer-gold Deposits of McDame Creek Area.

McDame creek flows into the Dease river on its left bank, about 60 miles north-easterly from Dease lake. The creek and its several tributaries dissects and drains a peneplanated plateau area of about 300 square miles. The elevation at the mouth at McDame Post is 2,420 feet above sea-level, and at Snow creek, about 25 miles up the creek from McDame Post, it is about 3,300 feet above sea-level.

Accessibility.—The creek is reached by regular steamer service to Wrangell, Alaska, from where the Stikine river is navigated by the regular river-boat service of the Barrington Transportation Company as far as Telegraph Creek. During 1931 the Taku Transportation and Trading Company, operated by William Strong, also inaugurated a transportation service between Wrangell and Telegraph Creek. A motor-road, 72 miles in length, of varying and questionable quality, connects Dease Landing on Dease lake with Telegraph Creek. The journey from Dease Landing to McDame Post, a distance of about 70 miles, is completed with powered small river-boats. To supply their trading-posts at Dease Landing, McDame Post, and Liard, the Hudson's Bay Company operates a freighting service by tractor and trailer between Telegraph Creek and Dease lake, and from thence by small river-boat and scow down the Dease river to McDame and Liard Posts.

J. C. Morrison, of Telegraph Creek, also operates an efficient and accommodating passenger and freighting service between Telegraph Creek and McDame Post and is equipped to contract for the varying classes of traffic into this country. The journey from Wrangell to Telegraph Creek occupies from two to four days, depending on the condition of the Stikine river. From seven hours to three days, depending on the condition of the road, is occupied in the journey between Telegraph Creek and Dease Landing. During wet periods and towards the close of the season this road can at times be practically impassable for anything but caterpillar traffic, and is badly in need of drainage, surfacing, and general conditioning to fit it for regular and comfortable car and truck service. The journey from Dease Landing to McDame Post occupies from about fifteen to sixteen hours, and about two days returning. A good wagon-road suitable for light motor-trucks extends from McDame Post to within 3 miles of Centreville, from the end of which a good pack-horse trail extends to Quartz creek, a total distance of about 30 miles.


SKETCH MAP
McDAME CREEK AREA
LIARD MINING DIVISION.
Scale of Miles
To accompany Report by J.T. Mandy, 1931
Resident Mining Engineer,
Prince Rupert, B.C.
B.C. Bureau of Mines.
6500'
6000'
6500'
7000'
5000' - 7000'
5000' - 7000'
Quartz cr.
Trout cr.
WING'S CAMP 3700'
KEAN'S CABIN
Pass to Cottonwood creek.
Snow cr.
Approximate
old high channel
Lake
Small lakes
Swamp area
Friendlison cr.
McDame Creek
Third North Fork of
Hot cr.
Lakes
Trail to Rosella Cr. 40 m. Prom McDame
Trail to Haskins mt.
Second North Fork
McDames cr.
Holloway bar
Trail
First North Fork
South Fork
CENTREVILLE 2880'
Discovery
Old Claims on Both sides.
old claim
China bar
PENDLETON CAMP
Astro
Paul gulch
Poorman cr.
Good Hope lake
Pass lakes
Trail to Dease and Liard rivers
Ten-mile cr.
Probable old channel
Six-mile cr.
Road
Dease river
Three-mile cr.
McDAME POST
2420'
Trail
Walker cr. 50 m.
Mosquito cr. 65 m.
Sylvester ph. 8 m.
Dease R.

It is understood that during the 1932 season the Canadian Airways, Limited, plans to operate an aeroplane service between Telegraph Creek and Atlin, which service, operating out from Telegraph Creek, if available for this section, should greatly facilitate traffic into the McDame Creek area. Aeroplane-landings should be accomplished with facility on Dease lake, numerous long stretches of the Dease river, and on several lakes in the McDame Creek area.

Cost of Supplies.—By the present transportation systems freight rates are about as follows: Wrangell to Telegraph Creek, $40 to $60 per ton; Telegraph Creek to Dease Landing, 5 cents per lb.; Dease Landing to McDame Post, 3 to 5 cents per lb.; McDame to Liard Post, 8 cents per lb.

The variation of rates from Telegraph Creek north is in accordance with the quantity of freight lots, the higher figure generally applying to small lots, such as prospectors', etc., outfits. For large lots special rates can be arranged.

Passenger rates are as follows: Wrangell to Telegraph Creek, $50 return, including meals and berth; Telegraph Creek to Dease Landing, $100 for a car, return, including kitchen; Dease Landing to McDame Post, $100 return, special trip for boat (say, two persons), including river navigator and kitchen (lay-over wait, at about $5 per day).

At Telegraph Creek special inclusive trips are contracted for by J. C. Morrison. By going in with the Hudson's Bay freight by truck or tractor from Telegraph Creek to Dease Landing, and from thence accompanying the down-river freight, reduced passenger rates, exclusive of "kitchen," can be arranged with the Hudson's Bay Company. By utilizing this freight-passenger service those wishing to travel only as far as McDame and return up-river by the same boat would have about four days at McDame and then catch the boat returning up-stream from Liard Post.

As a criterion of the cost of supplies in the area, the following prices quoted at the Hudson's Bay posts at Dease Landing and McDame as at September, 1931, are mentioned:—

Supplies at Dease Landing.—Flour, $15 per 100 lb; sugar, $18 per 100 lb.; coffee, 90 cents per lb.; tea, 20 cents per lb.; milk, $1 per 3 cans; dried fruit, 35 cents per lb., average; canned goods, 50 cents per can, average.

Supplies at McDame Post.—Flour, $19 per 100 lb.; sugar, $25 per 100 lb.; coffee, $1 per lb.; tea, $1 per lb.; beans, 24 cents per lb.; milk, 50 cents per can; klim, $1.25 per lb.; dried fruit (any kind), 50 cents per lb.; rice, 22 cents per lb.; bacon, $1 per lb.; salt, 75 cents per 3-lb. sack; pepper, 25 cents per 12-oz. tin; Epsom salts, 25 cents per 4-oz. package; gasoline, $1.75 per gallon; lubricating-oil (Mobile A), $3 per gallon; tobacco, $3 per lb.; tobacco (Old Port), $3 per lb.

With improvements in transportation facilities in accordance with the prevailing or prospective activity in this area, a reduction in passenger and freight rates and cost of supplies could be achieved.

Climate.—The area of McDame creek has the appearance of a dry belt, with a moisture precipitation of about 25 inches per annum. Snow precipitation is light and probably does not exceed an average of 3 to 4 feet. Indications generally point to an even more subdued moisture precipitation in this section than in that of the Dease Lake area to the south. Winter temperatures are low, with probably an extreme average of about 20° F. below zero, but the ground is not permanently frozen. No glaciers occur in the area. During the summer months the temperature is reported to be fairly high, but not uncomfortably excessive, with generally cool nights. Dease river is reported to be free from ice early in May, but on the shallow lakes ice remains until probably the end of May or early in June. Slush-ice is reported to form on the Dease river at about the middle of October, with the small lakes probably frozen over about this time.

Vegetables can be cultivated to maturity and excellent potatoes, turnips, radishes, carrots, etc., were seen at Centreville and Quartz creek. Wild fruits grow in abundance, especially soap-a-lalei, saskatoon, and cranberry berries. Typical and obnoxious flora characteristic of the wet coastal area, such as the "devil's-club," is absent in this locality. The low-level slopes are openly wooded with spruce up to about 18 inches in diameter, pine, poplar, larch, and birch. In the valley-bottoms and swampy areas are alder and willow. Moose, mountain-goat, mountain-sheep, grouse, ducks, and geese thrive in great numbers, with some caribou, rabbits, and grizzly bear. Grayling, trout, whitefish, and pike are prolific in the Dease river and lakes. The area generally is a game paradise. Mosquitoes and black-flies thrive in healthy, affectionate, and

voracious profusion during the summer months, but at about the end of August have succumbed to a possible overindulgence of abundant succulent diet.

Topography.—The area occupies part of an elevated upland plateau of about 2,500 to 4,000 feet general altitude above sea-level. Rising above this to altitudes of from 5,000 to 8,000 feet above sea-level are the bare crests and ridges of the Cassiar mountain range, at the north-easterly margin of which the area is situated. The important effect of the local topography is to afford comparative protection from excessive moisture precipitation and glaciation. Dissecting the plateau-base or lowlands is the main drainage system of the Dease river flowing in a general north-easterly direction. McDame creek and its several tributaries is an important major component of this system and flows in a general west to east direction.

The Dease River trough is a broad drift-filled valley with an average low gradient. Rock-outcrops are scarce along the stretch from Dease lake to McDame Post. The prominent cut-banks in places are generally composed of stratified river sands and gravels of probably inter- and post-glacial origin. Boulder-clays were not seen, although they may occur. Remnants of high terraces occur on both banks of the Dease river, particularly on the slopes of the high range south of Cottonwood river, where they occupy an elevation up to about 1,500 feet above the valley-bottom. In the McDame Creek trough, terraces, or terrace-benches, are a generally prominent topographical feature, particularly in the neighbourhood of Centreville. Here, at least three distinct bench-flats are observed on both sides of the creek, those on the right or south side being particularly prominent where they are dissected by the South fork. The highest observed terraced bench in this area occupies an altitude of about 3,700 feet above sea-level. The old camp of Centreville is built on the first or low bench, 2,880 feet above sea-level, and it was on this bench-level that most of the gold was recovered by the "old-timers." This slopes steeply up to the second bench-level at altitude 3,130 feet, with the third bench at 3,400 feet above sea-level.

What appear to be hummocky end-morainic deposits occur about 30 miles up McDame creek in the neighbourhood of Quartz Creek mouth. This section of the creek-valley, starting about 20 miles up, or 3 miles below Snow creek, is also featured by a comparatively flat gradient, small lake-remnants, and extensive willow-filled swamp areas.

Prominent esker and outwash topography features the lower area of McDame creek for about 8 miles up from its mouth. In this section the trail follows a typical esker ridge for a distance of about a mile. At about 7 miles up the creek a wide depression on the north side forms a low pass through the flanking range and is a prominent feature of the topography. This depression strikes in a north-easterly direction, approximately parallel to the Dease River valley above McDame Post, and intersects with McDame creek at about the point where the creek-valley makes a sharp bend from a general north-westerly to a due westerly direction. From the broad erosional character of the lower 8-mile section of the present McDame Creek valley, it is altogether probable that this depression represents the old channel of Dease river which was filled with glacial drift during Pleistocene time, and the stream consequently diverted to its present channel.

The topography of McDame Creek trough appears to represent a deeply dissected semi-drift-filled plateau upland. The sequence of sculptural influences leading to its present form may be somewhat complicated, and to definitely elucidate them a more lengthy period of examination than was available to the Resident Engineer would be required. An interpretation of the compiled evidence, however, and its bearing on placer-gold deposits is elaborated under the heading of "Geology."

Geology.—The McDame Creek trough parallels the north-eastern margin of the Cassiar granitic batholith of possibly lower Cretaceous age, at a distance of about 15 miles. This batholith strikes through the area in a north-easterly direction, with steeply plunging flanks. The rocks of the area are chiefly of metamorphic character and consist of brownish and thinly bedded shale and slate, greyish sandy argillite, quartzite, limestone, dolomite, calcareous schists, and possibly some calcareous tuff-beds. These rocks have been provisionally classed by G. M. Dawson (Memoir 629, G.S.C., 1887) as Ordovician to Permian, conforming to Kerr's classification for the formation at the immediate easterly contact of the Cassiar batholith in the neighbourhood of Cottonwood river (Geol. Survey Summary Report, 1925, Part A). A contact of the older roof-rocks with the batholith near the mouth of the Cottonwood river shows the easterly edge of the batholith to be plunging steeply beneath them. Numerous quartz veins up to 7 feet in width occur in the metamorphic roof-rocks and are a pronounced feature of the Quartz Creek

area, from which phenomena the creek derives its name. These are generally only slightly mineralized with specks of pyrite and generally always carry fine seams of limonite and siderite. Some gold-bearing arsenopyrite also occurs in the quartzose replacement-zones and free gold in quartz that had been panned from a vein was seen. Bed-rock is comparatively fresh, particularly in the central low-bench area of the creek, and does not show intense weathering. In the upper area of Snow and Quartz creeks, however, bed-rock weathering appears to be more pronounced.

The superficial deposits of the McDame Creek trough consist of stratified sands and gravels of probably chiefly Pleistocene (glacial drift) and post-Pleistocene (post-Glacial) age, overlain by alluvium of recent origin. Some of the stratified gravels examined in old tunnel-workings are semi-cemented, but the presence of large boulders indicates them to be of inter- or post-glacial origin. Whereas it is quite possible that Tertiary or pre-glacial gravels may occur, especially under the drift of the high-bench area, which is the oldest of the benches, none were seen that could be definitely identified as such.

The stratified gravels consist generally of material exotic to the immediate area, a pronounced proportion being greenstone, serpentine, and granite. They are characteristically coarse, with boulders from 12 to 24 inches in diameter distributed in them, particularly in the section immediately overlying bed-rock, and are interstratified with layers of sand. Large boulders up to 5 and 6 feet in diameter also occur, but are not general. These can be seen on the first low bench and in the bed of the creek. Several large boulders were also observed in the Quartz Creek workings, in which section the wash is generally coarser than in the neighbourhood of Centreville. Some of the larger boulders are sub-angular or have a flat cross-section and do not appear to have been subjected to much rolling.

In a section of the Quartz Creek workings unstratified glacial debris 15 to 20 feet thick is seen to overlie a layer of stratified gravel from 8 to 12 feet thick on bed-rock. This is overlain by about 7 feet of stratified interglacial gravel, on top of which is recent alluvium. Bed-rock of this cross-section occurs at about altitude 3,500 feet, conforming approximately to the high bench at Centreville, and, by tracing at intervals, in general alignment with this bench. In accordance with this and with exposures on the First, Second, and Third North forks and also on Snow creek, it can be logically assumed that the high-bench area paralleling McDame creek on its north side may contain relative characteristics.

The topographical and geological evidence indicates that the old channels of McDame creek occupied a much higher level in pre-glacial times than that of the present stream. The old channel or channels are now represented by remnants of the high benches along the valley-sides. At that time the creek probably junctioned with Dease river at about 7 miles up-stream from its present mouth. Placer gold was quite logically concentrated in these old channel high benches probably from the erosion of the numerous quartz veins known to occur in the area. Either through uplift, but more probably through the filling of the old channel with glacial debris, the stream was forced to cut a new channel. Coinciding with this period, it is possible that a blocking of the original outlet into Dease river by the filling of the old Dease River channel with glacial debris also occurred. This caused the formation of a lake area and may possibly account for the pronounced terracing on both sides of the valley corresponding to the elevation of the high bench. Subsequent cutting-down by the stream, with possibly alternating filling of the new channel and damming of its outlet during periodical ice advance and recession, produced the step-like terraced benches, the gravels of which were largely derived from previously deposited glacial drift, through which gold may have been scattered and then subsequently concentrated on bed-rock of the benches.

The terminal morainic deposits in the neighbourhood of the mouth of Quartz creek indicates the partial late advance of a valley glacier to that locality and may be one contributing cause for the absence of gold in paying quantities in the uppermost stretches of McDame creek. Generally, the effects of glaciation do not appear to be intense. Although no striations that would indicate the direction of ice-movement were observed, it is altogether likely that the main direction of ice-movement conformed to the major drainage-trough of the area, which is the Dease river. From evidence in the Dease Lake area cited by Kerr (Summary Report, G.S.C., 1925), and in the Dease and Liard River areas cited by Dawson (G.S.C., 1887), it would appear the main ice mass or sheet moved along the Dease valley in a southerly direction. In this case it is possible that the ice-sheet moved across McDame Creek trough, or that only small

subsidiary ice-tongues moving down the valley were active. In both these cases the effects of glaciation would be comparatively subdued.

The lowest bench in the creek-valley is the latest and of post-Glacial age, and derived its gold from a cutting-away of the older bench channels by post-Glacial transverse creeks originating in ice-cirque remnants and from the truncating of old-channel meanderings by the main creek at that time. Consequently this should produce the richest gold-bearing bench, and so was logically worked by the "old-timers." A comparatively late rejuvenation of the creek by uplift has probably occurred, enabling the creek to form several canyon-cuts and cut down to bed-rock below the lowest bench.

The fact that the benches of the south side of the creek above "Discovery" are reputed not to contain gold in paying quantities, and that in contradiction to the north side no bonanza gold was found around the mouths of the traverse creeks cutting them, such as the South fork and Friendlison creek, is remarkable. These south-side benches may, however, represent the southerly flood-plain margins of the ancient channels, with the actual channels existing on the north side. From topographical evidence it is also quite possible that the ancient trough of McDame creek may have been forked by intervening rim-rock. In this event the southerly branch, containing little or no gold, would conform to the direction of the upper reaches of the present creek heading in the neighbourhood of the Cassiar granitic batholith. It is understood that the south-side bench-gravels differ markedly from those of the north side, in that those of the south side contain a preponderance of granitic material, which this alignment may explain. The ancient northerly branch with its conforming gold-bearing north-side benches would then conform to the north side of the present creek and continue through the Quartz and Trout Creek troughs. However, before the south-side bench-area above "Discovery" can definitely be pronounced not to contain placer gold in paying quantities, it would seem that further intensive prospecting and testing would be necessary. Apparently, as far as could be ascertained, this area has only been subjected to cursory prospecting in recent years.

Placer-gold Deposits.—Placer gold was discovered in McDame creek in 1874 and during that year gold to the value of $200,000 was recovered. The following year recovery increased to $300,000, after which there was a gradual decline, and in 1895 the yield was only $9,600. From 1874 to 1895 this area yielded placer gold to the value of $1,597,500. This all came from individual operators using crude shovelling methods on shallow ground of the low bench, and also some limited drifting on the old-channel high bench. The records show an average daily yield from the old workings of $6 to $100 to the shovel when mining was at its best. Many Chinese miners participated in these operations. The gold was valued at $17.75 to $18 per ounce. From the mouth of Snow creek a weekly yield of 300 oz. for six and eight men is quoted. Other creeks in the McDame and Dease River area are also quoted as yielding good wages and, some of them, bonanza recoveries. These figures are significant and the records indicate that the McDame Creek area contained the richest shallow ground worked by "old-timers" in the Province of British Columbia.

Practically all of this gold was recovered from the shallow areas of the low bench of the old channel on the left bank of the creek, the richest ground of this category covering what appeared to be the swing-over of the old channel from the left to the right bank in the neighbourhood of the old Centreville camp. Some drifting in the higher bench-ground also yielded rich returns. The rich bench-ground of "Discovery" on the right bank, about 1 mile below Centreville, was probably a sharp bend of the old channel over to this side in conformity to the attitude of rim-rock. From "Discovery" to Quartz creek, a distance of about 13 miles up-stream, what appears to be an old channel occupies sections of the high-bench ground of the left bank and can be picked up at intervals with conforming rim-rock, which is particularly clear at its intersection by Quartz creek. Time was not available to allow of any possible tracing or study of this channel beyond Quartz creek. At Quartz creek, however, its character is so pronounced there is little doubt it extends for some distance beyond this in a northwesterly direction.

The richest ground and the most extensive "old-timers'" workings in the McDame Creek area covered the low sections of several transverse creeks which cut across this old channel between Centreville and Quartz creek. These workings are to be seen around the mouths of First North fork, Second North fork, Holloway's bar, Third North fork, Snow creek. No old workings which might have contained bonanza values are to be found opposite sections where

the high old channel is intact and has not been disturbed by dissecting transverse streams or truncated meanderings.

There is little doubt that the gold contained in the shallow bonanza gravels and on the low-level benches of the lower sections of these transverse creeks resulted from a reconcentration of the gold in the old-channel high-bench ground. From this evidence alone it is quite logical to conclude that the old-channel high-bench ground, at least in the neighbourhood of these transverse creeks, is gold-bearing, and it is possible that some of the intervening stretches of the sections of high-level old channel preserved from below Centreville to Quartz creek, a distance of about 14 miles, are also gold-bearing. At Quartz creek fair values have been recovered from the old channel during recent years' operations by D. Wing, with a small but inadequate hydraulic equipment. During the last two seasons some constructive prospecting by two or three individuals has indicated promising prospects on the undisturbed old-channel high-bench ground. This work has been in the neighbourhood of Centreville, on the First North fork, and between Deep and Snow creeks. The gold recovered by these prospectors is comparatively coarse, with an occasional nugget of about $1 value.

From the evidence it is apparent that the high-bench ground will not carry the bonanza values recovered by the "old-timers" in the reconcentrated low-bench shallow ground. Whether the second and third benches will vary in average gold content or carry gold in commercial quantities, and to what extent old-channel gravels containing gold are still preserved on bedrock below glacial drift, can only be determined by exploration.

The general aspects of the high-bench old-channel ground, together with the results of the limited prospecting so far completed, warrants extensive exploration of this whole area by drilling, small exploratory hydraulic plants, and other methods, with a view to the possible inauguration of extensive hydraulic operations should gold in paying quantities be indicated. Sufficient water under an efficient head can be procured for such operations from First North fork, Second North fork, Third North fork, and Deep creek.

The low swamp-area in the present creek-trough, extending from Deep creek to Quartz creek, a distance of from 4 to 5 miles, and margining the mouths of these creeks as well as Snow creek, is indicated as a possible extensive dredging proposition that warrants at least preliminary investigation with this end in view.

In connection with contemplated operations, it is apparent that at the outset costs will be high. With increasing or sustained activity, however, resulting in improved transportation facilities and lowering of freight rates, operating costs should eventually be materially reduced.

Placer Operations.—Operations on McDame creek in recent years have not been been numerous, nor has any extensive prospecting been carried out.

Pendleton Gold Mining Co.

This company, with offices in Seattle, Wash., carried out a limited amount of drag-line scraper work below Centreville on the *Agnes Lease No. 69* between the years 1923 to 1926 and some work in 1928. Financial difficulties and inadequate equipment afflicted the operations and no further work has been carried out since that time. The condition of title of the property at present has not been ascertained.

Much of the ground is below the level of McDame creek and some boulders of appreciable size occur. The ground is possibly not suitable for drag-line scraping operations. The area is located in the section of the creek where the old channel crosses from the north to the south side. Good values are reported to have been indicated and about $800 in gold is reputed to have been recovered from about 300 cubic yards of dirt containing a pay-streak 8 inches to 3 feet deep and of unknown width, in a total depth of about 20 feet. However, general depth of the ground and the values in it have not been definitely determined.

Centreville Hydraulic Lease.—G. A. Brown, of Victoria, and two men have carried out some very efficient prospecting on this ground in the neighbourhood of Centreville during the 1931 season. The lease covers the low-bench area to the creek and extends northerly up the mountain-slope, and includes the old-channel high-bench ground. Shovelling from an open-cut on slate bed-rock at a slide-rock sluff from the third bench to the second bench, at altitude 2,940 feet, showed, according to the owners, values of 65 cents per cubic yard. This test consisted of sluicing the contents of 452 cars averaging ⅛ cubic yard per car, from which $49 in gold was recovered. The material tested consisted entirely of broken slate bed-rock and surface alluvium, with an occasional pebble of gravel. The gold recovered was comparatively coarse.

On the second bench 100 feet of tunnel was driven in sixteen days, with the objective of hitting bed-rock. This tunnel was started at the collar of an old shaft that hit rising bed-rock in a drift at 17.5 feet depth. The Brown tunnel is too high to hit the bed-rock of this bench. In a winze sunk at the tunnel-face fair-sized boulders were encountered at a depth of 8 feet, indicating that bed-rock may be in close proximity to the bottom of the winze. Stratified coarse gravel, with some interstratified sand, is encountered in the tunnel, of possible post-Glacial origin.

About 200 feet south-easterly of the tunnel a shaft on the first bench hit bed-rock at a depth of 16 feet, but excessive water prohibited further operations. An old drainage-tunnel on this bench encountered large granite boulders when advanced about 60 feet and prevented its extension. Extensive shallow-ground "old-timers'" workings are to be seen on this bench.

Viking Lease.—This creek lease (No. 199) is owned by Frank Crawford, of Centreville, and covers the lower area of the First North fork. The owner is ground-sluicing glacial-drift debris sluffed from the high bench and carrying no values, with a view to tapping bed-rock of the second bench old channel. About 17 oz. of gold was recovered during the season.

Buccaneer Lease.—This lease (No. 280) is owned by G. A. Brown, of Victoria, and is located above and adjoining the *Viking* lease. It includes part of the McDame Creek high-bench old channel where it is dissected by the First North fork. Some cursory prospecting was carried out during the 1931 season.

Princess Edith Lease.—This bench lease (No. 281) is owned by G. A. Brown, of Victoria, and covers part of the McDame Creek high-bench old channel just west of the First North fork.

The old "Pocohontas" tunnel driven in the early days by McDonald and J. Hamilton is situated about half a mile up-stream from the mouth of the First North fork, where the high-bench old channel of McDame is cut by the First North fork. It is reputed to have been driven about 500 feet. The first 400 feet is reputed to have yielded about $400,000 in gold. The latter part of the tunnel did not return high values, but has possibly passed beyond the northerly margin of the old channel.

Based on these reputed values, it would seem that the *Princess Edith* lease warrants thorough exploration with a view to drifting or possible hydraulic operations. Some cursory prospecting was carried out during the 1931 season.

Snow Creek.—This creek is situated about 10 miles west of Centreville, with the mouth at altitude 3,300 feet. It embraces some of the richest ground worked by the "old-timers." The "Christie" ground at the mouth of the creek is reported to have at one time yielded over $300 to the shovel per day. There is still an appreciable area of virgin ground in the creek-bed where it cuts across the old channel above the old workings. The bulk of this ground is, however, wet and requires to be drained for operations. It is certainly worthy of investigation.

Dan Kean owns creek and bench leases in this area and has carried out some efficient prospecting in three localities during the 1931 season. The work has consisted of cutting through slide-rock in the attempt to reach the old-channel bed-rock of the high bench. Encouraging prospects have been found and a small quantity of gold, including some coarse nuggets, has been recovered.

Quartz Creek.—David Wing, who has two bench leases and one creek lease in this area, has been hydraulicking with a crew of three men on a "lay" during the 1931 season. A recovery of about 42 oz. of gold has been made. An excellent water-supply is available, but the plant, consisting of a 12-inch galvanized pipe-line to a monitor equipped with 3- and 4-inch nozzles operating under a head of 85 feet, is too small to efficiently handle the heavy wash and adequately clean bed-rock. During the season the ground was examined on behalf of the Dalhousie Mining Company, of Victoria. At the close of the season it is understood the property was taken over by this company, which plans extended operations with a more adequate equipment during the 1932 season.

ATLIN MINING DIVISION.

Taku River Section.

Whitewater. This group is described in the 1929 and 1930 Annual Reports; Bulletin No. 1, 1930, "Taku River Area"; and is also referred to in Bulletin No. 1, 1932.

This group and adjoining groups of claims have been optioned by the N. A. Timmins Corporation, of Montreal. Several adjoining claims have also been staked by this organization. About mid-season energetic preliminary exploration by diamond-drilling,

trenching, and stripping was commenced and continued until about the middle of December. In all, 5,300 feet of diamond-drilling in nineteen holes was carried out. Some encouraging results as well as some disappointments were encountered in this work. It is understood that so far the result of this preliminary work is inconclusive, but that indications warrant some further exploration under propitious conditions, which is planned for the 1932 season.

Mineral Mountain, Silver Bird, and Golden Star.

These groups, comprising twenty claims owned by R. G. Wilms and associates, of Tulsequah, are situated about 2 miles south-westerly of the *Whitewater* group. They are located on the north side of the North fork of Canyon creek, which flows into the Tulsequah river near its confluence with the Taku river. Late in the 1931 season discoveries of gold-bearing ore similar to that occurring on the *Whitewater* group were made on the *Silver Bird No. 5* claim. These groups were optioned by the Alaska Juneau Gold Mining Company and stripping operations commenced, which will be continued in the 1932 season. Reference is made to these properties in Bulletin No. 1, 1932.

Whitehorse and Snowflake.

These groups adjoin the *Whitewater* on the west and are owned by C. M. Lee and associates, of Tulsequah and Juneau. At about altitude 1,350 feet, on the *Whitehorse No. 1* claim, an open-cut 100 feet long exposes a partially silicified carbonate shear-zone composed of an intimate mixture of calcium carbonate, feldspar, and some siderite, sparsely mineralized with a little pyrite in places and showing green streaks of a nickel-chromium silicate. The zone strikes N. 60° W. and dips 80° north, following approximately the course of a small creek. In the cut an undelimited width of about 7 feet is exposed. A selected sample showing impregnated pyrite assayed: Gold, *nil;* silver, *nil.*

At altitude 1,425 feet, on the *Snowflake*, and about 1,000 feet north of the *Whitehorse No. 1* showing, an open-cut 60 feet long exposes a similar zone. Several other claims and groups have been staked by C. M. Lee in this area, which at the time of examination had not been prospected.

Little Wonder.

This group of eight claims is owned by H. J. Leonard and A. J. Payton, of Juneau, and occupies the ground to the top of the ridge westerly of the *Whitewater* group, adjoining the *Snowflake* on the north and west. Very efficient prospecting of two quartzose replacement-zones of appreciable width, carrying some pyrite mineralization, has been carried out. At altitude 1,750 feet, on the south of Whitewater creek, a quartzose carbonate zone 10 to 12 feet wide, with pronounced green nickel-chromium streaks, has been exposed by extensive open-cutting in a country-rock of mica-schist. The zone strikes N. 50° W., is extremely talcose in places, and shows some sparse pyrite mineralization. At altitude 2,100 feet an open-cut has been excavated on a quartzose shear-zone in altered quartz andesite. This zone strikes N. 70° E. (mag.) and dips vertically and is mineralized with disseminated pyrite. A sample of the unoxidized vein-matter assayed: Gold, trace; silver, trace. Several other showings that will be further prospected during the coming season have also been discovered on these claims.

Munster, Leinster, Warmth, and Celestial.

These claims are owned by John Creagh and are situated up the East fork of the Tulsequah river. During the 1931 season active prospecting was carried out by the owner, who reports discoveries of ore with encouraging gold values. About 3 miles north of the *Whitewater* John Creagh has also been prospecting a group of claims, and reports the discovery of two zones showing good assays in gold.

Canyon and Bear.

These groups are owned by G. Gilbert, of Tulsequah, and are situated on the East fork of the Tulsequah river, north-easterly of the *Tulsequah Chief.* During the 1931 season constructive prospecting was carried out by the owner, who reports the discovery of some promising showings. From a vein 3 feet wide on the *Canyon* group an assay of 0.44 oz. in gold is reported.

Taku Mines Co., Ltd.—The *Tulsequah Chief*, controlled by this company, is described in the 1929 and 1930 Annual Reports; Bulletin No. 1, 1930; and is also referred to in Bulletin No. 1, 1932. No further work has been carried out since the cessation of operations at the end of the 1929 season.

Manville.

This group, situated on the north side of the Taku river, near its confluence with the Tulsequah river, is owned by a syndicate of Juneau people, to which the property reverted after the relinquishment of an option in 1930

by the Alaska Juneau Gold Mining Company, Limited. The property is described in the 1929 and 1930 Annual Reports; Bulletin No. 1, 1930; and is referred to in Bulletin No. 1, 1932. During 1931 some further stripping was carried out in the creek above the big outcrop.

Ericksen and Ashby. These groups, owned by Messrs. Ericksen and Ashby and associates, of Juneau, are located on the left bank of the Taku river, about 2 miles east of the Taku River South fork. The showings are described in the 1929 Annual Report. During 1931 some open-cutting and stripping has been done and extensions of the showings have been uncovered.

Red Cap and Red Cap Extension. These groups, embracing fourteen claims, are situated at the headwaters of Lester Jones creek, on the westerly slope of Lester Jones mountain, about 2½ miles from the Taku river, and are owned by Neil Forbes and partner, of Tulsequah. The claims are reached by boat from Tulsequah to Lester Jones creek, a distance of about 12 miles, from where a steep trail leads to the camp-site at altitude 3,000 feet, at the foot of Forbes lake. During the 1930 and 1931 seasons intensive prospecting of an extensive area of pyritized feldspar porphyry has been carried out. A representative sample of this material exposed in a cut 40 feet long assayed: Gold, *nil;* silver, *nil.* It should be stated, however, that the owners have procured assays of around $2 in gold from this cut. A grab sample of this type of material exposed over a wide area on the mountain-slope assayed: Gold, *nil;* silver, *nil.* A sample of arsenopyrite 14 inches wide, occurring in a fracture-zone 10 feet wide, which follows a lamprophyre dyke at 5,100 feet altitude, assayed: Gold, trace; silver, trace. A sample of fine-grained mineralization in a vein 18 inches wide, and about 50 feet to the west of and probably representing the continuation of this showing, assayed: Gold, 0.1 oz. per ton; silver, 0.1 oz. per ton; arsenic, 0.2 per cent. This showing warrants further exploration on both the east and west sides of the creek-draw. Several showings in replacement-zones in quartzite (altered sandy argillite) carrying some chalcopyrite, galena, and zinc-blende and a wide oxidized shear-zone at the easterly extremity of the claims warrant further prospecting.

Rainy Hollow Section.

Gold Cord. This group, formerly known as the *Stampede*, is owned by William Bunting, of Vancouver. It comprises the *Gold Cord Nos. 1* to *8* and the *Yellow Jacket* claims. The ore occurrence is described in the 1927 Annual Report. Stripping and open-cutting was carried out during the 1931 season and some additional discoveries made. The property was examined in August, 1931, and a detailed description is contained in Bulletin No. 1, 1932.

Victoria. This property is owned by R. Kennedy, of Haines, Alaska, and is situated about 13 miles along the wagon-road from Pleasant Camp and about 1½ miles southerly from the *Maid of Erin.* The geology of the locality is featured by inclusion-segments of limestone in an intrusive granitic rock of gneissic texture. The ore occurrence consists of isolated lenses of massive galena and sphalerite in the limestone and is probably of contact-metamorphic origin.

At altitude 2,750 feet an open-cut in limestone exposes a face 10 feet long by 5 feet wide, well mineralized with galena, sphalerite, and some chalcopyrite, the sulphides in places being in massive distribution. A short distance north of this another cut exposes a similarly mineralized face 10 feet long and 5 feet wide. At altitude 2,700 feet and about 100 feet westerly a tunnel has been started and advanced 80 feet towards the projection of these showings. About 200 feet east of these showings a shallow shaft has been sunk on stringers and small irregular patches up to 1 foot in width of zinc-blende and galena with some chalcopyrite.

Victoria Extension. This claim adjoins the *Victoria* on the south and is owned by J. Kennedy, of Haines, Alaska. The main showing is in the deep canyon of the Jarvis river, about 1,000 feet south of the *Victoria* tunnel. This is reached by a steep trail down the canyon-side and consists of an irregularly mineralized lens of chiefly zinc-blende up to 3 feet in width occurring along a fracture in a band of garnetite in quartzite. A short tunnel has been driven on this at the base of the high and continuously crumbling bluff, which is a perpetual menace to life and limb. Mineralization is not well developed and very lenticular in structure.

Maid of Erin. This property, owned by R. Kennedy, of Haines, Alaska, is situated on Mineral mountain, about 14 miles along the old wagon-road from Pleasant Camp and about 58 miles from Haines. The showings consist of contact-

metamorphic replacements of bornite, chalcopyrite, and some magnetite, of appreciable extent, in garnetized and epidotized limestone-beds, parallel and contiguous to a granitic contact. Some secondary chalcocite is also developed in the surface outcrops. The showings have been described in detail in the 1921 and 1927 Annual Reports. During 1920 and 1921 a considerable amount of exploration-work was carried out by Seattle interests, which has exposed a limited tonnage of good-grade copper ore, but further extensive exploration would be required, with a considerably greater tonnage of ore indicated, to meet the exigencies of an operation in this situation. This could best be carried out by further diamond-drilling, which it would appear from the showings and mode of occurrence is warranted under propitious conditions. In recent years the property has been idle.

PLACER-MINING.

Squaw Creek. This creek is a tributary of the Tatshenshini river ("Little Alsek"), rising in British Columbia and flowing into the main stream in Yukon territory. The main route to the placer-workings on the creek is from Haines, Alaska, to Pleasant Camp by automobile-road, from where the old wagon-road is followed to the *Victoria* claim on Mineral mountain, and thence by trail, a total distance of about 100 miles, occupying about three days by pack-horse. Time was not available to continue the journey from Mineral mountain into this area, but from information imparted by parties on their way out, it would seem that placer-mining on Squaw creek has been quite active during 1931, with about twelve Indian and ten white prospectors shovelling in shallow ground. Good results are reported with individual recoveries of from $10 to $70 a day. It is planned to carry out a detailed examination of this area during the 1932 season.

ATLIN LAKE SECTION.

Atlin Ruffner Lead-Silver Mines, Ltd. This property is now being operated by Buffalo interests. The showings have been described in former Annual Reports and are also referred to in detail in Summary Report, 1925, Part A, Geological Survey of Canada. At the time of examination (June 29th) work was being concentrated on the long crosscut tunnel at elevation 4,126 feet, with the objective of intersecting Nos. 1, 2, 3, and 4 veins, and had advanced about 1,200 feet. During the first half of the year, drifting, crosscutting, and raising was carried out in "2 D" tunnel, at elevation 4,350 feet. A crew of between nineteen and thirty men has been employed. Additional equipment and power plant have been installed and some new buildings erected. Appreciable assistance has also been rendered by the Department of Mines and the Department of Public Works in the reconditioning of the road to this operation. It is planned to continue operations through the winter and coming spring, after which plans for further development will be dependent on the results achieved and indicated. Towards the end of September the crosscut tunnel was reported to have intersected a vein-structure about 30 feet wide, with 9 feet carrying about 12 per cent. combined lead and zinc values and about 14 oz. silver per ton, with some gold.

Relief. This is an old claim, worked some thirty years ago, and has been restaked by James Reid, of Atlin. The property is situated about 2 miles from the town of Atlin on the Como Lake road. During the 1931 season the old shaft, about 20 feet deep, located about 200 feet southerly of the road, has been reopened and timbered and some stripping carried out. The showing is a quartzose replacement-zone with stringers of quartz up to 12 inches wide radiating from it, in a carbonate country-rock. Parts of the zone are sparsely mineralized with pyrite. Although the attitude of the zone is not clear, it appears to strike N. 40° W. (mag.) and dip 60° east. A representative sample of quartzose material exposed at the bottom of the shaft, showing some pyrite, assayed: Gold, trace; silver, 0.28 oz. per ton.

Cornerstone. This group of four claims is situated on the northerly slope of Monroe mountain, about 6 miles from the town of Atlin, and is owned by James Reid, of Atlin. It is reached by following the Como Lake road for 4 miles, then 2 miles of bush road to the cabin at the foot of the mountain, from where a trail leads to the showings. These consist of silicified carbonate zones and fractured basic dykes with quartz stringers, carrying some pyrite, in a granite-porphyry country-rock. Several of these showings have been explored by open-cuts and a tunnel 40 feet long. The showings have been described in the 1924 Annual Report. In parts of the showings a sparse mineralization of pyrite can be seen. A selected sample of quartz showing some pyrite, from the dump of a shallow shaft

on the main showing at altitude 3,225 feet, assayed: Gold, trace; silver, 0.6 oz. per ton. A sample of chalcedonic quartz from a wide carbonate zone at altitude 2,780 feet assayed: Gold, trace; silver, 0.28 oz. per ton. A reputed deposit of sulphur on the peak of the mountain proved to be yellow lichen.

Hudson Bay. This group of seven claims is situated about 2 miles south-easterly of the town of Atlin, on the north-west side of Pine creek, and is owned by Thomas Kirkland, of Atlin. It is reached by automobile-road to within 1,000 feet of the main workings. The property is an old holding and about thirty years ago some work was done on it by a Lord Hamilton, of London, England.

The showing consists of an extensive silicified fracture-zone occurring in altered magnesite rocks of the probably lower Mesozoic "Gold Series." On the *Rosadle* claim the zone occupies a ridge along the west side of a low-lying draw, in the face of which several open-cuts and one tunnel have been excavated along a distance of several hundred feet. These workings expose silicified areas and radiating quartz stringers and veins up to 2 feet in width extending across the ridge for a width of from 20 to 60 feet. A shallow pit excavated on one of these veins on the top of the ridge exposes 2 feet of quartz sparsely mineralized with chalcopyrite, tetrahedrite, and an unidentified black mineral, accompanied by green nickel-chromium silicate streaks. A sample from this exposure assayed: Gold, 0.7 oz. per ton; silver, 13.2 oz. per ton. A grab sample from the dump assayed: Gold, 0.68 oz. per ton; silver, 7.40 oz. per ton. A sample of a quartz stringer 8 to 10 inches wide exposed at the bottom of a shaft 20 feet deep about 20 feet south of the pit assayed: Gold, 0.03 oz. per ton; silver, 0.20 oz. per ton. In this shaft several quartz stringers 8 to 10 inches wide, with green nickel-chromium silicate streaks, are exposed. A crosscut tunnel started at the foot of the ridge below these showings has advanced 60 feet, and it is estimated a further 25 feet should intersect the vertical projection of the surface showings. The property should be thoroughly sampled and, if warranted, further explored by diamond-drilling.

Imperial. This group of four Crown-granted claims is situated on Monroe mountain and is owned by J. Stokes, of Atlin. Adjoining the group on the north are the Crown-granted claims *Princess Pat* and *Pilot*, and on the west the *R.A.F.* and *Observer*, owned by J. Stokes, and Clarence Fraser, of California. Adjoining on the south are four claims owned by Emily Mason, of Victoria. The *Imperial* group was staked in 1899 and the rest about six years ago. The property is situated about 6 miles from the town of Atlin and is reached by the Surprise Lake automobile-road. The workings are situated at altitude 3,100 feet, about 1½ miles to the west of the road and about 600 feet above it.

In 1900 a small test-mill of five light stamps was installed by the Nimrod Syndicate, of London, England, and according to its reports yielded the following results:—

No.	Locality.	Tons.	Total Value.	Per Ton.
1	No. 1 level W	60	$392.75	$6.54
2	No. 1 level W	63	792.48	12.57
3	No. 1 level W	51	312.17	6.12
4	No. 1 level W	75	619.10	8.25
5	No. 2 level	25	75.00	3.00
	Totals	274	$2,191.50	.....

Average per ton, $8.

In 1902 a test sample of ore weighing 3,267 lb. net was sent to Pellew-Harvey, Bryant & Gilman, of Vancouver, B.C., who reported the ore to contain:—

Gold, 1.29 oz., value at $20 per oz.	$25.80
Silver, 1.26 oz., valued at 52 cents per oz.	.66
Total	$26.46

Judging from these results, it is possible that a poor extraction was achieved in the Nimrod Syndicate mill-testing.

The Nimrod Syndicate is reported to have only operated for about six months when it ran out of funds. No work has been done to explore for the continuation of the ore-shoot indicated

by the initial work or to ascertain its possible rake with depth. It is quite possible that other ore-shoots may occur in this vein along both its horizontal and vertical projections. The work carried out so far is mainly on the one vein on the *Paris Exhibition* claim. Several other showings of quartz veins and shear-structures also occur on the property and are worth exploration.

The main vein consists of a well-defined compound quartz vein up to 7 feet wide. In places the vein branches into two or three smaller veins with horses of country-rock between them.

The formation is a very dense-textured rock that has been microscopically determined by D. D. Cairnes as hornblende diorite and hornblende diorite porphyrite. In places, however, the rock appears to contain a high percentage of carbonate and in this respect sections of the formation may be relative to the magnesitic rocks of the lower Mesozoic "Gold Series." Sulphide mineralization is generally quite sparse and in the main vein consists of some galena, zinc-blende, and tetrahedrite. A selected sample of sparsely mineralized quartz from the small dump assayed: Gold, 12.78 oz. per ton; silver, 7.40 oz. per ton. The bulk of the gold is probably in the free state, which is indicated in mill-tests carried out by Pellew-Harvey, Bryant & Gilman, of Vancouver. These indicated that with a combination treatment of amalgamation followed by a cyanidation 97 per cent. of the gold and silver could be extracted. The property and showings are further described by D. D. Cairnes in Memoir 37, 1913, Geological Survey of Canada.

During 1931 the old workings have been cleaned out and the property put in good shape for any examination that may be undertaken. It is recommended to examining engineers for at least a thorough sampling and possible further exploration by additional underground workings or diamond-drilling. It is conveniently situated to transportation and topographical conditions lend themselves ideally to economical mining. There is also an appreciable water-power site on Pine creek, about 3 miles distant.

Placer-mining.

Placer-mining has been very active in this area during the 1931 season and shows signs of a healthy expansion in the future. Good recoveries have been made and encouraging development results have been achieved. These activities are reflected in an increase of over 100 per cent. in placer-gold production as compared with the 1930 yield. The Atlin Division produced, during 1931, 8,384 oz. of gold, valued at $142,528, as compared with 3,141 oz., valued at $53,397, for 1930.

The Gold Commissioner at Atlin reports that the gold sold for various prices ranging from $15.85 for Ruby creek to $16.75 for Otter creek. Spruce Creek gold averaged $16.40 at Atlin.

This is an excellent showing, and with the still unexploited placer-gold potentialities of the Atlin area, together with the fact that the larger operations on Otter, Boulder, and McKee creeks are still in the exploratory stage or had not reached the condition of steady production in 1931, is a decidedly encouraging augury for a still greater expansion.

Compagnie Francaise des Mines d'or du Canada.

This company controls a considerable section of the Otter Creek area and is operating under the local management of J. E. Moran. The operations are described in Bulletin No. 1, 1931, "Placer-mining in British Columbia." The following is a summary of the 1931 operations to the close of the season, kindly submitted by the management: "On Otter creek, Compagnie Française des Mines d'or du Canada vigorously continued the work of developing its hydraulic leases. A very considerable extension of the water-supply system was carried out by addition of the water of Quartz, Carvel, and Cub creeks through new ditches approximately 3 miles in length. On Union creek a dam was constructed some 350 feet in length to conserve a portion of the freshet waters for use in the drier months of the season and to regulate, when necessary, the flow through the main portion of the canalization system. The company has now in use about 11 miles of flume and ditch, leading water to Otter creek to supplement its natural flow. A large dam on Otter creek reserves the supply from the various sources and from this the water is released to the mine according to the requirements from day to day.

"At the mine, development was confined to laying sluices towards bed-rock and this work was advanced over 500 feet during the season. The removal of material in the path of the sluice advance was effected by monitors. The plan combined the features of ordinary sluicing and that of stacking back alongside the sluices a very considerable portion of the yardage to be disposed of.

"Although the sluice did not reach bed-rock, its advance encountered three distinct beds of gold-bearing gravel. At the finish of the season these three beds had become merged into one about 35 feet in thickness lying upon a bed of sand some 7 feet thick. Immediately below this sand there is another stratum of gold-bearing gravel which is being prospected by tunnelling up-stream to ascertain its thickness and values, and to learn, if possible, before resuming hydraulic operations in the spring, if this gravel lies upon the bed-rock.

"As the main objective of the company is to lay its sluices upon the bed-rock as quickly as possible, the management is making no special effort to mine these upper gravels at present, except such as must be disposed of for the sluice advance. This material is passed through gold-saving sluices and yields an appreciable part of the total cost of operations. Development-work this year uncovered both rims of the main deep channel. These are about 150 feet apart and it is in the deep depression between them that the sluices are travelling in the search for bed-rock. This company gave employment to about twenty-five workmen during a considerable part of the season."

NORTH-EASTERN MINERAL SURVEY DISTRICT (No. 2).

REPORT BY DOUGLAS LAY, RESIDENT MINING ENGINEER (HEADQUARTERS, HAZELTON).

INTRODUCTION.

The general features of the North-eastern Mineral Survey District have been well described in previous Annual Reports, to which the reader is referred. In the 1927 Annual Report and succeeding ones will be found bibliographical references.

The district exhibits a widespread occurrence of mineral, and wide diversification of types, and offers every indication of potential wealth in lode-minerals, non-metallic minerals, and coal; oil possibilities may also exist. In spite of the fact that the placer-mining field has been under extraction for the past seventy years, field-study confirms the view that this field is far from exhaustion and still offers major possibilities. Indeed, each year brings additional evidence in support of this view.

The master-features of the geology are three great parallel batholiths, the Coast Range batholith and the Cassiar-Omineca batholith, and between these another, the Central batholith. These cross the district in a north-westerly and south-easterly direction. It has hitherto been possible to distinguish only the first two mentioned batholiths, but each year brings additional information, and it is now readily possible to discern the third batholith, which will be referred to in these reports as the Central batholith. Between these batholiths are numerous satellitic intrusives. The general geology of the district is discussed in previous Annual Reports and in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia," to which the reader is referred. The important lode-gold occurrences of the district have been described in Bulletin No. 1, 1932, and are therefore not repeated in this report. Similarly, many placer deposits were described in Bulletin No. 1, 1931, "Placer-mining in British Columbia." In this Annual Report properties not described in these bulletins are included, but with regard to gold properties and gold potentialities of the district the reader should refer to these two bulletins.

GENERAL SUMMARY.

LODE-MINING.

At a time when depressed base-metal and silver markets and adverse financial conditions generally have arrested the expansion of base-metal mining, it is gratifying to record the fact that the progress achieved during the year in lode gold has been encouraging. In the lode-gold class, features of the year were the developments at the properties of Columario Gold Mines, Limited, near Usk, and the Cariboo Gold Quartz Mining Company, Limited, near Barkerville, described in Bulletin No. 1, 1932. The developments at the latter property in particular should stimulate the development of other properties in the same area. Although lode-gold mining in this district is yet in its infancy, nevertheless there is every indication that it will not be long before the production stage is reached.

A certain amount of small-scale effort was directed to base-metal properties, notably at the *Babine Bonanza* (Cronin mine), near Telkwa, by Chas. Theis, of Spokane; and at the *Silver Lake* group, Hudson Bay mountain, by W. H. Wilson & Sons. Encouraging results were secured at both the properties mentioned. A certain amount of work was also carried out at the *Ferguson* mine, Ingenika river, by Ingenika Mines, Limited. At certain properties in the Babine mountains, near Smithers, hopeful results are reported by the individual ownerships. At the *Wedge* group, on Pesika creek, Finlay river, underground development was carried out by the owners, Mort Teare and associates, of Prince George, with reported promising results. New discoveries are reported in new areas of both lead and copper, but it has not been possible to examine all of these as yet. There was no production of lode-mineral during the year.

PLACER-MINING.

The revival of interest in placer-mining has been very marked during the year. Not only have several new operations been inaugurated, but the number of individual prospectors in the field has been far greater than in previous years. Undoubtedly there has been a determined attempt on the part of many to extract a livelihood from the placer resources instead of seeking assistance from some other source.

The total placer-gold output of No. 2 District in 1931 was $115,277, as compared with $84,660 in 1930.

Among the more important placer operations may be mentioned: Germansen Placer, Limited, and the drilling operations of the Consolidated Mining and Smelting Company of Canada, Limited, in the Manson section of the Omineca Mining Division; New Waverly Hydraulic Mining Company, Limited, on Grouse creek; Lowhee Mining Company, Limited, on Lowhee creek: Consolidated Gold Alluvials of B.C., Limited, on Lightning creek; and the testing operations of R. Garrett and associates, directed by G. F. Dickson, on the Fraser and Goat rivers, in the Cariboo Mining Division; B.C. Hydraulics, Limited, at the *Bullion* mine; Moorhead Mines, Limited, on Morehead creek; Cedar Creek Placer Gold, Limited, on Cedar creek; and those of Barney Boe on Cedar creek, in the Quesnel Mining Division. In addition to the foregoing, many smaller operations of promise are going forward. It is gratifying to report that, generally speaking, the major operations are under skilled technical direction.

The discoveries and developments of the year in the older placer sections are the most important of recent years and encourage high hopes for the future. Such demonstrate the possibilities of the untouched placer resources and the need for their investigation, to which attention has been frequently drawn in these reports. It should be understood that there is still abundant scope for further investigation. It is becoming yearly more evident that the older placer sections contain much locked-up commercially recoverable gold. The discovery of the key to this wealth lies not in haphazard investigation, but in close field-study based on a knowledge of the principles of glacial geology and modes of placer occurrence, both general and local, followed by some actual preliminary testing, usually Keystone-drilling.

Rainbow creek, tributary of the Nation river, discovered in 1930 by George Snell, of Vanderhoof, attracted much attention during the year, and is the subject of a special report by John D. Galloway, Provincial Mineralogist, in "Placer-mining in British Columbia," Bulletin No. 1, 1931. Lorne creek, tributary of the Skeena river, may be said to have been "rediscovered" during the year and considerable activity took place there.

The Manson section, for many years practically dormant, experienced a sudden renewal of activity, and constructional operations on quite an extensive scale were carried out by Germansen Placers, Limited, and a systematic drilling campaign was carried on by the Consolidated Mining and Smelting Company of Canada, Limited. This section was the subject of a report, written after inspection this year by the Resident Engineer, in "Placer-mining in British Columbia," Bulletin No. 1, 1931; consequently that information will not be repeated in this report. It is, however, desired to stress the fact that this section, generally speaking, has undergone no close investigation and that it offers much promise. For example, one feature of this section is the evidence of buried channel cements. One of these, that on Vital creek, has already reached the productive stage, and deep-lead mining is well under way at the property of Gow Sing and associates. This is a property of undoubted promise and quite likely the bed-rock values in the centre line of the channel are of the order of 5 or 6 oz. per set (10-foot cap).

A new discovery in a new area is that of Dog creek, a north-easterly flowing tributary of Stuart river, made by H. Perison, of Fort St. James, in July.

Prospecting.

Lode-mineral.—Reference is invited to the Annual Reports for 1930 and 1929, under "Prospecting," wherein will be found outlines of the more favourable portions of the district, and also references to other reports in which much information is given on the subject. Much valuable general information will be found in "Prospecting in Canada," published by the Geological Survey of Canada. Detailed information concerning lode gold will be found in the recently issued Bulletin No. 1, 1932, published by the Department of Mines. It is unnecessary to repeat detailed information already given in these reports, but it is desired to emphasize the fact that an appreciation of the significance of the three batholiths and a knowledge of their exact geographic position are essential to intelligent prospecting. Further, while the situation of the aureoles, or zones of contact of these batholiths with other rocks, is rendered clear by the above-mentioned description, the position of all outlying bodies of batholithic rock, or satellites, remains to be determined by local prospecting. The position of many is known, of course, but probably a large number remain to be discovered. The region surrounding these satellites is usually highly favourable for lode-mineral occurrence.

Each year affords additional evidence of the fact that regions quite close to existing transportation systems and of general geologic promise are just as likely to contain valuable prospects as remote regions. Consequently the advisability of prospecting closely accessible regions is widely apparent. This fact has been the subject of constant reiteration in these reports, but it seems well to again draw attention to it.

Placer Gold.—While new bonanza discoveries are perhaps likely to be of rare occurrence, nevertheless each year brings additional evidence that even in the old placer-gold sections valuable finds still await the prospector. Some of these may be of such a nature that the prospector cannot work them himself, but he may be able to dispose of them to good advantage. Among the older sections, the Manson and Horsefly sections undoubtedly offer much promise and merit a great deal of further investigation. Likewise McConnell creek, tributary of the Ingenika river, but, unfortunately, the remoteness of the last-mentioned region and the fact that it is difficult of access is at present a detriment to prospecting and development. Attention has been very frequently drawn to the region between the Willow and Fraser rivers, west of the former river. In view of the ready accessibility of this region, the amount of game therein, and general possibilities, it merits close prospecting.

Oil.

Drilling operations for oil on the Yorston ranch, near Australian, Quesnel Mining Division, were carried on during the year by Frank A. Patrick and associates, but were suspended at a depth of 1,500 feet in the latter part of the year.

Non-metallics.

George H. Turner reports the contemplated installation of plant for drying and grinding mineral pigments at claims owned by himself and associates by the Big Bend of the Fraser river, 8 miles from Quesnel. Progress was unfortunately hampered by heavy rains.

Coal.

F. M. Dockrill continued steady development of his coal-mine near Telkwa, and the market for "Bulkley Valley Coal," the registered name of this coal, is steadily increasing as its good qualities become more widely recognized. A marked increase in the output took place this year.

The writer desires to express his thanks to the prospectors, operators, and mining men of the district for many courtesies extended.

OMINECA MINING DIVISION.

Skeena Section.

Columario Gold Mines, Ltd.

A total development footage of 415 feet was accomplished by this company at its property, the *Valhalla* and *Kleanza* groups, near Usk, comprising 210 feet of drifting in the *Dakota* tunnel on vein No. 6, 40 feet of drifting in Middle tunnel on vein No. 6, 30 feet of drifting in Lower tunnel on vein No. 6, and 135 feet of drifting in the tunnel on vein No. 7. A report by W. G. Norrie, consulting engineer, recommends development on a larger scale than has hitherto been carried out, and also the erection of the first unit of a mill. (*See* Bulletin No. 1, 1932, and previous Annual Reports.)

Diadem.

A small amount of underground development was carried out at this property by American Copper Mines, Limited, but nothing of importance was disclosed. A full account of this property will be found in the Annual Report for 1930.

Lucky Luke.—An option was obtained on this property (owned by L. E. Moody and R. Lowrie, of Usk) by R. W. Seelye, who carried out a small amount of preliminary work.

Bornite King.

This group, owned by Andrew Pete, of Usk, is situated in Bornite basin, at the head of an unnamed creek between Singlehurst and Chimdemash creeks. It is conveniently reached by a newly constructed trail from the *Four Aces* group, the distance from Usk being about 5 miles. The owner's camp is situated at elevation 3,875 feet.

The mineral occurrences consist of somewhat irregular fractures, some quartz-filled, in the prevailing volcanic flow-rocks, which are intruded in a number of places by tongues of aplite

and granodiorite. The minerals observed were chalcopyrite, bornite, and malachite, with lesser amounts of galena.

The work done consists of open-cutting, a tunnel 35 feet long on a 9-inch stringer, and an 80-foot crosscut, which has not reached its objective of two parallel slightly mineralized zones. Selected samples of sulphides show low values in precious metals, 1 to 2 per cent. copper and up to 3 per cent. lead. No showings of commercial importance have been disclosed, but the area is one warranting prospecting.

Diorite. This property, situated but a short distance from the Canadian National Railway track near Pitman flag-station, is owned by the estate of the late J. M. Dechene. A report on it will be found in the Annual Report for 1929. On this property occurs an extensive outcrop of aplite, which intrudes volcanic flow-rocks. The aplite appears to trend in a direction N. 70° W. (mag.) and outcrops in several different places on this property and on the adjoining *Grotto* group. On the *Diorite* the aplite is fairly well mineralized with chalcopyrite, smaller amounts of bornite, pyrite, and specularite.

At the end of the wagon-road from Pitman a tunnel has been started and driven 37 feet at elevation 540 feet with the idea of probing the downward continuation of the shear. Some good camp buildings were erected last year close to the portal of this tunnel. In view of mineral-showings and the very favourable situation of this property, further investigation is merited.

Grotto. This group, owned by G. Alger, J. Bell, Lee Bethurem, and associates, of Usk, is situated on Hardscrabble creek, about 1½ miles distant from Pitman flag-station, and immediately adjoins the *Diorite* on the west. A good wagon-road leads to the *Diorite* from Pitman and a pack-trail leads from the *Diorite* to the *Grotto*. For description refer to Bulletin No. 1, 1932.

Algoma. This group, owned by C. Vallee and associates, of Pacific, is situated on the north side of St. Croix creek at an elevation of somewhat over 3,000 feet above the Skeena river. It is reached by following the main St. Croix Creek trail for a distance of about 1½ miles from the mouth of the creek, at which point a steep branch trail leads to the cabin on the group at elevation 3,100 feet. At about elevation 3,325 feet the volcanic country-rock is intruded by granodiorite and there is some evidence of copper mineralization in the volcanic flow-rocks. While no individual showing was seen which warranted following up on its own merits, it is evident that the region exhibits general mineral promise and justifies close prospecting.

Helen. This group, discovered during the year by G. Alger and associates, of Usk, is situated on Sand creek, which flows into the Skeena river from the west a short distance north of Pitman flag-station. An extensive copper-zinc mineralization is reported, but available time did not permit of examination by the Resident Engineer. A sample of the mineral discovered assayed: Gold, 0.06 oz. per ton; silver, 4 oz. per ton; copper, 5 per cent.; zinc, 18 per cent.

Bermaline.—This group, owned by August Johnson and associates, of Ritchie, is situated at the headwaters of the North fork of Lorne creek and is distant from Ritchie flag-station about 16 miles by trail. For description refer to Bulletin No. 1, 1932.

Windfall. This group, consisting of eight claims, is a new discovery of the year, made by E. S. Tordiffe, M. F. Burke, and Frank Allen, of Cedarvale, who jointly with some associates own the property. It is situated on Porcupine creek, an eastward-flowing tributary of the Skeena river, and the mouth of which is about 1 mile north of Ritchie flag-station. The property is distant about 4 miles from the latter and is reached from it by a trail which follows the south side of the creek.

On the left bank of the creek, about 100 feet vertically above the latter, there is exposed by open-cut a strong, well-mineralized shear-zone replacement fissure, striking N. 60° E. (mag.) and dipping at 60° south-east. The width is about 10 feet, of which 5 feet on the foot-wall is heavily mineralized with zinc-blende, galena, pyrite, and a lesser amount of chalcopyrite. A sample across 5 feet assayed: Gold, 0.01 oz. per ton; silver, 7 oz. per ton; lead, 7.2 per cent.; zinc, 24 per cent.; copper, 0.9 per cent.

The country-rocks in the region are flat-dipping sedimentaries of the Hazelton series, which are intruded by alaskite in the near vicinity of the exposure. The alaskite is pyritized. A sample of it assayed: Gold, trace; silver, 0.40 oz. per ton. A few feet west of the open-cut the shear-

zone appears to be terminated by a graphitic fault, which strikes N. 45° E. (mag.) and dips at 50° north-west. The zone can be followed to great advantage in a north-easterly direction by an adit-drift. This property well merits further investigation and the attention of examining engineers is directed to it.

Dynamiter. This group, owned by W. Minther, of Cedarvale, is situated about 3 miles south of Woodcock, on the east side of the Skeena river, and is reached by a trail from the main road between Kitwanga and Cedarvale. The country-rocks in the region are the sedimentaries of the Hazelton series, which are intruded by stocks of granodiorite and alaskite.

Exposures lie between elevations of 1,225 and 1,475 feet. In the near vicinity of alaskite tongues the bedding-planes of an argillitic rock are in places heavily mineralized with pyrrhotite, arsenopyrite, pyrite, and a small amount of stibnite. At elevation 1,225 feet, 5 feet above a lake, a tunnel is run 65 feet on a bearing N. 65° W. (mag.), cutting obliquely the bedding-planes of the sedimentaries, which strike approximately east and west (mag.) and dip north at about 45°, and which are in places quite heavily mineralized as above indicated. At 30 feet from the portal a seam 2 feet in width shows a compact mineralization. A sample of this assayed: Gold, trace; silver, 0.2 oz. per ton.

About 150 feet distant from, and west of, the tunnel a shaft is sunk a depth of 21 feet, at elevation 1,265 feet, following the westerly continuation of the mineralization met with in the tunnel. The shaft exposes a width of 7½ feet of argillitic rock mineralized with arsenopyrite and heavily stained with iron. A width of 3½ feet on the hanging-wall is brecciated and shows the best mineralization. A sample across 3½ feet at the bottom of the shaft assayed: Gold, trace; silver, 0.36 oz. per ton; antimony, 0.5 per cent. Distant about 200 feet west of the shaft and 35 feet vertically above the latter, an open-cut discloses what seems to be the westerly continuation of the mineralization followed in the tunnel and shaft.

The region appears to be well mineralized and the poor gold values disclosed are disappointing in view of the mineralization, which might be expected to be more pronouncedly auriferous. Further prospecting in the region would, however, seem well justified.

Morning Star. An account of this property, situated near Woodcock and owned by D. C. McGregor, of Cedarvale, will be found in the Annual Report for 1930. Further work was done by the owner this year, who reports that analysis of one sample showed a small amount of tin. The existence of the latter in association with acid intrusives is of course quite possible. Small amounts of tin were discovered by the Geological Survey of Canada in the mineralization on Rocher Déboulé mountain.

Non-metallic Minerals.

Bockner of the North. This claim, staked in 1931 over a 4.5-acre catch-basin lake deposit of marl, is situated 1 mile west of Ritchie, a small station on the Canadian National Railway. It is owned by A. Johnson and A. J. Hillyard, of Ritchie. A sample of the white marl which is found covering the lake to an unknown depth was analysed and found to contain: Lime, 92.4 per cent.; insoluble matter, 6 per cent.; organic matter, 0.2 per cent.; iron oxide, 0.4 per cent.; alumina, 0.4 per cent.; water, 0.6 per cent. Marl has a small commercial value in agriculture as a correcter of acid soils and this deposit, which is conveniently located as to transportation, might be so used locally.

Hazelton Section.

There was but little activity during the year in this section. Assessment-work was carried out by Dan Macdonald, of Hazelton, on his *Summit*, *True Blue*, and *Black Pilot* mineral claims; by G. B. Tallman, of New Hazelton, on his *Midway* group; and by J. Miller, of Hazelton, on his *Brunswick* group. All these properties are on Rocher Déboulé mountain. Attention is directed to Bulletin No. 1, 1932, in which the view is expressed that the lode-gold possibilities of this mountain merit further investigation.

Smithers Section.

The most important feature in this section during the year was the commencement of operations on the *Silver Lake* and *Trade Dollar* groups on Hudson Bay mountain by W. E. Wilson & Sons, under the direction of C. M. Campbell, as the result of which options on these

and the adjoining *Silver Creek* and *Homestake* groups were renewed, with the stated intention of carrying out further work next year.

Silver Lake and Trade Dollar.

The former group is owned by L. S. McGill and P. Schufer, of Smithers, and the latter by Alex. and Angus Chisholm, of Smithers. A description of them and accompanying map of the elevated plateau on which they are situated will be found in the Annual Report for 1928. Operations were carried on under the direction of C. M. Campbell and a small force of men was employed during the summer and early fall. A small frame building was erected at a convenient point at elevation 6,300 feet and an oil-stove was used for cooking and heating purposes.

To date, evidence has been obtained of the existence of nine veins in all on the *Silver Lake* and *Trade Dollar* groups, of which three exhibit the earmarks of commercial importance as the result of prospecting to date. These three are veins Nos. 3, 4, and 5, and on these an extensive system of pits and open-cuts was opened up.

No. 4 vein was the scene of the discovery of the remarkably clean galena in 1928, and it might be remarked that further work did not disclose persistence of this particular lens locally, at any rate; but, generally speaking, the behaviour of this vein as further exposures were made was distinctly favourable and mineralization was found to occur at intervals, at any rate, over a length of 1,200 feet. Lenses of compact mineral varying in width from 1 to 30 inches, narrowing and again widening, were found in the numerous openings over the length mentioned. The mineralization changes in character from galena-sphalerite at the lower or western end to arsenopyrite-sphalerite-chalcopyrite at the upper or eastern end.

Vein No. 5 exhibited a mineralized length of 750 feet and mineralization possesses somewhat similar features to vein No. 4. Vein No. 3 shows a mineralized length of 600 feet, in which the galena-sphalerite mineralization is more prevalent than the higher-temperature arsenopyrite-sphalerite mineralization. At one point a width of 6 feet shows bands of sphalerite, chalcopyrite, and galena. Generally speaking, it may be said that this property is responding in a satisfactory manner to initial development.

Heather.

This group, owned by H. C. Wade, of Smithers, is situated on the ridge between the North and South forks of Simpson creek, near the head of the North fork. It is reached by following the *Empire* trail to the cabin on the *Jessie* and then climbing the mountain from that point onward. At elevation 5,350 feet on the north side of the ridge, between the forks of Simpson creek, an open-cut exposes a shear-zone of 4 feet 3 inches in width in the volcanic country-rock. Of this, a width of 2 feet 9 inches is mineralized with arsenopyrite and sphalerite. A sample across this width assayed: Gold, 0.10 oz. per ton; silver, 0.5 oz. per ton; zinc, 3.4 per cent. This shear-zone strikes N. 35° W. (mag.) and dips at about 50° south-west. What is quite possibly the continuation of this zone is exposed by open-cut on the south side of the ridge between the forks of the creek in the South Fork basin at elevation 5,375 feet, where a similar mineralization is exposed by open-cut. The strike here observed is N. 40° W. (mag.) and the dip about 48° south-west.

On the *Snowshoe* further work was done by H. C. Wade, of Smithers, one of the owners. Other properties on Hudson Bay mountain are described in Bulletin No. 1, 1932.

Babine Mountains.

In the Babine mountains further small-scale work was performed at the *Silver King* (property of Omineca Silver King Mines, Limited) and at the *Victoria* group (property of Lorraine Copper Silver Mines, Limited) by the respective owners, and encouraging results are reported in both cases. At the *Little Joe* further work was done by T. King, of Smithers, one of the owners of this property. At the *Rainbow* group, owned by Jas. Wright, of Smithers, a new discovery is reported of copper pyrites carrying good gold values. A sample of the ore taken by the owner and submitted for assay yielded the following returns: Gold, 1.10 oz. per ton; silver, 44 oz. per ton; copper, 17.6 per cent.

Telkwa Section.

Babine Bonanza M. & M. Co.

Small-scale operations were carried on during the year under the direction of George McBean. The most important result of development during the year was the striking of a nice body of ore in tunnel C. This tunnel on No. 2 vein has now been continued about 150 feet beyond the starting-point in the region

more immediately below the ore struck in tunnel B. This ore was struck after the visit of the Resident Engineer, but its width is reported as being 6 feet, and a sample taken by the management across this width assayed: Silver, 27.6 oz. per ton; lead, 27.3 per cent.; zinc, 11.2 per cent. This ore occurs at the end of the drift.

It is now rendered evident, as was formerly thought likely, that No. 1 and No. 2 veins intersect at this horizon in the face of tunnel No. 1. That being the case, the region south of the intersection should be one of particular promise, as was indicated in the Annual Report for 1930. Accordingly, after striking the above-mentioned ore in tunnel C, drifts were started in the vein showing near the face of tunnel No. 1, both northwards to connect with tunnel C and southwards to explore the vein south of the intersection. Operations were suspended in December for the winter, at which time the south drift had advanced, the management states, a distance of 100 feet, the vein being apparently about 9 feet wide and showing some quartz and a little galena. The north drift had advanced 60 feet and it was estimated that another 60 feet would require to be run to connect with tunnel C.

In tunnel C a raise has been put up a distance of 40 feet immediately below the ore-shoot encountered in tunnel B, and the back of the raise shows a width of 5 feet of good milling-ore.

In tunnel No. 2 a raise directed towards about the centre of the first ore-shoot met with in tunnel C has reached a height of 40 feet above the tunnel, and at this point the back shows a width of 2 feet 3 inches of ore, of which a sample taken by the management across 20 inches assayed: Silver, 60.4 oz. per ton; lead, 37.7 per cent.; zinc, 16.9 per cent.

In tunnel B there are indications of the likelihood of the existence of ore in the hanging-wall for 60 feet or more south-west of the point at which the drift ran out of the ore-body, and prospecting in this region would seem advisable at an opportune time.

This property is responding well to development and it would seem that its future is largely dependent upon the behaviour of what may be termed the main vein south of the point of junction of veins Nos. 1 and 2. The indications therefore point to the advisability of obtaining information on this point as the first step in development; that is, by advancing tunnels B, C, and No. 2 tunnel southerly. A 225-cubic-foot Sullivan portable air-compressor, oil-furnace, and drill-sharpener were installed during the year.

In the region of Milk creek, at the headwaters of the Telkwa river, a considerable number of prospectors carried out assessment-work on their properties, including the *Kitchener*, *Grandview*, *Comstock*, and *Rob Boy* groups.

On Dome mountain, at the *Free Gold* group, further work was done by the owners, Alex. and Angus Chisholm, of Smithers.

HOUSTON SECTION.

Croesus. This property is situated on Morice mountain and is owned by R. J. Douglas, of Houston, who reports the discovery during the year of a promising copper mineralization. Available time did not permit of inspection by the Resident Engineer, but the general geology of this property (limestone intruded by granodiorite) is known to be promising. Mention of this property will be found in the 1930 Annual Report.

Mammoth, Mison, and B.C. Leader. These properties, owned by Paul Tickoles, of Smithers, and associates, consist of a total of twenty-six claims and are situated north-east of Houston, being reached by a trail leaving the highway between 3 and 4 miles east of Houston.

A description will be found in the 1929 Annual Report on page 176. The country-rocks in the region are volcanics—breccias, rhyolites, and andesites. In the southern portion of the *Mammoth* group the rocks mentioned are intruded by a small basic stock which occupies an area on the surface of about 100 square yards. This stock consists largely of pyroxene and feldspar and may be classified as a coarse-grained diabase. About 2,000 feet or so in a north-west direction from this stock occurs a small dyke of similar composition. Some considerable distance from these intrusives there is stated to be on the west a granitic intrusive and on the north another small basic intrusive.

The mineral occurrence consists of a persistent sparsely mineralized zone, probably several hundred feet in width, striking in a true north-and-south direction. Mineralization consists of galena, sphalerite, copper pyrites, bornite, copper carbonates, and pyrite. A copper mineralization predominates in the western portion.

Commercial possibilities have so far not been rendered evident, although such may be disclosed by further work. As to whether this mineralization is syngenetic, originating from

the volcanic rock magma, or epigenetic, due to an intrusive source, it may be said that such exposures as have been inspected are considered to be epigenetic. Paul Tickoles has accomplished a great deal, single-handed, at this property, in the way of open-cuts and one tunnel 30 feet in length.

The following samples are representative of the mineralization:—A sample across 5 feet in the face of a tunnel on the *Mammoth:* Gold, trace; silver, 0.28 oz. per ton; copper, *nil;* lead, 0.8 per cent. About 400 feet distant from the above-mentioned tunnel, and 200 feet vertically above it, rhyolitic volcanics are intruded by a small diabase dyke 2 feet in width striking north and south (mag.), which cuts the bedding-planes of the volcanic at right angles. A sample across 7 feet in this region assayed: Gold, trace; silver, 0.16 oz. per ton; lead, trace. A sample of the more heavily mineralized portions of country-rock at this point assayed: Gold, trace; silver, 0.2 oz. per ton; lead, *nil;* zinc, 3 per cent.

Black Bear and Silver Stream.

These claims are situated between Walcott and Barrett flag-stations, about 2 miles west of the railway-track. At about 5 miles east of Walcott a trail leaves the track and follows up a creek locally known as Sunrise creek, on which the showings are situated. The claims are owned by A. K. Hemstreet, of Walcott, and by F. Munger, of Barrett. They adjoin on the west the *Vaino*, described in the 1928 Annual Report.

On the right bank of Sunrise creek a shear-zone in the volcanic country-rock 15 feet in width is sparsely mineralized with chalcopyrite, pyrite, and malachite. This strikes across the creek S. 50° W. (mag.) and dips at 60° north-west. A sample across 9 feet assayed: Gold, trace; silver, 0.24 oz. per ton; copper, *nil.* A sample composed of selected portions assayed: Gold, trace; silver, 0.16 oz. per ton; copper, 0.6 per cent.

Topley Section.

Golden Eagle.

A description of this property, owned by D. Heenan and C. Matheson, of Topley, will be found in the 1930 Annual Report. During the year the owners sank the shaft on the new vein to a depth of 37 feet and report no material change in the mineralization. An additional branch vein north-west of this shaft was also discovered during the year.

Further work was also done on the *Maple Leaf* group, which adjoins the *Golden Eagle* on the east, by the owner, L. Kylling, of Topley. Showings on the *Evergreen* claim of this group are described in the 1930 Annual Report. On the *Randolph* and *Cat* claims, owned respectively by Chris. Wold and R. J. Jannack, of Topley (a description of which appears in the 1928 Annual Report), some additional work was done by the owners. Matthew Sam also did some work on the *Cup* group, of which he is owner.

Burns Lake Section.

On the *Golden Glory* (described in the 1930 Annual Report), owned by W. Reed and R. H. Gerow, of Burns Lake, the owners report having driven a tunnel 90 feet in length during the year. On the adjoining *Silver Glance* some further work was done by the owner, J. C. McLean, of Burns Lake. An account of the *Stella*, a molybdenite property near Endako, owned by A. Langley, of Endako, and associates, will be found in the Annual Report for 1929. On the *Sonya-Hectoria* group, near Fraser lake, further work was done by the owner, P. C. Banquarel, of Fraser Lake.

Hidden.

This claim, owned by Arthur Goodwin and B. Munroe, of Fort Fraser, is situated about 6 miles south of Fort Fraser. It is reached by crossing the ferry over the Nechako river at Fort Fraser and following one of the logging-roads (over which a car can be driven) for a distance of about 4 miles. A foot-trail leads from the road to the property.

On the south bank of a large dry gulch an open-cut exposes a quartz vein 25 feet in width. The strike of this is about N. 25° E. and the dip 60° north-west. About 75 yards south-west of the point of exposure sheared granodiorite is exposed on the top of the south bank of the gulch. The walls of the vein are not exposed, but it would seem to be of the nature of a vein-dyke, inasmuch as within it are small seams of granodiorite. In places the vein is oxidized and iron-stained and a sparse mineralization of pyrite and galena is exhibited. A sample across 3 feet of the more oxidized portion assayed: Gold, trace; silver, 0.44 oz. per ton. A sample of the more leady portions only assayed: Gold, 0.03 oz. per ton; silver, 0.76 oz. per ton; lead,

0.4 per cent. This showing merits further work, and it is suggested that the walls should be exposed and an effort made to trace the vein.

Extensive outcrops of granodiorite occur in this region to the west, south of Fraser lake, which are considered as being portions of the "Central batholith." The region is covered with a more or less dense growth of vegetation and it is quite possible that a large portion of it is underlain by batholithic rocks. Justification exists for searching for gold-quartz veins in this region.

NORTHERN PORTION OF OMINECA MINING DIVISION.

At the *Ferguson* mine, Ingenika river, assessment-work was carried out by Ingenika Mines, Limited, on certain claims. For description *see* previous Annual Reports.

At the *Wedge* and *Protection* groups, Pesika creek, Finlay river, an adit-drift was run during the year by the owners, Mort Teare and associates, of Prince George, with, it is stated, encouraging results. An account of this property will be found in the 1930 Annual Report.

The trail to the *Rainbow* group, Ankwill creek, Takla lake, was improved during the year by the owner, Frank Martin, of Hazelton. An account of this property will be found in the 1930 Annual Report.

In the Manson section small-scale prospecting and initial development operations were carried out by Germansen Development Syndicate, Limited, under the direction of W. F. Paquette, at its properties, the *Black Hawk* group on Blackjack mountain and the *P.E.M.* and *Mother Lode* groups on Germansen river. The mineralization on the first mentioned is silver-lead-zinc; that on the other two groups is gold-copper. An account of these properties will be found in Bulletin No. 1, 1932.

Blue Ridge. This property, owned by F. Weber, of Fort Grahame, is situated at the head of a tributary of Duck creek near the headwaters of the latter. A pack-trail leads to it from Old Hogem on the Omineca river, the distance from Old Hogem being about 15 miles. Old Hogem can be reached either by pack-train from Takla Landing (two days' journey) or by boat from the Finlay river, except during high water. The boat trip can only be made by experienced navigators. The Black canyon on the Omineca river is extremely dangerous for the inexperienced at all stages of water. The Omineca river at Old Hogem can be forded by horses at low water and the trail starts from the north bank of the river almost opposite the ford. Duck creek flows southerly into the Omineca river and joins the latter about 8 miles below Old Hogem.

The region immediately adjoins the eastern flank of the Cassiar-Omineca batholith. Rock-exposures on the trail were seen to be entirely granodiorite for some miles north of the Omineca river, but as the headwaters of Duck creek are approached there is evidence of inclusions and remnants of roof-rocks.

Topographically the country is featured by an elevated extensive plateau at elevation 5,010 feet (elevation of Old Hogem, 2,585 feet), from which mountains rise to heights of between 1,000 and 1,500 feet above the plateau. Some of the tributaries of Duck creek have their sources on this plateau, and all tributaries occupy wide valleys and extensive meadows flank the banks of these tributaries. The summits of the mountains are more or less rounded and relief somewhat matured.

The property is situated on a mountain-spur at the head of a tributary of Duck creek. At one point a large portion of the spur consisting wholly of granodiorite is seen to be mineralized with chalcopyrite and stained with copper carbonates. The tonnage of cupriferous rock at this point is undoubtedly very great, but, while the cliff-like nature of the exposure renders accurate sampling difficult, the copper contents of the rock-mass as a whole would not seem likely to exceed about 0.5 per cent. copper. A reasonably close approximation to the copper content could be gained by sampling the extensive talus accumulation at the foot of the exposure.

About a quarter of a mile east of the above exposure, near the summit of the spur, and on the east slope of the latter at elevation 6,185 feet, an open-cut exposes a well-mineralized zone 50 feet in width. This appears to have a definite true east-and-west trend, but exposures are few and rock-outcrops are obscured by mountain grasses. A sample across this width of 50 feet assayed: Gold, trace; silver, 0.6 oz. per ton; copper, 1.5 per cent.

Other copper-showings are reported in this area, which it is evident merits close prospecting. Especially should search be directed for remnant portions of the rocks which formerly roofed the batholith and which offer particular promise.

Coal.

Operations of F. M. Dockrill.—F. M. Dockrill is operating Lots 391 and 401 under lease from the owners, the B.C. Coal and Land Company. This property immediately adjoins that of Telkwa Collieries, Limited, and its position is shown on the map on page 158 of the 1926 Annual Report; Lot 391 is immediately south of Lot 401.

Mining operations were continued during the year on the 14-foot seam of coal, which outcrops on Lot 391 on the right bank of Goat creek, close to the point at which the Hunter Basin road crosses the creek. The distance of the coal-bunkers from Telkwa Station is 7 miles, and the road was greatly improved during the year by the Department of Public Works.

The seam strikes approximately true north and south and pitches at a slight angle into the hill. It has been opened up by two slopes approximately 50 feet apart, Nos. 1 and 2 (of which No. 1 is the more northerly). The length of No. 1 is 210 feet, and at the bottom of it is the sump, to which the water drains from all parts of the workings. No. 2 slope is 225 feet in length, and at the bottom of this No. 1 level, 130 feet in length, connects with No. 1 slope. Crosscuts are being run at distances apart of 60 feet southwards from No. 2 slope, the underlying scheme being to mine by the room-and-pillar system. Mainly for prospecting purposes a tunnel has been run north of No. 1 slope a distance of 60 feet. Within the area described there is no evidence of any major disturbance. Save for a small shale-seam, 2 or 3 inches in width, in the middle of the coal-seam, the coal is clean. Its good qualities are becoming more widely recognized and the local market is growing. The following analysis is representative of the clean coal, and it is to be noted that its classification closely approximates to "high-carbon bituminous": Moisture, 1.8 per cent.; volatile combustible, 22.6 per cent.; fixed carbon, 64.95 per cent.; ash, 10.65 per cent.; B.T.U., 13,361.

Placer-mining.

Apart from sluicing operations at low water on bars of the Skeena river between Hazelton and Pacific, activity focused at five different centres—namely, Rainbow creek, the Manson section, Lorne creek, McConnell creek, and Dog creek. For descriptions of the first two areas *see* Bulletin No. 1, 1931.

McConnell Creek.—P. Jensen, of Hazelton, the original discoverer of this creek, spent the entire season at his claims, and M. J. Brown, of Tulsa, Oklahoma, was engaged in prospecting in the vicinity, and has applied for a number of leases on this creek and the Ingenika river. It is a noteworthy fact that P. Jensen has worked each year at his property on this creek since its discovery by him in 1907, and he has gained very considerably more than a livelihood as the result of his efforts. A detailed description of this creek by the late William Fleet Robertson, then Provincial Mineralogist, will be found in the Annual Report for 1908. This creek has not been examined by the Resident Engineer.

Lorne Creek.

In the Annual Report for 1930, pages 154 to 159, will be found a general description of Lorne creek and a detailed description of the lower portion of the creek, including "Dry Hill," covered by Stewart A. Corley's lease. To this reference is invited, as descriptive matter contained therein will not be repeated in this report.

There are three headwater branches of this creek—namely, the South fork, which joins the main creek about 5 miles above the mouth; the main creek above the South fork, to which latter it flows parallel, north-easterly; and the North fork, which joins the main creek about 2 miles above the South fork. The two first mentioned rise in and flow through V-shaped deep valleys. The North fork rises in a wide valley at the head of the gently sloping divide between this valley and that of Douglas creek, and flows for upwards of 3 miles through a wide flat-bottomed valley, in which meadows flank both its banks. It then enters a deeply dissected valley, with steeply sloping sides, which become rapidly more precipitous down-stream until they become canyon-like at points of the lower reaches of the main creek, where the depth of the valley is over 2,000 feet. Considered as a whole, the course of the main creek-valley below the junction of the North fork is fairly uniform, but the creek makes a number of short sharp turns in the rocky gorge which contains it. In fact, the narrow gorge through which the creek flows is a great obstacle to recovery of the gold on bed-rock, as it is difficult, if not impossible, at most points to divert or wing-dam the creek.

The South fork and that portion of the main creek above the junction of the North fork were not examined, as placer activity centres on the portion down-stream from the last-mentioned point.

The creek is a large one, the flow of water amounting to several thousands of cubic feet per minute. Its gradient is steep, approaching 5 per cent. The country-rock through which the creek flows consists entirely of flat-dipping, thickly-bedded sedimentary rocks, conglomerates, argillites, and quartzites of the Hazelton series, locally disturbed and intensely silicified by numerous intrusions of granitic rock.

The numerous quartz veins, all more or less mineralized, which are to be seen at almost all points of the creek from the mouth upwards are an obvious indication of the local source of the placer gold; a conclusion further confirmed by the appearance of the gold itself, which is fairly coarse and nuggety. One nugget found this year by James Jones weighed 1½ oz. The placer occurs on low-lying benches of small dimensions and in the bed of the creek. Numerous remnant segments of earlier channels, of which "Dry Hill" (S. A. Corley's lease) is the most important, are to be seen at different points of the creek, at vertical heights above the creek varying up to 500 feet. The indications are that the valley is a very old one, dating from early Cretaceous or even possibly late Jurassic times.

The efforts of prospectors at the present time are directed to the recovery of gold from the low-lying benches and that on bed-rock in the creek. The segments of earlier channels have received but little attention for some years. At the close of the year, however, F. A. Neville, of the Fairbanks Utility Company, Fairbanks, Alaska, secured an option on S. A. Corley's lease (described in full in the 1930 Annual Report), the intention being to first prospect in the vicinity of "Dry Hill" pit.

The possible placer-gold content of the extensive meadows at the head of the North fork, in view of the auriferous veins known to exist in that region, is a most interesting speculation. So far as is known, no testing whatever has been done in this vicinity. It would seem impossible to reach bed-rock by sinking shafts at this point, because any attempt to do so is likely to prove abortive owing to the heavy flow of water that would be encountered. Keystone-drilling, therefore, would seem to be the only method to adopt to determine values.

An account of the various claims and leases staked on the creek follows.

Lease of A. McNaughton.—This lease is situated at the mouth of the creek. Gold in the gravels in this region would seem to have originated from the ancient "Dry Hill" channel, reconcentration having been effected by Lorne creek cutting down through the upper end of this channel. The waters of the Skeena river also played some part probably in reconcentration. The owner was working mainly during the year in the Skeena valley.

Lease of J. Jones.—This lease, owned by James Jones, of Hazelton, commences at a point about three-quarters of a mile above S. A. Corley's lease (described in full in the 1930 Annual Report), extending half a mile up-stream.

The owner has managed to make a living by washing the gravels on many very small low-lying benches which are to be found on the creek, and also by recovering some gold from the bed-rock of the creek. The unusually high water prevailing throughout a very large portion of the season has greatly impeded the efforts of the owner and those of other prospectors on the creek. The owner recovered one nugget weighing 1½ oz.

Possibilities, on the investigation of which the owner has not embarked, are afforded by two old channel segments which occur on the lease, one on the left bank and the other on the right bank. Both rims of the former are exposed on the left bank of the creek, and an old tunnel now caved is run in the bank of the creek at about 30 feet above the creek.

The channel segment exposed in the right bank at the upper end of the lease is what was formerly known as the "Hardscrabble" mine, to which reference is made in the 1914 Annual Report. Bed-rock of this channel seems to be about 80 feet above Lorne creek. The left rim and portion of the old channel gravels are exposed at the outlet end, at which point a few old timbers mark the portal of an old tunnel. There is nothing to prevent starting a tunnel at this point and drifting the old channel. Gravels could be dumped to the creek-level and washed at that point. This segment seems of considerable length, and the outlet must be situated in the bend of the creek immediately above this point, which is covered with dense vegetation and timber-growth. No great expenditure of capital would be required to drift the channel segments

referred to, and while there is no definite information as to gold contents, the possibilities would seem to justify the enterprise, although it is necessarily speculative.

Claims of Eric Larson and Associates.—These cover the creek in the vicinity of the old sawmill and operating water-wheel erected by the Dry Hill Hydraulic Mining Company many years ago. On the left bank of the creek in this region there appear to be two old channels in addition to one contemporaneous, or nearly so, with the modern creek, and which was used as an intake for the water-wheel. One is situated a short distance from and above the creek, and the other, a much longer segment, lies farther back from the creek. The latter apparently received a great deal of attention by very early operators, whose efforts are marked by several tunnels and other workings now completely caved. Numerous very old buildings now in complete ruin indicate that much work was originally done at this point. Just what results were secured are unknown, and unless some of the old workings are cleared it is not possible to form an opinion as to potentialities.

The owners of these claims sank two pits to bed-rock in the channel previously used as an intake for the water-wheel, but found no material amount of gold at this point. It is understood that they contemplate investigating some of the old workings mentioned above.

Claims of M. Orr, J. Russell Smith, J. Matheson, and Associates.—These claims are situated about 1 mile above the junction of the South fork on the main creek and represent a new discovery made by M. Orr, of Pacific. On the right bank of the creek in this region is a low-lying bench 15 feet above the creek. This bench is the largest bench observed on this creek, which is characterized by an entire absence of low-lying benches of any appreciable size at other points. At the lower end of the bench the creek swings to the north through a canyon. Surface pits sunk in this bench are said to have disclosed promising gold values.

At the time of inspection the owners were running a tunnel in the rock between the left rim of the old channel and the right rim of the present channel, from the lower side of the canyon at about 25 feet above water-level on this side, estimating that the thickness of the rib of rock would not greatly exceed 50 feet. The underlying idea being, after completion of the tunnel, to divert the creek through it and clean the bed-rock in the canyon, and thereafter sluice bench-gravels above tunnel-level. It is understood that the tunnel did not break through in the distance anticipated and that the approach of winter rendered further work impossible until spring. Before continuing the tunnel an accurate survey is necessary and should be made, but, even so, the level of the bed-rock of the old channel will still be an unknown factor. Close prospecting, and some open-cuts on the lower side of the canyon and on the upper side, should, at any rate, establish fairly accurately the position of the old channel. There seems no reason to infer that there are any falls in the old channel in this region, in which case the level of bed-rock on the lower side of the canyon should be much the same as that of the modern creek in this region, and the old channel bed-rock gradient is probably between 4 and 5 per cent. Open-cutting on the right bank of the creek on the lower side of the canyon may quite possibly disclose the mouth of the old channel, as the cover of morainal matter near the creek is not heavy. Once found, it merely remains to continue drifting in it on bed-rock. This property merits investigation.

Porcupine Creek.

Porcupine creek flows easterly into the Skeena river about 4 miles north of Lorne creek, to which it is approximately parallel, and which in general characteristics it closely resembles, save that its valley is not quite as deep. The rocks exposed by both creeks are precisely the same.

Sunset. Some evidence of placer gold was found on this claim, owned by M. F. Burke, E. S. Tordiffe, and Frank Allen, of Cedarvale, and situated about 4 miles above the mouth of the creek. In the right bank of the creek there is some evidence of the possible existence of a segment of a buried old channel between 1,000 and 1,200 feet in length, opposite the shear-zone exposed on the *Windfall* mineral claim. No material amount of investigation had been carried out at the time of inspection on September 16th, and in the absence of such it is not possible to form an opinion as to potentialities.

Porcupine. This claim adjoins the above-mentioned *Sunset* claim down-stream. On the right bank of the creek there is a low-lying bench about 250 feet in length, on which some test-pits have, the owners state, disclosed some coarse gold

which may have originated from the old channel on the *Sunset* claim. Further work is necessary before an opinion can be formed as to potentialities.

Dog Creek.

A discovery of gold was made on this creek during the year by D. Purvis and H. Perison, of Fort St. James. This creek flows north-easterly into the Stuart river and is crossed by the motor-road from Vanderhoof to Fort St. James, about 14 miles south of the latter place. A rough wagon-road leads from the point where the creek is crossed by the motor-road mentioned to within a short distance of the discoverer's claim. The creek is therefore in a very accessible region and the wagon-road mentioned could at small expense be converted into a motor-road.

No outcrops of bed-rock or rim-rock were observed within the area inspected in the vicinity of the Discovery claim. The creek has cut down to a depth of about 100 feet in the Nechako plateau, the average width of the valley being in the neighbourhood of 300 feet. Various benches, mainly low-lying, on both sides of the creek indicate the successive levels of its waters as they cut down through the valley-filling on the restoration of drainage in post-Glacial times. The mode of placer occurrence exemplified by the discovery and near-by claims is that of post-Glacial runs on false bed-rock. The gold is mainly moderately coarse flake gold, and the origin of the gold is indicated as resulting from the reconcentration of the glacial material accomplished by the creek as it cut its way down through the valley-filling. Owing to the entire absence of rock-exposures in the portion of the creek examined, no opinion can be formed as to the possibility of the existence of gold on true bed-rock. In any case, clearly the benches should be prospected first. The creek is of moderate size and should even at low water furnish an adequate supply of water for sluicing. The creek gradient is low, about 30 feet per mile.

H. Perison's Discovery Claim.—Two discovery claims, each 500 feet in length, were allowed to H. Perison and D. Purvis. The discovery was made at the upper end of H. Perison's claim at the upper end of an extensive bench, lying only a few feet above creek-level and but a short distance from the creek on the left bank of the latter. At this point gravels a few feet in thickness overlie a false bed-rock. At the time of inspection on September 30th very little work had been done and only a few cubic yards had been washed, there not having been sufficient time to allow of hauling in sluice-flume lumber.

One-tenth of a cubic yard from the discovery pit was rocked by H. Perison and the Resident Engineer, from which gold to the value of 25.86 cents and platinum to the value of 0.10 cent was recovered, indicating a gold value of $2.58 per cubic yard and a platinum value of 1 cent per cubic yard. This does not necessarily indicate that average values of the bench are of this order, but rather that it is a promising prospect which well merits further investigation.

As mentioned, the discovery is at the up-stream end of the bench, which widens to several hundred feet down-stream, in which direction it extends for at least 1,500 feet. A small tributary valley, in which water does not run at all seasons of the year, enters the main valley, somewhat below the centre of this bench. At this point there would seem to be a possibility of local enrichment of the bench, information as to which could readily be gained by sinking a few pits in this region.

At the time of inspection nine claims had been staked above the discovery claims and three below the latter. Several of the respective owners were on the ground carrying out preliminary testing, which is stated to have yielded promising results in several cases. At this time none of the owners, with the exception of H. Perison, had had time to get sluice-flume lumber on the ground.

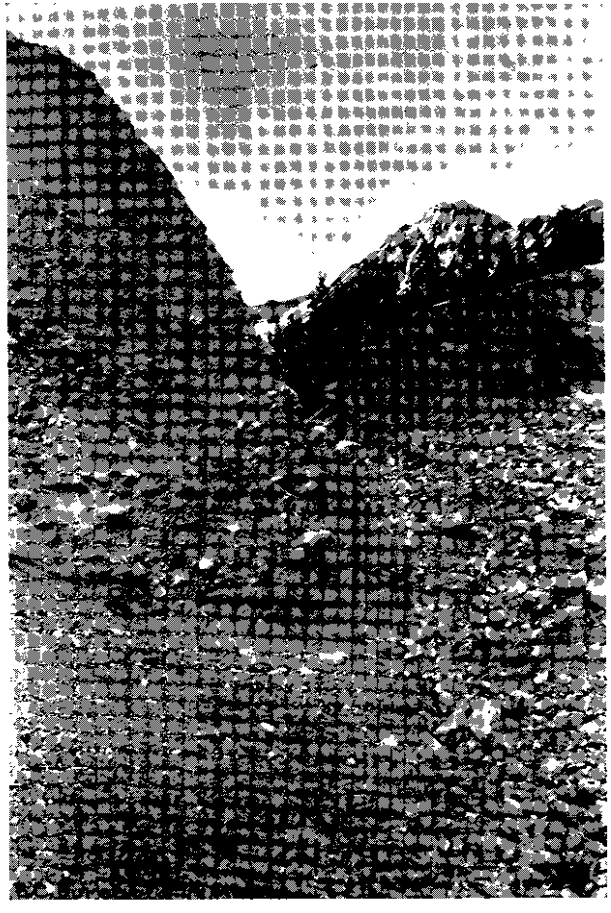
PEACE RIVER MINING DIVISION.

It was not possible for the Resident Engineer to visit this Mining Division during the year. Accounts of this Mining Division will be found in the Annual Reports for 1923, 1926, 1928, and 1930, and also in "Placer-mining in British Columbia," Bulletin No. 1, 1931, published by the Department of Mines.

CARIBOO MINING DIVISION.

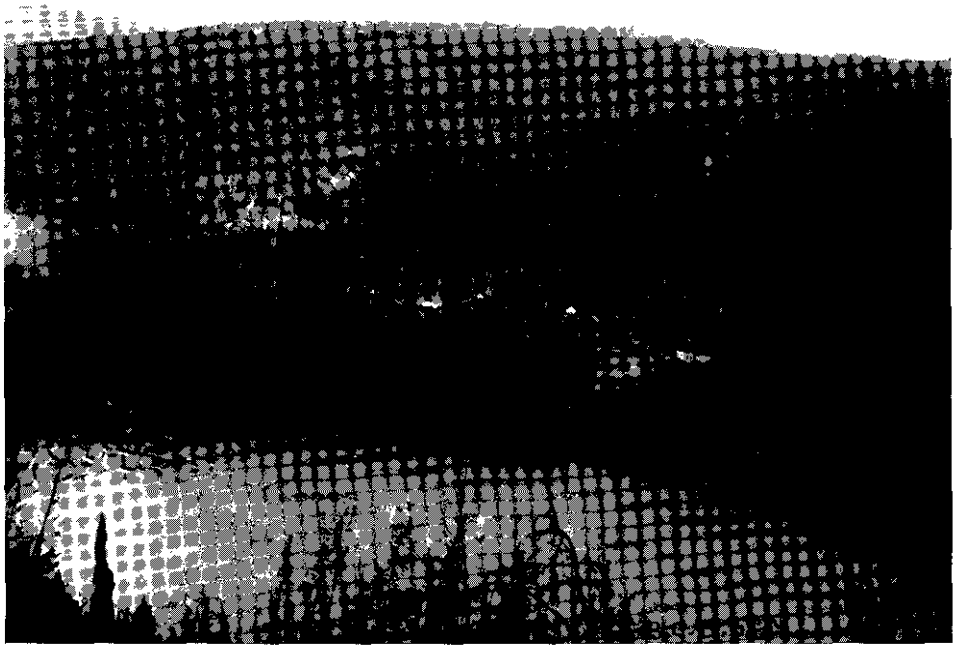
Lode-mining.

Extended reference to all important lode-gold properties situated in this Mining Division will be found in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia," issued by the

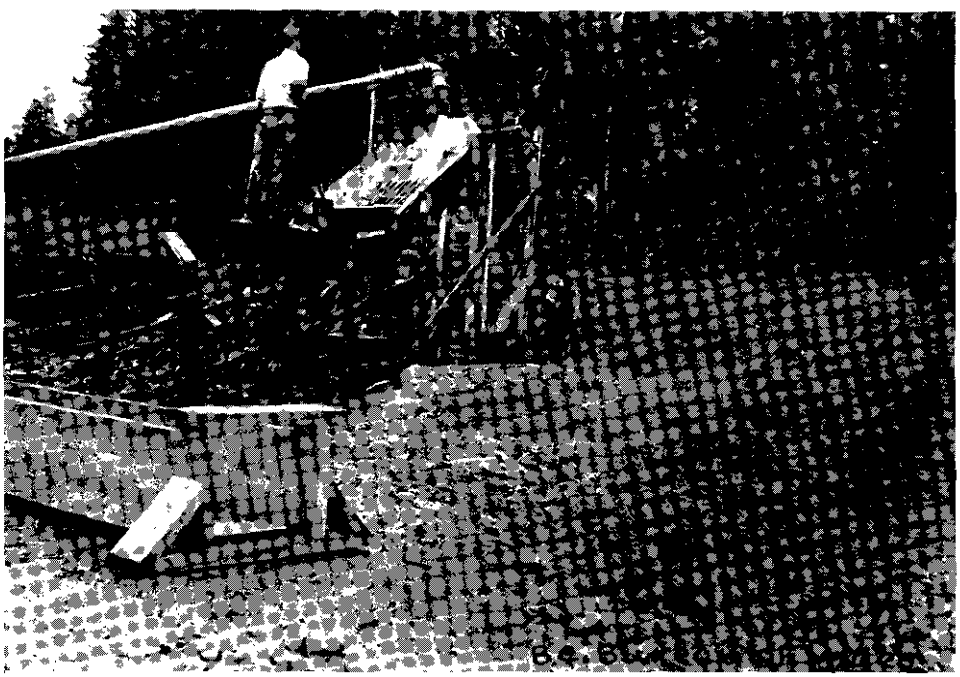


Quartz Creek, McDame Creek—Stratified Gravels.

Dease Creek Mines Corporation, Dease Creek—Keystone Drill.



Cariboo Gold Quartz Mining Co., Ltd.—Camp above Jack of Clubs Lake.



Garrett Placers, Fraser River—Sluicing Operations.

Department of Mines, and no detailed mention of those properties is for that reason made in this report. Such properties are the *Myrtle, Black Jack, Independence, Kitchener, Proserpine, Aurum, Hudson, Perkins, and Cayenne* groups; and the properties of the Cariboo Gold Quartz Mining Company, Limited, and the Quesnel Quartz Mining Company (under option to Cariboo Lode Mines, Limited).

PLACER-MINING.

The production of placer gold for the year was $63,716, as compared with $42,483 in 1930. An abnormally heavy rainfall during the year created more favourable conditions for hydraulic mines than have been experienced for a number of years. The chief contributor to the output from this Mining Division was Lowhee Mining Company, Limited, on Lowhee creek. At the *Trehouse* and *Ketch* hydraulic mines unusually good results were secured by the respective operators. Hydraulic operations were resumed on Grouse creek by the New Waverly Hydraulic Mining Company, Limited, and at the *Last Chance* hydraulic mine near Stanley by W. M. Hong and associates. Extensive testing operations were carried out on the Goat river and on the Fraser river, between the mouth of the former and Loos, by R. Garrett and associates under the direction of G. F. Dickson. Promising new discoveries were made on Hixon creek by E. Hann and J. Strbac, and on the Cottonwood river near Cottonwood House by V. E. Johnson and J. Wukelid (property now controlled by Mogul Gold Mining Company). Another new discovery is reported on Terry creek by T. H. Campbell, but owing to lack of time inspection could not be made. Canyon creek was the scene of considerable activity on the part of prospectors following upon the discovery of O. Lindquist and H. Hjort in 1930. Numerous prospectors were working on the numerous bars of the Fraser river between Prince George and Soda Creek during the year.

Goat River.

Operations of R. Garrett and Associates.—These comprised preliminary testing by means of drilling with an Empire drill and by sluicing various benches at points from the mouth of the river upwards, where twenty-one creek leases are held. Operations were carried on under the direction of G. F. Dickson, base camps being established about 2 miles above the mouth of the river on the right bank, and at Boulder creek, about 17 miles above the mouth of the river. It is understood that as the result of the extensive testing operations carried out some results of promise were gained, but that no definite plans have been formulated as to future work.

An examination was made up Goat river as far as Boulder creek. In this vicinity the river runs in a deeply dissected comparatively narrow valley and enters a deep canyon a mile or so in length, about 6 miles above its mouth. From the canyon downward to the point of entry into the Fraser valley the river runs on true bed-rock, which consists of metamorphosed, slightly schistose, highly silicified, thinly bedded conglomerates, quartzites, and argillites, of very uniform strike and dip. The strike is north-westerly and the dip south-westerly, while the river flows north-easterly. There is thus afforded remarkably perfect riffling. A feature of the country-rock is the large number of well-mineralized quartz gash-veins which cross the formation and resemble lenses rather than veins.

Above the canyon, in the vicinity of East and West Boulder creeks and for some miles farther up-stream, the river runs over a false bed-rock of glacial silt which cannot be far from true bed-rock. In the bed of the river at this point are many large boulders. On this false bed-rock it is understood that promising values in fine gold are found, and it was the discovery of such which attracted attention to the creek in former years, notably in 1921 (refer to 1922 Annual Report, page 123). It is also apparently a fact that the services of a diver and necessary equipment were secured in 1917 for the purpose of exploring "The million-dollar pot-hole," as the pool just below the canyon entrance is called. It is also understood that various benches above and below the Boulder creeks show promising gold values.

There is every indication that the present valley of the Goat river was in existence in Tertiary times and the existence of the numerous mineralized quartz-lenses in the country-rock is strongly suggestive of the local origin of gold on this river. There is, however, no reason to infer that the placer deposits formed in Tertiary times did not suffer from the effects of glacial erosion. While the gold now found in this river quite possibly had its original source in the valley, it probably results from reconcentration of the glacial debris in the valley effected by the waters on the restoration of drainage as they cut down through this debris. With

reference to pot-holes, it might be mentioned that it is opposed to experience to find gold in such, for the reason that the very causes which tend to create pot-holes are entirely unfavourable to the retention of gold therein.

Fraser River between Goat River and Loos.

Operations of R. Garrett and Associates.—These holdings comprise thirteen leases between the mouth of the Goat river and Loos. After preliminary testing by drilling with an Empire drill, attention mainly focused on a large bar in the vicinity of Mile 33 (that is, 33 miles west of McBride) on the Canadian National Railway, distant 7 miles below the mouth of Goat river. The bar is quite extensive, covers practically two leases, and is situated on the left bank of the river. Values are stated to range from 30 to 90 cents per cubic yard over a depth of about 3 yards, as ascertained by testing operations to date. Overlying the pay-gravels, which range in thickness from 9 to 14 feet, is a barren overburden of sand from 4 to 7 feet in thickness. Pay-gravels overlie a false bed-rock of tightly packed sand. A ½-cubic-yard McCormick-Deering Trackson gasoline-driven shovel was installed at this point, together with sluicing plant, for the purpose of thoroughly testing the bar. The sluicing plant erected consisted essentially of a movable grizzly with bars 2 inches apart, placed on rails, delivering undersize to a 16-inch belt-conveyor (speed 150 lineal feet per minute), delivering to a bucket elevator, discharging to another grizzly with bars 1 inch apart. Undersize from the latter passed to sluice-flume 144 feet in length containing an undercurrent. The gold is, of course, extremely fine and the gravels contain much garnetite and magnetite. It is understood that an alternative scheme was tried whereby gravels were dumped direct by the Trackson shovel to a grizzly at the head of the sluice-flume. At the time of the visit of the Resident Engineer in October the plant was not in operation, having been dismantled for the winter. The bucket elevator and belt-conveyor were operated by a small gasoline-engine, and sluice-water was supplied by a 6-inch centrifugal pump (Smart-Turner) delivering 1,050 gallons per minute and operated by an 18-21-horse-power Petter gasoline-engine.

The capacity of the plant is stated to be 200 cubic yards per shift of ten hours, and the cost, including overhead and amortization, 20 cents per cubic yard. About 1,000 cubic yards of gravels were treated during the year, but operations were greatly hampered by the unusually high water prevailing during the year. Camp buildings were erected by the railway at Mile 33, to which supplies are delivered direct by the Canadian National Railway. It was planned to continue drilling with the Empire drill during the winter.

Claim of Alex. Munroe.—The owner has been working on this bar for some years, his claim being situated on a lease held by Robert Garrett. His method is to shovel off the barren overburden by hand and transfer the gravel by wheelbarrow to a "grizzly" set up at the river's edge. He reports the ground as carrying good values.

Hixon Creek.

A general description of Hixon creek will be found in the 1930 Annual Report and further mention is made in the 1927 Annual Report.

Lease of E. Hann and J. Strbac.—In the reports cited above fairly full accounts of the general features of this property will be found, which it is unnecessary to repeat herein. The owners, whose address is Hixon, made a notable discovery of residual gold in 1931. On this property on the left bank of the creek is a low-lying bench, with fairly heavy timber-growth on a barren overburden of silt and rotten timber, 12 feet in thickness, overlying a stratum 6 feet in thickness of large quartz and rock boulders resting on a false bed-rock of white clay. This stratum forms the pay-streak. The gold is coarse residual gold, and the owners this year recovered 74½ oz. from somewhat under 400 cubic yards of gravel.

The difficulty that the owners experience is that, in spite of such good ground, they have to accomplish by hand much laborious work in removing the heavy barren overburden and the heavy boulders in the pay-stratum, and finally have to shovel the finer gravels to a sluice-flume above their heads, as the sluice-flume must be placed high up in order to give the necessary grade for tailings-disposal. This should constitute ground for a power-shovel.

The further operation of this property is of great geologic and commercial interest and gives rise to the question as to whether the source of this gold will be found. The property undoubtedly possesses much merit and warrants full investigation.

Golden Eagle Mines, Ltd.

This company, incorporated in the United States, is operating the property formerly held by Golden Reward Placers, Limited, and consisting of seven creek leases on Hixon creek, commencing at a point just below the falls and extending from this point up-stream 3½ miles to the lease owned by E. Hann and J. Strbac. A description of this property will be found in the 1930 Annual Report. Small-scale operations of the nature of preliminary testing and investigation were carried out during the year under the direction of J. S. Ogilvie. Camp buildings were erected by the road just above the falls, and a shaft was sunk between the road and the creek at this point, which reached solid rock at a depth of 15 feet.

As has been previously pointed out, the topography in the vicinity of the falls very strongly suggests that in this region there exists a buried ancient channel segment in the left bank of the creek. Depth to bed-rock and values are unknown, but can readily be ascertained by Keystone-drilling. At the upper end of this property, just above the shafts sunk by B. Briscoe on the lease held by him, the creek occupies a rocky channel between this point and the lease held by E. Hann and J. Strbac, while on the right bank of the creek in this region is a high glacial moraine. Here again indications point to the likelihood of the existence of a buried ancient channel segment in the right bank of the creek.

It is stated that during the year somewhat over 100 cubic yards of surface gravels were sluiced on B. Briscoe's lease, indicating an average of $1.35 per cubic yard at this point. This ground possesses features of merit and justifies intelligent investigation.

Terry Creek.

It was not possible to visit this creek during the year, but a general description of it is to be found in the 1930 Annual Report. A new discovery on this creek during the year is reported by T. H. Campbell.

Canyon Creek.

Attention was directed to this creek in 1930 owing to the discovery in that year of coarse gold by O. Lindquist and H. Hjort. In consequence of this a considerable amount of activity by prospectors developed during the present year.

Canyon creek is a large stream, which, after meandering in a wide valley in an almost due westerly direction, at about 20 miles above its mouth, enters a narrow and deep, steep-sided valley, canyon-like in part, in which it continues for between 4 and 5 miles, and then continues thereafter in an almost due northerly direction in a wide flat-bottomed valley until it joins the Fraser river. The lower portion of the creek-valley is occupied by a number of ranchers. The recent discovery of placer was made in the deeply dissected valley, and recent efforts by prospectors have been almost entirely confined to that portion of the creek.

The mode of occurrence of placer exhibited is that of fairly coarse gold on true bed-rock (over which the creek runs at all points of the deeply dissected valley), and also on false bed-rock on numerous benches which flank both banks of the creek. The country-rock consists of volcanic flow-rocks and argillite, and were seen at one point to be intruded by granitic rock. Quartz veins do not appear to be numerous, but were noted at one point. The region is, however, directly in the course of the Central batholith and the local origin of the bed-rock gold is indicated. And it seems probable that the gold occurring on false bed-rocks on the benches, although it may have been transported a considerable distance, as the waters of the creek cut down through the glacial debris on restoration of drainage in post-Glacial times, is to a large extent derived from this valley. In the deep portion of the valley the creek gradient is in the neighbourhood of 250 feet per mile, and there are small falls in this portion. Above and below this the gradient is very much less.

The upper portion of the canyon is reached by a trail about 10 miles in length which leaves the highway at Lot 3173. The lower portion of the deep valley is reached by following a rancher's road leaving the highway about 5 miles south of the Canyon Creek bridge and leading to the wide portion of the valley. After crossing the creek a trail on the right bank is followed up the creek.

Leases of O. Lindquist and H. Hjort.—These are situated in the upper part of the deep portion of Canyon Creek valley, and it was on O. Lindquist's lease that the owner discovered some coarse gold in 1930. Various low-lying benches show promising indications of placer on a false bed-rock, but the efforts of the owner and his partner were, at the time of the visit

of the Resident Engineer on June 9th and 10th, mainly directed to the recovery of the coarse gold on bed-rock. At that time the owners were engaged in hauling in sluice-flume lumber. Efforts to wing-dam the creek to permit of recovery of bed-rock gold were greatly impeded by the unusually high water prevailing during the year, and it is understood that recoveries were not, for this reason, as satisfactory as would otherwise have been the case.

Lease of S. Hissa and Associates.—This lease is situated above the deep portion of the valley, about 2½ miles up-stream from O. Lindquist's lease. The owners were engaged in rocking gravels on the flat-dipping left rim-rock. The depth to bed-rock in this portion of the valley would not seem to be great at any point, but the potentialities can only be ascertained by extensive testing.

Lease of J. D. McInnes.—This lease is situated at the lower end of the canyon, at the point at which the creek emerges and flows through a wide-bottomed valley. A low-lying bench at this point about 500 feet in width contains a few feet of gravel overlying a false bed-rock of clay. Gravels overlying the latter contain fairly coarse flake gold. Recovery is by means of shovelling into a sluice-flume.

Leases of A. J. Hurtubise and M. Caine.—These adjoin that of J. D. McInnes up-stream in the order mentioned. Characteristic of both are fairly extensive low-lying benches on both banks of the creek. Promising results are said to have been gained by preliminary prospecting of the bench-gravels which overlie a false bed-rock. At the time of inspection in October A. J. Hurtubise was engaged in getting sluice-flume lumber on to his ground.

Lease of D. J. Morgan and H. Froland.—This lease adjoins up-stream that of M. Caine, and one lease only, that of S. Falkus, intervenes between it and O. Lindquist's lease. Effort on this lease has been directed to the recovery of the bed-rock gold and it is understood that the results to date have been gratifying. There are small falls in this part of the creek, and in the bed of the stream are many large boulders. Immediately overlying bed-rock is a thin stratum of silt in which the gold occurs. It is proposed next year to endeavour to divert the creek at this point over a low-lying bench which occurs on the left bank, in order to clean the bed-rock.

Barkerville Section.

Leases of M. J. St. Clair and Associates, Cottonwood River.—These comprise two bench leases situated on the left bank of the Cottonwood river, distant about 1½ miles up-stream from the highway-bridge near Cottonwood House, from which point a trail leads to the property. It represents a new discovery in 1931 made by V. E. Johnson and J. Wukelid, the original stakers of the ground, from whom it was acquired by the present owners, who in turn have transferred control to the Mogul Gold Mining Company, of Victoria.

The property comprises a low-lying bench about 8 feet above the level of the river, the length of which is about 3,000 feet and the width may average in the neighbourhood of 200 feet. The feature of the placer-gold occurrence on this bench is that there are two pay-streaks, each lying on false bed-rock—one at a depth of about 3 feet and the other just above present water-level at a depth of about 8 feet. The upper pay-streak engaged the attention of the old-time operators, as is evidenced by somewhat extensive workings at the lower end of the bench and at points down-stream from this. But these operators failed apparently to discover the lower pay-streak, possibly because the river was then running at a higher level than at present.

The gold in the upper pay-streak, which consists of fine carbonaceous gravel on a tight silt false bed-rock, is fine; that in the lower pay-streak consists of coarse flake gold, well worn. The thickness of the lower pay-streak is about 3 feet and it contains some fairly coarse gravel up to 12 to 16 inches in size. The lower false bed-rock is clay or hard-pan.

The direction of this bench being tangential to the curve of the present river at this point, it is evident that the river has changed its direction since this gold was deposited, or else the source of the gold is lateral. The following surrounding features are worth noting: True bed-rock outcrops at the upper end of the bench; a draw is perceptible in the central portion of the bench in the river-valley; just down-stream from the bench a high bank of glacial debris is exposed.

At the time of inspection the owners had sunk a few pits down to the lower false bed-rock, one pit being 200 feet back from the river, and encouraging results were stated to have been obtained. It is quite possible that investigation will demonstrate that this property constitutes a profitable power-shovel operation. The promising values indicated by preliminary testing,

the shallowness of the deposit, and the absence of any large boulders are all features which support such a view.

It is therefore recommended that the preliminary investigation necessary to determine this point be carried out. This can readily be done by sinking a number of test-pits systematically distributed over the entire bench down to the level of the lower false bed-rock, a definite yardage being washed from each pit and values based upon the recovered gold. Subsequently the advisability of some Keystone-drilling may be indicated to determine if there is a still lower pay-streak below those already known.

The question as to whether this gold is or is not of lateral origin (that is, whether it originates from the Cottonwood river itself or from a tributary or cross-channel) would seem to merit some study of local features, which might enable a more definite opinion to be formed upon this question than is now possible. A favourable feature of this property is its accessibility and comparatively small expense would be involved in getting equipment on the ground.

Leases of W. C. Slade and Associates, Mosquito Creek.—A description of this property, situated at the junction of Mosquito creek with Lightning creek, will be found in the 1930 Annual Report. Further evidence as to the existence of a buried ancient channel segment in the left bank of Mosquito creek was disclosed by the owner during the year. He has cleaned out an old tunnel formerly driven by early operators in the left bank of Mosquito creek, at a point a considerable distance up-stream from the owner's hydraulic pit. The bearing of this tunnel, S. 12° E. (mag.), is approximately at right angles to the direction of the creek. In the vicinity of the portal this tunnel passes through what appears to be the right rim of the buried channel, in which latter it continues for about 100 feet. There is no evidence of the left rim or of bed-rock, and no evidence is afforded by this tunnel of the depth to bed-rock or of the values thereon. Still, it affords useful evidence that a buried channel exists and confirms topographical indications of such.

The owner continues each year, single-handed, his painstaking efforts to reach the bed-rock of the channel down-stream from the tunnel by advancing his hydraulic pit approximately at right angles to the supposed course of the channel, but progress is inevitably slow in the circumstances and with the only supply of water which his means enables him to render available. During the year he obtained some coarse gold in the hydraulic pit, which quite possibly originates from the ancient channel. Keystone-drilling would seem to be an essential preliminary to successful effort at this property, which merits thorough investigation.

Consolidated Gold Alluvials of B.C., Ltd., Wingdam, Lightning Creek.—This company, which controls the property on Lightning creek formerly held by Lightning Creek Gold Gravels and Drainage Company (*see* 1930 Annual Report) and also the old *La Fontaine* property, started operations during the year under the management of N. C. de Ronne. The first objective is the mining of gravels lying on a false bed-rock at a depth of 120 feet below the collar of No. 2 shaft, in which good values were, it is stated, indicated by Keystone-drilling originally. Accordingly, initial operations focused on reconditioning No. 2 shaft, and comprised retimbering down to water-level, construction of gallows-frame and sluice-house, installation of pump and hoist, and boilers (wood-burning) for the operation of the two latter. At the time of the visit of the Resident Engineer in October this preliminary work was going forward, but had not been completed. The pump to be installed is a No. 10 Layne and Bowler well-pump of capacity 1,800 gallons per minute, requiring 175 horse-power for its operation, the power being supplied by a 205-horse-power boiler. Another smaller boiler supplies power for the hoist, which requires 55 horse-power. The No. 2 shaft is a 3-compartment shaft of dimensions 11 by 6 feet in the clear. Definite plans are to be made for mining bed-rock gravels, the ultimate chief objective. Additional Keystone-drilling will also probably be undertaken before actual mining of bed-rock gravels is commenced.

Property of C. M. Sundberg, Donovan (Poorman) Creek.—A description of this property, which is one of the more important of the smaller hydraulics, will be found in the 1927 Annual Report. Since that report was written the owner has continued piping operations, following the tributary draw discovered in 1927, which contains the main run of gold, which latter was lost prior to the discovery by the present owner in 1927.

A feature of this property is the shallow overlie of glacial debris, the total depth from surface to bed-rock not exceeding 50 feet at any point. The character of the gold is coarse, slightly worn, typical "lead gold," which occurs in the schist bed-rock and in gravels immediately

overlying bed-rock, the thickness of which is a few feet. The character of the latter is mainly "flat-wash" gravels. Bed-rock gradient is steep, somewhat over 12 inches per box (12 feet). Dump facilities are good. From the description it will be apparent that this property exemplifies highly advantageous features for hydraulicking.

Lease of J. F. Williams.—Boulder creek is a small northward-flowing tributary of Lightning creek, the mouth of which is just opposite that of Jawbone creek, and is the next creek up-stream from Donovan (Poorman) creek, on the south side of Lightning creek.

At a point 425 feet vertically above Lightning creek, Boulder creek flows over bed-rock and topographic indications strongly suggest that a buried ancient channel segment lies in the right bank of the creek in this region. At this point the attention of early operators was drawn to the creek from the gold found in the modern creek. The indications point to the likelihood that this gold was derived from the ancient channel by the cutting through it of the modern creek. The owner, J. F. Williams, of Stanley, by ground-sluicing at this point has exposed the strata on the right bank of the creek, which consist of boulder-clay overlying a thickness of about 8 feet of gravels resting on a thickness of 8 feet of slum, which latter again overlies a thickness exposed of 8 feet of gravels. Both gravel-bands are said to be auriferous. Bed-rock is not exposed on this side of the creek.

This property is now under option to H. Bissonnette and warrants thorough investigation. Conditions for hydraulicking are good in so far as bed-rock gradient and dump facilities are concerned. Water-supply was not investigated. The creek was so named by J. F. Williams because of the many boulders in its bed, which consist largely of quartzite or silicified quartz-schist and are up to 2 or 3 feet diameter in size.

Lease of E. M. Falck.—On the left bank of Lightning creek, about 800 feet above the mouth of Anderson creek, E. M. Falck, of Cottonwood, has opened up a small hydraulic, with the idea of piping out this portion of the bank of Lightning creek in which are some old workings. An old shaft, now caved, the collar of which is about 60 feet vertically above the head of the sluice-flume installed by E. M. Falck, is stated to have been sunk to a depth of 60 feet and to have struck good values. The owner also contemplates sinking a shaft in the left bank of Lightning creek just below this point in anticipation of finding auriferous bench-gravels, the presence of which is stated to have been indicated by the *La Fontaine* mine-workings.

Last Chance. The *Last Chance* hydraulic property on Last Chance creek was reopened during the year by W. M. Hong and associates, the sluice-flume being repaired and piping resumed. This property has in previous years occupied the attention of successive operators. Hydraulic operations consist of piping a buried ancient channel which exists in the right bank of the modern creek. The property is owned by W. M. Hong, of Barkerville.

Cariboo Eagle. The *Cariboo Eagle* property on Houseman creek is owned by Mrs. Gertrude Murphy, and a road passable for cars has now been completed to the property from Stanley. For several years hydraulic operations have been directed to piping out the buried ancient channel which exists in the left bank of the creek. This channel was originally drifted to an extent unknown to the present operators by Otto Muller, who is stated to have encountered ground averaging about 3½ oz. to the set (5-foot cap). The present operators have in the course of piping ascertained that these old workings are between four and five sets wide, but the distance they extend up-stream is not known. Accordingly, this winter it is planned to drift in from the face of the pit in an effort to gain some information on this point.

The character of the recovered gold is coarse. The length of the sluice-flume is now 800 feet, but, inasmuch as the gradient of the bed-rock is increasing, it is hoped that it may shortly be possible to dispense with portion of the flume. Further accounts of this property will be found in the Annual Reports for 1926 and 1927.

Ketch.—At this property, on Devils lake, owned by W. J. Houser and associates, of Barkerville, very much better results were gained than in any recent previous year.

Property of Julius Powell.—This property is situated about half a mile above the mouth of Coulter creek, which is a south-westerly-flowing tributary of Slough creek. On the right bank of the creek an hydraulic pit has been opened up on what appears to be the buried channel of a tributary of the main creek. The pit cuts the course of the buried channel obliquely, and the left rim of the buried channel seems to be exposed on both sides of the pit. In the face of the

latter a thickness of about 25 feet of boulder-clay overlies about 5 feet of "flat-wash" gravels on the rim.

The owner of this property is a man of considerable inventive and constructive ability. A sawmill operated by water, a two-story frame building, an ingenious device for automatically turning the water in and out of the pipe-line, an electric-lighting plant, and radio set have not only been installed, but have actually been constructed by the owner on the ground, and very largely from improvised material. It seems remarkable that such powers should be evinced by one who is entirely self-taught.

Property of L. Ford and R. McDougall.—The owners, whose address is Barkerville, continued piping operations during the year on this property on Dragon creek. The immediate objective is the piping of the buried ancient channel previously explored by earlier tunnels. Piping operations have also disclosed a run of gravel of considerable proportions, the course of which is approximately parallel to the Willow river and which merits Keystone-drilling. Refer also to the Annual Reports for 1927 and 1930 and to Bulletin No. 1, 1931.

Sing Dang, Point, and Tong Sing Tong Properties.—These properties on benches on the left bank of Slough creek have been operated by Chinese for a number of years and have been a material factor in the placer-output from this Mining Division for many years. The *Point* mine has been under operation for upwards of forty years. The output during the present year, however, fell off considerably.

The gold occurs in glacial gravels lying on high benches, but in every case the gold is always found in the numerous small draws or depressions in the benches, and not on the higher portions. Another curious fact is that no gold whatever is found in the bed-rock. These are features which would seem to indicate a higher channel above these benches as the source of the gold.

Lowhee Mining Co., Ltd. This company continues as the largest individual contributor to the placer production from this Mining Division. Productive ground was met with during the year, but operations were greatly hampered by the caving-in of large masses of the heavy glacial debris which overlies bed-rock gravels.

New Waverly Hydraulic Mining Co., Ltd., Grouse Creek. After carrying out a considerable amount of Keystone-drilling, hydraulic operations were resumed by this company in the fall under the direction of C. W. Moore. A certain number of holes were drilled in the "Old Waverly" pit and immediately west of this, but the majority were situated considerably south of this and included two cross-sections 300 feet north and 450 feet south respectively of the Barkerville–Antler Creek road. A total of thirty-seven holes was drilled and the results are stated to have been encouraging. Hydraulic operations were resumed at the head of the "New Waverly" pit, just above which there is evidence of a pre-Glacial channel crossing that hitherto followed. Moreover, up-stream and just west of this point recent Keystone-drilling is stated to have yielded promising values. The pit will therefore be advanced up-stream just west of the "Old Waverly" pit towards the region in the vicinity of the Barkerville–Antler Creek road, which recent Keystone-drilling also indicated as showing promise. The "Old Waverly" pit is used as a flushing-reservoir and very greatly facilitates piping operations.

Lease of Paul Gaines.—Paul Gaines, of Barkerville, has a creek lease on upper Grouse creek, above the former famous *Heron* claim. The richness of the benches on both its banks, at numerous points, was a feature of this creek when it was originally worked in the sixties. Paul Gaines has installed a small hydraulic plant on the creek and has obtained evidence of a buried channel on a bench on the right bank. The face of the hydraulic pit shows glacial debris overlying a thickness of about 9 feet of "flat-wash" gravels. At the time of inspection in October, work had not proceeded far enough to enable an opinion to be formed as to the values in the gravel.

A considerable distance up-stream from the above lease on the right bank of the creek, at a considerable elevation above the creek, there is a buried channel segment which may be the original upper end of the creek, as it is stated that the creek at points above this yielded but little gold. This channel evidently received considerable attention from early operators and has been drifted in part, although with just what results is not known. Erosion has entirely removed all down-stream portions, save that there is a distinct depression west of the present creek, about 2 miles down-stream, which may have been occupied by this early channel. This

channel would seem to merit close field-study, which might throw further light on any commercial possibilities.

Trehouse Hydraulic, Cunningham Creek.

Better results were gained at this property than have been experienced for some considerable time past. It is owned by F. J. Tregillus, J. House, and F. de Witt Reed, of Barkerville, and a description of it will be found in the 1928 Annual Report. Unusually good results were obtained as the result of the year's operations on the low-lying bench, a few feet above creek-level, situated but a short distance up-stream from the point at which Keystone-drilling was undertaken in 1930, of which mention will be found in the 1930 Annual Report. Inspection of the pit discloses that at the outer edge of the bench the auriferous gravels rest on a false bed-rock of slum, but farther in a thickness of 8 or 9 feet of pay-gravels directly overlie true bed-rock. The inference is that the latter were undisturbed by the glacier which occupied this creek, and, moreover, they seem likely to extend back from the creek for a material distance. Topographic features suggest the likelihood of the existence in this region, and down-stream to a point, at any rate, below the line of holes drilled last year, of another bench about 140 feet vertically above the creek, and still another about 20 feet above the latter. The indications are, further, that the line of holes drilled last year did not penetrate the two benches mentioned. There seems every justification for several cross-sectional lines of holes down-stream to probe possibilities and to ascertain if energetic development of this property is justified. A good supply of water can be rendered available. This property merits thorough investigation. A road, passable for cars, leads to it from Barkerville.

Leases of D. McIntyre and W. E. Thompson.—D. McIntyre and W. E. Thompson, of Barkerville, are investigating a possible "high run" in Downey pass, on the western slopes of Valley mountain. In this region a fairly well-defined bench extends, at elevation about 4,200 feet from Williams Creek valley to, and possibly beyond, Mugford creek, flowing westerly into Downey pass somewhat over 1 mile north of Williams creek. This bench is covered by three leases held by D. McIntyre and W. E. Thompson, and by one, the most northerly in the vicinity of Mugford creek, held by J. Campbell.

There are grounds for the belief that there is a north-and-south run of gold in the direction of the *Thistle* pit on 8-Mile lake, with which this bench may have some connection, but as to which but little direct evidence has been obtained. The owners of this property have sunk a shaft 20 feet deep at elevation 4,255 feet in the central portion of the bench and have erected an excellent cabin in the vicinity.

The only really direct evidence of values is afforded by the fact that Mugford creek, which cuts this bench practically at right angles, was productive in this region. The left bank of this creek where it cuts the bench would seem to be the point to which preliminary prospecting of this bench should first be directed. A little work here may uncover the bed-rock bottom, in which case some drifting might be carried out with the idea of gaining evidence as to values. Hopeful results might justify more extensive testing by means of the Keystone drill.

Lease of J. Campbell, Downey Pass.—The owner is utilizing a small creek from the bench above described to ground-sluice the hillside below the bench just south of Mugford creek. Reference to the report on the property of D. McIntyre and W. E. Thompson will indicate where there is considered a likely point for investigation on J. Campbell's property.

Hurdy Hydraulic.—The *Hurdy* real-estate property, owned by E. W. Giddings, of Barkerville, is situated on the right bank of Williams creek, opposite Mink gulch, and a general description will be found in the 1926 Annual Report. Piping was continued during the season.

Lease of J. Chouse.—This lease, held by J. Chouse, of Barkerville, is situated on Summit creek about 1 mile below the mouth of 9-Mile creek. From the mouth of the latter down-stream, Summit creek occupies a narrow steep-sided valley, in part canyon-like, having cut through the south-western flanks of Slide mountain. Upwards of 50 feet above water-level, on the right bank, quite an extensive bench occurs. The surrounding topographic features lend some support to the view that 8-Mile creek formerly occupied a channel on this bench, originally joining Summit creek about 1 mile below its present junction. To probe this possibility the owner has run a tunnel in the right bank of the creek for a distance of 255 feet, a short distance above water-level, about 1 mile below the mouth of 8-Mile creek. This tunnel is run for the first 125 feet on a bearing S. 23° E. (mag.), then bends somewhat to the right, and the final 100 feet are run due south (mag.). After running through a rib of rock, gravels were encoun-

tered to the face, which shows rock up to the lagging. The results of this painstaking effort on the part of the owner are therefore inconclusive. Inasmuch as there are no marked topographic or other features in this vicinity to aid in localizing the mouth of any possible old channel of 8-Mile creek, further tunnelling is a matter of uncertainty with the available data for its guidance. The owner has installed a small hydraulic plant utilizing water impounded from the bench, but the quantity available is small and the head indifferent. Otherwise, were a better water-supply immediately available, information as to the possible channel might be secured by piping off the bench. The owner has also opened up a small hydraulic pit a short distance down-stream from the mouth of the tunnel, and it is understood that he has under contemplation the matter of bringing a water-supply on to the ground from 8-Mile creek.

Willow River, Dredging Possibilities.—In view of the fact that a very large number of tributary creeks have proved rich, the dredging possibilities of the Willow river have been the subject of frequent discussion. While there can be no question as to the immense yardage available, values and depth to bed-rock are to all practical intents and purposes largely unknown factors. Granting that glacial erosion of bed-rock gravels may have been quite appreciable, and granting that bed-rock may be too deep in any case to be reached by dredging, there is still the possibility of gold-runs on a false bed-rock at dredgable depth. This consideration, added to the large gold-bearing area drained by the Willow River tributary water system, would seem to afford justification for some preliminary Keystone-drilling, at any rate, to determine those critical data, in the absence of which the matter is so largely a question of mere speculation.

Mention has been made in this report of an old channel discovered by L. Ford and R. McDougall at their property on Dragon creek, the course of which is there approximately parallel to the Willow river and 230 feet vertically above the latter. The occurrence of a somewhat similar bench at about the same elevation above the river, at intervals, for some miles down-stream from Dragon creek having been reported, a brief inspection was made of the Willow river in this region. The route followed was from Beaver Pass House via Beaver pass and Tregillus creek to the Willow river: thence down-stream following the Willow river to Berry and Deadwood creeks, and returning following the left bank of the Willow river up-stream to Dragon creek.

On Berry creek the old workings would seem to have been concerned with gold resulting from reconcentration of a bench at 265 feet vertically below the Dragon Creek bench. On Deadwood creek the workings are very extensive and quite possibly the gold results from creek-waters cutting through a large bench at an elevation of 205 feet vertically below the Dragon Creek bench. The amount of quartz boulders in the beds of these creeks, especially in that of Deadwood creek, is a marked feature. These benches, although at slightly different elevations, may quite possibly indicate former channels of the Willow river. It is also quite possible that the gold found originally on Rouchon creek, a tributary on the east side of Tregillus creek, and on Baldhead creek, a tributary on the east side of Beaver Pass creek, and at other points on the east side of Beaver pass may have resulted from reconcentration of an early channel of the Willow river. It may therefore be said that in that portion of the Willow river examined—that is, between Dragon creek and Deadwood creek—there is evidence pointing to the existence of former channels cut through by modern creeks, and that any preliminary Keystone-drilling with a view to determine dredging possibilities might well be located within this region. It might be added that about 2 miles up-stream from Deadwood creek rim-rock is exposed on the right bank of the Willow river. Refer also to Bulletin No. 1, 1931, page 59.

Among other individual operators may be mentioned: M. McComish and M. Anderson at 8-Mile lake; J. P. Roddick on Pine creek; and J. F. Williams at the *Ah Quay* claim near Stanley. J. F. Williams reports that his *Ah Quay* claim and Dry Gulch placer property have been optioned to W. Errington.

Bluebell. This and nine adjoining claims are owned by Jas. Thompson, of Barkerville, and are situated between Downey pass and Pine creek, a region in which there are numerous quartz-feldspar dykes. On this property a large quartz vein outcrops at intervals, striking about N. 76° E. (mag.), with steep dip. This is sparsely mineralized on the surface, but practically no work whatever has been done on it by way of exposing the outcrops to advantage—by open-cuts, for example. A sample taken across 6 feet from one outcrop disclosed only traces of gold and silver, but one sample is not to be regarded

as conclusive, and it is recommended that some of the outcrops might be exposed by open-cuts to a depth of a few feet and again sampled.

QUESNEL MINING DIVISION.

Extended reference to all important lode-gold properties situated in this Mining Division will be found in Bulletin No. 1, 1932, and no detailed account of these properties is, for that reason, given in this report. Such are: *Yanks Peak*, *Midas*, and *Jane* groups on Yanks peak, and certain other prospects.

Placer-mining.

The production of placer gold for the year was $45,866, as compared with $37,179 in 1930. The largest individual contributor to the output from this or any other Mining Division within this district was B. Boe, of Cedar creek. The year was marked by several new discoveries of importance, described in detail in the ensuing sections of this report. Several newly incorporated companies commenced operations during the year—namely, Cedar Creek Placer Gold, Limited, on Cedar creek, where an extensive Keystone-drilling campaign presaged important developments; Moorehead Mines, Limited, on Morehead Creek; and B.C. Hydraulics, Limited, at the *Bullion* mine. Much general activity was manifested on the part of individual and small-scale operators throughout this Mining Division, and the numerous bars on the Fraser river received much attention.

Quesnel Section.

Lease of W. Bertram.—This lease, owned by W. Bertram, of Quesnel, is situated on Lot 6178, just below the Big Bend of the Fraser river, and comprises a portion of a large low-lying bench or bar on the left bank of the Fraser river, formerly known as "Long bar," and which was extensively worked in the early days, water being brought on to the ground from 10-Mile lake. The black sand contained in the gravel is platiniferous. At the time of inspection, work was confined to the sands immediately adjacent to the river, the top few inches being shovelled off and washed in a "grizzly." At this point a very approximate test indicated about 3 lb. of black sand per cubic yard, assaying: Gold, 28.96 oz. per ton; platinum, 0.28 oz. per ton. Operations in the early days on productive ground were apparently confined to the higher-lying portions of the bar, and it is stated that a portion of this higher ground still remains where much higher values in platinum can be obtained.

Lease of S. R. Craft, Woods Placer Dredge.—This lease, owned by S. R. Craft, of Quesnel, is situated on the right bank of the Fraser river, a short distance down-stream from and opposite the above-described lease of W. Bertram, and quite possibly the origin of the gold is the same in both cases. On this lease, however, there is stated to be a fairly definite direction to the run of gold on the low-lying bench. Test-pits are stated to have disclosed values in gold up to 60 cents per cubic yard. At the time of inspecting this property in July there was being constructed in the river a "Woods placer dredge," N. H. Sutherland being in charge. This is a type of suction-dredge with a new principle embodied. In effect it is a compromise between the bucket and suction dredges, exemplifying the principles of both.

The "buckets" of the Woods placer dredge are made of rubber disks concaved and attached to an endless sprocket-chain at intervals. These "buckets," or "valves," as they are called, perhaps more nearly approach the form of hollow hemispheres than anything, and exactly fit, with necessary clearance allowance, a 10-inch pipe 12 feet in length, which corresponds to the "ladder" of an ordinary bucket dredge. The "ladder" is made of any particular length to suit the ground to be dredged. Ladder and bucket line are placed in the bow of a small scow and can be raised or lowered, as in the case of an ordinary bucket dredge. Motive power in this particular case was supplied by an automobile-engine. Travel of the bucket-line develops a strong suction in the 10-inch pipe, and, in addition to the suction, there is the digging and conveying action of the buckets. Any boulders that will not pass through the 10-inch pipe cannot of course be handled. In the case of this particular dredge there were sixteen buckets or "valves."

Gold saving and washing appliances can be designed to meet the requirements of any particular case. In this particular case the operator of the dredge stated some months after inspection of this property that while the dredge functioned satisfactorily as far as digging was concerned, it was not found possible to effect a satisfactory saving of the fine gold. It is

stated that this type of dredge operated satisfactorily in Saskatchewan, that its capacity is 150 cubic yards per ten hours, that it requires the attention of two men, and that the gasoline-consumption for motive power per ten hours is 6 gallons.

Leases of H. W. Adcock and Associates.—This property comprises several bench leases, owned by H. W. Adcock and associates, of Edmonton, and situated on the left bank of the Quesnel river, just below Beavermouth. A road passable for cars in dry weather leads to the property from Quesnel, from which the distance is about 30 miles. The leases cover ground that was extensively hydraulicked many years ago, a water-supply being brought in from Beaver creek for the purpose, but just what results were secured is unknown.

In this region, somewhat over half a mile down-stream from Beavermouth, an extensive bench about 120 feet above the river flanks the left bank of the latter. The ancient channel lies closely adjacent to the Quesnel river, from which it is separated by the right rim of the former. Originally hydraulic pits were opened up from the river. In one of these, the highest up-stream, when the rim was encountered, stopping further hydraulic advance, a tunnel was run at a point 15 feet above the river, through the right rim for a distance from the portal of about 300 feet, the sluice-flume being placed in this tunnel, and piping being continued on completion of the latter. The country-rock passed through by the tunnel and showing on the floor of the pit is argillite (carbonaceous) intruded by granitic tongues. It is only comparatively close to the end of the tunnel that rock shows, the remainder of the pit being covered with material which has sloughed off the face and walls of the pit, but it seems doubtful if bed-rock was reached. Had the latter been the case, and it must have been apparent at the time of piping, there would have been no difficulty in continuing to pipe out the old channel up-stream from this point, for an appreciable distance; the bed-rock gradient is hardly likely to be less than 1 per cent., and may of course exceed this. As determined by aneroid, the height of the mouth of the tunnel in the pit is 40 feet above the lower end of the tunnel.

About 1,200 feet or so down-stream from the above-described pit, two others, immediately adjacent, were opened up a short distance above water-level, but these show no evidence of rim or bed-rock. The total yardage piped by the early operators from the three pits mentioned is very considerable, amounting to several hundred thousand cubic yards, but the values recovered are unknown. The gravels exposed disclose no large boulders. It is stated that originally before the hydraulic installation was made a shaft was sunk in the vicinity of the up-stream pit to bed-rock from the top of the bench, the depth being 90 feet, and that promising values were obtained.

This property merits thorough investigation and Keystone-drilling to determine not only depth to bed-rock and values thereon, but also the average values of the overlying glacial gravels. The combined total yardage of this property, that of the Drummond Flat channel up-stream, and that of the channel on Pre-emption Lot 9887 down-stream, all closely adjacent, is undoubtedly vast. So vast as to undoubtedly justify the closest investigation, followed by some preliminary drilling, at any rate.

At low water on March 1st, 1931, Beaver creek had a flow of 15 cubic feet per second. The cost of restoring the original water-supply of this property is estimated by the management at $50,000. The abundant water-supply from Swift river could also be rendered available if warrant for its utilization were found.

Lease of A. E. McGregor, G. C. McGregor, and C. Stanfield.—This property on the Quesnel river, which is described in the 1930 Annual Report, has been optioned by H. W. Adcock and associates and some preliminary testing operations were carried out in the fall.

LIKELY SECTION.

B.C. Hydraulics, Ltd., Bullion Mine.

The *Bullion* mine was operated during the entire season by B.C. Hydraulics, Limited, a newly incorporated company, a subsidiary of the Quatsino Copper Company, under the management of W. Sugarman. Upwards of 200,000 cubic yards were piped, and in addition extensive testing, by means of systematic channel-sampling of face and rim-rock gravels, was carried out. The management states that the year's operations were strictly in the nature of a thorough test to determine average values, and upon the results future plans will be formulated.

The following matters are being considered by the management: (*a*) The advisability of installing some mechanical means for stacking large boulders; (*b*) increasing the volume of

water used as a ground-sluice in the face of the pit. The large hydraulic operators are beginning to realize that better efficiency can be secured by use of a much greater volume of water as ground-sluice than has hitherto been employed. While under present practice a proportion of the total water available is invariably used as ground-sluice, that proportion is comparatively small. The tendency is in the direction of reversing the respective proportions of ground-sluice and high-pressure-monitor water; the underlying idea being to cut the gravel-bank with high-pressure water and effect rapid removal of disintegrated gravels by means of a ground-sluice of large volume.

Moorehead Mines, Ltd.

Moorehead Mines, Limited, was incorporated in 1930 for the purpose of operating the property formerly owned by the Morehead Mining Syndicate on Morehead creek. The registered office of the company is Vancouver; the manager is E. C. Annes and the superintendent is F. Jacobie. A description of the property with map will be found in the Annual Report for 1927. Much constructional work was carried out during the year, comprising the installation of the first unit of the company's water system. This is the company's low-level system and is derived from the Little Lake water system, the water being impounded by a dam 75 feet long by 10 feet high (filled-crib type), at the outlet of the lake, and the supply regulated by gates, via Little Lake creek, to a diversion-dam at the junction of Morehead and Little Lake creeks. At the latter point is the ditch-intake, and the water is thence conveyed by ditch and portions of Dutcher flume to a penstock giving a head at the monitors of 100 feet. The pipe-line, 1,000 feet in length, starts at the penstock with 44-inch pipe reducing by stages to 18 inches at the two monitors, a No. 8 (8-inch nozzle) and a No. 9 (9-inch nozzle). The capacity of this plant is 3,000 miners' inches and it was completed and the water turned in on November 1st. Subsequent operations are described by the manager as follows: "We operated with the No. 9 monitor only for a period of seven days, November 1st to 7th, and during this time moved about 30,000 cubic yards of overburden material which had caved into the pit. Cold weather forced us to shut down operations on November 7th, and due to this fact and the fact that all the material washed was overburden only, no clean-up was made. The pit is, however, in wonderful shape to commence operations with the spring run-off, as we have virgin pre-Glacial gravels exposed on all sides of both machines. Two of our lakes are full of water, and we understand that there is already a record snowfall in the district, so that we should have a very good run during the first part of the season of 1932. Following the freeze-up, the crew was kept on the job and construction-work started on the permanent camp, several buildings of which are well along. We closed camp on December 15th, but expect to open again during the later part of March so as to be ready for spring operations."

At the time of inspection of this property at the end of October it might be mentioned that coffee-coloured gravels were in evidence on the right rim of the ancient buried channel, and these gravels at this property are known to carry good values.

This company controls water rights covering a watershed area of about 70 square miles. In addition to the Little Lake water system above described, there can be rendered available under a head of 525 feet the supply from a watershed area of about 55 square miles. This entire high-level water-supply can if necessary be diverted to the low-level system below Little Lake dam, thus permitting of great flexibility for cutting or sluicing.

Operations of B. Boe, Cedar Creek.—B. Boe, who now, it is understood, owns the property originally held by the Cedar Creek Mining Company, continued pump-hydraulic operations during the year on the *Sheridan* lease, following the direction of the gold-run south-eastwards. The results he gained were a feature of the year, the production from this ground constituting the largest individual contribution to the total output from the entire district for the year. The mining practice followed is described in the 1930 Annual Report, and the direction of the gold-run, which is one of the most important of modern placer discoveries, is clearly shown on the map on page 198 of the 1928 Annual Report. B. Boe has developed the pump-hydraulic system to a high degree of efficiency, and under favourable conditions a maximum yardage of 450 yards daily can be washed. The dredge-pump (capacity 75 cubic yards per hour—20 per cent. solids) is used either to stack tailings or directly in series with the monitor pump to deliver gravels to the sluice-flume. The riffling employed in the latter merits mention owing to its efficacy in disintegrating clay—a very important feature in the case of this property. In the bottom of the flume is laid canvas; on top of this cocoanut matting; and on top of this four plies of expanded metal, the mesh of which increases upwards from 1 to 6 inches.

Work during the year afforded very striking proof of the local origin of the gold, which has been found to be present in the bed-rock to a noteworthy extent, and, moreover, the richest portions of the bed-rock are those in which occur small quartz veinlets, which are conceivably the roots of eroded veins. At the pit-face on the *Sheridan* lease the bed-rock was seen to be immediately overlain by shattered country-rock, presumably pre-Glacial detritus, above which were gravels and glacial debris, the two latter largely commingled.

It is of course the intention of B. Boe to continue piping up-stream south-easterly, and in view of the discoveries on the north side of this creek at the property of Cedar Creek Placer Gold, Limited, the outcome of events at B. Boe's property, and its relationship (if any) to the discoveries on the north side of Cedar creek at approximately the same level, are matters of much interest. Refer also to the 1928 and 1930 Annual Reports.

Under agreement with B. Boe, the north-western extremity of the latter's property was being prospected during the year by K. Finlayson and M. Farrell, who employed open-cast mining methods.

Cedar Creek Placer Gold, Ltd.

This company was incorporated during the year for the purpose of operating certain placer leases on the north side of Cedar creek. The registered office of the company is 541 Georgia Street West, Vancouver; the president is Alexander Robert Mackie. By way of preliminary, a few words as to the topography may be helpful. Cedar creek has its source in Cedar Creek meadows in a wide flat-bottomed valley which extends south-easterly for some miles. This valley continues north-westwards virtually as an elevated plateau flanked by Spanish mountain on the east, and bounded on the west by the steeply sloping valley of Quesnel lake. The elevation of this ancient valley is between 3,000 and 3,200 feet and the width of the north-western portion is at least a mile. It is covered by a dense growth of timber north-west of the meadows and numerous windfalls on the north side of Cedar creek. The only break in this ancient valley is the deep gash cut in part probably in pre-Glacial times by the obviously much more recent Cedar creek. The discovery of 1921, where B. Boe is now operating, may be regarded as being situated at the western extremity of the ancient valley. The temporary camp of Cedar Creek Placer Gold, Limited, is situated on the north side of the modern Cedar creek, about 4,000 feet distant in a straight line from the camp buildings of B. Boe, and the leases held or controlled by the Cedar Creek Placer Gold, Limited, extend for some miles south-east of Cedar Creek meadows, and for some miles north-west of the latter point on the north side of the modern creek.

An extensive Keystone-drilling campaign was carried out during the year by Cedar Creek Placer Gold, Limited, a total of fifty-six holes being drilled, totalling 1,700 feet of drilling. The management states that the results disclosed the existence of a main ancient valley on the north side of Cedar creek and one tributary valley. The main valley has not yet been completely cross-sectioned by even one row of drill-holes, but the width to date is stated to be 1,000 feet. It is stated by the management that the drilling indicates values and that further drilling will be carried out in 1932.

There is no outward and visible evidence of the gold contents of the channels discovered by Cedar Creek Placer Gold, Limited, and responsibility in connection with the announced results of Keystone-drilling is assumed solely by that company.

Preliminary investigation has not yet advanced sufficiently to enable this company to formulate any definite plans for actual mining operations, but in the fall work was started on an impounding-dam at the head of Cedar creek at the north-west end of Cedar Creek meadows. This was to be 400 feet long by 8 feet high, and it is understood that it was completed before operations were suspended for the winter. The flow of water as very roughly measured on October 16th was about 600 cubic feet per minute. It is understood that this water-supply is to be used for general washing purposes. A good system of local roads was also constructed by this company on its property and temporary camp buildings were erected.

Nelson-Furler Leases, South Fork of Quesnel River.—An account of this property will be found in the 1926 Annual Report, and a description of the pump-hydraulic plant installed in 1928 will be found in the Annual Report for that year. Operation of this plant was continued during the year by Mrs. T. M. Day, optionee of three bench leases. This property is very conveniently situated, being somewhat over 2 miles from Likely, with which it is connected by a road passable for cars. It has certain features of promise, but possibilities can only be fully gauged by Keystone-drilling. The gravels contain a noticeable amount of pyrite, which is stated to carry

good gold values, in addition to placer gold. It seems probable that the source of the gold on this property is either lateral or it results from the reconcentration of the gold contents of the ancient South fork on the opposite side of the river as it was cut through by the waters of the modern river.

Leases of T. W. S. Taylor.—Two creek leases are held by T. W. S. Taylor and associates, of Likely, extending from the mouth of Rose gulch to the lake. The road which follows from Likely the north side of the South fork of the Quesnel river is passable for cars as far as Rose gulch. A short trail leads from the road to the property.

Investigation of the old pits on the right bank of the gulch resulted in the uncovering of a promising run of gravel on a false bed-rock, which is being followed up with a small hydraulic plant installed. Some powder is used to break up the tight overlying glacial clay and gravel. Immediately overlying the false bed-rock is the pay-stratum, consisting of gravels about 3 feet in thickness, which contains coarse gold. This is overlain by a thickness of 8 feet of clay and gravel mixed, on which rests a thickness of 2 feet of "chicken-feed" gravel. There is some fine gold in these overlying strata and the whole material from the false bed-rock upwards is stated to constitute productive ground.

Moose Syndicate.

The Moose Syndicate is a private syndicate, of which R. M. Reid is manager, owning five bench leases on the left bank of the North fork of the Quesnel river. The lower end of the property is about 2¼ miles above the mouth of Murderers gulch. The North fork of the Quesnel river at several points between Quesnel Forks and the Spanish Creek bridge cuts through its former pre-Glacial channel, segments of which exist on both sides of the modern river. In post-Glacial times the waters of the modern river in cutting down through the glacial debris occupying the valley has effected in part a reconcentration on various false bed-rocks of the gold contents of the ancient stream. These false bed-rock concentrations were particularly productive on the left bank of the river between this property and the lease of W. F. Bendtsen (refer to 1925 Annual Report), just below Murderers gulch, and were extensively worked by the early miners and receive attention from present-day operators also. These reconcentrations appear as benches on the left bank of the modern river at various heights above it up to 250 feet. The bed-rock values of the ancient channel segments have not been thoroughly probed at any point.

The indications are that on the property of the Moose Syndicate, from the upper end of the leases down-stream for a distance of about 6,000 feet, there exists a buried ancient channel of the North fork. Overlying this are extensive benches (which were formerly partly worked by earlier operators), occurring tandem-fashion at heights of 50 feet, 100 feet, and 170 feet respectively above the river in the vicinity of the lower end of the ancient channel. The lowest bench is a rock bench with gravels resting on it and is possibly not far above the bed-rock of the ancient channel, but the advisability of preliminary Keystone-drilling is indicated on this bench to delimit the ancient channel, the depth to bed-rock, and the up-stream gradient. At this point the Moose Syndicate has opened up a rock-cut 300 feet in length through the rim-rock of the ancient channel. A sluice-flume has been constructed in this cut and a certain amount of piping carried out by using a monitor under low head deriving its water-supply from a tank on the bench, to which water is pumped from the river by a 6-inch centrifugal pump (capacity 1,000 gallons per minute) driven by a 60-horse-power gasoline-engine.

Just below the rock-cut mentioned the modern river may have cut across the ancient channel, but the latter reappears a short distance farther down-stream again in the left bank of the former and continues on that side for about 2 miles, when at the lower end of W. F. Bendtsen's property it is again cut by the modern river.

Preliminary operations of the Moose Syndicate focus on bringing a water-supply on to their ground from Spanish creek, making use of an old ditch as far as the latter serves. To saw the lumber necessary for flume-construction a sawmill was being erected at the time of inspection. The head of water available is excellent, and it is understood that an adequate supply is available under the water rights.

This property merits thorough preliminary investigation. It is conveniently situated, being distant about 7 miles from Likely, and is reached by a branch road, not yet quite completed, about 1½ miles in length, from a point on the Likely–Keithley road, about 5½ miles from Likely.

Lease of J. Shaw.—This property, on the North fork of the Quesnel river, is described in the 1927 and 1930 Annual Reports. The pump-hydraulic plant installed at the property in 1930

was not operated for longer than about six weeks, the owner reports. Some very coarse gold is found on a false bed-rock at this property, but it is understood that values are somewhat spotty; nevertheless, it would seem to merit further investigation.

Spanish Creek.—At the end of September an option was acquired by Douglas McEachrane on the *Standard* group of placer leases held by the Prudential Trust Company on Spanish creek, and on certain adjoining leases on that creek held by C. and P. Burns, and also on the leases near the mouth of Black Bear creek held by the two latter. This ground covers the ancient channel which lies buried in the right bank of Spanish creek in this region, and concerning which a very full account will be found in the 1924 Annual Report, under "Ennis Gold Mining Company." No developments of importance have subsequently transpired beyond the short-lived operations of Spanish Creek Mines, Limited, in 1928, which are chronicled in the 1928 Annual Report. At the time of the visit of the Resident Engineer on October 19th no operations had been commenced by the present above-named optionee.

It is understood that some further work was done during the year both at the property of Matthias Gold Mining Company (*see* 1930 Annual Report) and at that of the Quesnel Gold Mining Company (*see* 1927 Annual Report), but at the time the Resident Engineer visited the region in which these properties are situated, operations had been suspended for the year in both cases.

KEITHLEY SECTION.

Placer Engineers, Ltd.

The operations of this company are concerned with the investigation of a buried ancient channel segment of 4-Mile creek. Continuation of piping operations recorded in the 1930 Annual Report resulted in the discovery of what appears to be the ancient channel at a point about 1,800 feet up-stream from the *Onward* pit. At the time of inspection on October 18th the ancient channel had only just been reached, but the bed-rock of the latter had not been uncovered, and it was therefore not possible to form an opinion as to whether this channel could be followed up-stream from the present pit. In any case there should be no difficulty in piping out the channel, which is buried in the left bank of 4-Mile creek.

This property undoubtedly exhibits considerable promise. There is an indicated channel-length of 1,800 feet, as mentioned, between the *Onward* pit, the presumed down-stream end, and the present point of exposure, and the up-stream extent from the latter is unknown at present. Rich ground was found originally on the *Onward* claim, which augurs well for the channel now under investigation. H. A. Rose was in charge of operations.

Leases of F. L. De Long.—F. L. De Long owns one bench lease on the left bank of Keithley creek, immediately down-stream from the mouth of Weaver creek, and one creek lease on the latter. The gravels in the pit overlying bed-rock contain moderately coarse well-worn gold (the largest nuggets obtained had a value of $7.50), also galena, pyrite, and pseudomorphs of hæmatite after pyrite. Overlying these gravels is a stratum several feet in thickness of glacial silt containing large fragments of rock and lignitized twigs. Bones found in this stratum this year have been sent by the owner to the Geological Survey for identification. This property merits investigation.

Leases of Hans P. Halen and Associates.—An interesting new discovery was made on Snowshoe creek by Hans P. Halen (address, P.O. Box 587, Kamloops), who together with his associates holds four bench leases. The topography of Snowshoe creek in the region where a long bed-rock tunnel was formerly run by J. Adams strongly suggests the likelihood of the existence of a buried channel segment in the left bank of the creek.

With this possibility in mind, the present operators, utilizing water from Snowshoe creek below the junction of French Snowshoe creek, installed an hydraulic plant, and opened up a pit in the left bank of Snowshoe creek at a point about 900 feet above its junction with Keithley creek. At about 65 feet vertically above the creek, piping operations disclosed a high channel, which is quite possibly, as the operators think, merely the right rim of a deeper channel, which appearances suggest continues up-stream in the right bank of Snowshoe creek. This raises the highly interesting question as to whether the channel discovered is in reality the upward continuation of a pre-Glacial channel of Keithley creek—an entirely reasonable conjecture.

This discovery is not only very interesting, but may quite likely prove of considerable importance, and merits thorough investigation, as the down-stream and up-stream extent from the present point of exposure seems likely to prove very material. Apart from the general

geologic surrounding conditions, which in themselves afford warrant for probing the matter, sufficient gold has been recovered to justify detailed investigation. This discovery is another instance which may be cited in support of the view that even the oldest portions of the placer sections merit careful scrutiny.

Leases of R. Reinhold and Associates.—Four bench leases owned by R. Reinhold and associates, of Keithley Creek, are situated north-east of Keithley creek in the Cariboo Lake valley, about 300 feet vertically above the lake. The owner, following the hypothesis that there might be a "high run" of Keithley creek in this region, discovered topographic features supporting such a view and suggestive of a buried channel segment trending parallel to the lake at the elevation mentioned. At one point a small draw cuts this supposed channel trending in a due easterly direction, and at this point the owner proposes to commence investigations. Very little work as yet has been done, beyond, it is understood, obtaining colours by panning at a few points.

The greater portion of the channel now occupied by Keithley creek is obviously modern, and in early pre-Glacial times the indications are that it occupied channels north of the present one. Evidence of this is afforded by the *Kitchener* mine and by more recent workings. The idea that an old channel exists on this side of the present creek in the Cariboo Lake valley, conceived by R. Reinhold, is possible, although no direct proof of it has as yet been obtained. Nevertheless, preliminary investigation is merited, and later Keystone-drilling may be justified to test the possibilities.

Property of O. Sandberg.—Two-mile creek flows into Cariboo lake from the west, about 2 miles south of Keithley creek, and has its source in a small lake on the flat, known as 2-Mile flat, which extends between Keithley and Rollie (Duck) creeks at an elevation of between 350 feet and 500 feet above Cariboo lake. O. Sandberg's leases are situated on 2-Mile creek and the adjoining flat.

The creek is a small one, which at about 1½ miles above its mouth cuts through an older channel, and segments of the latter lie buried in both its banks. Both segments have been partially probed by tunnels run by O. Sandberg. In the left bank a tunnel approximately 70 feet in length follows the older channel for the major portion of this distance, but bed-rock is not exposed at any point. The width of the channel is about 15 feet. The down-stream continuation of the old channel is followed in the right bank of the creek by a tunnel 35 feet in length, which exposes the right rim of the channel, but bed-rock has not been uncovered. In the vicinity of the first-mentioned tunnel 2-Mile creek occupies a steep-sided rocky channel, and just above this promising values are stated to be contained in the gravels. O. Sandberg, who owns a Keystone drill, is considering doing some preliminary drilling on 2-Mile flat, and has built a cabin by the creek.

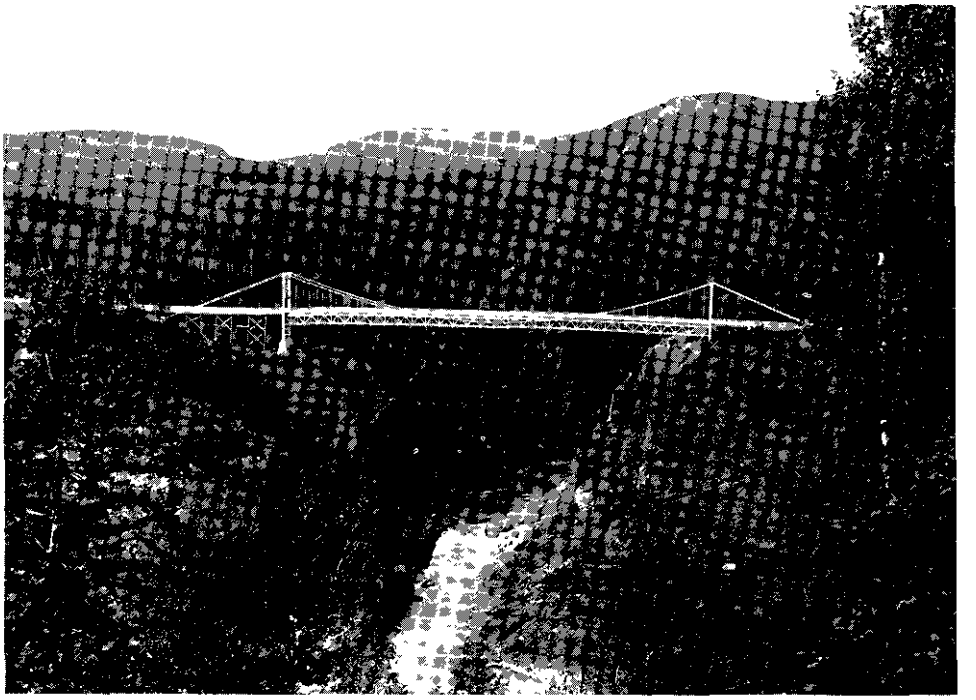
Horsefly Section.

The Horsefly section exhibits placer possibilities of magnitude, but further investigation is required before these can be fully gauged. At several points, however, sufficient work has already been done to demonstrate that further investigation is fully justified. The area is accessible by car and possesses an abundant water-supply.

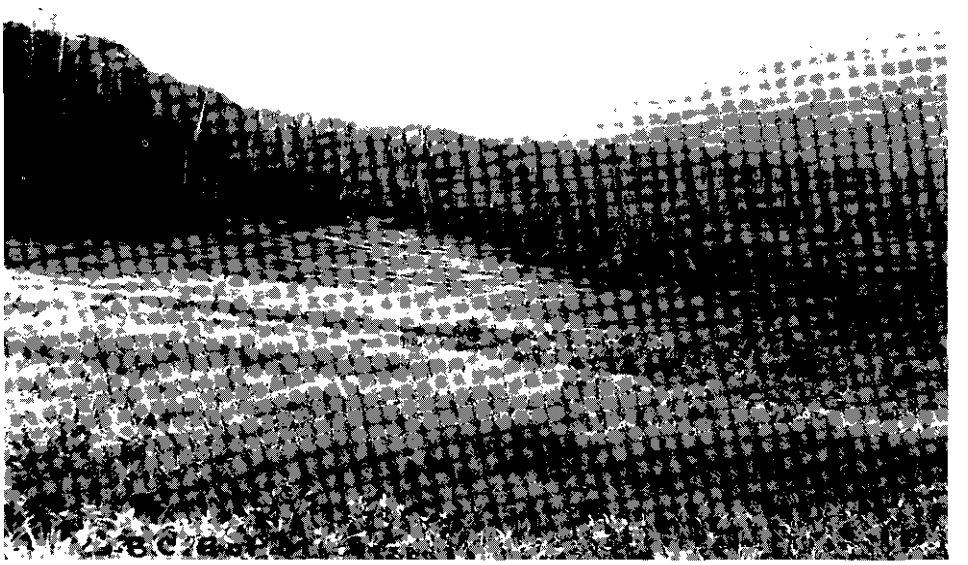
The modes of placer occurrence found in this section are among the oldest, from the geologic standpoint, known in the Province. The section has been much less studied than any other of the older placer areas, and for that reason is very much less known. To all practical intents and purposes, active mining in this section may be said to have ended about thirty years ago, when operations were either entirely suspended or carried on with greatly diminished energy, at the three, as it then seemed, apparently detached placer occurrences, the *Miocene* mine, Ward's Horsefly mine, and Hobson's Horsefly mine.

These three properties, although all situated within a radius of 6 miles on the left bank of the modern Horsefly river, proved extremely puzzling for very many years and were very difficult to correlate. Their origin being to a large extent obscure, further search was rendered more than ordinarily difficult. Very full information concerning these properties will be found in the Annual Reports for 1902, 1918, and 1920, and it is therefore unnecessary to repeat the details therein given, but a few general remarks are advisable.

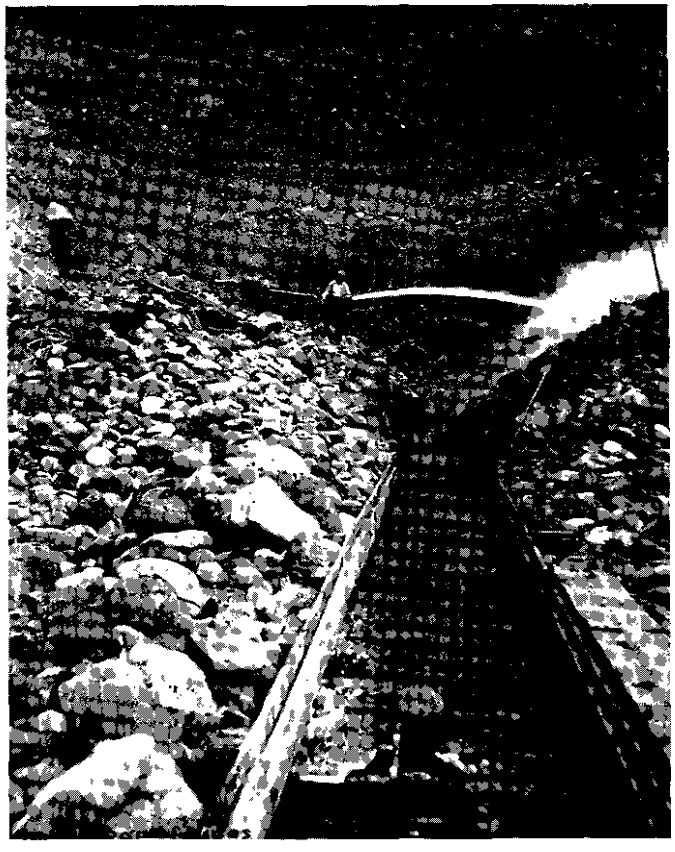
The *Miocene* mine, situated on the western outskirts of Horsefly, consists of a shaft 550 feet deep, and tunnels and other workings therefrom, sunk in a deep gravel-filled channel of apparent Tertiary age. The gravels consist wholly of resistant well-worn quartz pebbles, none of any large size, and exemplify a typical residual gravel. While insufficient information as to bed-rock



Hagwilget Bridge, Bulkley River, near Hazelton.

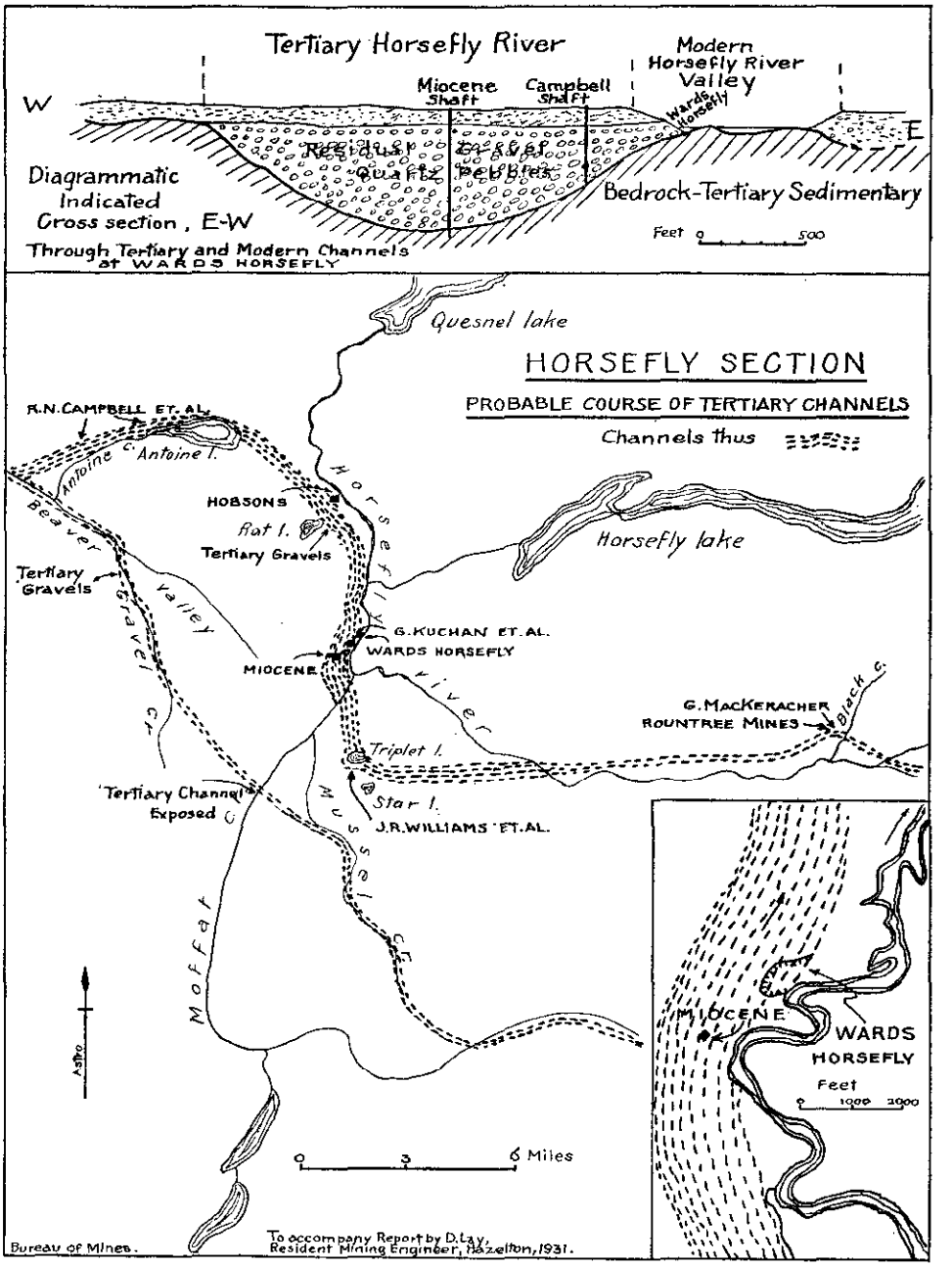


Lorne Creek—Head of North Fork from Bermaline Mine.



Crow's Bar Placers, Ltd.—Workings on Fraser River.

Sodium Carbonate Claim, near Cherry Creek, Kamloops.



values was gained by these workings, they proved the important fact that the bed-rock and rim-rock of this deposit is a Tertiary shale, and precisely the same as the rock upon which rest the down-stream deposits of Ward's Horsefly and Hobson's Horsefly mines. And it is in this rock that the modern Horsefly river has carved a channel in the vicinity of these last two mines, which are situated on its left bank.

Ward's Horsefly mine is situated nearly 2,000 feet down-stream from the *Miocene* mine, in which area by far the most important deposits were found on the left bank of the Horsefly river, although to a limited extent concentrations were found on the right bank of the river. The indicated age of these deposits is pre-Glacial, and possibly to some extent inter-Glacial.

The richest were found to occur on the left bank of the river directly overlying solid rock, believed to be Tertiary shale. Some values were also found to occur on a false bed-rock of clay. Accounts clearly indicate that on the left bank of the river this Tertiary shale dipped gradually to the west.

At Hobson's Horsefly mine, distant 5 miles down-stream from Ward's Horsefly mine, an extensive low-lying rock bench of Tertiary shale flanks the left bank of the river. Immediately overlying this, and exposed by two hydraulic pits, for some hundreds of feet is an extensive gravel-deposit, cemented so as to constitute virtually a loosely held conglomerate and capped by glacial debris. The pebbles are very largely quartz, well-worn, none of any appreciable size. Originally several acres were piped off in this region, water having been brought in from Moffat creek and hydraulic plant installed. Inability to obtain sluice-flume grade and the cemented character of the gravel offered insuperable difficulties to this type of mining, and after running an extensive system of tunnelling in this deposit, in 1897 it was opened up as a lode mine and a stamp-mill was erected at this point. These operations were subsequently discontinued presumably because they were not found profitable, but the records indicate that 11,000 tons mined and milled yielded $1.46 per ton.

It is particularly to be noted that although what first attracted attention to this property was the reconcentrated or resorted placer deposits, which were found on the bed-rock of the modern river in this region and on the rock benches at the fringes of this deposit, caused by the more modern waters passing over the weathered and disintegrated edges of this ancient channel of presumably Tertiary age, the latter as now exposed is not, of course, a reconcentrated deposit. Incidentally it might be added that values indicated and its extent clearly call for its close investigation at the hands of modern operators.

It was clearly perceived by the earliest operators that Ward's Horsefly mine exhibited evidence of a resorted or reconcentrated placer deposit. In view of the fact that a valley trending about east and west enters the Horsefly River valley from the east (in which direction it also passes into the valley of the modern river up-stream), and because of the existence of the upper end of the master Beaver valley in close juxtaposition west of this point, it was a natural inference to entertain the view that this deposit was due to reconcentration of the gravels of this cross-channel. But Keystone-drilling at the upper end of the Beaver valley during the past few years quite disproved the existence of such a cross-channel, bed-rock being found at only 40 feet from the surface. Moreover, all the facts indicate that in the vicinity of the settlement of Horsefly there is a deeply carved north and south trending channel, which was in existence even in Tertiary times, and which south of this, in the vicinity of Triplet lake probably, curves round sharply to the east. That being the case, from Tertiary times onwards to the present day the waters of the Horsefly river have apparently always made the sharp turn northerly in this region, after having flowed westerly for many miles, that is exhibited by the modern river, but the actual channels occupied, although closely parallel, were somewhat different from the original channel. The east and west channel referred to and noted entering the Horsefly River valley from the east, near Ward's Horsefly mine, is probably a pre-Glacial channel which turns due north at this point.

The view is held that the gravel-deposit at Hobson's Horsefly mine is an integral portion of the Tertiary Horsefly river, and quite possibly represents a Tertiary rejuvenated phase of the deeper Miocene channel, which it immediately adjoins on the east. This would account for a difference in the character of the gravels. The bed-rock of the hydraulic pit at this mine is about 550 feet above the bottom of the *Miocene* shaft.

In recent years the Resident Engineer has devoted a considerable amount of time to field-study at intervals, as the result of which, together with data gained by the geologic and topographic survey of the Pacific Great Eastern land blocks and recent discoveries of prospectors, it is now possible to present a much clearer conception of placer occurrence in this section than formerly.

While much information is yet lacking, it has been definitely established that there exist in this section both a buried Tertiary Horsefly river and a buried Tertiary Moffat Creek tributary. Both these channels are deeply buried and are in part capped by volcanic rocks, and so rendered more than ordinarily difficult to trace. Both have been termed the "White Channel," from the fact that the gravels of both consist in large measure of well-rounded residual quartz boulders, none of any great size. This characteristic feature renders either channel conspicuous when erosion has removed either volcanic capping or glacial overlie.

It should be understood that, while the exact course of this ancient river is only partly known, it has been identified at a sufficient number of critical points to remove the views advanced herein from the realm of mere speculation, although much remains to be determined by actual investigation.

Some idea of the proportions of this ancient stream may be gained from the fact that in the vicinity of the settlement of Horsefly its channel is about 600 feet deep, and quite possibly half a mile in width, and these are about the dimensions of its gravel-filled channel for some miles down-stream from this point. It is probably buried for the greater portion of its length between its source, probably the headwaters of the Crooked river, and its mouth, the position of which is purely conjectural, but which may be on the Fraser river some miles below Quesnel. It is therefore evident that the total yardage of gravel in this channel and that of its Moffat Creek tributary is vast, and its investigation is a matter of great commercial and geologic interest in view of the probable great total gold content with a modicum of platinum.

The view is held that it is the effect of reconcentration of the gold contents of this ancient river by modern streams cutting into it which has originated most important and known occurrences of placer in the Horsefly section. That being the case, it is considered essential that before studying individual occcurrences the importance of this buried ancient river should be appreciated, all known exposures of it fixed in the mind, and some idea formed of its probable position at other points. Available facts indicate that this ancient river flowed by way of the Crooked River and McKinley Creek valleys and subsequently occupied a channel on the north side of the present Horsefly river for some considerable distance down-stream. The ancient river continued down-stream probably for some miles on the north side of the modern river, eventually crossing the course of the latter and reappearing in the left bank of the latter at the *Miocene* mine at the settlement of Horsefly. It continued thereafter parallel to and just west of the modern Horsefly river for about 5 miles in a northerly direction; then by Rat lake, swinging westerly away from the course of the modern river and entering the Beaver valley by way of Antoine lake at a point somewhat west of the present mouth of Antoine creek.

The Tertiary Moffat Creek drainage seems to have been by way of the present headwaters of this creek and Mussel creek, crossing the modern Moffat creek just below the falls (where the Tertiary channel is exposed on both sides of the creek as a lava-capped channel of large proportions) and continuing north-westerly to enter the Beaver valley by way of Gravel creek.

It is not clear whether the Triplet and Star Lake Tertiary gravels, on which are staked the leases of John Williams and associates, belong to a phase of the Tertiary Moffat Creek drainage, or whether they are part of the Tertiary Horsefly river, which, crossing from the north side of the modern river, turned south at this point, reappearing at the *Miocene* mine. The latter is probably the correct view.

It seems certain that the *Miocene* mine marks the channel of the Tertiary Horsefly river, and that from this point for about 5 miles down-stream it exists in the left bank of the modern Horsefly. Its right rim is actually exposed at Ward's Horsefly mine and at Hobson's Horsefly mine. Its gravels are exposed at Rat lake in the vicinity of the latter, at which point obviously the ancient river began to swing west of the course of the modern river, and it is highly probable that it continued west in the vicinity of Antoine lake and Antoine creek, and that reconcentration of its gravels effected by Antoine creek has originated recent discoveries of gold and platinum on that creek made by R. N. Campbell and associates, further described subsequently in the body of this report.

The view held is that the two important deposits of Ward's Horsefly mine in entirety, and Hobson's Horsefly mine in part only, owe their origin to the fact that waters occupying much the same channel as that of the modern river cut into the right rim of the ancient river at these two points, and effected a reconcentration of the gold contents of the more ancient river on the right rim of the latter. At only two points was the ancient river cut by the more modern, and therefore at only two points was there any important placer deposit in the modern river. Striking proof of this is being afforded by what is taking place to-day in the vicinity of Hobson's Horsefly mine. During the thirty years since operations were stopped at this property the modern river has effected a nice reconcentration of the tailings from this property; a fact which was grasped with commendable enterprise by local prospectors, George Kuchan and associates, who staked leases in this region and are turning their powers of perception to great advantage. The view held entirely dissipates what were entertained as conflictions by the earliest operators of these properties. The latter apparently fully recognized some possible

connection between the gravels of the *Miocene* mine and those of Ward's Horsefly and Hobson's Horsefly mines, but apparently entertained the view that the direction of flow of water was from north to south because the solid rock was higher above the modern river at the latter mine than at the former. The difference in the character of the gravels at both mines from those of the *Miocene* mine is, under the view held, what is to be expected of course, the gravels of the more modern river mingling with those of the ancient. Under this view also, inasmuch as the rim of the ancient stream was not cut so deeply at Hobson's Horsefly as at Ward's, it would naturally be higher above the modern stream at the former mine. It is quite possible that in this region the deposit may be lacustrine, due to lava-damming in Tertiary times, for example, but that in no way affects commercial possibilities. Again, it is probable that this region, like that of the not-far-distant Cedar creek, was uplifted in Tertiary times, and the consequent stream rejuvenation caused reconcentration in the manner described in pre-Glacial times. The final rejuvenation was, however, by way of Quesnel lake and the modern Horsefly river in post-Glacial times, and it seems likely that waters following this course passed over the right rim of the Tertiary Horsefly river at Ward's Horsefly mine and effected a reconcentration thereon of the gold contents of the ancient stream. The same process was repeated at Hobson's Horsefly mine, 5 miles down-stream, at points adjacent to the course of the modern river. But there is no reason to suppose that the region of the consolidated gravels probed by the underground workings of this mine has been subjected to any reconcentration, and further investigation at this point is much needed.

In view of the limited data available, the foregoing views are necessarily postulatory, but inasmuch as they rest on a substratum of the facts available, even if only partly correct, they may aid in guiding investigation in the right direction.

The points referred to at the commencement of this section are here enumerated to facilitate reference, but will be subsequently more fully described:—

(1.) Property of R. N. Campbell and associates, of Horsefly, on Antoine creek.

(2.) Hobson's Horsefly mine, now covered by leases held by George Kuchan, of Horsefly.

(3.) Leases of G. McKeracher and Rountree Mines, Limited, on Black creek.

(4.) Leases of John Williams and associates at Triplet and Star lakes. An account of this property is given in the 1927 Annual Report. It has been previously pointed out that this deposit probably represents the Tertiary Horsefly River channel. The depth to bed-rock is here probably very considerable. Some Keystone-drilling was carried out on this ground in 1930, but while the exact results are unknown, it is understood that drilling was discontinued before reaching bed-rock owing to shortage of casing. There is no evidence suggesting that this deposit has been subjected to any reconcentrating action.

(5.) What is assumed to be a Tertiary Moffat Creek channel, which flowed into the Beaver valley by way of Gravel creek, is cut through by Moffat creek just below the falls and is well exposed on both sides of the creek. This would seem to be a favourable point for Keystone-drilling.

It is desired to point out that at all these points the superficial evidence is of a positive order. Further, that in the case of the first three mentioned sufficient gold has already been recovered to afford that superficial tangible evidence which is the essential justification for the further intelligent development of any mining enterprise. The investigation of Hobson's Horsefly mine should appeal strongly to those large mining companies which have hitherto focused their efforts mainly on lode-mining enterprise.

Leases of R. N. Campbell and Associates, Antoine Creek.—A complete description of this property will be found in the 1930 Annual Report. What seems likely to prove a discovery of importance was made by the owners during the year. A shaft sunk to a depth of 12 feet on the gently sloping right bank of Antoine creek, just below Antoine lake, discloses a depth of 6 feet of glacial material overlying a thickness of 6 feet of gravel closely resembling the "blue gravel" of Ward's Horsefly mine. This gravel shows nice coarse flake gold and further investigation should be made at this point. The shaft is about 90 feet vertically above Antoine creek; consequently, possibilities could be very cheaply and quickly investigated in a preliminary way by running a tunnel into the bank of the creek a short distance above the latter and in a direction approximately at right angles to the creek. This preliminary investigation should be followed by Keystone-drilling in this region and at points farther down-stream to more fully gauge possibilities. It seems quite likely that the gold found on a false bed-rock down-stream from the point of the new discovery, and which formed the original discovery at this

property, represents a reconcentration effected by Antoine creek of the gravels of the buried ancient channel previously mentioned.

Hobson's Horsefly Mine, Leases of George Kuchan.—This property, originally known as "The Horsefly Hydraulic Mining Company," is now covered by leases held by George Kuchan and associates, of Horsefly. It can be reached by car from Horsefly. A very full and valuable account of this property will be found in the 1902 Annual Report which merits careful study. To briefly recapitulate: The records indicate that up to 1898 a tunnel had been driven for 1,200 feet through the north or right rim of the channel and some 5,400 feet of branch tunnelling had been run in the cemented gravels. Further, it is reported that 9,900 tons resulting from these workings were milled, from which was recovered gold to the value of $14,564.21, or $1.46 per ton. At the same time 1,100 tons of free gravel were washed, yielding $1.44 per ton. Upon these figures the late William Fleet Robertson, then Provincial Mineralogist, makes the following comment in the 1902 Annual Report: "If the values reported by the management as average continue to be maintained (and there is no apparent reason to expect the values to decrease), this proposition should be one of the most attractive in British Columbia." Owing to the great development in mining methods during the thirty years or so, Mr. Robertson's comment applies with even greater force to-day than when it was first made. Investigation required is the clearing-out of the 1,200-foot rim-rock tunnel and thorough sampling of the 5,400 feet of underground workings run in the cemented gravels in 1897, to ascertain if large-scale mining possibilities exist.

Leases of Rountree Mines, Ltd., and G. McKeracher, Black Creek.—There is but little to add to the fairly full account of this property given in the 1930 Annual Report. The management reports that piping operations were continued during the year and that another 300 feet was added to the existing sluice-flume. This property shows considerable promise and well merits investigation, but some additional Keystone-drilling to determine certain criteria is regarded as a well-advised preliminary step. Critical factors, apart from the question of yardage and values, are the bed-rock gradient of the buried ancient channel, likewise the level of its bed-rock in relation to that of Black creek. The determination of such should precede other operations.

CENTRAL MINERAL SURVEY DISTRICT (No. 3).

REPORT BY H. G. NICHOLS, RESIDENT MINING ENGINEER (HEADQUARTERS, KAMLOOPS).

INTRODUCTION.

The general features of the Central Mineral Survey District with regard to location, topography, geology, transportation, and modes of mineral occurrences have been well described in previous Annual Reports, to which the reader is referred. In the 1929 Annual Report a tabulation with bibliographical references by Mining Divisions was given of the areal classification of the known occurrences of minerals of potential economic importance. The bibliographical table, given in the 1929 Annual Report, is now supplemented by the following additional reports:—

G.S.C.: Summary Report, 1929, Part A, by C. E. Cairnes.
G.S.C.: Summary Report, 1929, Part A, by N. F. G. Davis.
G.S.C.: Summary Report, 1930, Part A, by C. E. Cairnes.
G.S.C.: Summary Report, 1931, Part A, by J. F. Walker.
Annual Report of the Minister of Mines, No. 3 District, 1930, by H. G. Nichols.

Lode-gold deposits in the district were fully described in Bulletin No. 1, 1932, recently issued by the Department of Mines. This information is not reprinted in this report, so those who are interested should secure a copy of the bulletin.

With the exception of a wide stretch of the Interior plateau in Clinton Division, mineralization of one kind or another is found distributed throughout every part of the district; nevertheless, development has been handicapped by the prevailing conditions of low relief and scanty exposures in many of the areas where there is good promise of successful development at some depth. The most notable exception to these conditions is to be found in Yale, Ashcroft, and Lillooet Divisions, as well as a small corner of Clinton Division, covering sections of the east flank of the Coast range. Owing to the highly inaccessible character of the extreme western edge of these Divisions, exploration has not been carried much beyond the outlying spurs of the range, and it is here that the most successful results have attended development.

High mountainous country is also the characteristic of the eastern belt covering the western flank of the Gold range. This area is underlain by ancient sedimentary rocks. In common with all other parts of the Province, mineralization is related to intrusions of plutonic rocks, but there is a wide variety of type dependent upon the temperature conditions of their origin. In general it may be said that copper ores are identified with the western belt, where erosion has cut deeply into the underlying rocks, and to certain sections of the interior, where stocks of plutonic rock are exposed at surface. On the other hand, the mineralization of the lead-zinc-silver type is found mostly in the eastern belt of crystalline rocks, where important outcrops of plutonic rock are scarce.

There are also some types of distinctly low-temperature ores such as those of mercury and antimony, and as set out in more detail in the bulletin on lode-gold deposits, above referred to, there are several different types of gold-bearing ores to be found in every division of the district.

From the point of view of prospecting, the depressing effects of low base-metal prices have been offset by the keenness evidenced in the search for gold. From the table following it will be seen that there was an actual increase in the number of claims and leases recorded:—

Mining Division.	Claims and Leases recorded.		Certificates of Work.	
	1930.	1931.	1930.	1931.
Kamloops	213	261	369	313
Clinton	57	78	113	76
Lillooet	192	328	371	388
Ashcroft	87	106	76	63
Yale	276	144	500	389
Nicola	108	67	210	108
Vernon	77	71	93	54
Totals	1,010	1,055	1,732	1,391

Activity was not confined exclusively to gold properties, and it is fitting at this time to pay tribute to the perseverance of those prospectors who have continued to open up prospects of a base-metal character, and even to continue their search for more. The outstanding feature of the year's work in the district is the development of the *Pioneer*, now one of the leading gold-producers of the Province, and giving a more important position to this district in the records of the mining industry of the whole Province than it has yet occupied during its history. There is every indication that the coming season will witness still further activity in prospecting, and that the pursuit of mining, which has more than held its own under conditions of great stress, will attract an increasing number of workers into the hills in 1932.

Mineralogical Features by Mining Divisions.

Kamloops Mining Division is identified for the greater part with the watershed of the Thompson river and with Interior Plateau conditions. A rough zonal arrangement is to be noted in the mineralization of the Division in a north-west and south-east direction. The north-eastern section is characterized principally by mineralization of the lead-zinc-silver type, while that lying to the south-west, of an indefinite border-line of demarcation, is mostly represented by copper mineralization.

In regard to this latter section, the geological features, which have been described in detail by G. M. Dawson in his memoir on the Kamloops Map-sheet, include to a notable extent isolated exposures of granitic stocks, intrusive into volcanic and sedimentary rocks, while a large proportion of the surface is overlain by more recent Tertiary rocks.

The copper mineralization occurs in shears and fractures in the granite as well as in the rocks intruded by it, and in the latter case the widespread character of the mineralization is to be remarked, mineral being found in several localities where no objective evidence of the relationship to an intrusive rock is to be found. These conditions, generally speaking, indicating as they do the existence of underlying bodies of intrusive rock with which the mineralization is genetically associated, point to conditions under which exploration at depth may be considered to be the prime requisite in the development of ore-bodies of economic importance.

The overlying Tertiary rocks, themselves, also have a value from the point of view of mineral-deposition, more especially in the vicinity of the centres of this late vulcanism where deposition of copper minerals and also of cinnabar are found in the surrounding volcanic rocks of Triassic age. To these Tertiary rocks also are to be related many occurrences of non-metallic minerals such as sodium carbonate. These are found in the form of lake deposits, and the results of recent boring operations suggest the occurrence of underlying beds of the salt which would enhance materially the prospects for their economic utilization.

The lead-zinc-silver deposits of the north-eastern section of the Division are found in the crystalline schists and quartzites of the pre-Cambrian belt that stretches along the eastern border of the Division, and in a zone adjacent to this old shore-line, in which the principal occurrences thus far discovered are found along the valley of the North Thompson river between Louis creek and Vavenby.

Placer-gold mining has not been active within the Division during recent years, although the stream-gravels of some of the smaller creeks formerly provided profitable occupation for individual operators, notably on Tranquille creek, Louis creek, and Hobson creek. Successive attempts have been made to work the bars in the main river and the benches flanking these streams, but no systematic testing-work has been carried out upon which prospects of success might be based.

Clinton Mining Division occupies the north-west corner of the district, and is wholly covered by a portion of the watershed of the Fraser river with its tributary, the Chilcotin river. A large portion of the Division is occupied by the Chilcotin plateau, an extensive range land at an elevation of approximately 4,000 feet above sea-level, in which rock exposures are scarce and prospecting for minerals has not been carried on to any great extent. The western section of the Division abuts upon the eastern flank of the Coast range, and here a mineralization that is more or less characteristic of batholithic conditions is found. The eastern section of the district is also drift-covered to a certain extent, and with the exception of the high land bordering the boundary itself, prospecting for metallic minerals has been largely confined to the valleys of streams tributary to the Fraser river, along which placer-gold mining on a small scale has been carried on for many years.

In general, it may be said that the Division has been handicapped by the distance from transportation of the more favourable areas for metallic mineralization, such areas lying in the extreme south-western and north-eastern corners, although one exception is to be noted in the case of the small section around the lower reaches of the Bonaparte river, where both gold and base metals have been found in association with the Cache Creek rocks. Extensive beds of coal are also found in the valley of Hat creek.

Underlying rocks of this series as well as Tertiary basalts are responsible for a large number of deposits of non-metallic minerals in the area around Clinton, in the south-eastern portion of the district. There are here a number of saline lakes which are generally understood to owe their content to leaching agencies probably connected with springs by which the mineral constitutents have been derived from these rocks. Such deposits include sodium carbonate, hydromagnesite, and Epsom salts, the two latter classes being particularly referable to the Cache Creek series.

Lillooet Mining Division lies to the south of Clinton Mining Division and embraces the entire watershed of the Bridge river, as well as that of the Lillooet river above Lillooet lake. The Division includes on its extreme eastern end the town of Lillooet, on the Fraser river, which represents the nearest point of railway transportation. The entire Division is occupied by mountainous country, the western half lying within the heart of the Coast range and, as might be anticipated as the result of the deep erosion by the glacial streams and rivers, a large number of natural exposures of bodies of mineral are found. This feature is reflected in the premier position that is occupied by this Division among the mineral-producing areas of the whole district.

The development of the gold-mines of this Division resulted from the pioneer work of placer-miners who followed up the trail of placer gold from the point upon the Fraser river at Lillooet where, in years gone by, a notable extraction of the metal was obtained from bars and bench-gravels below the mouth of the Bridge river. Following this development, the handicap of inaccessibility has been greatly reduced by the construction of roads and trails, by means of which prospecting has been encouraged and a wide vista of possibilities for the discovery of ore-bodies is being opened up.

Ashcroft Mining Division covers the valley of the Thompson river below Kamloops lake and the point of confluence between this river and the Fraser at Lytton, extending down to a point on the Fraser river a few miles above Keefers, on the Canadian Pacific Railway. The northern half of the Division is occupied very largely by volcanic and sedimentary rocks of Triassic age and by later flow-rocks, and the occurrences of metallic minerals that have been discovered up to the present time are represented chiefly by deposits of cinnabar in the Triassic rocks in the vicinity of centres of Tertiary vulcanism. There are certain deposits of non-metallic minerals in this section of the Division, including gypsum and refractory clay. The southern half of the Division includes a large portion of the Highland Valley area, in which there is widely scattered copper mineralization in Triassic rocks and in granite; and deposits of sodium carbonate are found in the valley of the Thompson river near Spences Bridge. On the west, precipitous country bordering the Fraser river lies within the mineral-zone identified with the eastern flank of the Coast range and the Cascade mountains, along which discoveries of gold, copper, lead, and zinc are being found all the way up from the International boundary to the north-western limits of the district. This corner of the Division, difficult of access as it is, represents an area holding considerable promise of mineral discovery.

Yale Mining Division includes the watershed of the Fraser river down the length of its canyon as far as Hope, and, continuing beyond, it covers the watershed of the Skagit river down to the International boundary. The greater part of the section to the west of the Fraser river represents an extension towards the south of the mineral-zone above referred to in the Ashcroft Mining Division and is subject to the same difficulties of accessibility. This mineral-zone is intersected by the valley of the Coquihalla river, which represents, reasonably enough, the locus of greatest activity in the Division, interest being inspired by the discovery of exceptionally high-grade gold ore.

Farther to the south the mineralization, which, in common with that of the area in general, is related to the intrusion of dioritic rock into greenstone and sedimentaries, is represented by the base metals lead, zinc, and copper, and important ore-bodies due to replacement in limestone are found with associated gold and silver values.

Nicola Mining Division is centred around the town of Merritt; it occupies a large portion of the Nicola plateau south of Kamloops Mining Division and extends down to the low divide at the headwaters of the tributaries of the Tulameen river on the south. It is bounded on the west by the mountainous country of the Yale Division and on the east by the Okanagan valley.

The characteristic rocks of this Division are greenstones of the Triassic age, referred to as the Nicola series, and there are areas, as around Stump lake and in the immediate vicinity of the town of Merritt, where the characteristic minerals are of the lead-zinc-silver type. The Stump Lake area has received the greatest amount of attention, and there is here promise of the establishment of a mining camp such as was visualized by G. M. Dawson many years ago.

The Division in general represents an area over which mineralization is widely spread in relation to fractures and joint-planes in the greenstone, and many attractive bodies of ore have been discovered as the result of surface prospecting, for which, however, up to the present time, the amount of underground development necessary for the proof of continuity has been lacking.

The town of Merritt itself is situated in an important coal-basin, from which there has been a steady production.

Deposits of non-metallic minerals such as gypsum are found in the western section of the Division. The area is largely occupied by plateau country, which is valuable range land, but does not offer facilities for prospecting.

Vernon Mining Division occupies the extreme south-east corner of the district, covering the entire Okanagan valley as far south as Penticton. This Division since 1859 has attracted a considerable amount of attention by reason of the occurrences of placer gold which were found in the streams heading out of the divide between the Okanagan watershed and that of the Kettle river. In particular, the bench-gravels on Cherry creek, a tributary of the Shuswap river in the north-eastern section of the Division, were responsible for placer-mining activity as long ago as the year 1874, which has never completely died out. Placer-gold workings have also been conducted on streams flowing into Okanagan lake from the west.

Conditions in regard to lode-mining vary considerably; on the east there is a section of territory in which pebble conglomerates, quartzites, and schists of pre-Cambrian age afford some evidences of a workable zinc content with associated gold and silver values. Towards the centre of the Division silver-lead ore-bodies are found in rocks of Triassic age, while farther to the west higher-temperature minerals are found in association with stocks of intrusive rocks of varying composition. This section of the country has been very little prospected and has not been mapped by the Geological Survey of Canada. There are good prospects for the development of copper ore, and chromium has been discovered in association with serpentine areas on the western side of the lake.

Production.

The following table shows the lode-mineral production of No. 3 District:—

Mine.	Ore.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.
Lillooet Mining Division—						
Pioneer	32,369	28,153	.....	.....	.....	.....
Nicola Mining Division—						
Planet	940	288	10,498	5,609	87,527	12,080
Yale Mining Division—						
Aurum	22	38	.....	.....	.....	.....
Dawson	30	130	21	.....	.....	.....
Totals	33,361	28,609	10,519	5,609	87,527	12,080

In addition, structural materials to the value of $150,486 were produced, and miscellaneous minerals, including gypsite, gypsum, and soda, to a value of $184,163. Coal production was 28,878 long tons.

KAMLOOPS MINING DIVISION.

Shuswap Lake Section.

Venus. Some further exploration-work was carried out on this property, situated on Crowfoot mountain on the north side of Shuswap lake. A description of the mineral occurrences was given in the Annual Report for 1930. Lead-zinc-

silver mineralization is found in scattered workings within a zone about 150 feet wide in a broken limestone formation. This limestone-belt has been intruded by a porphyritic rock and is fractured in every direction. In the surface workings blocks of unaltered limestone are found, and apart from the general inclusion of all the workings within the north-south belt, before mentioned, there is no definite evidence of a continuous vein or mineralized lead, and such ore as was encountered in the shallow workings was not found to persist in depth. Some of this ore was of exceptionally high grade. A somewhat sketchy programme of electrical prospecting was carried out and a chart of equipotential curves was prepared which was assumed to indicate a continuous ore-body at some little depth. The indications, however, were slight, but they were assumed to point to an ore-body pitching in a southerly direction, and a shaft was sunk with the object of intersecting this ore-body at a depth of about 20 feet. The results were not satisfactory and the formation that was passed through showed structural conditions that were at variance with the interpretation of the electrical-prospecting results. In view of the uncertainty of the mineral occurrence it would probably have been better to have followed up the electrical-prospecting work with a diamond-drill hole at the point of maximum mineralization indicated by the geophysical work rather than take a chance on structural theories. It appears possible that the reactions noted in this work were due to the influence of the several disjointed bunches of mineral exposed in the surface workings, as it is notable that all the deflections of of the equipotential curves include such occurrences. In view of the general line-up of these exposures, as noted above, some further work by diamond-drilling would seem to be justified, but the extremely broken character of the ground does not permit of a too optimistic view being held. The property is reached by trail about 10 miles long from Magna Bay and is owned by C. F. Johnson and associates.

Speedwell. Further prospecting-work was done on this group, situated on the Adams plateau and described in the Annual Report for 1930. This work was devoted to tracing up the mineral-zone towards the north-east, where the plateau area is intersected by the deep ravine of the East fork of Spillman creek. As previously described, there is an exposure of intrusive rock in the precipitous valley of this creek, and the importance of prospecting around the contact of this intrusive with the sedimentary formation, in which the zones of lead-zinc-silver mineralization are found, has been realized. The work carried on during 1931 resulted in the discovery of further bodies of mineral of the same general type as those previously encountered in this area, at about midway between the plateau outcrops and the precipitious bluff, referred to above. This discovery is encouraging as showing the strong persistence of the mineralization, which, in this and in other zones, has now been traced over the surface for over 3 miles; and it affords further inducement to more intensive prospecting, looking to the location of a favourable point for carrying out development at greater depth below the original surface of the plateau area and in the contact-zone.

King Tut. F. A. McLeod, of Salmon Arm, did assessment-work on this group, adjoining the *Speedwell*, on which some good showings of lead-zinc-silver ore occur. The general grade of this ore is, however, too low to make development on any scale attractive at the present market price of the metals.

Lucky Coon. This group represents the original discovery of the lead-zinc-silver ore-bodies on the plateau. A systematic, if somewhat hurried, examination was made by the Granby Mining, Smelting, and Power Company three years ago, and several diamond-drill holes were put down and the quite extensive system of open-cuts and trenches was added to. This group occupies the south-western end of the north-westerly of the two main mineral-zones on the plateau and is owned by H. McGillivray and associates, of Chase. It is reached by a good trail 13 miles long from Adams river.

Mosquito King. This group covers a persistent lead occurring in a zone lying parallel to and at a distance of about 5 miles to the south-east of that on which the properties above described are located. The property is described in the Annual Report for 1930, and no developments of particular importance have occurred since that time. Further exposures have been made, however, by the owners, Bischoff Bros., of Celista, more particularly towards the south-west end of the main line of mineralization, and a parallel lead has also been exposed in surface workings south-east of this line of mineralization. The showings on this group are the strongest in this camp, but the values are not sufficiently high to be attractive at the present time.

NORTH THOMPSON RIVER SECTION.

Homestake. Some interest was shown in this gold-quartz property on Jamieson creek and the trail was improved with assistance from the Department. As described in previous reports, facilities exist for development, at moderate expense, of the large bodies of quartz occurring in shears in granite, in which some occasional high values are found. The further investigation of this property at this time would be a reasonable speculation.

Smuggler. Following inquiries that indicated a limited market for the manganese ore occurring as a superficial deposit on this property at Birch Island, some expenditure was made in improving the road to provide for shipments. The manganese was required for the purpose of manufacture of fertilizer in the first instance, and mining of limited amounts could be carried on cheaply with the possibility of developing a larger supply that may be available for other purposes such as steel-manufacture. The prospects for development in this way, however, did not materialize. The property is interesting by reason of the variety of mineral-deposits; attention having been directed, in the first place, to the occurrence of fluorite and strontium minerals, and subsequently to siliceous veins carrying a high-grade silver-lead content from which some shipments were made three or four years ago. The property is controlled by Smuggler Hill Mining and Development Company, of Kamloops.

War Colt. Although no further work has been done on this property, situated in the Clearwater area, of which full descriptions have been given in previous reports, it is understood that the option exercised by Eastern interests represented by J. Errington, of Toronto, has not been ceded and that further work is in contemplation. The further investigation of the extensive and widespread development of quartz-lenses and veins in this area, in which low average values in gold and silver are found, with occasional patches of considerably higher enrichment, is warranted, and would undoubtedly have been undertaken but for the great difficulties of access. As previously described, the area may be reached either up the valley of the North Thompson river, or from the Quesnel Lake system, or from the Fraser river on the north; in all cases the distance from railway is between 45 and 65 miles, with considerable difficulties attending transportation. On the *War Colt* property, lying at a lower elevation than any of the other occurrences exposed on the adjoining groups, base-metal mineralization is also found with associated gold values.

Summit. This group, situated on the eastern slope of the divide between the Azure river and the Clearwater Lake system, has been described in previous Annual Reports and in the Summary Reports of the Geological Survey of Canada for 1927 and 1929. The geology of this area is also described in the last-named reports. Recent assessment-work has been devoted to the showings from which some high gold values have been obtained that are related apparently to a system of fracturing crossing the general trend of the formation.

Grizzley.—Work on this group, adjoining the *Summit* on the north-west and owned by A. P. Horne and associates, of Blue River, has been confined to the requisite assessment.

Allies. This property, situated in the neighbourhood of Pass lake, at the head of Tranquille creek, and owned by O. S. Batchelor and associates, of Kamloops, has been described in some detail in Bulletin No. 1, 1932. High values have been obtained from a decomposed rusty material associated with quartz stringers and bodies of shattered quartz in open-cuts on a gently sloping hillside, in a broken formation.

Windpass. While no attempt has been made to reopen this property, situated at Chu Chua, it would seem that the present conditions in regard to the importance of gold-supply are favourable to a renewal of activity. This property has been described in the Annual Report for 1925 and in Bulletin No. 1, 1932. A considerable expenditure has been incurred in the development of the mine, in which reserves of ore valued at $200,000 are estimated to have been proved. Economic realization of the gold content would appear to depend upon the erection of a treatment plant, for which preliminary arrangements were made some years ago, but the plans were abandoned following the failure of development to outline the continuation of the ore-bodies thus far exposed in the flat-dipping vein.

Lakeview. The option that was held upon this property, situated on the rolling upland west of Mount Olie, by Premier Gold Mines, Limited, was abandoned early in the year. This action resulted from the failure of surface and near-surface exploration to open up any continuation of the exceptionally high-grade gold-bearing arsenopyrite that had been exposed in open-cut workings by the owners. While this work undoubtedly dissipated the hope of developing an easily worked ore-body of the character indicated in the original exposure, it did not dispose finally of the possibilities in connection with a recurrence of this high-grade mineralization under different conditions. This property, which is owned by P. Johnson and F. Lambert, of Mount Olie, was described in the Annual Report for 1930 and more recently in Bulletin No. 1, 1932.

SOUTH THOMPSON RIVER SECTION.

Rambler and Gambler. These two claims are located alongside the road leading from Savona to Merritt, at a distance of 14 miles south of the former place at the lower end of Kamloops lake. The claims represent relocations of an old prospect where occurrences of cinnabar were found in a belt of dolomite and are owned by D. J. McDonald, of Vancouver. Some attractive specimens of the cinnabar were found at one point in the form of knife-blade seams, and impregnations and traces of the mineral were discovered in open-cuts spread over a length of about 60 feet. A pit was dug to a depth of about 12 feet on the main showing, and rock on the dump bears out the contention that something in the nature of a small chamber of ore was encountered, but no mineral of a like character is to be seen in any of the walls of this working. The localization of the mineralization in this favourable formation lends some encouragement to a limited amount of further prospecting, but it would appear that there is no marked probability of the existence of ore-bodies other than those which have been found up to the present time.

Transvaal. A small amount of additional exploration-work was carried out by G. Novak on this property, situated on Forge mountain, in the Highland Valley area. As pointed out in previous reports, there is extensive copper mineralization in this area, more particularly in the granitic rocks. The *Transvaal* property is located on the margin of spurs of this intrusive, and the greater part of the mineralization is found in the very shattered volcanic rocks near the contact. The character of all these ore-bodies may be described as affording promise of a supply of low-grade copper ore, but a large amount of development is called for, and even in those cases where attempts have been made to open up mines in this area the localization of ore-shoots has not been of sufficient importance and the works have been suspended. In the case of the *Transvaal*, the very broken condition of the ground presents an added difficulty to small-scale operations such as have been attempted pluckily by the owner.

PLACER-MINING.

Three-mile Creek.—A considerable amount of work has been done on this property, which was referred to in the Annual Report for 1930 under the heading of Eakin creek, under the control and guidance of D. B. Sterrett. Previous work, devoted to ground-sluicing immediately below the original dam, which was constructed by J. R. Lockwood, was suspended in favour of operations a little farther down the creek. A second dam was constructed, fitted with a boomer-gate, by aid of which a channel was cut down to bed-rock, and preparations were made for construction of a bed-rock flume and for provision of means for handling boulders and disposal of tailing. For the first-named purpose elaborate arrangements were made, including the installation of quite heavy hoisting machinery; and in regard to the second, a considerable amount of blasting-work was done in order to cut a channel through the narrow canyon of the creek below the workings. In the course of this work the extreme irregularity of the bed-rock was shown, and at one place a pot-hole was discovered, upon which the greater part of the work was then concentrated in the anticipation of finding a heavy concentration of gold. An elevated sluice was constructed and all material was delivered to it by means of an overhead line. An encouraging production was obtained from the gravel excavated from the upper end of this pot-hole, but it was found ultimately that this resulted from the boomer-gate operations, the gold being washed down from the section of creek-bed above the pot-hole. Some of this gold was quite coarse and good nuggets are obtained on the slaty bed-rock. It is reported that gold valued at about $500 was obtained in this manner, but subsequent attempts were not as

satisfactory, and there is but little doubt that this recovery was derived as stated above and was not in any way representative of the average value of the gravel in the pot-hole. A heavy expenditure has been incurred in these operations, by which it would seem that a small prospect has been glorified into the semblance of a major operation.

McLure Mines.—Operations were commenced, by a Vancouver organization represented in the first instance by A. Armes, upon bench-ground situated at McLure at a distance of about 28 miles north of Kamloops, on the North Thompson river. Four bench leases and one dredging lease were acquired on the east side of the river, covering a low, wide, level bench, the foreshore being covered by small boulders and pebbles, while the upper layer of the bench is composed of silt. It was claimed that average values of around 75 cents per cubic yard were obtained from a number of pits dug to a depth of about 18 feet and scattered irregularly over this bench land. On the strength of this representation a considerable expenditure was incurred in the construction of a plant designed to operate this ground by means of a drag-line scraper, but owing to financial difficulties these preparations were not completed, and later investigations are understood to have failed to verify the contentions in regard to values as quoted above. Previous operators report having obtained good values from the beach-gravel of the existing river-channel, and it is not impossible that a channel or channels may have existed below the present bench area and that "pay" might be found in such channels at some unknown depth, there being no indication of bed-rock in the vicinity. However this may be, the only logical approach would be by way of systematic testing by drill, and it would appear to be unlikely that values of economic importance would be found to be distributed throughout this area.

Louis Creek.—No further advance has been made in projected operations for hydraulicking the gravels of this creek, and it is understood that several of the leases have been dropped following negative results of testing-work that has been carried out. There are possibilities of profitable work by individual operators, but, as pointed out previously, the conditions are not such as to warrant returns from large-scale operations upon the bench-gravels.

Hobson Creek Gold Mines, Ltd.

Work has been carried on throughout the year, in face of very great difficulties of transportation, in connection with preparations for hydraulic-working of bench-gravels on the east side of Hobson creek, which flows into upper Clearwater lake. The property is approached from the head of the East arm of Quesnel lake, where a wagon-road has been constructed across the 8-mile portage between this lake and Hobson lake. Supplies are again transferred to light scows fitted with outboard motors to the head of the lake, where they are hauled by teams up the 2¼-mile trail to the property. Previous operations were devoted to reopening tunnel-workings from which it was reported that good values were obtained by old-time operators. This tunnel is driven in for a stated distance of about 200 feet from the creek-level below a 200-foot bank of glacial debris banded with strata of local concentration. Some testing-work carried out over a face of this bank is reported to have given encouraging results, and the policy was decided upon by Hobson Creek (Cariboo) Gold Mines, Limited, of building a flume capable of delivering water under a head of 280 feet with the object of hydraulicking the whole body of this bank of gravel and debris. This flume is about 1¼ miles in length and metal construction has been adopted. At the time of inspection the material was being delivered and it is understood that washing operations will be commenced early in 1932.

Non-metallics.

Non-metallic occurrences in this Division are represented by sodium-sulphate lake deposits south of Tranquille, sodium-carbonate lake deposits in the same area, gypsum-deposits at Falkland, and deposits of marl and red shale near Kamloops.

These deposits have been embraced within the survey of non-metallic occurrences of the Province which was conducted during the year by A. M. Richmond. Deposits of mica occur in pegmatite dykes in the Clearwater area. These pegmatite dykes traverse ancient schists and quartzites and their outcrops may be traced for considerable distances across the summit of Mica mountain, situated at a distance of about 25 miles north of Canim lake. Access is by means of an Indian hunting-trail starting from the east end of the lake and following a more or less direct northerly course of approximately 20 miles, thereafter making a wide detour of about 15 miles over a rough country reaching to an elevation of 6,400 feet above sea-level. Some prospecting-work has been done on these deposits, but the only workings of any importance

are represented by open-cuts extending to a depth of about 12 feet for a distance of about 35 feet at one point where the pegmatite dyke shows a width of approximately 15 feet. The dyke narrows quickly towards the north over the level surface of the summit, where bigger outcrops again occur and in the opposite direction towards the south. Massive outcrops of the pegmatite dykes are found down the slope of the hill for a distance of approximately 350 feet. In this particular section there appears to be a zone about 200 feet wide, in which the glistening mica-schists are traversed by a series of the dykes. The composition of these dykes varies considerably; over a greater part of their extent, as exposed at surface, quartz and feldspar fluctuate as the predominating minerals, with subordinate amounts of muscovite. At the point where the excavations were made some years ago the muscovite is developed to a predominating extent, and in the broken rock of the dumps around these workings the mica is found in sheets 6 inches and over in length. It would appear, however, that this character of mica was better than the average grade in the dykes, as similar development is not observable in the exposed faces of the pegmatite rocks in the open-cut except at one point close to the surface. It also appears that there is a greater development of mica at the surface in the narrower sections of the dykes. In this connection the following quotation from L. Reinecke, in Memoir 118, Geological Survey of Canada, is of interest: "An outcrop of one of the dykes contains crystals 6 inches in diameter, but the diameter in general would rarely be more than 3 inches and the greater part of the outcrop was barren."

CLINTON MINING DIVISION.

Buzzer and Windfall. These groups of claims, situated in the Taseko Valley (Whitewater) area, have been further prospected by the locator, E. J. Taylor. The former group, covering wide zones of copper-gold mineralization in an altered granite, described by V. Dolmage as miarolitic, presents considerable difficulty in the way of development by reason of the gentle slope of the ground where they are exposed, and little more than surface indications have been discovered as the result of work confined to individual activity. The principal zone appears to be related to, if not in direct continuation of, the zone of alteration upon which some development-work was carried out by Consolidated Mining and Smelting Company of Canada, Limited, three years ago and which is exposed higher up on a mountain-side. This development did not have immediate results of sufficient attraction to warrant continuation of the operations at that time, but some attractive features were discovered. The copper is found in the form of chalcopyrite disseminated through the altered rock and in patches of solid mineral. Gold values are low in general, although higher values are found irregularly distributed. The distance from transportation is a serious handicap to development and the future of this field must depend almost exclusively upon the presence of gold values of payable amount.

On the *Windfall* group E. J. Taylor continued to do profitable work in the recovery of gold by washing the decomposed material which constitutes the superficial deposit of the *Windfall* claim that attracted so much attention some years ago, and has so far defied efforts to trace it underground.

Flint. This group, situated on Scottie creek, has been under option to Consolidated Mining and Smelting Company of Canada, Limited, for the past two years and a considerable amount of exploratory work has been done in an attempt to define the boundaries of the chromite-deposit which occurs in an altered serpentine formation. A number of irregularly spaced ore-bodies of fair grade have been proved and there is a wide area in which the rocks are sparsely disseminated with chromite and magnetite. It is understood that this work is to be resumed in 1932 and that no effort will be neglected to prove the existence of commercial deposits.

Big Slide. There has been renewed activity on this property, situated at the mouth of Kelly creek where it enters the Fraser river about 25 miles above Lillooet. This property was the site of quite extensive operations many years ago, when a chlorinating plant was erected for the treatment of a gold-quartz ore which occurs in a disturbed volcanic formation. This plant was destroyed some years ago and recent operations have been devoted to development of the veins. Surface prospecting at a distance of two or three claim-lengths from the original workings indicate that the vein occurrence is not continuous, but that there are a succession of lenses following a more or less general direction. It is understood that capital is being raised for the further operation of this property.

Timothy Mountain.—No further work was done on either the molybdenite or complex ores which are found in close association on the summit of this mountain in the north-east corner of the Division, but it is understood that the interest acquired in these properties by Consolidated Mining and Smelting Company of Canada, Limited, is retained, and that further development will be commenced when there is an improvement in general conditions.

Beatrice. A group of claims of this name has been located on a section of the conglomerate formation which traverses the country alongside the Cariboo road between Ashcroft and Clinton and is intersected by the valley of Maiden creek, a tributary of the Bonaparte river. Traces of gold have been found in this conglomerate and it is reported that assays as high as $1.60 per ton have been obtained from samples taken from certain horizons exposed on the face of a precipitous bluff where a thickness of 400 or 500 feet of flat-dipping strata of the conglomerate is exposed. This occurrence has been referred to in Bulletin No. 1, 1932.

PLACER-MINING.

Crow's Bar Placers, Ltd. The placer-ground of this company is situated on the Fraser river, about 50 miles above Lillooet, and is reached by road from Jesmond, skirting Big Bar mountain and dropping down by rough truck-road about 1,500 feet to the river-valley. Old workings were carried on by Chinese on both sides of the river from a ditch about 100 feet above low-water mark. A wide bench extends on the east side of the river at a height of about 150 feet above the stream, sloping down towards it on the down-stream side, a second bench about 100 feet high continuing round the bend of the river beyond this point. So far as could be seen, the material of these benches is loose and poorly assorted glacial material, but the opinion is held by the present operators that an old channel passed under this bench joining the present channel about a quarter of a mile down-stream.

The old workings are believed to have been confined to the section of this old channel exposed on the face of the bench, and it is noticeable that none of these old workings were carried back to any great distance from, or height above, the river. The present operators are opening up a pit by hydraulicking with water pumped from the river through an 8-inch pipe, and in this pit a bed of what looks like river-gravel has been exposed, with a width of about 12 feet. This bed appears to be dipping slightly into the hill. All the old workings are below the point at which this bed appears. The bottom of the pit is about 50 feet above mean water-level; there is then about 25 feet of poorly assorted material with many big boulders; on top of this is the 12-foot bed, and then again there is from 25 to 30 feet of loose bouldery material capped by a heavy layer of silt. More than usually good recoveries are being made from this 12-foot bed, and it is noticeable that the character of the gold is quite distinct from that in the rest of the bench material, being considerably coarser up to split-pea size, whereas the gold in the glacial material is very fine and in the usual very small amounts. It is therefore possible that the old workers on Crow's bar were attracted by the spill-over from this old channel.

If this bed does dip into the hill there is some doubt as to how far back such a channel might extend, and as to the depth of overburden to be handled and possibilities are indicated of economic treatment by drift-mining. The present methods are admittedly costly, but are justified as prospecting measures. A length of 170 feet of sluice-boxes with block riffles has been constructed and test sections are cleaned up every day or so; in this way a fair idea of values is obtained, and it is said that there is no doubt whatever that the coarse gold comes from the presumed old channel.

The present intention is to carry back the face of the pit in the hope that the channel will come down to the level of the pit, thus getting away from the necessity of handling the 25 feet of practically barren material with heavy boulders lying below it. The trouble is that this would add another 25 feet to the amount of barren ground to be handled above the channel.

While this theory opens up a possibility of quite an important old channel extending over an unknown distance below the wide bench that covers several hundred acres on the east side of the river, there is also the possibility that this 12-foot bed only represents a local concentration, but the general appearance certainly favours the more hopeful outlook. Cabins have been built and a crew of about five men is employed.

Ward's Bar.—The usual amount of placer-mining was carried out by individual operators on this and other creeks tributary to the Fraser river from the west.

NON-METALLICS.

Deposits of sodium sulphate, sodium carbonate, magnesium sulphate, and clays occurring in the Clinton area have been the subject of examination by A. M. Richmond and will be described in reports to be issued from time to time.

LILLOOET MINING DIVISION.

Pioneer. The general situation in regard to this property has been described in Bulletin No. 1, 1932. Briefly, it may be stated that the development carried on during the past year has been extremely satisfactory and that the work now in hand, when completed, is expected to make this property the leading gold-producer in the Province. A further extension of 3,120 feet of development-work was completed during 1931, including 1,100 feet of drifting, 750 feet of raising, and 250 feet of crosscutting. The 500-foot level, west drift, was continued for 150 feet; the sixth level, east drift, was continued for a further 80 feet; the eighth level, west drift, was continued for 650 feet; and the ninth level, west drift, was continued for 140 feet. The average width of the vein as exposed on and below the 800-foot level is 3 feet, with a maximum width of 8 feet, and the stopes are carried with an average width of 4 feet. The average value over this stoping-width is $18 per ton. Assays up to $260 per ton have been obtained from sections of the vein below the 800-foot level. The general structural conditions show no sign of change in depth and ore-shoots are found to lengthen in both directions, but more rapidly towards the west. About 35,000 tons of ore is reported to have been blocked out as the result of last year's development-work, and about 32,300 tons was treated in the mill, of which about 10 per cent. came from development headings. This ore came from between the fifth and eighth levels. The total recovery value of bullion during the year was $581,931. Additions to the mill included a 150-ton Dorrco filter, but this has not been in steady operation. The new mill, calculated to give a total capacity of three times the present tonnage, is expected to be ready for operation by the first of November, 1932. By that time it is anticipated that development will be carried down to the 1,625-foot or fourteenth level, and that the sinking of the shaft will be in progress to a further depth. The new shaft was connected through from 200 feet below the 1,000-foot level to within 60 feet of surface, but equipment was not completed as at December 31st. An average of ninety-eight men was employed during the year.

Lorne. This property has been fully described in previous reports and features in connection with recent geological investigation are discussed in Bulletin No. 1, 1932. The property is being operated by Bralorne Mines, Limited, controlling a 60-per-cent. interest in Lorne Gold Mines, Limited, and the present plan of operation is focused upon the realization of returns from ore-bodies already proven. During 1931 a total of 2,000 feet of development-work was carried out; this included 1,400 feet of drifting, 500 feet of raising, and 100 feet of sinking, all of which was done on the *King* vein between the 800-foot level and surface. It is reported that no new ore-shoots were opened up and that 21,000 tons of ore is estimated to be blocked out on this vein with an average value of about $13 per ton. For the treatment of this ore a 100-ton treatment plant was under construction and was 85 per cent. completed as at December 31st, 1931. This mill, adopting a system of treatment embodying amalgamation and flotation, was expected to be in operation about February 10th, 1932. Over 100 men were employed towards the latter part of the year during the construction of the mill, with an average of fifty since this company commenced operations on April 1st, 1931.

Bridge River Consolidated Co. The *Why Not* and *Forty Thieves* properties, situated towards the north-west end of the diorite stock on Cadwallader creek, have been operated by Bridge River Consolidated, Limited, and development-work was carried out under the supervision of David Sloan, of the *Pioneer*. The tunnel which was driven in on the *Why Not* vein was continued for a total distance of about 500 feet with the object of striking the anticipated intersection of this vein with the *Jewess* vein, outcropping on the surface. The results of this work were not particularly encouraging, but development is being continued.

The *Forty Thieves* vein is found outcropping over a distance of over 600 feet along the side of a precipitous bluff, and a crosscut tunnel was driven in from a point near the bottom of this bluff and about 60 feet below the lowest outcrop exposed at the north-western extremity. This crosscut encountered the vein at a distance of a little more than 100 feet and a drift is

Clearwater River—Mica Deposits.

Pioneer Gold Mines of B.C., Ltd., Bridge River.

Union Mine, Grand Forks—Ore in No. 1 Tunnel Stope.

Union Mine, Grand Forks—Light Portable Diamond-drill for Surface Operations.

being carried towards the south-west under the outcrops above mentioned. Good assays have been obtained from these outcrops at various points.

Lucky Jem. This property, better known as the *Eldorado*, is situated in the Eldorado basin north of the Bridge river and east of Gun creek, at a distance of about 12 miles due north from the confluence of the two streams. The property is owned by Grant White, of Bridge River, and has been described in some detail in Bulletin No. 1, 1932. Some high gold values are obtained over a definitely localized area in what is taken to be a surficial deposit, resulting from the decomposition of a system of veins of arsenopyrite carrying notable gold values.

Cinnabar King. This group, consisting of seven claims, is located on the southern slope of a mountain on the east side of Tyaughton creek, about 2 miles below Relay creek, in the Bridge River area. A belt of dolomite, probably a dolomitized rhyolite porphyry having a strike of approximately south-east and north-west, outcrops down the side of a ravine and across the summits in both directions, having a width of from 80 to 180 feet. Adjacent rocks are granite porphyry, diorite, and serpentine. Cinnabar is found impregnating the dolomitic rock and in knife-blade seams associated with calcite. Surface material pans cinnabar on the slope of the hill and in the adjacent creeks. The only work consists of one open-cut, but costeaning has been started. In the open-cut there is a silicified band in which values appear to be higher, but the general average is very low. The property is attractive because of the extent of the favourable formation and it is quite possible that chambers of ore of commercial value may be developed in this belt. At a distance of about 1 mile towards the north-west, the *Rose* claim is located on Mudslide creek, which flows into Tyaughton creek below Relay creek; here, some quite high-grade exposures of cinnabar-bearing rock are found in a much crushed and altered basaltic formation. One short tunnel has been started, but the best specimens are obtained from open-cuts over a width of about 75 feet. This property is owned by B. Chromer, of Tyaughton.

Anderson Lake Mining and Milling Co. The property owned by this company on McGillivray creek has been under option to C. Noel and associates and some interesting development-work has been carried out, with the result that some exceptionally high-grade gold-quartz ore has been found in shoots in the extensive bodies of quartz. The occurrence of such shoots of ore constitutes the attraction of this property and resulted in the quite extensive development-work that was carried on some years ago. The occurrence, with some account of previous operations, is described in Bulletin No. 1, 1932. Conditions for development are favourable and the property presents opportunities for operation on a large scale rather than as being attractive from the point of view of the individual high-grade ore-shoots.

Alpha. Work on this property, owned by W. Davidson, which is situated on the Bridge River road about 2 miles below Gun creek, was discontinued. This work, which included 400 feet of drifting on a quartz vein in a shear on the Bridge River series, was done by Consolidated Mining and Smelting Company of Canada, Limited, but the results were not conclusive.

Gold King. This property, owned by C. Barbour, situated in the Tenquille basin, was examined in the interests of local capital by Victor Dolmage, but no further action was taken. The occurrence, which has been described in previous Annual Reports, represents an attractive prospect, there being a well-defined mineral-zone in a shear identified with the near-by batholithic contact, in which gold values are found in association with galena and zinc-blende in massive pyrrhotite; opportunities are favourable for exploration at depth by means of diamond-drilling.

Placer-mining.

Lower Bridge River Placers, Ltd. This company, with headquarters in Vancouver, owns five bench leases and several creek leases covering a stretch of Bridge river about 5 miles below Horseshoe Bend, at a distance of about 12 miles above the mouth of the river. On the north, or inner, side of the wide sweep taken by the river there is a large accumulation of tailing from old-time operations along a lower bench reaching to a height of about 40 feet above the stream. On the opposite bank a series of three benches is covered by two claims. The upper bench reaches to a height of something over

100 feet above the stream; the middle bench, extending down-stream for about 600 feet, is approximately 50 feet in height and is 100 feet wide, and the lower bench, farther down-stream, cuts out against bed-rock on the western extremity of the holdings.

A cable has been stretched across the river and operations have been confined to testing-work on this southern side. Twenty bore-holes were put down with a small churn-drill, operated by an 8-horse-power gas-engine and using 4-inch casing. These holes have been spaced 100 feet apart along the rim of the benches and bed-rock is stated to have been reached in all cases, depths varying between 12 and 43 feet. Good results are reported to have been obtained from the upper half of the middle bench and in all the holes on the lower bench. It is planned to continue the systematic testing of the ground by drilling another row of holes farther back from the river, and the project is therefore being handled in an entirely praiseworthy manner. The question of subsequent operation presents some difficulties, and it is understood that plans provide for the use of a mechanical excavation, such as a gas-shovel, and for pumping water from the river for washing purposes.

In regard to the creek leases, practical operation of the river-gravel would appear to depend upon the diversion of the stream in connection with the completion of the B.C. Electric power project on Bridge river. A cabin has been constructed and five men are being employed on the property.

McGillivray Creek.—Some further prospecting was carried out on this creek, but no operations on any scale were undertaken during the year.

ASHCROFT MINING DIVISION.

Ashcroft. This group, situated on the north side of the Thompson river at a distance of about 20 miles below Ashcroft and owned by H. Blair, of Vancouver, and associates, is described at some length in Bulletin No. 1, 1932. There is a series of quartz veins from which encouraging assays in gold are stated to have been obtained.

June. This prospect, situated on Gladwin creek, between Spences Bridge and Lytton, is described in Bulletin No. 1, 1932. A tunnel was driven by W. S. Clark and associates, of Spences Bridge, to intersect a body of quartz carrying some pyrite and in which it is reported that gold values have been found.

Vidette Lake.—This property, situated at the head of Deadman river, at a distance of about 45 miles north of Savona, at the lower end of Kamloops lake, is under option by D. B. Sterrett and a small treatment plant has been erected for the recovery of values from a series of narrow quartz veins. The property is described in Bulletin No. 1, 1932.

NON-METALLICS.

Occurrences of sodium sulphate, magnesium sulphate, gypsum, and diatomaceous earth were the subject of examination by A. M. Richmond in a survey of the non-metallic resources of the Province.

COAL.

An interesting occurrence of coal-measures has been prospected by H. Curnow and associates, of Spences Bridge. This prospect is situated at an elevation of about 1,600 feet above the valley of the Thompson river, at a distance of approximately 1½ miles west of Spences Bridge, in an isolated area of sedimentary rocks surrounded by volcanic formations. The coal-measures are exposed in the sides of a dry ravine on a northern slope of a rolling country flanking the river-valley on the south. A tunnel has been driven for about 40 feet and an incline put down to a distance of about 99 feet on the flat dip of a seam showing a uniform thickness of 6 feet 6 inches. The coal in these workings is a brown shaly lignite. On its strike and dip this seam should be accessible at a considerably lower elevation on the slope of the hill and some further prospecting for improvements in the quality of the coal might be justified.

YALE MINING DIVISION.

Dawson Gold Mines. Some further development has been carried out on the intersection of the dyke and flat veins at a depth of about 30 feet below the old workings, and some high-grade ore has been found. The mill was reconditioned and operated with the production of concentrate for shipment. This property and operations are described in Bulletin No. 1, 1932.

Aurum. Further prospecting-work was carried out on the *Idaho* showing under the same management as that of the Dawson Gold Mines. The work consisted, for the greater part, of open-cuts, both up and down the hill from the original exposure, under which a crosscut tunnel was driven, and was carried out for the purpose of proving the continuity of the silicified zone. Some erratic values are reported, but no defined vein has been proven.

A.M. and August. Development-work was continued on these properties, situated at Cedar Flats, near the Hope–Princeton road, and at a high elevation above the Skagit River valley, by Consolidated Mining and Smelting Company of Canada, Limited. The mineral occurrence is represented by a copper impregnation with low associated gold values in a zone of brecciated quartzite; it is understood that the development is to be continued during 1932.

B.C. Nickel.—With the exception of a little prospecting-work and preparation for driving a proposed tunnel, no further work was done on this property, situated at the head of Emory creek.

Rambler.—E. P. Rice and associates did assessment-work on this group, situated near the head of the Peers creek, and report encouraging results.

Placer-mining.

There has been some activity in the acquisition of leases on both the Coquihalla and Fraser rivers, but no operations of importance have to be recorded.

NICOLA MINING DIVISION.

Skookum Creek. This group of eight claims, owned by L. H. Davis, of Spences Bridge, and associates, is situated at the head of Skookum creek, which flows into the Nicola river at a distance of 14 miles below Spences Bridge, at an elevation of about 4,500 feet. The claims cover a mineralized area in altered granite, outcropping at scattered points in a rolling country which represents the southern extension of the Highland Valley area. The principal exposures occur in the valley of the creek. The mineralization consists of malachite, bornite, and specularite in zones of crushing and fracturing in the granite. The main fracturing system follows a direction of approximately N. 60° (mag.), and the lead follows a line of movement and crushing within this zone which has a general direction of N. 80° E. and with a flat dip of 22° to the south. Sparse mineralization is also found in the fractures. In the zone of crushing narrow veins of malachite with several small kidneys of bornite are fairly persistent, having a width of from 4 to 10 inches. One of these veins has been stripped down the side of a hog-back for a distance of about 200 feet, and an incline was driven partly on the dip and partly on the strike of this flat-dipping vein for a distance of 35 feet and was then turned off in the direction of its strike. From this drift a winze has been sunk on the vein to an incline depth of 72 feet. The average width of this vein is about 6 inches and it is fairly heavily mineralized throughout.

Similar occurrences occur on the opposite side of the creek and some further prospecting-work has been done, including the driving of a tunnel from just above the creek-bed and at approximately the same depth as that attained in the winze. The surface indications, due to the oxidation of the copper content of this narrow vein, are probably misleading, and there would not appear to be much prospect of developing a larger body of ore than has been found in the workings so far accomplished.

Leadville.—No further work was done on this property, owned by Comstock of B.C., with headquarters in Seattle, Wash.

Planet. This property has remained idle following the cessation of operations by Planet Mines and Reduction Company of Nicola, Limited, at the beginning of the year. It has been pointed out in previous reports, and may be repeated here, that the technical success and financial failure attending these operations were due to the ill-advised attempt to work, on a disproportionate scale, one small vein of a whole series which together might form the basis of profitable development.

Mary Reynolds. Further prospecting-work was done on this property, from which high silver values were obtained in one section of a quartz vein occurring in a zone of alteration in the Nicola greenstone, and it is reported that some encouraging results were obtained from surface workings. This work was done by J. L. Brown, of Vancouver.

PLACER-MINING.

Placer-mining operations have been carried out on the Nicola river about 9 miles below Merritt, where a wing-dam was constructed to divert the stream, exposing an area of boulder-strewn gravel in the river-bed about 150 feet wide at the widest point and reaching down-stream from the dam for a distance of about 600 feet. Attempts were made to work this gravel by means of horse-drawn scrapers and a primitive method of sluicing. A fairly heavy content of black sand is found in this gravel with a very slight amount of fine gold. Assays of samples of the black sand have not yielded encouraging results, although there are reports of high values having been obtained.

VERNON MINING DIVISION.

White Elephant. No further work of importance was done on this property, owned by Pre-Cambrian Mines, Limited, of Seattle, Wash., and situated at a distance of 4½ miles from Ewings Landing on the west side of Okanagan lake. Work was commenced on a new incline shaft, but was confined to the section above the existing workings some 30 feet below surface, and the old shaft below these workings has been bulk-headed. No further development at depth has been undertaken. The plant and machinery is kept in good condition, one man being resident on the property.

Skookum. This group, owned by H. J. Blurton, of Vernon, is situated on the high land flanking Deep creek on the west side of and approximately 4 miles from the North arm of Okanagan lake. A number of quartz ledges, reported to carry a low gold content, occur in a sedimentary and volcanic formation in association with porphyritic intrusions, and exceptionally high values in gold and silver have been obtained from one working-place. The property is referred to in Bulletin No. 1, 1932.

St. Paul. Work was continued on this property, on Monashee mountain, by the St. Paul Mining Company, of Vancouver. A description of the workings and the geology is given by C. E. Cairnes in the Summary Report, Part A, of the Geological Survey of Canada for 1930.

Jumbo. H. J. Blurton continued prospecting-work on this gold-quartz property, situated alongside the Kamloops highway at a distance of 2 miles from Vernon. The vein in which visible gold is found irregularly distributed occurs in a very disturbed formation.

PLACER-MINING.

Minor operations were continued by individual prospectors on Cherry creek and Siwash creek, and leases have been acquired on the Shuswap river below Sugar lake, where good values are reported to have been obtained.

SOUTHERN MINERAL SURVEY DISTRICT (No. 4).

REPORT BY PHILIP B. FREELAND, RESIDENT MINING ENGINEER (HEADQUARTERS, PENTICTON).

INTRODUCTION.

The general features of the Southern Mineral Survey District (No. 4) have been well described in previous Annual Reports, including geology and prospecting areas. The lode-gold features of the district are fully outlined in Bulletin No. 1, 1932. To these reports the reader is referred, as information previously given is not, as a rule, repeated in this report.

A list of reports on the district appears in the Annual Report for 1928 and maps covering the district can be obtained either from the Mines Department, Bureau of Mines, or from the Surveyor-General's office in Victoria. It is advisable for any one considering a prospecting-trip to obtain all the geological and topographical maps available.

In the Annual Report for 1929 the transportation features of the district have been mentioned in detail, so they will not be repeated here, except to say that there is no better system of transportation anywhere in British Columbia. The high-power electric line runs through from east to west and will afford power to any operation. In addition to the roads, etc., mentioned formerly, the following have been built: A narrow road from Carmi to Kelowna; an extension of the Princeton–Hope highway beyond the junction of the Pasayten and Similkameen rivers, which opens up transportation in a well-mineralized area; the completion of the trunk trail from *Copper Mountain* to the Ashnola river; a new cut-off road to the *Gold Drop* mine; as well as substantial assistance towards reconditioning other roads and trails throughout the district.

The continued depression of metal prices throughout the year made very little difference to the total output in the district in comparison to 1930. This was due to the fact that there were very few operating companies relying upon the price of copper, lead, and zinc for their existence. The closing-down of the *Nickel Plate* mine caused a heavy decrease in gold-output and entirely eliminated the production of arsenic. The *Union* mine assisted in offsetting this decrease, and should other ore-bodies be found as rich in gold as those already discovered an increase may ensue. Taking the district as a whole, production of both gold and silver has stood the test of very low prices remarkably well and speaks very highly not only for the type of operator, but for the mines themselves.

Amongst the silver-producers, the *Bell* mine, with a record of sixteen years of steady profitable operation, proved that a profit could be made even with silver at 26 cents an ounce. The *Wellington* mine, on the same mountain, operated intermittently for a time and shipped only such ore as was mined in development and from which a sufficient profit was made to finance exploration and allow a small margin for dividends. The *Highland Lass*, which is controlled by the Bell Mines, Limited, shipped comparatively small amounts of ore during most of the season until more permanent shear-zones were discovered. In 1932 the mine will commence paying dividends. Reliable reports have been heard regarding the opening-up of the *Beaver*, which adjoins the *Bell*, so that in 1932 a much larger tonnage of silver ore may be looked for from this source.

In Jewel Lake camp the *Gold Drop-North Star* group has been reported to be developing well and ore shipments commenced. During 1932 a great deal of exploration-work may take place in this camp, which contains some attractive quartz veins. In Franklin camp many claims have been taken up, and if voluminous inquiries are any criterion, there will be an "old-time" rush as soon as weather conditions permit.

In the placer-grounds on the Tulameen and Similkameen rivers and on Rock and Boundary creeks many "snipers" were at work, with the result that some attractive high-channel prospects were uncovered, and incidentally many men were able to eke out a living.

The coal-mines at Princeton are understood to have been working at nearly capacity with a brighter outlook for 1932, providing the operators take a greater interest in local marketing possibilities. In the non-metallic section of the industry there was a reduction in output due to non-operation of the *Rock Candy* fluorspar-mine and the closing-down of the Hedley Gold Mining Company's plant, which produced arsenic. Limestone was produced at Fife for flux at the Trail smelter and brick by the Doukhobors at Grand Forks.

The courtesy, kindness, and hospitality shown by all mine operators and prospectors is gratefully acknowledged.

PRODUCTION.

The following table shows the mineral production of District No. 4 for 1931:—

Division.	Ore.	Gold.	Silver.	Copper.	Lead.
	Tons.	Oz.	Oz.	Lb.	Lb.
Grand Forks	56,764	16,577	572,096	.....	61,301
Greenwood	3,145	176	514,971	.....	290,139
Osoyoos	.....	.....	.....	.....	.....
Similkameen	70	265	4,817	.....	45,469
Totals, 1931	59,979	17,018	1,091,884	.....	396,909
Totals, 1930	783,620	24,979	1,122,696	15,493,571	398,958

Division.	Zinc.	Coal.	Limestone and Quartz (Flux).	Brick.	Platinum.
	Lb.	Tons.	Tons.	$	$
Grand Forks	93,538	.....	24,916	10,000*	.....
Greenwood	420,284	.....	.....	.....	.....
Osoyoos	.....	.....	519	.....	.....
Similkameen	5,602	160,947	.....	.....	1,783
Totals, 1931	519,424	160,947	25,435	10,000	1,783
Totals, 1930	.....	171,738	20,635	16,862	771

* Estimated.

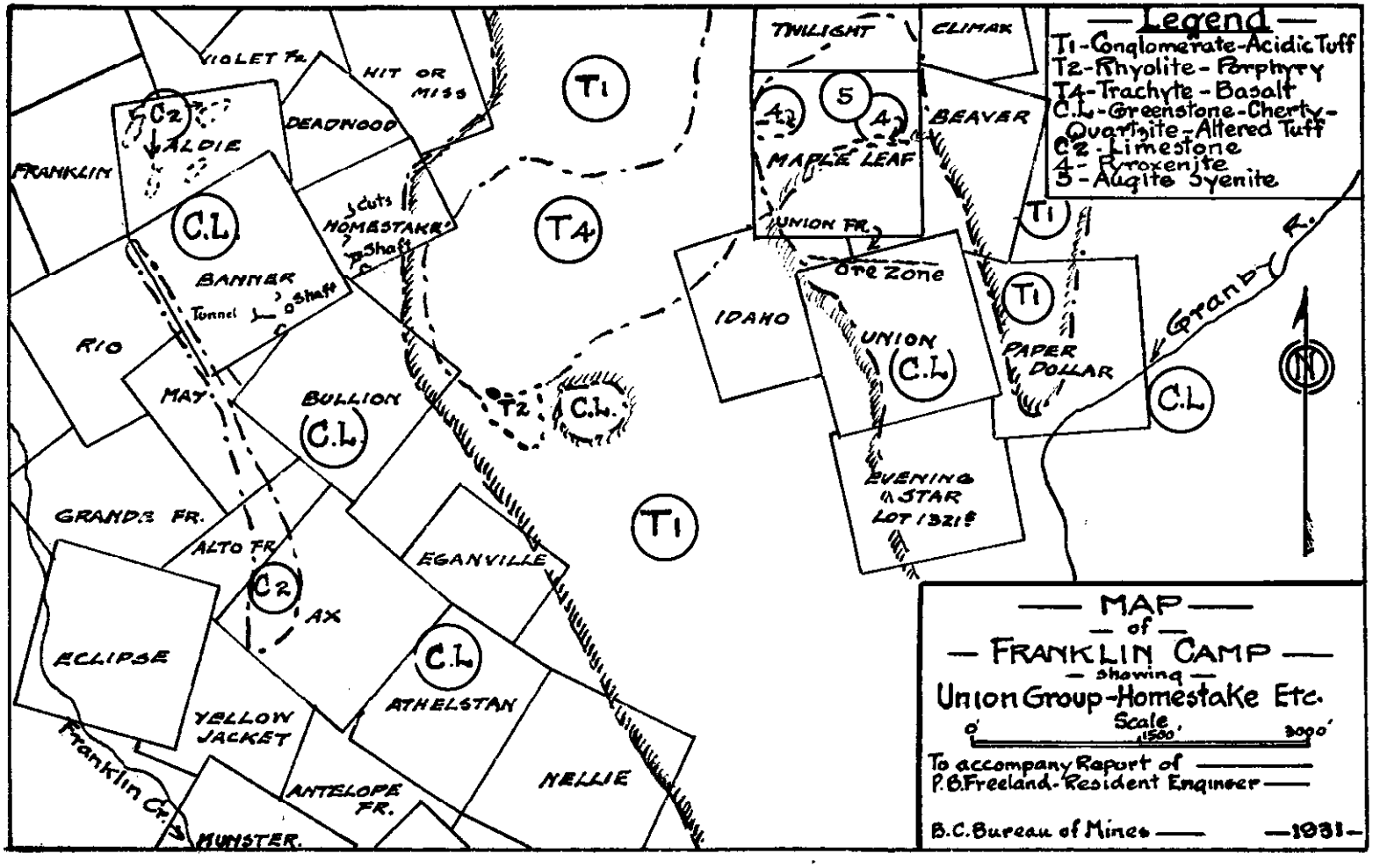
GRAND FORKS MINING DIVISION.

FRANKLIN CAMP.

The geology and future possibilities of this camp, situated about 45 miles north of Grand Forks on the Granby river, were outlined in Bulletin No. 1, 1932.

Union. This group, consisting of six or more claims, is registered under the name of J. F. McCarthy, of Wallace, Idaho, and financed by the Hecla Mining Company, of the same address. The mine was continuously operated during the year and 56,666 tons of milled ore produced 1,616.9902 tons of concentrates, which was shipped to the Trail smelter. Besides this 54.7425 tons of high-grade raw ore was shipped to the Bunker Hill smelter at Bradley, Idaho. The shipment of raw sorted ore analysed as follows: Gold, 41.05 oz. per ton; silver, 18.65 oz. per ton; lead, 8.55 per cent.; copper, 0.98 per cent.; zinc, 9.05 per cent.; insoluble, 47.8 per cent.; iron, 4 per cent.; sulphur, 8.3 per cent.; lime, 8.9 per cent. Ten tons of high-grade ore was also shipped to the Trail smelter.

A great deal of newspaper publicity has been given to the finding of higher-grade ore in the mine, and from these accounts the reader might have gained the impression that immense bodies, assaying thousands of dollars per ton, had been found. It is true, however, that the discovery was a most psychological one, which offers important future possibilities to the camp as a whole, and has prolonged the life of the *Union* mine operations, which were destined to end shortly after the New Year if new ore had not been developed. Tremendous difficulties have been experienced by the company in its search for new ore, owing to several factors, the chief of which was that no apparently valuable mineral-outcrops occurred on the strike to the west of the old glory-hole and surface prospecting failed to uncover anything but comparatively barren quartz. It has been fairly well demonstrated, however, that the ore values peter out on the strike and dip into low-grade quartz, and that it is only in favourably structural zones, where faulting has occurred, that minable shoots are found. Two kinds of faults have been observed dipping vertically and horizontally, some of which are pre-mineral and other post-mineral. The former evidently created a dam against which enrichment took place, and the latter displaced the ore-bodies; so that structural conditions appear to govern the future possibilities of the camp.


Legend
T1-Conglomerate-Acidic Tuff
T2-Rhyolite-Porphyry
T4-Trachyte-Basalt
C.L.-Greenstone-Cherty-Quartzite-Altered Tuff
C2-Limestone
4-Pyroxenite
5-Augite Syenite
MAP
of
FRANKLIN CAMP
showing
Union Group-Homestake Etc.
Scale 0' 1500' 3000'
To accompany Report of P.B.Freeland-Resident Engineer
B.C. Bureau of Mines 1931
VIOLET Fr.
HIT OR MISS
DEADWOOD
FRANKLIN
ALDIE
C2
C.L.
BANNER
Tunnel
Shaft
Cuts
HOMESTAKE
Shaft
RIO
MAY
BULLION
C.L.
T1
T4
T2
C.L.
TWILIGHT
CLIMAX
A2
5
4
MAPLE LEAF
BEAVER
UNION Fr.
T1
Ore Zone
IDAHO
UNION
C.L.
T1
PAPER DOLLAR
C.L.
Grand R.
N
EVENING STAR LOT 1321
GRAND Fr.
ALTO Fr.
C2
AX
EGANVILLE
ECLIPSE
C.L.
ATHELSTAN
YELLOW JACKET
Franklin Cr.
ANTELOPE Fr.
NELLIE
MUNSTER.

The discovery of the new ore-body was made by diamond-drilling from the extension of the No. 1 tunnel west. This hole, driven for 70 feet horizontally north, passed through about 4 feet of good ore. Later a tunnel was run to develop this find, which proved to be only a small segregation, through the centre of which the drill-hole had passed. The drift was continued in search of ore in a northerly direction for 200 feet under a comparatively barren outcrop, and the first segment of faulted high-grade ore was struck. The new ore, occurring in three slightly faulted shear-zones, strikes about east and west, dips slightly to the north, and has a maximum length of about 200 feet. An upraise driven from the extension of No. 3 tunnel, below and through which the ore is handled, failed to disclose any large tonnage of ore below No. 1 level. The body has apparently been delimited on No. 1 level to the west and peters out into barren quartz at that elevation. In the stopes that are being driven above No. 1 tunnel the ore-shoot rakes up to the west and over the barren part found in the tunnel. Flat faults have thrown the top part of the ore in the stopes over to the south, where at present it continues to hold its strike and dip. There is about 300 feet of ground between No. 1 tunnel and the surface in which possible high-grade ore-bodies may occur. The ore-bodies vary from 4 to 10 feet in width, having enriched stringers and lenses on both foot and hanging walls.

A considerable amount of diamond-drilling is being done underground in prospecting for new ore. During the summer an "X-ray" drill was used for surface work, using borts instead of black diamonds in the bits. This machine gave satisfaction and is both useful and economical when required depth of hole measures between 50 and 85 feet and the rock is not exceptionally hard.

Due to the fact that the new ore-body contains a higher percentage of galena, pyrite, sphalerite, chalcopyrite, and free gold lightly coated with sulphides, it was found necessary to add two Wilfley tables to the mill flow-sheet. After grinding, the pulp passes over the tables, which save the free gold and some of the galena. All the overs pass into a new settling-tank which has been built outside the mill; and after settling, into the flotation unit for final concentration. In this way the free gold, which will neither amalgamate nor float satisfactorily, is saved.

Homestake. This claim, mentioned in Bulletin No. 1, 1932, and situated about 3,000 feet west of the *Union* mine on the Franklin Creek slopes, is owned by Ab. Fee, Pat Byrne, and associates, of Grand Forks. About thirty years ago this claim was staked and shortly afterwards Crown-granted. Later it reverted to the Crown for non-payment of taxes and in 1928 was leased by the present owners and acquired in 1929. Development-work consisted of six open-cuts and shallow shafts, the deepest of which was about 10 feet. All these workings, which extend for a distance of about 500 feet, form a gradual semicircle and were excavated in highly altered sediments similar to gangue and country-rock of the *Union* mine. The ore-minerals are pyrite, galena, sphalerite, and lesser amounts of chalcopyrite in a gangue of quartz. Most of the old workings were cleaned out by the present owners and all except one contained only low values in gold and silver. In one of the shafts, about 10 feet deep, a hole was drilled and shot in the south-east side and a picked sample of the broken ore assayed: Gold, 24.9 oz. per ton; silver, 15 oz. per ton. Later, a 40-foot open crosscut was driven from down the hill which tapped the lead a few feet below the bottom of the shaft. Samples taken across 4 feet of the vein near the bottom of the shaft assayed: Gold, 0.60 oz. per ton. Picked samples assayed 9.20 oz. and 3.20 oz. per ton. Another 3-foot sample across a well-mineralized section assayed: Gold, 2.20 oz. per ton. It is evident from this sampling that the character of the ore and the uneven distribution of values resembles the *Union* ore-deposition, and until a considerable tonnage is broken and assayed it is impossible to arrive at any average value per ton.

The strike of the ore in this shaft is approximately S. 30° E. (mag.), with a dip of about 50° to the north-west, which if continuous will follow a line through the north-west corner of the *Bullion*. Owing to the semicircular shape of the surface mineralization found in the workings, there seems to be some doubt as to the general strike of the ore-zone, which may possibly have been influenced by local disturbances and the centre pushed to the south-west. The topographical features of the ground in the immediate vicinity portray the likelihood of severe faulting, especially to the south-east, on the projected strike of the ore-body. In the underground workings of the *Union* mine the ore has been thrown apparently about 200 feet by one fault, so that until more work is done on the *Homestake* the strike of the ore can only be

guessed at. An attractive characteristic lies in the fact that apparently faulting is essential to the finding of pay-ore in this camp, so that the future possibilities of the *Homestake* are consequently important. The owners intend to sink the shaft deeper and generally explore the area. A trail leads from the Franklin Camp road, about 1¾ miles south of the *Union*, up to the claims, a distance of about 2 miles.

Banner. This claim is owned by Pat Byrne and associates, of Grand Forks, and adjoins the *Homestake* on the south-west. A considerable amount of work has been done since the claim was staked in 1898, consisting of a shaft about 25 feet deep on a fissure containing sphalerite, galena, chalcopyrite, and pyrite in a quartz gangue. A crosscut has also been driven about 175 feet farther down the hill, but the ore exposed in the shaft was not reached. Picked samples of this ore assayed about $18 per ton in mixed values. The country-rocks are altered tuff, quartzite, and other similar Franklin group rocks. It seems possible that the ore found in the shaft is the top faulted section of a fissure, the roots of which lie farther into the hill and to the east; in which case the crosscut was not driven far enough. More development is justified.

In former Annual Reports the *Copper No. 2*, *McKinley*, *Averill* group, *Buffalo*, *Maple Leaf*, *Glouster*, and many other properties have been mentioned. A report upon the platinum possibilities of Franklin camp was made by Wm. Thomlinson, for the Munition Resources Commission, in 1918. For those who have not access to a copy of this report, the Resident Engineer will be glad to supply information regarding gold and platinum assays contained therein.

In Bulletin No. 1, 1932, extensive areas containing similar geological formations to that of Franklin camp were mentioned, and Morrell camp and R. Simpson's claims were advised as being suitable for investigation. A lot of exploration-work has been done on the *Juditta* group in the former camp and some low-grade ore uncovered containing similar minerals to those found in the *Union*. Occasionally small high-grade pockets containing free gold occur in the quartz veins, but up to the present no large bodies have been found. Possibly structural conditions were not favourable where the work was done and a further search necessary.

On R. Simpson's group, located near the mouth of Pass creek, which includes the *Exchange* claim, some gold has been uncovered in quartz veins, also massive pyrite containing gold and silver values. On the *Little Bertha*, farther north and across the Granby river, gold associated with pyrite has been mined, and at the present time a Pullman, Wash., company is driving a long crosscut (now nearly 900 feet) into the mountain in an endeavour to intersect the downward extension of the pyrite-pyrrhotite-gold-copper deposits in limestone, located on the *Pathfinder* group about 800 feet above and mined in the early days. On the *Superior* claim on Volcanic mountain, a short distance south of the *Little Bertha*, gold is found in the pyrite-pyrrhotite replaced limestone-deposits. Very little work has been done upon this claim to prove its value. All these claims are near both railway and motor-road transportation and a more intensive search is warranted.

The *Yankee Boy* and *Yankee Girl* claims, situated on Hardy mountain, are owned by James Hutchinson, of Montreal. These claims, mentioned in the 1924, 1925, and 1930 Annual Reports, have been worked spasmodically and some gold-bearing quartz ore shipped to the smelter. The veins, which vary from 2 inches to 2 feet, occur in the greenstones. Transportation is good.

Humming Bird Frac. This claim, owned by Carl Anderson, Grand Forks, has shipped some gold-bearing pyrite-pyrrhotite ore in past years. The ore occurs in lenses and veins in the replaced limestone-beds which have been tilted along the edge of the Granby River valley. A continued search for ore is being carried on by the owners. In the vicinity of Grand Forks there are two deposits, one of silica, which is said to be commercially pure, and another of marble, which polishes well. Both these are extremely handy to railway transportation.

Cascade Area.

Mention has been made from time to time in past Annual Reports of the occurrence of chromite on Castle mountain. Besides the massive chromite found on the *Mastodon* group, there are several other claims lying to the north-east that contain large segregations of disseminated pebbled chromite that have been uncovered by surface workings only. This ore is high-grade material carrying over 40 per cent. $Cr_2 O_3$. The deposits occur in the usual lenticular form

in the highly serpentinized dunite rocks which invade the entire area. Excellent railway and motor-road transportation, as well as electric power facilities, adjoin the claims.

On the *Midnight* and *Blacktail* claims assays of 0.015 and 0.012 oz. per ton were reported by the Munition Resources Commission from chromite samples.

Paulson Section.

Molly Gibson. This group, mentioned in several Annual Reports, including 1918, 1919, 1928, and 1930, and situated about 4 miles from Paulson, is owned by the Molly Gibson (Burnt Basin) Mining Company, Limited, of Rossland. This year assessment-work was done and a rawhide trail cut from the workings down to the 6-foot trail; the intention being to mine and ship some ore from one of the open-cuts which was said to contain high gold values. A few tons, it is understood, were taken down to Paulson during the winter and left at the station when it was found to be too low grade to stand the cost of the freight and smelter treatment. A sample of the ore taken from the floor of the cut assayed a trace in gold and silver per ton. A mechanic's lien has been registered against the property for non-payment of wages.

Other claims in Burnt basin include the *Halifax*, a silver-lead-zinc prospect; the *Monitor* and *Montrose*, which both have similar types of mineralization in the limestone-beds and have been mentioned in former Annual Reports. The *Motherlode* claim, which lies to the north of the above, was reported upon by R. W. Brock under the heading of the "Contact Consolidated Gold Mines, Limited," in 1904, and also in the 1925 Annual Report.

Lightning Peak.

This area was particularly mentioned in Bulletin No. 1, 1932. Part of Lightning Creek area is in the Greenwood Mining Division.

Waterloo Gold Mines, Ltd. In March, 1931, the Waterloo Gold Mines, Limited, entered into an agreement with A. S. Hatfield, Penticton, trustee of the Waterloo Consolidated Mines, Limited, an authorized assignor, whereby the said A. S. Hatfield transferred to the new company all of his right, title, and interest in the Waterloo Consolidated Mines, Limited, for consideration set out in the agreement. Development during the early part of the season was concentrated upon sinking the inclined shaft on the *A.U.* claim, commenced in 1930, to a depth of 70 feet and drifting on the vein 72 feet, with a crosscut at the end of the drift 40 feet long. During the autumn this work was discontinued and a lower tunnel (No. 4) driven on the *Waterloo* claim. In the shaft on the *A.U.* values increased in depth and a 6-inch sample carrying $70 per ton in gold was recorded by the management. A sample of sorted ore taken from the bottom of the shaft whilst the mine was being examined in September assayed: Gold, 1 oz. per ton; silver, 24.5 oz. per ton; lead, 10.5 per cent.; zinc, 8 per cent. This compares with a 10-inch sample taken 14 feet down the shaft in 1930, which assayed: Gold, 0.36 oz. per ton; silver, 16.6 oz. per ton: lead, 8.2 per cent.; zinc, trace.

The vein pinches and swells, having a maximum width in the shaft of about 24 inches and an average of about 8 inches. Minerals found in this quartz vein are composed of pyrite, galena, sphalerite, and chalcopyrite. In the drift from the shaft the vein is narrow, badly broken and warped, due to faulting and the intrusion of a narrow porphyry dyke. The junction of two veins, which was the original shaft objective, was not reached before the attempt was abandoned.

The No. 4 tunnel on the *Waterloo*, commenced in September, was driven ahead for a total distance of 165 feet, and, according to the management, 50 feet of high-grade and 70 feet of medium-grade ore, varying from 3 feet to 6 feet 6 inches in width, the latter being valued at about $16 per ton, was struck. Most of this ore was found in the schistose rock, but indications of limestone are again appearing in the face of the tunnel. Tunnel measurements to date are as follows: No. 1, 150 feet; No. 2, 380 feet; No. 3, 75 feet; No. 4, 165 feet. A shipment of ore was made during the winter, including 19½ tons of gold ore from the *A.U.* and 13½ tons of silver ore from the *Waterloo*. The mine was closed down during the winter.

During 1930 C. E. Cairnes, of the Geological Survey of Canada, spent a short time making a reconnaissance survey of the area and his report appears in the Summary Report, G.S.C., 1930, Part A. In this report a detailed account of the following claims is given: *Morning*, *Dictator*, *Potosi* group, *Waterloo* group, *A.U.*, *Silver Spot*, *Gold Plate*, *Lumpy*, *Rampulo*, *Killarney*, *Lightning Peak* group, *Pay Day* group, *Big Hill*, *Pilot*, and *Uta*. Reports upon all these

claims, except the *Morning*, *Gold Plate*, *Pilot*, and *Uta*, have appeared in previous Annual Reports. During 1931 assessment-work was done on the un-Crown-granted claims and development on most of the others. No spectacular finds were made, but interesting mineralization was discovered on the *Morning* and *Potosi* groups.

Development in this camp has been necessarily slow, because not only is the country generally flat, but there is a considerable amount of surface-soil covering, which retards prospecting. Dr. Cairnes's report upon geological conditions may be looked upon as exceedingly hopeful in regard to future mineral possibilities, so that with sufficient capital backing those interested are warranted in investigating this camp. Diamond-drilling appears to offer the best and quickest method of ascertaining ore possibilities at depth, and also whether or not the series of gold-bearing quartz veins on the *A.U.*, *Dictator*, and *Morning* groups of claims either join or increase in size some distance below the surface. The contact of the *Waterloo* vein system and the above quartz veins also offers attractive possibilities.

GREENWOOD MINING DIVISION.

Wallace Mountain.

Bell Mines, Ltd., and Highland Lass.

The Bell Mines, Limited, with headquarters in Kelowna, operated both the *Bell* and *Highland Lass* continually throughout the year. The low price of silver, which averaged below 30 cents an ounce, was a distinct handicap, but in spite of this a sufficiently large profit was made to compensate the owners for the operation. The ore shipped averaged about the same as in former years, namely: Gold, 0.03 oz. per ton; silver, 200 oz. per ton; lead, 6 per cent.; zinc, 7 per cent.; and the total shipments from the *Bell* for 1931 amounted to about 1,800 tons. The *Bell* has been in continuous operation since 1916 and it is probable that this is a record for a small silver-mine in the Province. The total gross production from the mine to the end of 1930 exceeded $1,000,000, and from the appearance of the mine there are many more years of successful operation ahead of it.

The *Highland Lass*, which adjoins the *Bell* on the north, experienced some difficulty in former years in discovering sufficiently large and permanent ore-zones in the quartz diorite to carry on profitably owing to the dissipation of values at the contact of the Wallace formation which overlies the area. During the summer a shear-zone containing high-grade silver ore was discovered underground near the *Bell* line. A winze was sunk on this find and several car-loads of ore have been shipped. The future of the mine at the present time looks much more promising. Henry Lee is consulting engineer for the Bell Mines, Limited.

Sally Mines, Ltd.—Only preliminary exploration was done in 1931 on these properties, adjoining the *Bell*, by a small crew of men under the management of J. Hanna.

Wellington Syndicate, Ltd.

During the early part of the year, only sufficient ore was mined from the *Wellington* to pay for exploration. Later on, when the price of silver rose to 30 cents an ounce, more regular shipments were made. The mine is well developed and in a position to take advantage of any rise in the price of metals. No work of outstanding importance was done on any other claims on Wallace mountain.

Balaclava, Silver Hoard, Hidden Treasure Fraction, Zora May.

These claims, situated on Dry creek, on the south slope of Wallace mountain, are owned by the Crater Lake Mining Company. They have been developed by numerous open-cuts and short tunnels on a very slightly mineralized zone which follows the foot and hanging wall of a narrow porphyry dyke which varies in size from ½ to 6 inches in width, and contains small, widely separated lenses a few inches in extent of galena, sphalerite, and occasional films of native silver. Nowhere in the workings were any minable widths observed. Recent development consists of a lower tunnel driven 108 feet into the hill and 30 feet under an old 60-foot drift, on the floor of which there were supposed to be indications of an ore-shoot. A stringer of ore was found on the dyke contact in the lower tunnel containing similar minerals to those found above, but no bodies of ore found that could be profitably mined.

Butcher Boy.

This claim, owned by James Kerr and associates, of Carmi, adjoins the old *Carmi* mine on the north-west side. During the winter of 1930–31 a shipment of ore was made to the Trail smelter, containing values in gold and silver valued at $28 per ton. The west drift was extended on a quartz vein varying from 1 to 5 feet

in width and mineralized with pyrite containing low values in gold. At the bottom of the 80-foot shaft and for about 48 feet to the east, higher-grade ore was found in a shear-zone averaging about 28 inches in width, and the car-load was mined and shipped from this section. The ore apparently rakes under the shaft to the west, and should sufficient capital be available the deepening of the shaft can be recommended. The vein can be traced for several hundred feet to the west on the surface. The mine is particularly well situated, close to transportation, water, and timber.

Inyo-Ackworth. These claims are controlled by Herbert Fry, Beaverdell. Development consisted of driving the lower tunnel ahead with the idea in mind of tapping the downward extension of the ore found in the upper open-cut. (*See* Annual Reports for 1925 and 1930.)

KETTLE RIVER SECTION.

Mogul Mining Co., Ltd. This company, with headquarters in Victoria, developed the *Mogul* group of claims on Horseshoe mountain, about 24 miles up the Kettle river from Westbridge (*see* Annual Report for 1929). A contract was let during the summer to drive a crosscut to tap the bottom of the old shaft. This tunnel is 135 feet long and is connected with the shaft by an upraise of 10 feet. About 35 feet in the crosscut a lens of ore was struck which was found to be a comparatively small body of high grade about 4 feet long and 2 feet wide, formed against a fault. The crosscut was continued from near the shaft in a southerly direction for about 17 feet on a slightly mineralized fracture, and from thence S. 56° W. (mag.) for 22 feet. The last leg of this tunnel was driven under the drift run formerly from the bottom of the shaft in a south-westerly direction and in which segregations of ore were found. The new lower tunnel developed a cherty quartz, containing segregations and isolated pyritohedrons of pyrite in the quartz diorite, except in and near the face, where dense pyritic mineralization occurred lying under a flat fault.

The following table shows assay results on twelve samples:—

Description of Sample.	Gold.	Silver.
	Oz. per Ton.	Oz. per Ton.
1. Across 4 feet, slightly mineralized diorite in short drift, 10 feet above vertical shaft	0.40	0.20
2. Across 4 feet in 10-foot shaft, 527 feet south-west of main shaft	Trace	Trace
3. Grab, decomposed arsenical iron and quartz from 10-foot shaft	0.20	0.20
4. Silicified material, nearly all quartz, no sulphides, dump at main vertical shaft	0.78	0.22
5. Selected high grade, with considerable amount of arsenopyrite, main shaft dump	5.40	1.10
6. Across 7 feet, face of old drift from bottom of main shaft	0.24	0.12
7. Across 3 feet 6 inches, west side of same drift as sample No. 6	0.30	0.06
8. Ore-lens 35 feet from mouth of tunnel, north side	2.90	0.40
9. Across 2 feet, 20 feet down from collar of main shaft	Trace	Trace
10. Across 2 feet, 30 feet down main shaft	0.03	0.30
11. General sample of heavy pyrite ore from face of lower tunnel (November)	0.60	0.40
12. General sample of quartz from same locality as No. 11	*Nil*	*Nil*

Some very satisfactory values are found in this prospect wherever there are favourable localities for ore-deposition, and although up to the present the segregations are comparatively small and scattered, further development appears to be warranted, so that proof may be obtained whether or not the permanent and larger mineralized bodies occur either at depth or away from the influence of a narrow porphyry dyke which intrudes the quartz diorite close to the main shaft.

A log bunk-house and kitchen to accommodate about eight men has been constructed on the property and a narrow road about 4 miles long, with several very steep grades, has been built to the camp. There is plenty of good timber, but water is scarce for mining purposes in the vicinity of the workings. About 3,000 feet to the east a comparatively large quantity of water could be stored in one of the Triple lakes, and 2 miles due west the Kettle river runs at an elevation several hundred feet below the workings. Work was proceeding during the winter with a small crew.

The *Silver Dollar*, *Hackla*, *Barnato*, adjoining the *Mogul* claim, have been described in former Annual Reports. Reference to the geology of this area appears in Bulletin No. 1, 1932.

Jewel Lake Camp.

Jewel-Enterprise. This group, reported upon in the Annual Report for 1930 and mentioned in Bulletin No. 1, 1932, has been bonded by the Dentonia Company, of Calgary, under a Dominion charter. The officers of the company are: Nelson S. Smith, president, Olds, Alta.; J. M. Robertson, director, Nelson, B.C.; A. C. Galbraith, director, Calgary, Alta. The authorized capital is 1,500,000 shares of no par value and the issued capital 185,000 shares. No development-work has been done on the properties by this company up to the present time, but it is understood that payments due the claim-owners have been made.

Gold Drop-North Star. This group, consisting of three or more claims lying to the north-east of the *Jewel*, has been optioned from the former lessees by Penticton interests under the management of R. L. Clothier. The original owner of the *Gold Drop* was Louis Bosshart, Greenwood, who during former years made ore shipments totalling 13 tons, containing: Gold, 24 oz.; silver, 141 oz.; lead, 61 lb. During 1931 the former lessees uncovered an extension of the *Gold Drop* vein about 200 feet uphill and to the north-east of the upper tunnel portal. After stripping about 6 feet of overburden a high-grade shoot containing tellurides, free gold, pyrite, and lesser amounts of galena in quartz was found and about 30 tons of ore sorted. A shipment was later made to the Trail smelter.

Development consists of open-cuts, shallow shafts, and tunnels on the vein, which varies from a few inches up to 5 feet in width for a distance of approximately 1,000 feet, commencing on the *Gold Drop* about 500 feet from the north-east line and continuing in a north-easterly direction across the *North Star* claim. In the lowest crosscut tunnel only stringers of quartz were found after driving about 200 feet. It seems likely that this tunnel happened to be driven across a narrow part of the vein. In the upper *Gold Drop* tunnel, 35 feet higher in elevation, the vein was struck about 40 feet from the mouth and following for 70 feet, where the vein split, one branch continuing for 50 feet in a north-easterly direction and the other for 45 feet nearly due east. The east vein, which varies in width from 15 to 54 inches, contains higher-grade ore, and an upraise driven to the surface produced about 12 tons, which was shipped to the smelter. The discovery of rich ore on this vein extension promoted a renewed interest in this camp, which had lain dormant for many years, with the result that a small engine and compressor have been installed and several men are at work developing the mine. On the *North Star* an old tunnel has been cleaned out, and, according to the management, 2 feet of quartz which assays about $100 per ton in one of the old stopes, and in another stope assays $16 per ton over 4½-foot widths, have been found. Unofficial reports state that a shipment will be made to the smelter early in 1932. If the above statements regarding the *North Star* are correct, a more optimistic outlook may be maintained and systematic development undertaken, with the hope that improved ore-widths may be found at depth in a similar way to those prevailing in other parts of the camp.

Two roads serve the area, one about 6 miles long leading to Eholt and another to Greenwood, 8 miles distant; both places being on the Canadian Pacific Railway. The camp lies between the elevations of 3,700 and 5,000 feet, the former being the height of Jewel (Long) lake, where plenty of water is obtainable for mining purposes. The formations are metamorphosed sediments, generally schistose, invaded by igneous rocks, mostly granite and porphyry dykes probably of Tertiary age.

On the *Ethiopia*, *Enterprise*, *Jewel*, etc., a vein nearly parallel to that found on the *Gold Drop* has been developed and high-grade sections of ore discovered.

On the west side of the lake similar types of veins have been developed to a small extent on the *Electric*, *Lakeview*, *Roderick Dhu*, and *C.O.D.* Samples of sorted ore from the *Electric*, on which a short tunnel has been driven, assayed: Gold, 1.68 oz. per ton; silver, 22.9 oz. per ton; lead, 1.6 per cent. On the *Roderick Dhu* sorted ore assayed: Gold, 1.12 oz. per ton; silver, 1.5 oz. per ton. Similar values were found on the *Lakeview*. On the *C.O.D.*, which has not been examined, fairly reliable reports have recently come to hand stating that a quartz vein having an average width of 4 feet, striking north and south and dipping slightly to the west, was

uncovered by surface cuts, and a 5- by 9-foot shaft sunk 70 feet deep. The ore-minerals are pyrite, galena, free gold, and telluride. Samples taken many years ago assayed as follows:—

Description.	Gold.	Silver.
	Per Ton.	Oz. per Ton.
1. Sample taken from surface cuts	$12.55	4.0
2. Average six samples taken from first 17 feet in shaft	8.70	.....
3. Sample taken 17 feet down shaft	22.20	.....
4. Three samples taken 35 feet down shaft	16.50	.....
5. Sample from south side and 40 feet down shaft	58.25	6.0

The *C.O.D.* is located about 4,500 feet to the south-west of the *Jewel* and the present owner is L. A. Altman, Travellers Hotel, Sacramento, California. The names and addresses of the owners of Crown-granted claims in this area can be obtained by writing to the Gold Commissioner, Penticton, B.C.

Greenwood Section.

The numerous past producers of gold ore are mentioned in Bulletin No. 1, 1932. The Annual Reports from 1896 to 1906 contain some fairly reliable information regarding the ore shipments and values found when mining was active in the neighbourhood. Special attention is called to this section for prospectors and a careful exploration recommended.

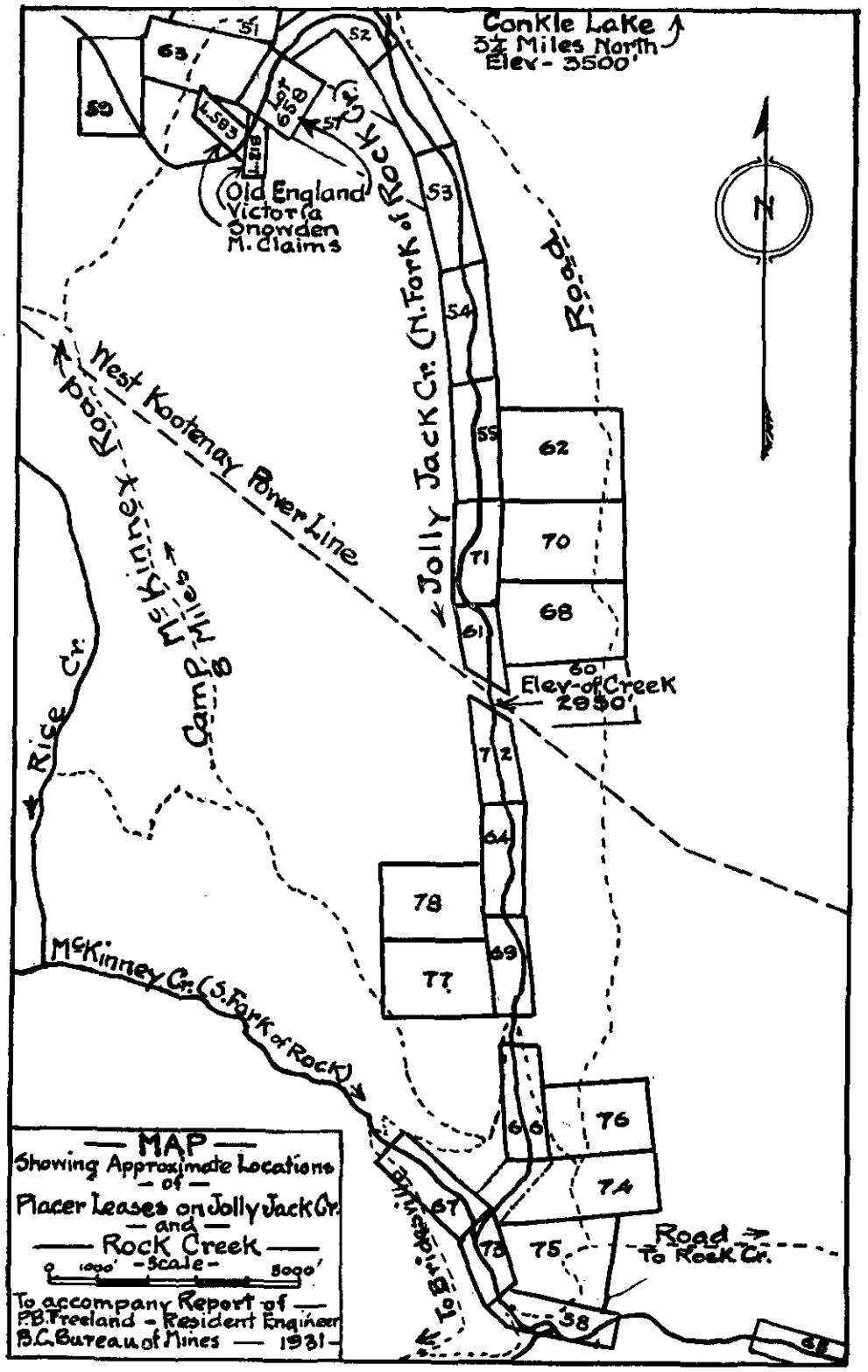
Camp McKinney Section.

A good deal of assessment-work was done on quartz veins in this area during 1931 and some high-grade ore is reported as found. The terrific forest fire which swept through the camp this year destroyed many cabins, corner posts of Crown-granted claims, location posts, prospectors' tools, and timbered tunnels and shafts, creating a great hardship on the owners. To offset this, the ground and rock-exposures are cleared of brush, permitting an unobstructed view hitherto unknown. Much improved transportation and electric power, available at the camp, will greatly facilitate future mining projects.

Placer-mining.

Placer-mining received an impetus during 1931 owing to the demand for gold, and also many unemployed men, rather than accept charity, prospected the creeks and obtained sufficient returns by "sniping" to maintain themselves. The result of this work was that some apparently old high channels were discovered and a new outlook regarding possible production from Rock creek envisaged.

The history of placer-mining on Rock creek and Boundary creek dates back to 1860–61, when the first gold was found and mined by a Mr. Beame. Extracts from letters written by William G. Cox, Commissioner at Rock Creek, to the Colonial Secretary in 1861 give some data regarding costs and recovery in those days, when all supplies were brought long distances by pack-trains. Some claims produced from $15 to $22.50 per man per day and others about $4 per day. Retail prices for food were reasonable, except the cost of flour, which was 20 cents per pound; potatoes, 22 cents per pound; and tea, $1.25 per pound. During the six months from June to November, 1860, about $83,000 was officially reported as won from the creek. James Copland, of Rock Creek, who mined the creek from 1865 on, reports that the average pay was about $20 per sluice-box, and the largest nuggets found were slightly over an ounce. Only comparatively shallow diggings were worked owing to the fact that pumps and water-wheels, etc., had to be made of wood on the spot, and these primitive tools were generally inadequate when attempt was made to reach the gravels at the bottom of the present creek. Where shafts were sunk the following cross-section was found: First, the present creek-water, which did not penetrate to any great depth, which is a most important point; then recent gravels containing a few boulders, the largest of which is about 2 cubic yards; followed by about 4 feet of slum, 2 to 8 feet of quicksand, from 2 to 6 feet of cemented gravel, and then variable widths of pay-gravel on bed-rock; or a total depth between 35 and 40 feet. From the most reliable accounts good values were found on bed-rock, but the flow of surface water into the workings could not be discharged by the wooden pumps then in use and work was abandoned. One attempt at sinking was made near the mouth of Baker creek (marked Rock creek on new topographical maps), a short distance


Conkle Lake
3½ Miles North
Elev - 3500'
Old England
Victoria
Onowden
M. Claims
Jolly Jack Cr. (N. Fork of Rock)
Road
West Kootenay Power Line
McKinney Road
8 Miles Camp
Rice Cr.
Elev of Creek
2950'
McKinney Cr. (S. Fork of Rock)
To Bridge
Road
To Rock Cr.
MAP
Showing Approximate Locations
of
Placer Leases on Jolly Jack Cr.
and
Rock Creek
Scale
1000'
5000'
To accompany Report of
P.B. Freeland - Resident Engineer
B.C. Bureau of Mines — 1931

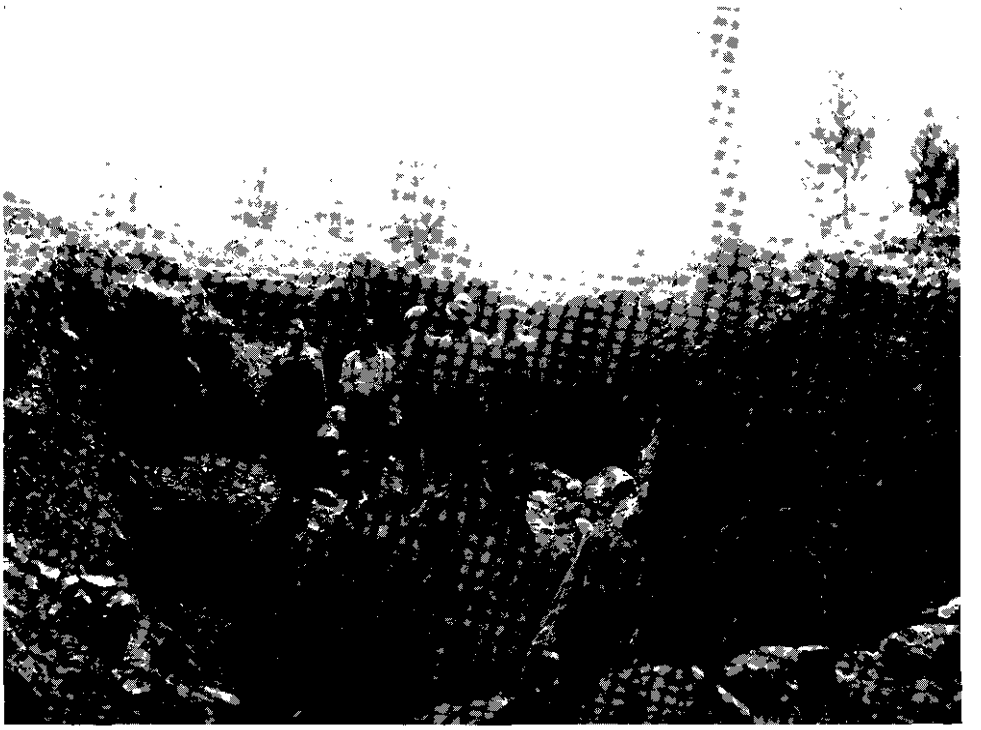
below the old road crossing on the south side of lease No. 58, where there would be no hindrance from water. The shaft was sunk presumably 40 feet, and according to reports a drift was driven some distance towards the creek-bed, and a hole punched up into the water-soaked gravels, which flooded the tunnel and stopped any further work. The elevation of the collar of the shaft probably is about 15 feet above the level of the present creek and the shaft was sunk to an insufficient depth before drifting commenced. The timbering in the shaft is in good repair and sinking could be resorted to without much expense. Along the rim-rock opposite this shaft several thousand dollars' worth of coarse-gold nuggets were mined, so that the area appears to be attractive. A drain driven 300 feet on bed-rock above the canyon on Lot 67 (McKinney creek), a few years ago, produced some attractive coarse gold. Unfortunately the bed-rock dipped down going up-stream and an excess of water prevented further operations. Work done on the west side of Lot 73 and Lot 67 strongly suggests the possibility of an old channel forming a semicircle 800 feet long, commencing on Lot 67 and flowing out where the Pringle tunnel has been driven on Lot 73. Some coarse gold was mined from this old channel bed-rock 20 feet above the present creek in 1916. Lot 58 is staked at the mouth of the canyon, where the valley widens and where the precipitation of gold would naturally occur after being carried through the narrow gorge.

As far as can be seen or found out from the old-time miners, this ground has only been superficially worked and the lower creek strata is virgin. Attempts were made to mine it by driving open drains, in one instance 900 feet long, but water and quicksand drove the miners out. On Lots 74 and 76 rim-rock with good "pay" was found about 150 feet above the present creek. Lots 76, 74, 75, and the north part of 58 are staked on a flat bench about a quarter of a mile wide and about 250 feet higher than the creek. The finding of a high rim-rock and the general topographical features have led to the conclusion that, at one time, an old channel flowed from the north-west corner of Lot 76 to the north-east corner of Lot 58, and that a change of flow was brought about by the damming of the stream by glacial debris. This theory could be demonstrated by prospecting the present creek-slopes along Lots 58, 74, and 75. Similar conditions have been proven on Lot 55 and are likely to exist in certain localities over the entire length of the creek, so that trenching the steep banks can be recommended wherever topographical features are favourable. On Lot 52 work has demonstrated possible old high channels and there seems to be every likelihood that the creek once cut across through Lot 57. On Lot 65, owned by O. Wheeler, Rock Creek, some prospecting has been done at the upper entrance of a canyon where the creek-bed widens out to several hundred feet. This ground appears to be, and from all accounts is, virgin, and offers possibilities to any one financially able to test it.

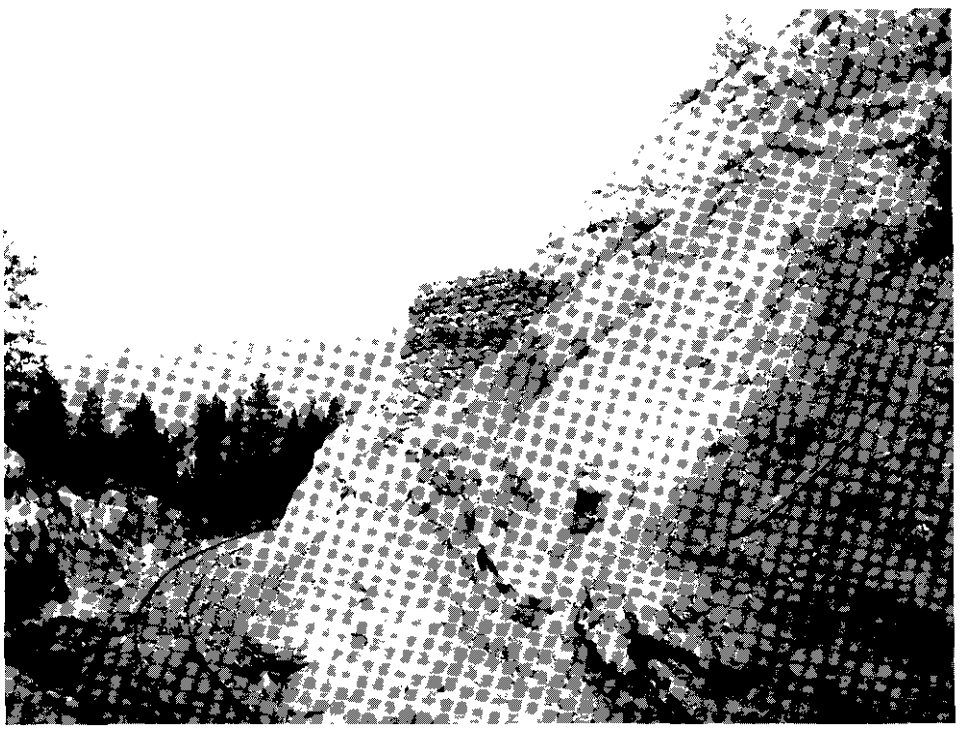
Having carefully examined the creek and extracted all possible information from men who have mined the creek both in the past and present, the conclusion has been arrived at that only the gold from the more easily worked alluvial gravels has been extracted, and there still remains important stretches of the present creek-gravels and also old high buried channels to be explored. The cemented gravel where found on the high channels contains the gold. Official tests have been made and an average of $1.45 a cubic yard was found in the cemented gravel. Nearly all the gold is coarse and rusty in colour. Occasionally lemon-yellow nuggets are found. The average gradient of the creek is 250 feet to the mile. Bed-rock varies, but where seen is gneissic or schistose and offers an excellent natural riffle for gold. The source of the gold is at present uncertain; the opinion of many being that it has been eroded by stream-action from local quartz veins; and of others that glacial action conveyed it from Camp McKinney, where gold quartz exists. The Camp McKinney bullion assayed: Gold, 635 fine; silver, 340; whereas the Rock Creek bullion is: Gold, 856½ fine; silver, 130; so that if the fineness is any criterion the gold is either local or was brought by glaciers from some other source. No quartz veins of commercial value have been found along the drift-covered banks. On White's bar, which was spectacularly rich, according to accounts, the gold was discovered in weathered and disintegrated quartz, which pointed strongly to the fact that a whole section of the vein had been gradually broken down and deposited within a comparatively short distance from its original source.

As will be seen on the map, the creek is particularly well served with roads which have been built at no great distance from either side, and electric power is available from the West Kootenay line crossing the creek.

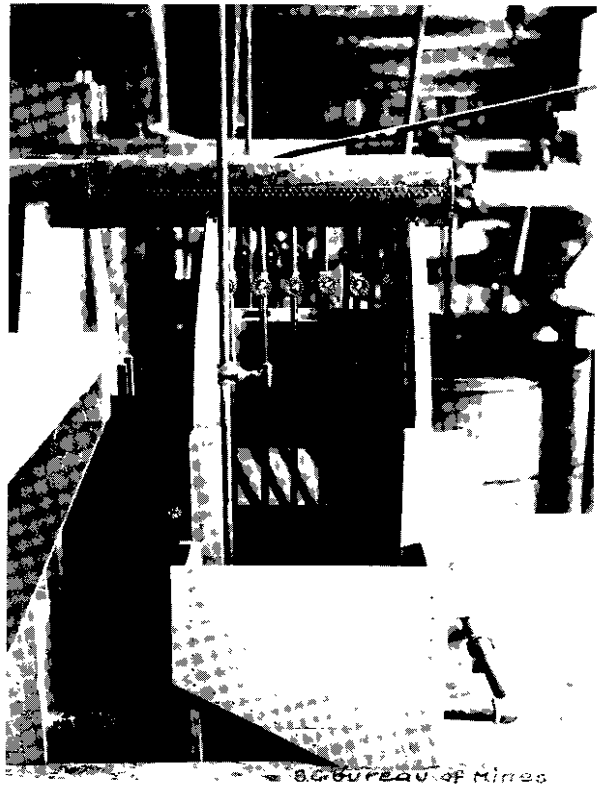
Boundary creek was also mined in 1860 and an unknown quantity of placer gold extracted from its mouth up-stream for about 4½ miles. Above Boundary Falls no values were found,



Golden Zone Mine, Osoyoos Mining Division—Ore in New Open-cut.



Bentonite sacked for Shipment, Princeton.



True Fissure Mill—Sheeler Cell.

United Copper M.C., Bugaboo Creek.

so that the origin of the gold is probably located somewhere below that point. Some rich gold stringers were discovered on the east side of the creek which were too narrow to mine profitably, but which may have been sufficiently numerous before erosion to create a source of supply. The average gold recovered in 1861 amounted to $12.50 per day to the man.

On Cedar creek, which flows into Kettle river from the west side about 12 miles north of Westbridge, placer gold has been mined. Above the first canyon there are extensive old workings on a bench about 6 feet above the present creek, also about 2 miles farther west up-stream. The gold panned along the creek was found to be fine and well rounded, pointing to the fact that it had travelled far. There is a deep depression about half a mile long by 500 feet wide, formed below the first canyon and a short distance west of the road by glacial moraines which have probably formed a catch-basin for any gold-movement. Nothing but superficial work has been done there and bed-rock was not reached. The creek disappears under the moraines and there is no sign of water-flow at its confluence with the Kettle river.

On the Kettle river, in the neighbourhood of the present road crossing and for a few miles south, placer gold was mined in the early days. The origin of most of this gold has been traced to the quartz veins found in the argillites on Monashee mountain. In these veins pockets and segregations of free gold and galena occur, but up to the present no persistent average values have been found. The area is well covered with soil and glacial material and further prospecting is warranted. This year a few men found some attractive values along the river-bank about three-quarters of a mile below the bridge, and there seems to be no doubt that there is a gold-run if it can be located. It is also worthy of attention that there is a resorting of gold-bearing gravel going on at the present time, so that, in spite of the fact that some placer-mining was done thirty years ago, concentration since that time may have created sizable placer deposits.

Jewel (Long) lake, situated about 8 miles north-east of Greenwood, discharges its waters at the present time into Boundary creek. A study of the topography on the north-east end of the lake and the huge gravel moraines deposited there lends strength to the theory that at one time the lake-waters flowed into Pass creek and down into the Granby river. Free gold in quartz veins, which occurs near Jewel lake, does not mean that placer gold will be found in adjoining streams, but the locality offers possibilities, and a thorough testing of the Pass Creek bed-rock and low bench-gravels should be made.

SIMILKAMEEN MINING DIVISION.

Summit Camp, Tulameen.

Silver King Mining Co.

This company's holdings on Treasure mountain, reported upon in the 1930 Annual Report, were again operated during the year by W. B. Dornberg and associates, of Vancouver. The original mill, consisting of a crusher, rolls, sets of jigs, and Wilfley tables, was altered, because it was found that better results could be obtained by flotation. A No. P 4 Pulmac grinding-machine, having a capacity of 5 tons, and flotation-cells to replace the jigs were installed. During preliminary operations satisfactory results were obtained, but it was found later that the facings of the Pulmac machine were too soft to withstand continuous grinding and the wear and tear bent the screens, so that the coarse material passed into the cells, where its specific gravity was too great to permit successful flotation. Harder steel facings for the Pulmac were tried, it is understood, without satisfactory results. It is the intention of the management to install a new fine-grinding machine in 1932 and continue operations. Preliminary tests produced some clean lead concentrates, which were hauled by truck 21 miles to Tulameen and shipped to the Trail smelter.

All the ore milled was mined above No. 2 tunnel and after rough sorting transported to the mill by aerial tram. Future development planned consists of driving an intermediate crosscut to tap the vein between No. 1 and No. 2 tunnels, with an upraise between, which will permit plenty of air-circulation. The exploration of the higher levels of the mine is to be highly recommended, because there is but little doubt that ore-shoots containing a higher percentage of silver-bearing galena will be found there in preference to the lower elevations, most of which have been proven to contain a maximum amount of zinc.

The ore occurs on both sides of the porphyry dyke in No. 2 and No. 3 tunnels. In No. 1, the highest tunnel, only one side of the dyke has been developed, and it is reasonable to suppose that another ore-body will be found on the foot-wall. The width of the dyke in No. 2 tunnel averages about 27 feet, so that a comparatively short crosscut in No. 1 would prove whether or

not similar conditions exist there. Between No. 2 tunnel and the surface there is an approximate difference in elevation of 475 feet, which is mostly virgin ground, and it is within this area that future development is warranted. Work was discontinued during the winter.

Eureka. This group, owned by Andy Jensen and associates, of Tulameen, adjoins the Silver King Mining Company's holdings on Treasure mountain. Similar conditions prevail on each property and work on the *Eureka* has proven the continuance of the ore-body in that direction. In the upper workings there are two veins on each side of the porphyry dyke containing segregations of galena carrying up to 100 oz. in silver per ton and 50 per cent. lead. Most of the development has been done at lower elevations, where a preponderance of zinc was found. Indications of vein-structure were discovered this year beside the road above the cabin, but at the time of examination in August they were undeveloped.

Tulameen Nos. 1, 2, 3, etc. These claims, lying about 4 miles up the Tulameen river from Amberty creek, are owned by A. Chisholm and Joe Diotte, of Tulameen. The properties are situated near the eastern contact of the Coast Range batholith with the sedimentary rocks. Mineralization occurs in the fractures of the unaltered slates and argillites close to the contact of a porphyry dyke and consists mainly of pyrite, with occasional segregations of galena and sphalerite. Development-work consists of numerous open-cuts, trenches, and short tunnels close to the creek, but up to the present time no minable bodies of ore have been located. The area is an interesting one that warrants more prospecting.

The following claims, situated to the north and adjacent to the Tulameen river and mentioned in the Annual Reports for 1928, 1929, and 1930, have been developed by their owners during 1931 with favourable results: The *Lucky Todd*, *Crown*, etc., owned by Dan Vuich, are situated close to Railroad creek; the *Spokane-Motherlode* group on Rabbitt mountain, owned by J. Osborne; and H. Lowe has been prospecting some likely-looking quartz veins close to the Bear Creek road. Most of the mineralization found upon these claims is copper.

General.

Placer gold found in Whipsaw creek in the past has led to a considerable amount of lode-gold prospecting in that vicinity during the past few years. Amongst those claims being prospected are the *Virginia*, owned by W. S. Wilson and associatess, of Princeton; the *S. & M.* group, owned by Sam Spencer, Princeton; and the Copper Basin Mines, Limited, of Vancouver. The latter company shipped a car-load of ore to the Trail smelter, which carried about $5 per ton in gold and silver. The geology of the district, described by C. E. Cairnes, is quite attractive and there are several widely distributed mineralized areas that are worthy of careful investigation. Owing to the low price of copper the *Copper Mountain* mine was not operated by the Granby Consolidated Mining, Smelting, and Power Company.

Coal.

The Princeton coal-basin, as described by Chas. Camsell, of the Geological Survey of Canada,* measures roughly 14 miles long, with a variable width of from 3 to 5½ miles. The Oligocene sedimentary rocks which cover the area contain lignitic coals which have been mined in a small way for many years. Numerous drill-holes bored in the basin have shown coal-seams varying in width from a few inches up to 18 feet. Most of the drilling (*see* Camsell's map) has been done near Princeton and along the Similkameen river to the south; the deepest hole being 1,000 feet and aggregates of clean coal reach 34 feet 5 inches.

At the present time there are four operating companies in No. 4 District—the Tulameen Coal Mines, Limited; Pleasant Valley Coal Mining Company, Limited; the Blue Flame Collieries, Limited; and the Coalmont Collieries, Limited—having a total output in 1931 of 182,966 long tons, which is an increase over 1930.

The first operating company in this field was the Vermilion Forks Mining and Development Company (later Princeton Coal and Land Company), which mined coal on the east bank of the Similkameen river close to Princeton. Of late years this company ceased active operations, and its holdings, which are large and embrace some of the most likely coal-bearing areas, are held by the Princeton Properties, Limited, with P. W. Gregory, Princeton, as agent. No coal-mining is being done by the latter company, and the different lots owned, including those adjacent to the Blue Flame Collieries, are being offered for sale at attractive prices.

* Preliminary Report on Part of the Similkameen District, G.S.C., 1907.

A recent discovery of a 14-foot seam of coal was made on Bromley creek by R. Haigh, of Princeton, on Lot 385, a short distance west of what is known as Sharp's drill-hole (*see* Camsell's map), in a tunnel about 90 feet long. The seam dips about 37° east and strikes N. 26° W. (mag.) towards the drill-hole. According to Camsell, this hole is 863 feet deep, and in that distance seventeen seams of coal were struck, having an aggregate thickness of 50½ feet, the thickest of which was 9 feet. No log of this drill-hole is at hand at present, but the above discovery is important and an added attraction to the field. Other parallel outcrops have been found as well as surface indications along the strike, so that the continuity of the seam has been proven for a long distance. On the south side of the map-area several other workable seams have been discovered, but not developed to any great extent owing to insufficient capital backing.

Most of the Princeton coal is being shipped to Vancouver, where an apparently ready market is found. The following prices are quoted f.o.b. at the railway, plus switching charges of about $1.50 a car-load. The Tulameen Coal Company and the Pleasant Valley Company are close to the railway-track, whilst the Blue Flame coal has to be trucked 9 miles, hence the extra cost.

Size.	Tulameen Coal Co.	Blue Flame Co.	Pleasant Valley Co.
	Per Ton.	Per Ton.	Per Ton.
Lump	$5.00	$5.50	$4.75
Egg	4.50	5.00	4.25
Nut	3.50	4.00	.....
Pea	2.00	2.60	2.00
Slack	.....	2.00	1.25

It is generally understood that the above mines were working during the winter season nearly up to capacity, so that it was impossible to supply a much larger market. In this respect it may be mentioned that, within a radius of about 250 miles of Princeton by railway, over 20,000 tons of coal was shipped from Alberta for domestic and other uses, in spite of the fact that railway freights were higher owing to the longer haul and the total cost per ton to the consumer, larger. On consulting some of the coal-dealers in the district, the consensus of their experience was that the public demand was very variable and some people liked one type of coal and others another, at the expense of both the operator and the dealer; the extra cost being paid for by the public. Complaints were also received that there was too great a variance in car-load products.

With a comparatively large undeveloped coalfield at Princeton and a possible increased market within an easy railway radius, there seems to be no reason why a much larger output should not be reached, providing the public demand is satisfied to some extent and the cost per ton, which is the governing factor, kept at a figure low enough to compete favourably with outside points. To increase production in the Princeton field it will probably be necessary to develop some of the other seams which have been discovered, especially those close to existing railway transportation.

The Coalmont field, lying about 14 miles west of Princeton, which supplies steam-coal for the railways, produces an excellent product that has been successfully used in furnaces and automatic stokers. The latter, which have been tried and proved to give a steadier heat and to be more economical by between 30 and 45 per cent. than hand-firing of coal, offer an increased market for this type of coal, providing the costs can be kept within a favourable competing radius. The Blue Flame coal has also been giving satisfaction in the stokers.

Placer-mining.

On the Tulameen and Similkameen rivers many men, during the hard times, were able to make a living by "sniping" for gold and platinum in the shallow gravels. It is impossible to even estimate the production from this source, because much of the gold was shipped across the border into the United States, where a premium was obtained. No spectacular finds were reported, but the fact that men ignorant of placer-mining were able to save sufficient values to support themselves is a favourable feature. A considerable amount of placer prospecting was done on 5-Mile and Siwash creeks, but only flake-gold was found. In the latter creek, many years ago, some coarse gold was mined from the benches and on shallow bed-rock, but apparently no serious attempts have been made to sluice the creek-bottom gravels.

John Guest Leases.—Most of the leases held by John Guest on the Tulameen and Similkameen rivers and controlled by the Lodestone Placer Mining Company, Limited, of Vancouver, have lapsed for non-payment of dues. These holdings included twelve leases from Tulameen village up and down the river, fifteen leases about 2 miles below Coalmont, and eighteen river leases from Princeton down the Similkameen river. R. A. Brooke, National Resources Investigator, 3560 Dundas Street, Vancouver, reported very extensively upon these holdings in 1931.

In regard to the operations of John Guest, it may be said that during the past few years attempts were made to mine the bench-gravels below Coalmont by means of an electrically driven drag-line bucket shovel (*see* 1929 Annual Report). Since then nothing has been done on this property and the shovel and equipment remain on the ground. On the formerly owned bench leases above Tulameen a log bridge was built across the river and the foundations for machinery, grizzly, and sluice-boxes constructed. Owing to lack of capital this operation never materialized. On the river leases below Princeton nothing was done besides prospecting the surface gravels, where attractive colours were panned.

Slate Creek Consolidated Placers.

This company, under the management of Norman McCormick, of Tulameen, continued driving the "Bluff" tunnel on the east side of the mouth of Slate creek until the late summer, when work was stopped. According to the management, the existence of a channel was proved and a shaft will be sunk 600 feet east and south of the former working during 1932. The tunnel driven over 2,000 feet under the bed of Slate creek was lost, owing, it is stated, to water-soaked gravels filling the workings. No drilling has ever been done to ascertain the depth of bed-rock.

Champion Creek Placers, Ltd.

This private company was incorporated in 1931, with head offices at 744 Hastings Street West, Vancouver. Attempts were made to ground-sluice the gravels lying on what appears to be an old "cut-off" channel. Due to an insufficient head of water at that season of the year, the attempt was abandoned temporarily. A frame camp was built, including kitchen and sleeping-quarters, and, according to the management, active operations will commence in 1932 when high water is available. Pipes were laid from the dam above and preparations made for hydraulicking the gravels on the south side of the Tulameen river near the mouth of Champion creek, where a possible old channel might exist. Preliminary work, which produced some values in gold and platinum, consists of open-cuts, trenches, and ground-sluiced pits. The area warrants further prospecting below the confluence of Champion creek and the Tulameen river.

Granite Creek Mining & Development Co.

The installation of a suction-pump, compressor, engine, and sluice-boxes on a pontoon was completed on the company's leases at the junction of the Tulameen river and Granite creek by the Bedrock Mining Company, of Vancouver, operating a sub-lease. The operation necessitated the employment of divers to guide the end of the suction-nozzle under water. Good results were obtained, as far as the removal of the loose gravel was concerned, but as soon as boulders and cemented gravel were encountered the operation was considerably retarded and very little headway could be made. Only light colours of gold were found in the top gravels.

Several other operations took place up and down the river from Tulameen village and some attractive prospects discovered, especially on the *Sootheran* lease. The *Roney* lease, which is located on a high bench about 4 miles below Coalmont, has produced a quantity of gold and platinum in the past. In spite of this there still remains a large section of ground on the east side that is unworked and appears to be attractive, providing sufficient capital is available to test the ground, find out the depth and lay of bed-rock, and plan a suitable means of working the gravels economically. The Canadian Pacific Railway skirts the edge of the leases next to the Tulameen river. On Granite creek the *Andrew Gordon* lease, above the forks of the stream, and several other small operations were worked by small gangs of men.

A. S. Black leases cover part of the ground originally owned by National Holdings, Limited, of Vancouver, about 4 miles west of Princeton, on the Tulameen river. Several men prospected the ground under a royalty arrangement with the owner, but only a small amount of gold and platinum was saved, it is reported.

Bentonite.

Several cars of bentonite were shipped to the B.C. Refractories, Limited, Vancouver, from the deposits which occur associated with the coal-seams near Princeton. This material, which has extraordinary absorption powers, is used as a filler, etc., for different manufacturing

purposes, and, it is reported, was the only producer of its kind in Canada during the year. This important mineral was reported upon in 1930 by Hugh S. Spence, of the Mines Branch, Ottawa.

OSOYOOS MINING DIVISION.

Hedley Gold Mining Co.

This company, after many years of successful operation of its *Nickel Plate* mine at Hedley, decided to close down early in the year. Several reasons were given for this step, the chief of which was their inability to discover a sufficient amount of pay-ore to warrant continuance, and although there appears to be a likelihood of a comparatively large tonnage of $3 to $5 gold ore, this has not been proven, but only indicated.

It has been known for many years that the *Mascot Fraction*, which is owned by Dunc. Woods, of Hedley, and which is located within the zone of the *Nickel Plate* mineral-deposits, contains some ore. The exact tonnage has not been blocked out, but the Hedley Gold Mining Company mined a certain amount of ore from each side of this fraction. Terms agreeable to both the company and the owner of the *Mascot* could not be arranged, so that the ore in the fraction still remains intact. The size of the *Mascot Fraction* is 17.2 acres, but due to the lenticular-shaped ore-bodies found in the mine it is impossible to state whether or not the ore found on the boundaries of the claim persists in width throughout the area.

Golden Zone.

This group, owned by a syndicate of Princeton men under the management of A. V. Kiper, of Princeton, was reported upon in 1930 and mentioned in Bulletin No. 1, 1932. Development-work in 1932 consisted of driving the lower tunnel ahead for a total distance of 115 feet, stripping and cleaning out old cuts and putting in new open-cuts on the strike of the lead. As mentioned in former Annual Reports, the quartz vein is more or less dissipated on the contact, and in the volcanic tuffs and sediments the ore-bodies are enlarged and enriched by the addition of heavy pyrite and arsenopyrite carrying gold and silver. Advice from the management states that during the winter of 1931 seven men were employed cleaning out the main shaft, which had been unwatered to the 95-foot level. This old shaft is, according to reports, about 100 feet deep, with drifts and crosscuts driven on and across the mineral-zone. Samples taken across the lead in one of the recent cuts by the management assayed $28 in gold and $3.42 in silver per ton. Owing to the heavy overburden some difficulty has been experienced in tracing the ore-zone where it enters the sedimentary and volcanic rocks. This prospect is an interesting one that appears to warrant capital for further investigation. Samples taken are as follows:—

No. 1. Across 3 feet from foot-wall of vein, new open-cut: Gold, 0.46 oz. per ton; silver, 3.7 oz. per ton.

No. 2. Across 9 feet from No. 1 sample to hanging-wall: Gold, 0.26 oz. per ton; silver, 3 oz. per ton.

No. 3. Across 5-foot quartz vein in 6-foot shaft south of above cut: Gold, 0.06 oz. per ton; silver, 1 oz. per ton.

No. 4. Picked sample of quartz and pyrite from face of tunnel: Gold, 0.04 oz. per ton; silver, 4.8 oz. per ton.

No. 5. Picked sample of heavy pyrite from 40-foot shaft: Gold, 0.04 oz. per ton; silver, 1 oz. per ton.

No. 6. Dense pyrite from new open-cut: Gold, 0.64 oz. per ton; silver, 2.3 oz. per ton.

No. 7. Concentrates from old mill-bin: Gold, 1.18 oz. per ton; silver, 3.7 oz. per ton.

No. 8. Tailings from old mill-dump: Gold, 0.13 oz. per ton; silver, 1.4 oz. per ton.

Sterling Gold Mines, Ltd.

This company, with headquarters at 612 Dominion Bank Building, Vancouver, optioned nine claims on Sterling creek, about 4 miles west of Hedley, from the owners, Dan McKinnon and associates. Most of the development was done upon *Patsy No. 2* claim, which is located about 1½ miles up Sterling creek from its junction with the Similkameen river. Numerous open-cuts, short tunnels, and shallow pits were dug on two quartz veins varying from a fracture to about 4 feet in width on the surface. A crosscut tunnel was also run for 60 feet in an endeavour to tap the upper vein, but without success up to date. The veins strike N. 25° W. (mag.) and dip about 38° into the hill to the east. The outcrops, which have been traced for several hundred feet along the east slope of Sterling creek, differ in elevation by about 135 feet (barometric). The lower vein where developed pinches to about 6 inches in width. The upper ore has not been developed

beyond 8 feet in depth. The formations in which the ore occurs are chiefly highly altered sediments and brecciated volcanic tuffs. A short distance up hill and to the east, also along the base of the hill, the diorite intrusive outcrops. The ore-minerals are pyrite and arsenopyrite. Samples taken vary from $2 to $10 in gold per ton over a width of 8 inches.

During the winter two men have been employed driving a crosscut from the lower tunnel on the old *Patsy* claim, situated on the south bank of the Similkameen river a short distance below the mouth of Sterling creek (*see* 1928 Annual Report). According to Dan McKinnon, the owner, two mineralized fractures have been crossed, striking parallel to the main vein and carrying values in gold of $5.60 and $11.60 in gold per ton. According to a survey made the main vein lies still farther west. It appears probable that several veins, striking at right angles to the diorite which outcrops to the south of the workings, have been formed in the argillites. The Sterling Gold Mines, Limited, supplied food, powder, and coal for this development.

Some exploration-work is being done, it is understood, on the old *Pollock* group, situated on Henry creek. In Chas. Camsell's Memoir No. 2 a description of the vein system, geology, and development will be found.

Nelson. This group, reported upon in several of the past Annual Reports, is now controlled by the estate of James McNulty (deceased). During the year three Hedley residents did assessment-work on the *Nelson* claim and several old open-cuts were cleaned out and new cuts and trenches excavated. The continuance of the ore-zone was found down the hill towards the foot of the basin, and from 4 to 6 feet of gangue, mineralized with pyrite, pyrrhotite, and arsenopyrite, uncovered. Samples assayed from $2 to $5 per ton across these widths. The country-rocks in the vicinity are sedimentaries and brecciated volcanics intruded by gabbro and diorite dykes. The mineral occurs in beds and lenticular bodies in the sediments, close to the igneous contact, and resembles the *Nickel Plate* type of ore-deposition. In the shaft above, values up to $40 per ton in gold were found. More exploration, with sufficient capital to diamond-drill, appears to be warranted in this area.

Lookout and Mountain View. These claims, owned by E. Mills and associates, of Keremeos, and located about 1¾ miles by trail up Tenas creek from its junction with the old *Nickel Plate* road, were mentioned in the 1923 Annual Report. Since that time a tunnel has been run at an elevation of 44 feet below the shaft-collar, a total distance of 109 feet, which places the drift-face about 25 feet beyond the vertical downward extension of the shaft. Only stringers and displaced pieces of quartz were found in the drift until a fault was struck about 12 feet from the face, where an 8-inch quartz vein in place was uncovered. Most of the ore mined was oxidized, except occasional segregations of pyrite and minute columnar crystals of arsenopyrite. Free gold was found in the shaft where the vein had faulted. The sedimentaries, mostly argillites, in which the vein occurs, have been badly crushed and displaced where the development-work was done. A log cabin which will accommodate about four men was built about half a mile below the workings. Water is scarce in the immediate vicinity of the camp.

Oro Fino Mountain Section.

This section, which lies approximately 4 miles due east of Olalla, and which has been mentioned in the 1929 and 1930 Annual Reports under the headings of "*Oro Fino*," "*Independence*," and "B.E. Mining Company," and in Bulletin No. 1, 1932, has received a good deal of attention of late, due to the search for gold-producing properties. The claim-staking in the area dates back to 1898, when the Fairview camp was being developed, and, as in the case of the latter, some spectacular finds of free gold, generally associated with galena, were found in the quartz-outcrops. History relates that the owners of claims and others have been insufficiently provided with capital to explore its possibilities. A few years ago one of the larger companies diamond-drilled what is known as the B.E. Mining Company's claims, which are owned by Al. Piper and associates, of Oliver. The results of this work, it is understood, demonstrated that the vein system, although variable in width, persisted to some depth below the surface and that values were not constant. A study of the surface conditions portrays the fact that the segregations of mineral, including pyrite, galena, and often free gold, occur only in favourable structural areas or where faults and slips have been the direct cause of enrichment. This being the case, it can be readily seen that a diamond-drill could easily hit or miss the higher-

grade segregations and is only useful in this area for determining the vein continuity. As far as the future possibilities are concerned, sufficient capital is necessary to ascertain whether or not there is a sufficiently large tonnage of both high- and low-grade ore that contains average values which will permit profitable operations. This can be done by drifting or sinking upon the vein and sampling every 5 feet or less.

Short tunnels and shafts have been excavated on the *Oro Fino*, *Independence*, and the *B. & E.* groups and some very rich pockets and widely separated stringers of free-gold ore in quartz discovered. It is understood that E. A. Somerville, of Vancouver, controls the *Oro Fino* and *Independence* claims, and work done by him during the past two seasons uncovered a limited section of very rich gold ore in an open-cut and tunnel on the *Independence*.

The Fairview camp has been mentioned in Bulletin No. 1, 1932, and includes the *Morning Star*, *Stemwinder*, *Black Diamond*, and other claims.

Dividend and Lakeview.

These claims, mentioned in the 1927 and 1930 Annual Reports, are still under lease from the Dividend-Lakeview Consolidated Mining Company to W. B. Reilly, Chas. Antonson, and Dave Lonie, of Oroville, Wash. It is understood that a sub-lease has been given to M. F. Watt, 414 Pender Street West, Vancouver. During the year Vancouver interests other than M. F. Watt completed a geological survey, mine examination, and later an electrical prospecting survey, the results of which are unknown. Reports upon these groups of claims were made by the Provincial Mineralogist in 1897–98, also in 1913. According to these reports, sixteen car-loads of ore were shipped, containing values ranging from $15.59 to $31.73 per ton in gold. The copper content was negligible.

Past development done on the *Dividend* claim is as follows: Numerous open-cuts, shallow shafts, and short tunnels have been driven upon oxidized mineral outcrops, having no apparent surface connection, over an area about 400 feet square. In the main workings, ore has been stoped out in what is termed the "glory-hole" across widths of, roughly, 35 by 35 feet from the surface down to the No. 1 tunnel, which is driven approximately 35 feet below. Presumably the ore shipped in the early days came from this stope. In No. 1 tunnel (upper), which has been driven for 100 feet to the east and for 55 feet to the west of the collar of the shaft, some ore was found. From a point 20 feet east of the centre of the shaft to the east face, a distance of about 85 feet, the ore averages about $6 in gold per ton. Isolated sections assayed $15 and $18 per ton. An intermediate drift, not examined, is said to be about 50 feet below and driven for some distance both ways under No. 1. This tunnel followed a narrow high-grade ore stringer from which samples up to $100 per ton have been taken. In No. 2 or the lowest tunnel, which has been driven for 375 feet in a south-easterly direction, with several branches to the north-east, east, and south-west, one of which connects with the shaft, no mineralization was seen except in the drag of a well-defined fault, upon which 100 feet of tunnel was run. The fault strikes slightly east of south and is nearly perpendicular. Any projection of the ore-body downward vertically or to the north-west for 150 feet would probably have been discovered in this tunnel, or have been intercepted in the shaft or upraise, should it have dipped to the north. Of this there apparently is no sign, so that if there is any more ore in this area it will probably lie to the east or in the direction of No. 1 tunnel-face. About 60 feet south-west of the "glory-hole" on the surface there is an open-cut about 25 feet long, in which is exposed vein-matter varying from 3 to 5 feet in width, containing pyrite and arsenopyrite, etc., which assays across these widths from $6 to $18 per ton. The connection between this outcrop and the main ore-body, if any, has not been proven. Other open-cuts driven in narrow heavy gossans, containing pyrite and magnetite carrying low values and having no apparent connection, are dotted about in this area. The ore-deposit is of the contact-metamorphic type, formed in the sedimentary and volcanic rocks, which occur in large remnants in this section. Judging by the shape of the mineral-zones mined and other indications, it seems probable that the ore-bearing solutions deposited their burden only in certain structurally favourable areas, which in most cases, where developed, are small and lenticular in shape.

The assertion has been made that the dumps contain ore, and grab samples taken from and near the surface of the upper one assay between $8 and $10 per ton, and from the lower dump from $2.50 to $4.40 per ton. In view of the fact that many car-loads of ore have been shipped from the upper tunnel stopes, and that both the upper and lower tunnels have been driven chiefly in waste rock, it seems unsafe to estimate any large tonnage even of a milling-grade ore from this source. The projection of No. 1 tunnel south-west for about 40 feet will probably prove or

disprove the existence of the downward extension of the gold-bearing arsenopyrite found in the surface cut. The extension of the intermediate tunnel east may also develop some ore.

General.

The Tiger Gold Group Syndicate's holdings north of the old *Horn Silver* mine, reported upon in the 1928 Annual Report, have been acquired by the Mak Siccar Gold Mines, Limited, with registered offices at 425 Howe Street, Vancouver, and A. T. Miller as manager. The claims were not examined this year.

The general geology close to Olalla was mentioned in Bulletin No. 1, 1932. Nothing was done upon the *Golconda* during the year, but some claims lying to the north were prospected by Dan McEachern, owner. On the *Sunrise* claim, owned by W. C. McDougall, of Olalla, a strong quartz vein has been developed by short tunnels, open-cuts, and shafts. The general run of the quartz is low grade, in which occasional segregations of pyrite and galena occur containing good values in gold. The vein follows a fine-grained porphyry dyke in which minute crystals of pyrite can be seen. Only traces of gold and silver could be found in the quartz and dyke-rock. The whole of this area has been surveyed by H. S. Bostock, of the Geological Survey of Canada, and his report and maps will be a great assistance to the prospectors when published.

White Lake Basin.

This coal-basin was referred to by Chas. Camsell, of the Geological Survey of Canada, in his 1912 report, and also in the Annual Reports for 1920, 1922, and 1926. Since 1926 very little work has been done on the properties and the tunnels, plant, etc., allowed to fall into disrepair. The last owners of the property were the Southern Okanagan Collieries, Limited, with head offices at Penticton, under the direction of R. Hookham, of Summerland. Whether or not this company still controls the coal leases is not known.

The area of the basin is estimated at 1,280 acres, having a maximum thickness of about 2,000 feet of sandstone and shales, outcropping along the rim. Whether this is a true width is not definitely known, because faulting may have occurred which might cause a superimposition of the beds. Tremendous igneous activity has taken place around the basin, and besides the main batholithic intrusion there are many varieties of later porphyry dykes, and volcanic rocks have been strewn over the entire section. There seems to be no doubt but that the heat generated from the batholith has affected the coal-seams to a great extent, and instead of a lignite coal, similar to that found in the Tertiary beds at Princeton, and to which age the White Lake coals have been assigned, a product lower in volatile and combustible matter and higher in fixed carbon is found. The high ash content is probably due to some extent to surface contamination and cleaner coal will be found at depth. An analysis of four samples follows:—

Description.	No. 1.	No. 2.	No. 3.	No. 4.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Moisture	6.1	8.6	8.0	12.5
V.C.M.	23.5	27.5	21.6	18.6
Fixed carbon	57.3	52.8	41.3	55.9
Ash	13.1	11.0	29.1	13.0
Width of sample	14″	24″	40″	30″

Since the development of these seams wider outcrops of coal have been found in other parts of the basin; also the Canadian Pacific Railway has built a connecting-link between Penticton and Oliver, so that the distance to rail transportation has been considerably reduced. If the field develops an aerial tram could be constructed 2 miles long across country to the railway.

A great deal more development is required to prove the existence at depth of workable coal-seams in this basin, but should this prove satisfactory a ready market should be found in the Okanagan valley, where many thousands of tons of Alberta coal are consumed yearly. Satisfactory trials of this coal, it is understood, have been made by the railways, and consumption from this source, as well as from automatic stokers, which are giving satisfactory results in a reduction of heating expense by between 30 and 40 per cent., will also add materially to the future possibilities. An investigation of this field is recommended.

EASTERN MINERAL SURVEY DISTRICT (No. 5).

Report by B. T. O'Grady, Resident Mining Engineer, and A. M. Richmond, Assistant Resident Engineer (Headquarters, Nelson).

(Reports marked * are by A. M. Richmond.)

INTRODUCTION.

The general geographical, geological, and topographical and other features of this district have been described in previous Annual Reports. The reader is also referred to Bulletin No. 1, 1931, "Placer-mining in British Columbia," and Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia," as detailed information regarding gold properties contained in these publications is not repeated in this Annual Report. In 1932 Trout Lake Mining Division was absorbed into Lardeau Mining Division.

General Summary.

The continued abnormally low metal prices have resulted in the successive shutting-down of all independent company operators of silver-lead-zinc mines, and at the time of writing the base-metal production of District No. 5 is confined to that made by the *Sullivan* mine of the Consolidated Mining and Smelting Company at Kimberley. Although the bulk of the district output has been for many years supplied by this mine, independent shippers of the Slocan and Ainsworth Mining Divisions, and latterly the *Monarch* mine near Field, formerly contributed an important production in the aggregate. Mining in the two camps mentioned has gradually declined, so that at the present time the only operations are small ones by leasers. Silver prices are an important factor in profitable production in these areas and operators with ore reserves are marking time until at least silver and lead prices improve. Gold-mining activities were largely concentrated in the Nelson Mining Division, and near Rossland leasers were busy on several small high-grade properties on O.K. mountain. The remaining lode-gold activities, of minor extent, occurred at widely separated points in the Fort Steele, Slocan City, Ainsworth, Arrow Lake, Revelstoke, and Lardeau Mining Divisions.

The very gratifying demand for the fertilizers produced at the Warfield plant by the Consolidated Mining and Smelting Company, referred to under Trail Creek Mining Division, assures the ultimate success of this great undertaking at the psychological time of difficulty in the base-metal industry. The faith of this company in the future is clearly evidenced by the successive additions being made to the hydro-electric plants of the West Kootenay Power and Light Company, the latest of which, the Corra Linn plant on the Kootenay river, is nearing completion.

Hydro-electric Development.

Largely in connection with the fertilizer undertaking, the development of the Corra Linn power project by the West Kootenay Power and Light Company, the subsidiary of the Consolidated Mining and Smelting Company, has been energetically proceeded with during the period under review, and will be brought in early in 1932, thereby increasing the power company's output by an additional 57,000 horse-power.

Geological Survey Work.

In the Salmo district the work done last summer by J. F. Walker completed the mapping and examination of mineral occurrences in an area of about 400 square miles, being the rectangular space bounded by latitudes 49° to 49° 15′ and longitudes 117° to 117° 30′. The geological and topographical map, on the scale of 1 inch to 1 mile, and accompanying Memoir are in the course of preparation. Near Cranbrook, in the East Kootenay, C. S. Evans started the mapping of a quadrangle between longitudes 115° 20′ and 116° and latitudes 49° 20′ and 49° 45′. He was taken ill during the summer, however, and the work was abandoned for the season.

PRODUCTION.

Mine or Group.	Tonnage.	Character of Ore.
Ainsworth Mining Division—		
Davenport or Flint	9	Silver, lead, zinc.
Little Daisy	3	Gold.
Fort Steele Mining Division—		
Sullivan	1,621,718	Silver, lead, zinc.
Nelson Mining Division—		
Catherine	20	Gold, silver, lead, zinc.
Clubine	24	Gold, silver.
Euphrates	47	Gold, silver.
Gold King	2	Gold, silver.
Golden Age	1	Gold, silver.
Perrier	152	Gold, silver, lead, zinc.
Reno	11,944	Gold, silver, lead, zinc.
Second Relief	465	Gold, silver.
Ymir-Wilcox	500	Gold, silver, lead, zinc.
Slocan Mining Division—		
Grey Copper	2	Silver, gold, lead, zinc.
Ivanhoe	14	Silver, lead, zinc.
Leadsmith	8	Silver, lead, zinc.
Ruth-Hope	194	Silver, gold, lead, zinc.
Silversmith	2,376	Silver, gold, lead, zinc.
Standard	18	Silver, gold, lead, zinc.
Trail Creek Mining Division—		
I.X.L.	22	Gold, silver.
Midnight	90	Gold, silver.
Snowdrop	1	Gold, silver.
Total tonnage	1,637,610	

GOLDEN MINING DIVISION.

Monarch. At this mine, owned by the Base Metals Mining Corporation, Limited, near Field, mining operations were carried on during the early part of 1931 and included the continuation of production drifts and raises on the east and west *Monarch* ore-bodies. Later, operations ceased and no production was made during the year. Past production figures from the *Monarch* are as follows:—

Up to and including.	Tons.	Silver.	Lead.	Zinc.
		Oz.	Lb.	Lb.
1926	42,246	64,427	8,977,319	228,000
1929	1,730	1,419	396,231	.....
1930	75,054	61,217	12,084,062	11,180,379

The 1929 and 1930 figures cover the period when the 300-ton mill of the above company was operated. Given favourable metal-market conditions, indicated reserves are believed to be sufficient to operate the mill at its present capacity for about four or five years. Ore-reserve figures would, however, vary considerably in proportion to the value placed on the important zinc content of some of the deposits. Contrary to rumoured anticipation in regard to future resumption of operations, it is not supposed that any expansion of the present mill capacity would be seriously considered until warranted by the definite results of further exploration.

Witwatersrand Syndicate, Ltd.—At the silver-lead-zinc prospect of this syndicate, on the North fork of McMurdo creek, development-work has been carried on by G. W. Edwards, of Golden, with a crew of sixteen men. References to the property are contained in the Annual Reports for 1929 and 1930.

Independent Copper. The claims comprising this group, owned by H. W. Conover and associates, of Castledale, are located 6 miles by pack-trail from the 19-Mile camp on the Bugaboo Creek road. The elevation of the camp buildings is about 7,400 feet or approximately 2,750 feet higher than the road at 19-Mile. The rocks of

the area consist of metamorphosed schistose sediments which have been classified as members of the Windermere series of late pre-Cambrian age. These rocks have been intruded in places by greenstone dykes which have been altered to chlorite-schists. They are also attributed to the pre-Cambrian. In one instance the fracture along which the intrusive found its way has also been the channel followed by the younger mineralizing solutions which have given rise to a vein along the side of the dyke. The old superficial workings are scattered over a considerable area of gently sloping, open ground above timber-line. The principal group of workings are situated on the edge of a glacial basin at an elevation of about 8,185 feet (lower tunnel). These workings consist of a large surface excavation and two tunnels about 40 feet apart vertically which develop a vein 12 feet wide. The upper one, very short, is nearly filled up with broken rock. The lower tunnel, 125 feet long, is run as a diagonal crosscut for the first 70 feet and continues as a drift for 55 feet under the ore-zone mined in the short tunnel and surface excavation above.

The vein, consisting of disseminated iron and copper sulphides, and their oxidation products, in a siliceous gangue, strikes north-westerly and south-easterly. The country-rocks here are slates and altered greenstone dyke, the mineralization apparently following the direction of fracturing caused by the intrusive. The dip of the vein approximates the vertical.

From the surface excavation several car-loads of sorted ore, largely consisting of chalcopyrite with a small amount of quartz, are reported to have been shipped about the year 1915, when the group was known as the *Copper Butte*. A sample taken across 8 feet on the eastern side of the showing remaining above the upper tunnel assayed: Gold, 0.03 oz. per ton; silver, 1.6 oz. per ton; copper, 1.43 per cent. The short upper tunnel could not be inspected to advantage owing to caving. Some copper mineralization is apparent along the walls of the lower tunnel-drift, but could not be fairly sampled, and some crosscutting would be necessary on this level to determine the width and grade of mineralization at this horizon. A sample of ore selected from the dump derived from these workings assayed: Gold, 0.03 oz. per ton; silver, 1.6 oz. per ton; copper, 17.21 per cent. Further development would be necessary to prove the continuity of the deposit, the ground below it to the north-west being covered with deep drift. The vein can be seen to continue towards the south-east in bluffs, not readily accessible, just below the summit of the ridge.

The above-described workings are about a mile away from the camp occupied by the writer during his visit. At a lower elevation and about half a mile from the camp there are some scattered superficial workings, including a short crosscut tunnel and a shallow shaft. These workings develop lenses of quartz up to 8 feet wide, mineralized with disseminated copper and iron sulphides. These lenses apparently conform in strike and dip with the enclosing schists, which have an easterly-westerly strike. In some showings the mineralization is uniformly distributed and would constitute mill-feed if sufficient tonnage of similar material could be developed. These occurrences have no apparent connection with the first-described deposit about half a mile away.

Minor activities in the Golden Division include prospecting-work carried on by N. T. and T. Edwards and associates, of Revelstoke, on their *Quartz Creek* copper prospect described in the Annual Report for 1930.

WINDERMERE MINING DIVISION.

No lode-mining activity occurred in this Division during 1931 other than prospecting and assessment work. Twenty placer creek leases on Dutch creek have been applied for by J. L. McKay, of Athalmere. Extensive work is planned to be done in the spring. Considerable hand-work was done during the summer.

FORT STEELE MINING DIVISION.

The history of mining development in this important Division is contained in the past Annual Reports of this Department, of which that for 1930 summarizes geological information available in publications of the Geological Survey of Canada.

Sullivan. This mine and 6,000-ton concentrator of the Consolidated Mining and Smelting Company at Kimberley have been dealt with exhaustively in the technical press, to which the latest contribution is contained in *Mining and Engineering World* in a series of articles by G. J. Young, associate editor. The April article summarizes

the geological and physical characteristics of the deposit, character of the mineralization, mining methods, and development. The milling operations are dealt with in detail in the May number. The unprecedented low metal prices have been largely offset in the case of this great operation by the large decrease in mining and milling costs brought about by improvements in operating technique and co-operative effort of the force in general. The mine has been responsible for the great bulk of the silver, lead, and zinc produced in District No. 5 during 1931. The tonnage milled during this period was 1,612,213 tons, as compared with 1,910,949 tons in 1930, the decrease being due to the zinc and lead cartels on production. The daily tonnage was maintained at about 5,500 tons, but fewer days were worked. Development-work carried out includes 250 feet of sinking in the 3-compartment winze sunk on a 30° angle to open up the ore-body below the 3,900-foot level.

At the coarse-crushing plant a Lynch dust-control system was installed, which has greatly improved working conditions, and the new waste-crushing unit for supplying crushed rock to the Canadian Pacific Railway was completed. A tex-rope drive was installed on the 36- by 42-inch Buchanan crusher. Additions to underground machinery include a 10-ton Granby-type mine-car with double trucks and two electric steel-sharpening furnaces. No new construction was undertaken at the concentrator.

Lead. At this group, situated 12 miles by trail from Torrent Station on the Kootenay Central branch of the Canadian Pacific Railway, development-work was continued by Blake Bros., of Fort Steele. Since the property was described in the Annual Report for 1928 the incline shaft has been deepened. This work was subsequently discontinued owing to difficulty with water and a crosscut tunnel has been driven some 70 feet below and 200 feet to the north-west of the shaft. A good showing of milling-grade silver-lead-zinc ore is reported to have been encountered in this new tunnel 80 feet in from the portal.

Finley-Leask. This group, comprising eight claims owned by R. H. Finley and J. Leask, of Cranbrook, adjoins the highway and railway 3 miles south-westerly from Aldridge Siding on the Crowsnest branch of the Canadian Pacific Railway. The country-rocks of the deposits are the rusty-weathering argillaceous quartzite and quartzite of the Aldridge formation, which strike northerly and dip to the east about 40°. Work has been done on two separate deposits which apparently coincide in attitude with the enclosing rocks. Of these the most easterly consists of a wide zone of decomposed gossan, containing low values in silver and lead with appreciable percentages of zinc and manganese, which has been partially prospected by two trenches and a short tunnel. Surrounding the showings there is a heavy slide of angular fragments of quartzite, which condition has retarded exploration. A grab sample of the iron-stained earthy material exposed in the trenches assayed: Gold, 0.1 oz. per ton; silver, 1.3 oz. per ton; lead, 0.25 per cent.; zinc, 8.3 per cent.; manganese oxide, 9.94 per cent. The manganese mineral occcurs in black streaks in the oxidized mass. In the short tunnel, temporarily blocked with debris, the gossan is reported to have been found to be underlain by a compact glacial wash, which complicates matters. In the trenches, however, the deposit apparently strikes and dips with the prevailing attitude of the formation. The very large cohesive mass of oxidized material, even if not in place, could hardly be far from its original source. Folded structures exist in the adjoining area, which, together with the favourable formation, country-rock similar to the *Sullivan* and *St. Eugene* mines, indicate an important prospecting possibility in the vicinity. About 300 feet to the west a tunnel 60 feet in length has been driven along a quartz vein which widens from 1 foot at the portal to 4½ feet at the face. From a point 30 feet in from the portal the vein is of consistent width, from 4½ to 5½ feet wide, and well mineralized with iron sulphides. The hanging-wall quartzite is well defined, but no definite foot-wall boundary is exposed, more mineralization being indicated on that side. The following samples were taken:—

Width.	Location.	Gold.	Silver.
Feet.		Oz. per Ton.	Oz. per Ton.
5	30 feet back from face	0.46	2.0
5½	20 feet back from face	0.05	1.1
5	10 feet back from face	0.02	1.5
4½	In face	0.02	1.2

Gold values approximating 1 oz. per ton were obtained from samples selected from the vein near the portal. While the values are evidently spotty, the gold being apparently associated with arsenopyrite, which is present with other iron sulphides, this deposit is an interesting one meriting further exploration. Crosscutting to the foot-wall side to determine the full width of mineralization seems advisable, and extension of the drift might encounter a concentration of values as it approaches a point opposite the probable source of the first-described showings to the north-east.

Homestake. A reference to the proposed new activity at this property, on Perry creek, is contained in the recently published Bulletin No. 1, 1932, but the following additional information has since been obtained: A deal was made in November between the Cranbrook Gold Mining Company, E. W. Watson and M. B. Morrison, both of Calgary, the bond calling for 300 feet of tunnelling and the establishing of camps before May 31st, with an expenditure of approximately $25,000 during the subsequent twelve-month period. Some machinery has been shipped from Calgary, but access to the property has been retarded by the deep fall of snow. Tunnel-workings which have been inaccessible for many years have recently been reconditioned and made available for inspection.

References to the property by W. Fleet Robertson, J. D. Galloway, A. G. Langley, A. M. Richmond, and the writer are contained in the Annual Reports for 1898, 1915, 1925, 1929, and 1930 respectively; also in Geological Survey Memoir 76, "Cranbrook Map-area," by S. J. Schofield. The proposed new activity should have an important bearing on the economic possibilities of the numerous similar quartz veins in the Perry Creek area.

Phosphate.

Exploration has been continued on a reduced scale by the Consolidated Mining and Smelting Company at its phosphate properties tributary to the Crowsnest branch of the Canadian Pacific Railway. Development at the Lizard Creek property, near Fernie, was stopped in February. At the Crowsnest property development-work was carried on until the middle of May. A large tonnage of low-grade phosphate rock, averaging about 50 per cent. B.P.L., was opened up. Considerable experimental work was done to concentrate this material. The phosphate rock at present used at the Warfield fertilizer plant is being shipped from Montana and Idaho. Prospecting for higher-grade rock was carried on in the Flathead country and on the west side of the Elk river.

Huchcroft Granite-quarry.—Shipments were suspended during 1931 pending recovery of economic conditions affecting this proposed new industry. Meanwhile testing has been carried on by J. F. Huchcroft, of Cranbrook, to determine the economic possibilities of the two distinct types of granitic rock present. Future prospecting will be directed to ascertaining the height of available types, sizes of blocks obtainable, uniformity of texture, and other features.

Placer.

Since the publication of Bulletin No. 1, 1931, "Placer-mining in British Columbia," which included references to exploration carried on by R. J. Gunther and W. A. Drayton, of Fort Steele, at two points on Wild Horse creek, the following information has been received: E. W. Watson, of Calgary, has staked thirty creek leases on Perry creek, forty creek leases extending from Wycliffe to Skookumchuck creek, following what is supposed to be an old dry creek-bottom, also one dredging lease on the St. Mary river and two dredging leases on Skookumchuck creek, one bench lease at Skookumchuck and two bench leases at Wycliffe. Calgary interests are reported to be backing the undertaking, which has involved an expenditure of several thousand dollars in Government fees. A start has been made on sinking a shaft on the Perry Creek ground included in the holdings of the Perry Creek Syndicate, consisting of G. M. Bell and associates, of Calgary.

SLOCAN MINING DIVISION.*

All company operations, including production and development, have now been suspended in this Division pending an improvement in metal prices. Considerable success attended some of the past few years' development operations, and with better prices substantial production of silver, lead, and zinc can again be expected. Lessees were active in the area, and several car-loads of sorted ore were shipped from the *Silversmith*, *Ruth-Hope*, and *Standard* (now

part of the Western Exploration Company's holdings) mines, while at the *Victor*, *Canadian*, *Ivanhoe*, *Elkhorn*, *Soho*, and others, leasing operations preparatory to shipping were being carried on. Development-work at the *Van Roi* and *Black Colt-Queen Bess* groups was discontinued early in the year by Clarence Cunningham, of Alamo. Further work was undertaken at the *Mountain Con* property at the head of Carpenter creek by C. A. McLeod, of Edmonton, the owner. Encouraging results were obtained by prospecting operations on the *Roseberry* group on Slocan lake, where values up to $1.40 per ton in gold were obtained over a wide zone of pyritization. Disappointing development-work carried on since 1928 by the Blue Bird Mines, Limited, at its property saddling the Jackson Basin-Carpenter Creek ridge, was discontinued early in the summer months.

SLOCAN CITY MINING DIVISION.

Only minor leasing and exploratory activities occurred in this Division during 1931. Information concerning gold and gold-silver occurrences in the area is contained in the recently published Bulletin No. 1, 1932. Substantial mining activity is expected during the coming season by N. Bertrandias and H. F. Phillips, of Portland, Oregon, in connection with the *Anna* and neighbouring silver properties on Springer creek. The *Anna* is described in the Annual Report for 1927.

AINSWORTH MINING DIVISION.

In this Division, formerly responsible for a substantial production of argentiferous lead-zinc ores, development and production operations are marking time, as in the adjoining Slocan camp, and activities have been limited to those by leasers and prospector-owners. Publications of the Geological Survey of Canada covering portions of the Ainsworth Mining Division include: Memoir 117, "Geology and Ore Deposits of the Ainsworth Mining Camp"; "Slocan Area, Ainsworth and Slocan Mining Divisions," Summary Report for 1916; "Kootenay Lake District," Summary Report, Part A, for 1928; Memoir 161, "Lardeau Map-area." The revised geology, by C. E. Cairnes, of the Slocan camp, which includes a portion of the Ainsworth Mining Division, is awaiting publication. Information concerning gold and gold-silver occurrences is contained in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia," which includes references to the Woodbury Creek area and the Scranton Consolidated Mining Company's property on Pontiac creek.

Violet. This interesting silver-gold prospect, at the head of Woodbury creek, to which specific reference was omitted in the publication above mentioned, is described in the Annual Report for 1921. Some activity is expected at the *Violet*, in which J. Henry, of Ainsworth, is interested, during the coming season.

During 1931 the concentrator equipment and power plant of the Cork-Province Mines, Limited, was dismantled, the latter being sold to the *Lorne* mine in the Bridge River district. Small shipments of silver-lead ore were made from the *Flint* property, situated near the head of Dago creek, by the owner, J. A. Carter.

Bluebell. No activity occurred at this silver-lead-zinc mine at Riondel during 1931, but its potentialities for future production are indicated in the 1930 annual report of the Consolidated Mining and Smelting Company, from which the following, being an extract from the report of W. M. Archibald, vice-president and manager of mines, is quoted:—

"Development of the *Comfort* group, adjoining the *Bluebell* mine, Ainsworth Mining Division, was continued and development of the lower levels produced fairly satisfactory results, with considerable promise of opening up some good tonnages of fair-grade ore.

"The *Kootenay Chief* claim of the same group was also developed and resulted in the exposure of some fairly extensive zinc-lead mineralization, with possibilities for a substantial tonnage of mill-ore from this section.

"Negotiations for a reduction in the option price of the *Comfort* group, which includes the *Kootenay Chief* claims, were partially successful and the option was taken up. Following this the interest of Messrs. Valentino and Riondel in the *Bluebird* mine was purchased, and at the end of the year the equities of Messrs. Fowler and Eastman in the *Comfort* option and the *Bluebell* mine were acquired, giving the Consolidated Mining and Smelting Company complete

title to all properties, with the reservation, however, that Messrs. Fowler and Eastman will receive one-sixteenth each of the operating profits after the Consolidated Mining and Smelting Company have received back in profits all their outlay, or $500,000, whichever is first attained. The *Bluebell* mine has been an important producer of lead and zinc for many years and, with the *Comfort* and *Kootenay Chief* ground, still has fair prospects of a considerable production under normal metal prices, although further development and plant additions will be required to place the properties on a proper operating basis."

Buckeye. A trip was made to this property, near Ainsworth, with A. O. Hayes, professor of geology of Rutger's University, New Brunswick, N.J., in connection with his examination on behalf of W. C. Dalglish, of Paterson, N.J., long connected with the ownership of the *Buckeye* and in charge of former development operations. The property, adjoining the *Highland* property to the north-west, is easily accessible from Ainsworth by good road and trail of a combined length of 2½ miles, of which the trail is about 1 mile long. A description of the *Buckeye* deposits by S. J. Schofield is contained in Geological Survey of Canada, Memoir 117, 1920, which contains a recapitulation of information published in the Report of the Commission appointed to investigate the zinc resources of British Columbia, Department of Mines, Canada, Mines Branch, 1906. The workings mentioned in these publications, less easily accessible now, were not all definitely identified. The ore-bodies occur as irregular replacement deposits in the Star limestone, the lowest member of the Silver Hoard formation which overlies the Josephine formation containing the *Highland* mine deposits. The latter occur in north-westerly-trending fissure-veins, cutting the north-south strike of the formation, the ore-bodies, extensively developed through seven levels, having had their greatest development in the zone of the vein intersections with green hornblende-schists. The *Buckeye* deposits are associated with a similar system of north-westerly-striking fissures, but occur as replacements in the north-south-striking limestone in the zones of intersection. The ore consists of pyrite, zinc-blende, and galena, and their oxidation products, in a gangue of silicified limestone, calcite, and quartz. The following is extracted from the report of the Zinc Commission:—

"Development-work on the *Buckeye* consists of two inclined shafts 100 feet apart, each about 40 feet deep, and one tunnel 200 feet long driven in under the shafts. The surface showing of zinc ore is considerable, but the work done does not seem to have been carried sufficiently far to expose the ore at depth. The two shafts are located on a north-east and south-west line, while the trend of the vein appears to be more north and south. There was too much water in both shafts to permit examination of the bottom. To the south of the first one a distinct mineralization is visible on the surface. The second shaft was started outside of the vein, with a view to intersecting it at a depth of about 70 feet, but it was never sunk to that depth.

"The tunnel, which is about 75 feet below the surface showings, was driven as a crosscut for 70 feet. At that point a body of zinkiferous ore has been intersected and followed for 45 feet. The ore-body only shows in the roof and has not been raised upon. Drifting in the tunnel was continued for an additional 150 feet through country-rock, when a second shoot of zinky ore was encountered at the breast, where it can be seen. This exposure appears to correspond with the principal surface showings and seems worthy of attention. In order to learn its extensions the tunnel should be continued. The work was evidently left immediately after ore was broken into, as it was considered of no value by the owners, who at that time were looking for clean silver-lead ore, and not for a matrix of zinc and iron ore with more or less galena mixed through it. A sample of the face (top and bottom) taken on the vein for a width of 18 inches assayed 23 per cent. zinc, but carries less than 1 oz. silver per ton."

In the report of S. J. Schofield (G.S.C. Memoir 117, 1920), he says: "A lower tunnel to tap the ore-bodies at depth has been driven at an elevation of 3,540 feet, or 100 feet below the outcrop. The tunnel penetrated the andalusite schists, but did not reach the Star limestone, which contains the ore-bodies. In 1918 preparations were under way to continue the first level of the *Highland* mine to reach the *Buckeye* ore-bodies." This proposed work was not undertaken, however, and the situation is not materially changed since these two reports were made.

The inspection, on which these notes are based, was confined to the outcrop workings consisting of two shallow shafts and several trenches on a bench at an elevation of about 3,600 feet, or about 1,835 feet above the level of Kootenay lake. The drift-workings, immediately below a 40-foot vertical shaft and two neighbouring trenches, could not be entered without delay

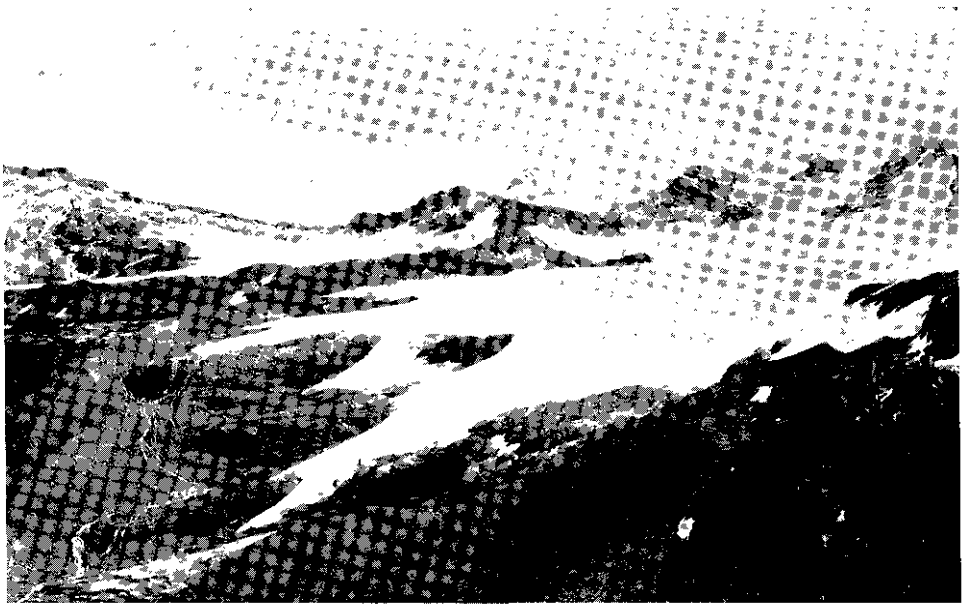
owing to some caving at the portal. Samples from the accessible showings in this group of workings gave the following results:—

Location.	Gold.	Silver.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Selected ore from dump at portal of tunnel	0.02	18.6	44.2	9.8
Selected ore from 40-foot shaft	0.02	20.2	42.2	5.9
Across 6 feet in trench 15 feet south of same shaft.	0.01	3.4	5.2	4.2
Selected from same trench	0.02	22.6	45.7	6.5

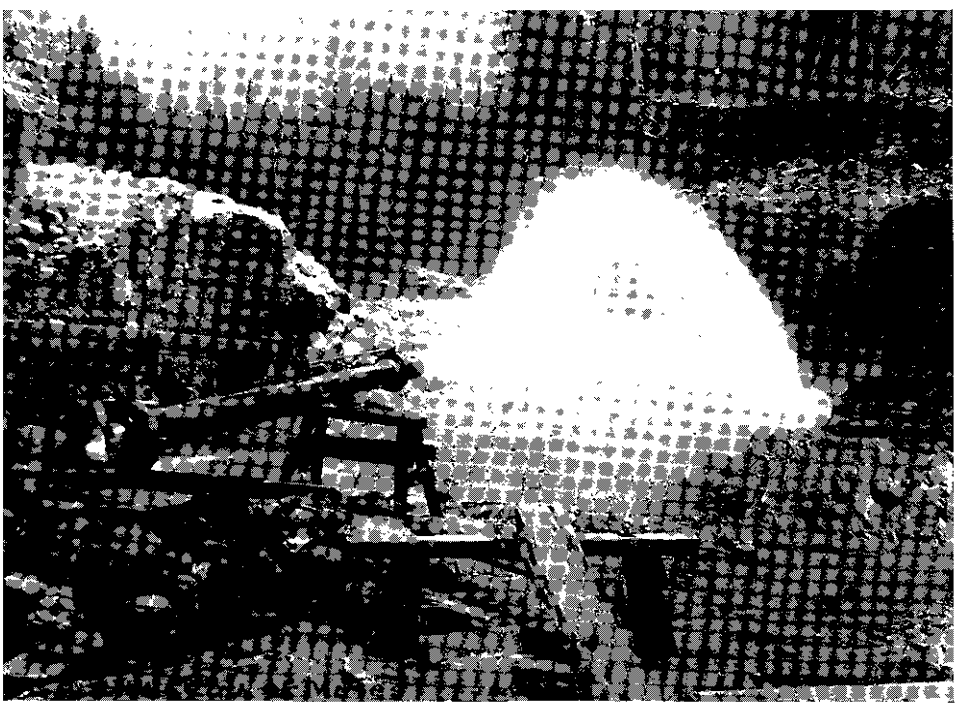
A few hundred feet to the north-west there is a 10-foot shaft developing oxidized material containing carbonates and bunches of galena, over a width of 18 inches, in a fault-fissure striking north-westerly and dipping steeply to the south-west or into the hill. Two samples taken here, representing selected material and a width of 18 inches, respectively, assayed: Gold, 0.02 oz. per ton; silver, 11.1 oz. per ton; lead, 37.2 per cent.; zinc, 0.9 per cent.; and: Gold, 0.01 oz. per ton; silver, 6.8 oz. per ton; lead, 15.3 per cent.; zinc, 5.6 per cent.

Summarizing conditions, there would appear to be several interesting objectives for continuing exploration. The fissure exposed in the 10-foot shaft, which parallels the fissure with which the mineralization is associated in the vicinity of the previously mentioned showings near the 40-foot shaft, should be traced to its intersection with the same limestone horizon, where replacement ore might be expected. The limestone itself might advantageously be prospected for other similar parallel fissures, since indications of gossan are in evidence at points along its trend. A little work by the owners to make all the workings accessible would seem to be desirable before an examination can be made which would do justice to the possibilities of the property. Systematic investigation should be directed to correlating the system of fissuring with that at the *Highland*, where, of three fissures, one was of outstanding importance. While the character of the deposits is entirely different at the two adjoining properties, the intersection of the main *Highland* fissure with the Star limestone should be an important objective for exploration. According to report, the No. 1 tunnel drift of the *Highland* mine would, if extended, prove the *Buckeye* deposits at a depth of 384 feet below their outcrop, but preliminary exploration would seem to be necessary before such an extended programme of development could be considered. The major replacement deposits explored in the Ainsworth camp have been in limestones of the Josephine formation and in the No. 1 limestone (*see* G.S.C. Map 1742, issued with Memoir 117), and the susceptibility of the Star limestone to mineralization of this character has not been tested to any appreciable degree in past exploration.

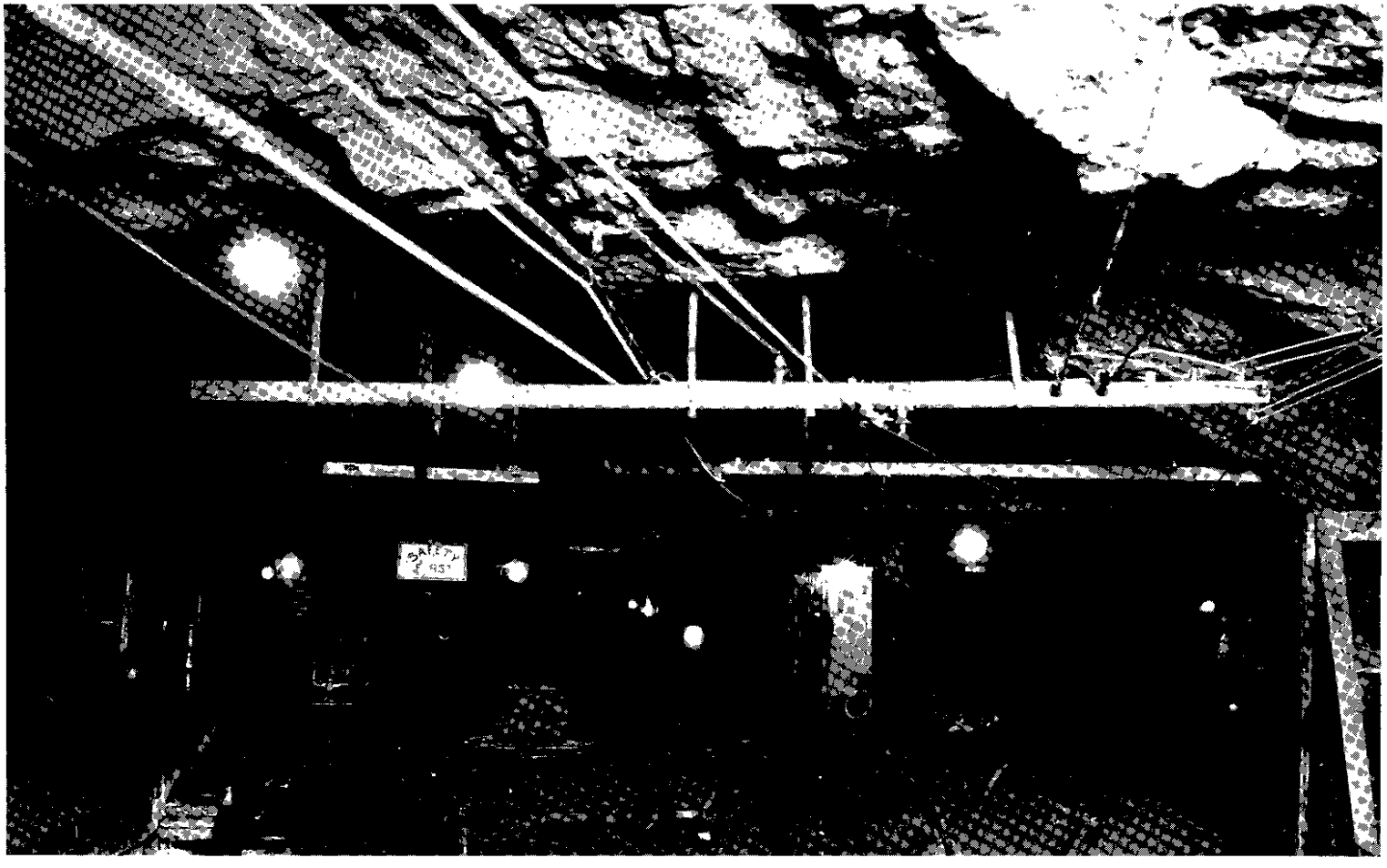
Contact. This property, including the *Fold*, *Con*, *Contact*, *Contact No. 1*, and *Contact No. 2* claims, owned by A. J. Curle, of Kaslo, is situated on the south-western side of Kaslo creek at 14-Mile, adjoining the highway and the railway west of Kaslo. The owner has accomplished a large aggregate amount of superficial exploratory work by open-cutting, trenching, and some prospect-tunnels, exposing extensive cappings containing remnants of lead and zinc sulphides associated with a mangano-siderite matrix. The workings examined vary from 175 to 575 feet in elevation above the railway. The widespread mineralization, exposed in the workings and indicated by the presence of much float-ore, would appear to consist chiefly of replacement deposits in limestone of the Slocan series, though in some cases ore has been developed in veins cutting the formation. The limestone, from 275 to 300 feet wide measured along the slope of the hillside, strikes easterly and westerly and dips to the south. To the north and south of the calcareous rock and parallel with it granite-porphyry dykes, similar to those dykes genetically connected with ore-zones in the Slocan, are exposed at intervals. Near the easterly extremity of the *Con* claim there is a group of five trenches at approximately the same elevation (575 feet) above the railway, which develop mineralization adjoining the hanging-wall of the limestone and in the proximity of a quartz-filled, north-easterly-striking fissure. In No. 1 open-cut, the most westerly of this group of workings, excavation had not reached solid rock, but a large boulder of oxidized manganiferous ledge-matter had been dug up which contained a substantial proportion of lead and zinc sulphides. In No. 2 and No. 3 trenches, going easterly, considerable oxidized material containing galena is exposed. In these two workings the mineralized material, which lies on the



International Group, Middle Fork of Spillimacheen River.



French Creek Development Co., Ltd.—Hydraulic Operations.



Consolidated Mining and Smelting Co. of Canada, Ltd.—Sullivan Mine. North End Station.

fairly steep hillside for a thickness of a few feet, is considered to be connected with another fissure striking north-east by east, in which ore is exposed just above the two trenches. Trenches Nos. 4 and 5 develop quartz and oxidized material in the first-mentioned cross-vein adjoining the hanging-wall of the lime-bed. Briefly summarized, the five workings, aggregating a large amount of trenching, indicate an extensive zone of mineralization adjoining the limestone-contact in the vicinity of the intersection of the two cross-veins. Going westerly from here the limestone has not been explored until the *Contact* claim is reached. Towards the westerly end of this claim three open-cuts develop at intervals what is known as the main fracture, which strikes north-westerly diagonally across the limestone from foot-wall to hanging-wall, a distance of 650 feet approximately. Of these, the principal working, a trench 75 feet long, develops a width of up to 20 feet of oxidized manganiferous material, containing oxidized lead and zinc ore in fair abundance, at the intersection of the fracture with the foot-wall of the limestone. The northerly limit of the mineralization in this working is not defined and extensions of the ore-zone are indicated by exposures in small cuts a short distance to the north. Two other cuts along this main fracture to the south-east contain showings of similar material only partially stripped. Along the hanging-wall of the limestone north of the principal working on the main fracture specified, two crosscut tunnels and extensive surface excavations indicate a large area of replacement mineralization of similar character, containing remnants of lead and zinc sulphides. Exposures of ore at other points are in evidence where fractures cut the limestone, and in this connection the mineralization, from present evidence, is concentrated in the area of numerous intersecting fractures on the *Contact* claim. The work done has not yet reached the stage where the character and continuity of the deposits can be definitely determined, but if those in the limestone are lenticular replacements the lenses are very numerous, suggesting large aggregate tonnage. The following results of assays and analyses have been supplied by the owner:—

ASSAYS AND ANALYSES.

Location.	Silver.	Lead.	Zinc.	Iron.	Metallic Manganese.	Remarks.
	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
General sample from zinc showing in upper tunnel east drift on *Contact* M.C.	.....	.....	23.4	.....	.....	
Manganiferous iron	.....	.....	.....	.....	18.10	
Manganiferous iron	.....	.....	.....	39.80	19.80	
Manganiferous iron	.....	.....	.....	36.60	14.50	
Surface carbonates	4.0	1.4	.....	.....	.....	
Selected galena from 10-inch fissure cutting limestone foot-wall	63.1	69.8	.....	.....	.....	
Surface material from second open-cut near lower tunnel, *Contact* M.C.	0.6	0.2	1.9	.....	.....	
Same place, selected galena partially oxidized	29.5	51.9	.....	.....	.....	
General sample from nine surface cuts	11.9	10.0	5.0	.....	.....	
Selected galena from same cuts	69.1	80.2	0.4	.....	.....	
General sample	.....	.....	.....	39.20	10.20	From same large sample. Also insoluble, 12.8 per cent.; lime, 1.1 per cent.; sulphur, 0.4 per cent.
Manganiferous iron	.....	.....	.....	40.28	17.88	
Manganiferous iron	.....	.....	.....	39.20	13.30	
Manganiferous iron	1.4	.....	.....	37.00	12.80	
From most easterly workings on *Con* M.C., selected galena	53.5	70.3	.....	.....	.....	
Same place, surface dirt (assayed for silver only)	2.7	.....	.....	.....	.....	
Same place, general sample, from open-cut 36 by 25 feet	3.0	4.9	6.8	.....	.....	Excluding lead and zinc sulphides, which form possibly 25 per cent. of showing.

ASSAYS AND ANALYSES—*Continued.*

Location.	Silver.	Lead.	Zinc.	Iron.	Metallic Manganese.	Remarks.
	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
In No. 1 *Contact* M.C. tunnel 60 feet in from portal	1.8	0.4	2.9	.....	.....	
Near face of same tunnel..	2.5	1.0	4.2	.....	.....	
15 by 7 feet at end of lower tunnel drift, *Contact* M.C.	0.8	Trace	1.4	.....	.....	
Partial analysis from two wide zones of mineralization in upper tunnel, *Contact* M.C.	0.4	0.4	0.3	45.50	19.90	Also gold, 0.09 oz. per ton; insoluble, 5 per cent.; with traces only of lime, sulphur, phosphorus, and carbon.

In connection with the manganiferous iron, of which there is a great abundance indicated, the following is extracted from a letter by Bradley-Fitch Company, of Minneapolis, referring to tests made in 1927:—

"The ore contained 17.88 per cent. Mn, 40.28 per cent. Fe. This ore was reduced at 450° C. for one hour and then digested one hour in our standard solution of ammonium sulphate. After this digest the pulp was filtered and the filter-cake washed and assayed. The filter-cake contained 1.61 per cent. Mn. We have found that in the reduction and digestion there is a loss in weight which is at least 20 per cent. Taking this loss into the calculation for the percentage of extraction, it shows that 92 per cent. of the manganese in the sample was extracted. The manganese is in the solution as the sulphate, and this is precipitated from the solution into the hydroxide by the ammonia gas that is generated in the digestion.

"Your sample of ore acted just about the same as do the ores we have run through our test-mill, and we feel that with an ore like the sample submitted the process we have worked out will concentrate this ore into a sinter that will contain from 65 per cent. to 70 per cent. Mn."

Further to this A. J. Curle writes: "In his 'Manganese and Production of Ferro-Alloys,' C. M. Weldt gives the analyses of ores used in a large number of furnaces in the making of spiegeleisen, in which the manganese content ranges from about 10 to 15 per cent. and the iron from about 35 to 38 per cent. The iron at the *Contact* being in the form of carbonate and the mangenese probably the same, calcining would drive off the carbon dioxide and increase the grade of the ore about one-third. The assays of the manganiferous ore given in the accompanying certificates are all from oxidized surface material. Should the unaltered material fall below the grade required for any purpose, calcining would improve it, and I have the much higher-grade manganese ore at the 7-Mile property on the same railroad, the addition of which would bring up the feed." This manganese property is referred to in Geological Survey of Canada, Summary Report, 1917, Part B, and in the Annual Reports for 1917 and 1918.

Silver Bear. This group of claims, owned and actively worked by Frank Helme, of Kaslo, adjoins the road on the eastern side of Keen creek, 5 miles from the railway siding at Zwicky. References to the property are contained in past Annual Reports, notably in those for 1919, 1923, and 1924. Past shipments aggregate a few hundred tons of high-grade silver ore, of which five car-loads mentioned in the Annual Report for 1924 averaged: Silver, 163 oz. per ton; lead, 8 per cent.; zinc, 12 per cent. About 4,000 feet of crosscuttitng, drifting, and raising, together with numerous open-cuts, develop two parallel veins in a crushed zone of metamorphosed sedimentaries of the Slocan series. Granitic dykes are present in the vicinity and a large granite area lies to the west. The veins strike northeasterly, but diverge in dip, the "foot-wall vein" dipping at from 70° to 80° to the east and the "hanging-wall vein" at about 50° in the same direction. Most of the development has been done in a group of workings at the northern end of the property, which develop the vein-zone to a depth of approximately 320 feet below the outcrop. The country-rocks are argillaceous and calcareous members of the series, the mineralization, consisting of galena, sphalerite, and carbonate ore, apparently occurring chiefly as irregular replacements in altered limestone. High silver values are associated both with the sulphide and oxidized ore, of which there are numerous

showings exposed at intervals over a length of some 2,000 feet of outcrop. Past efforts have chiefly been directed to explore for lenses of high-grade ore such as has been shipped, but the potentialities of the property for the development of tonnage of milling-grade ore have not been thoroughly investigated, and in this connection a large area of promising ground awaits underground exploration. In new showings opened up by crosscutting the foot-wall vein at the southern end of the property cadmium values occur in association with sphalerite, silver values at this point being low.

ARROW LAKE MINING DIVISION.*

Prospectors and small exploration parties continued to be active in this Division during 1931, devoting considerable time to the area north-east of Burton City and to the north-west of Edgewood. These activities are briefly described in the recently issued Bulletin No. 1, 1932, "Lode-gold Deposits," and will not be repeated here. The placer excitement which developed early in the summer on Barnes creek and its upper tributaries, and which was fully described in Bulletin No. 1, 1931, has died down and work was discontinued at most of the claims by the end of the summer season.

REVELSTOKE MINING DIVISION.

This report on the Revelstoke Division will necessarily be brief, being confined to information concerning current activities and excluding what has already been published in Bulletin No. 1, 1932, "Lode-gold Deposits," and in Bulletin No. 1, 1931, "Placer-mining in British Columbia." The history of mining and development is contained in the past Annual Reports of this Department. Publications of the Geological Survey of Canada covering portions of the Revelstoke Mining Division include: "Geology and Mineral Deposits of the Big Bend Map-area," published in the Summary Report for 1928, Part A; and Memoir 161, "Lardeau Map-area." The first mentioned covers the economic geology of numerous properties north and east of Revelstoke and the latter covers an area near the southern boundary of this Mining Division. The mineral-deposits of the Big Bend section have been made more easily accessible by the extension of the road north of Revelstoke, which has now reached Old Goldstream.

Big Bend Section.

Placer-mining.

French Creek Development Co., Ltd.

Hydraulic-sluicing operations have been conducted by this Vancouver company since 1927. W. G. Watson, of Vancouver, is president and managing director, and N. Remillard, of Revelstoke, is mine manager. Work was resumed early in April, 1931, on the company's *Goat* and *Gopher* bench leases. Following the resumption of operations, hydraulicking was continued in a disturbed section of the gold-bearing channel up to August 7th, during which time coarse placer gold to the value of $4,047.90 is reported to have been recovered, this gold maintaining an average assay value of $18.87 per ounce. Due to receding bed-rock encountered in the channel being worked, making it impossible to conduct economic sluicing operations through the sluice-box setting and dump as then arranged, it became necessary to make a rock-cut from the west bank of French creek, near the company's office, a distance of about 500 feet, in order to obtain favourable drainage and dump for tailings. Owing to a stratum of hard rock being encountered this rock-cut was not completed when the season's operations terminated in November due to the freeze-up. Following suspension of hydraulic operations in connection with the west-side bench leases, six men were put to work on the company's No. 2 property holdings, comprising creek leases along the present course of French creek, the purpose being to test the gold values in areas adjacent to bed-rock with the object of conducting drift-mining operations on that section of French creek situated above the *Old Consolation* mine-workings (No. 2 camp). W. G. Watson also reports that it is intended to test the intervening gravel areas during the coming summer months with a view to undertaking large-scale shovel operations in connection with the creek areas.

Minor placer activities, as previously reported, also occurred on McCulloch, Camp, tributaries of Goldstream below French creek, and on Smith creek, a tributary of the Columbia river from the west.

Lode-mining.

In the Big Bend lode-mining activities were limited to those by prospector-owners, including: A. Kitson and associates, of Revelstoke, at the *A. and E.* (gold-silver-lead-zinc) on Kelly creek; J. McMahon at the *Francis* and *Silver Bell* (gold-silver-copper) on 5-Mile creek; by H. Bylund and associates, of Revelstoke, at the *Sterling* (molybdenite) near the 35-Mile point on the road north of Revelstoke; and by T. A. Lloyd, of Revelstoke, at the *Frisbie* (gold-quartz) on the Jordan river, a tributary of the Columbia river from the west.

Sterling. This group of nine claims, adjoining the highway along the eastern side of the Columbia river, about 35 miles north of Revelstoke, has been actively worked by the owners, H. Bylund, A. Smith, and J. Mason, all of Revelstoke. The general formation of the area is composed of metamorphosed sedimentaries of late pre-Cambrian age, including mica-schists and argillaceous schists exposed in the workings. The general strike of the rocks is north-westerly, with north-easterly dip, but wide variations occur due to local disturbance. The workings, on the wooded side-hill between 100 and 200 yards easterly from the highway, consist of two open-cuts and a short crosscut tunnel. Molybdenite and pyrite in a quartz gangue occur in two silicified zones in mica-schist, the mineralization apparently conforming to the strike and dip of the enclosing strata. The molybdenite varies in character from disseminations to stringers and bunches of the clean mineral, molybdic oxide being present in the shallow surface zone. The upper vein, as exposed in an open-cut, is approximately 10 feet wide, but the exact width could not be determined owing to the dip not being clearly defined. Below this showing a short distance a crosscut tunnel had been driven 15 feet in flatly dipping argillaceous schistose rock containing considerable pyrite. A specimen of this assayed: Gold, 0.04 oz. per ton; silver, 0.4 oz. per ton. The showing in the open-cut developing the lower vein, about 6 feet wide, consists of silicified mica-schist containing streaks and lenses of molybdenite-pyrite mineralization. A sample of selected material from the upper open-cut, where the strongest mineralization was in evidence, assayed: Gold, 0.03 oz. per ton; silver, 1.1 oz. per ton; molybdenite, 1.45 per cent. If the vein-zone can be traced towards the Columbia river it will approach an area of igneous rocks where better concentration of the molybdenite might occur.

Cyanite.

Fine specimens of this mineral have been brought to Revelstoke at intervals by trappers and prospectors from a slide on the western side of the Columbia river between Death and Priest rapids, 40 miles northerly from Revelstoke, and a trip to this locality was made in June. The crystals are to be seen in numerous boulders and sections of shattered formation over a length of over 1,000 feet along the river. The gneissic rocks of the vicinity dip easterly towards the river, generally parallel to the surface of the ground, and the rocks have been extensively eroded and undermined. The large number of boulders containing the crystals, in a pegmatitic matrix containing quartz and mica, indicate that a limited amount of prospecting might locate similar deposits in solid rock formation. This is considered essential before extensive tests would be warranted to determine the value of the cyanite. Specimens sent W. B. Timm, Chief of the Division of Ore Testing and Metallurgy, Mines Branch, Department of Mines, Ottawa, aroused considerable interest, and a request was received for 200 lb. of similar material, as its suitability for industrial uses can be determined only by trial mixtures, which would entail the use of a considerable quantity of the mineral. The following information is extracted from an abstract of a paper by V. L. Mattson, published in the September, 1931, number of *Engineering & Mining World:*—

"The uses of kyanite fall into two general classes: (1) The field of high-temperature and electrical porcelains; (2) the refractory field. The first class includes such articles of spark-plugs, pyrometer-tubes, chemical and scientific porcelain, special grades of ovenware, and electrical specialties. In this field the requirement is obviously small but steadily growing. The andalusite from California now supplies nearly all of this demand. To compete in this field a kyanite must be extremely pure and almost free from iron and any other impurities that will discolour or impair its electrical properties. It must be remarkably uniform in grade. Even very slight variations in chemical analysis of two shipments would preclude its use in this special application. A careful study must be made to observe its exact inversion temperature, and this also must be constant in all parts of the ore-body from which shipments are to be made. Similarly, careful observations are necessary to determine the expansion and con-

traction coefficients within various temperature ranges. Many other physical properties are of greater or lesser importance, depending upon the use to which the material is to be put. The price of the raw material is important, of course, but superiority of product is paramount, and high-grade material commands a good price.

"In the much larger refractory field the specifications are not quite so rigid as far as appearance is concerned, but uniformity of product is still important. The price consideration in this field is also of great importance. That addition of kyanite to a refractory body improves its characteristics is generally acknowledged, but at what point the advantage of the addition of kyanite offsets its higher cost is a problem for study at the plant. It can be worked out only by co-operation between manufacturer and producer of the raw material. Additional possibilities for development lie in the direction of refractory cements and special porous bodies.

"From the foregoing statement of the requisites of a commercial kyanite product the conclusion is obvious that many problems must be met before a successful venture can be launched. Too much stress cannot be laid on the importance of determining the uniformity or lack of uniformity of the deposit. In several instances during the last ten years, selected specimens from various deposits have been the subject of considerable laboratory investigation. Favourable results were obtained and published, but when the commercial product was eventually placed on the market the results indicated in the laboratory could not be duplicated in practice. This represented no lack of sincerity on the part of the producer, but merely a lack of proper consideration of the value of uniformity.

"The problem of developing kyanite-deposits, in its first stages at least, therefore appears to be largely of a technical nature. In their sequence the requirements seem to be: (1) To locate a deposit of considerable size; (2) to determine its average kyanite content; (3) to observe, in a preliminary way, the physical properties of the particular kyanite occurring; (4) to determine efficient and economical means of securing the requisite purity and uniformity demanded in the finished product; and (5) to investigate the market requirements and the possibilities in the particular field for which the product seems most suitable."

The economic importance of the mineral would justify a search for a suitable deposit in the vicinity of the area mentioned and possibly at other points along the Columbia river where prospectors report having seen similar crystals.

Section East of Revelstoke.

Near Albert Canyon the *Regal Silver* and *Snowflake* properties have been quiescent and the only activity, other than by prospectors, was at the *Limestone Dyke* group, as described below.

Limestone Dyke and Iron Cap.

These groups, each comprising eight claims, are situated at the head of the Middle fork of Woolsey (formerly Silver) creek, about 8 miles from the *Snowflake–Regal Silver* trunk trail following the main creek, but at present a very roundabout route, some 18 miles in length, is followed to get to the properties, which are owned by the Alco Syndicate, of Vancouver. A considerable amount of prospecting-work has been accomplished under O. Larsen, local member of the syndicate at Albert Canyon, who made the discoveries, and M. C. Arnold, of Revelstoke. The formation in this summit country, in which elevations range from 5,000 to 7,500 feet, is composed of altered sedimentaries of pre-Cambrian age, including crystalline limestone, argillite, quartzite, and schistose derivatives, being the same general rock series in which the *Snowflake* and *Regal Silver* deposits are included. Numerous occurrences of galena, with generally a small amount of accompanying sphalerite, have been found in silicified limestone-bands traversing the high ground between the Middle fork of Woolsey creek and the headwaters of Carnes creek. High silver values are frequently associated with the galena, due to the presence of a mineral of the grey-copper type. The area also contains numerous quartz veins, chiefly in the argillites, mineralized in places with grey copper and pyrite, or their oxidation products. The limestones, of which there are considered to be eight beds, are intercalated with the argillites, the whole series striking north-westerly and dipping to the north-east. In the limestones lead, zinc, and iron sulphides occur in disseminations and in streaks and masses, galena frequently occurring in loose aggregates in an oxidized matrix. The very numerous showings are too scattered to be correlated with accuracy and cannot be itemized. In many cases the showings are exposed in bare outcrops and work has been confined to shallow digging at a few points. In one case such

work has been done in an extensive capping of oxidized decomposed material containing remnants of galena, sphalerite, and iron sulphides. The following sample results give an idea of the character of the mineralization:—

Description or Width.	Gold.	Silver.	Lead.	Zinc.	Copper.	Remarks.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	
Selected	0.02	0.4	.....	.....	.....	Graphitic schistose rock containing quartz in bands and stringers alongside creek near camp.
Selected	0.03	2.3	.....	.....	0.31	Copper-stained quartz from same place.
Selected	0.05	2.1	.....	.....	.....	Same vicinity, quartz selected by Ole Larsen.
Selected	0.02	0.4	.....	.....	.....	Same vicinity, from stained honeycombed quartz.
Selected	0.01	1.3	.....	.....	Trace	Same vicinity, quartz with copper-carbonate stains.
18 inches	0.04	0.3	0.30	0.57	.....	Quartz vein on foot-wall side of "No. 3 Limestone" band.
Grab	0.03	6.9	2.62	1.00	.....	Highest point examined. Disseminated galena associated with network of quartz stringers in brown weathering metamorphosed limestone.
Selected	0.06	142.2	82.84	0.73	.....	Same vicinity, from pocket of galena.
Selected	0.09	39.3	5.72	2.48	.....	Going downhill from above, representing disseminations and bunches of galena in altered silicified limestone.
Selected	0.02	16.2	16.96	1.55	.....	Similar showing a little farther downhill.
Selected	0.03	1.3	0.32	2.38	.....	Selected sulphide material from shattered brown weathering metamorphosed limestone, farther downhill.
Selected	0.06	1.3	0.21	2.02	.....	Carbonates from same place.
2.5 feet	0.05	71.1	0.60	5.10	2.55	Copper-stained quartz containing a sulphide mineral resembling "grey copper."
12 inches	0.04	33.6	33.75	14.18	.....	Vein containing fine-grained sulphides in calcareous gangue, on foot-wall side of last sample.
12 inches	0.03	3.4	0.35	29.63	.....	Extensive capping, foot-wall band of pyrite and sphalerite (about 100 feet above the basin).
Specimen	0.04	3.6	.....	27.53	.....	Extensive capping, specimen from same foot-wall band.
Selected	0.08	2.5	.....	.....	*Nil*	Extensive capping, selected from 3-foot hanging-wall band, chiefly arsenical iron.
Selected	0.12	4.4	.....	.....	Trace	From same hanging-wall band.
Grab	0.01	0.8	0.41	0.40	.....	Extensive capping, decomposed oxidized material (excluding remnants of galena).
Selected	0.03	120.2	68.51	1.66	.....	Small showing of clean galena (sample-tag got wet and is only partially readable).
Selected	0.02	76.1	77.70	1.09	.....	Clean galena from open-cut in limestone at lowest elevation examined (exclusive of graphitic rock in gulch below camp).
Grab	0.06	12.7	15.20	5.80	.....	Disseminated galena and sphalerite from same vicinity.
Selected	0.08	61.8	63.28	1.81	.....	Small showing in fracture cutting limestone between location of last sample and the "extensive capping" workings.

Small percentages of tin associated with galena are reported to have been obtained from samples previously assayed for M. C. Arnold, probably being due to the presence of minor amounts of stannite in places. Concluding these notes, mineralization, both in the limestones and in quartz veins in the argillites, is widespread, denoting a prospecting area of potential importance. Reasonably convenient access could be afforded by construction of a trail on a good grade for a roughly estimated length of 8 miles, following the Middle fork of Woolsey creek and diverging from the previously mentioned trunk trail at a point about 2½ miles from the Canadian Pacific Railway at the *Regal Silver* siding west of Albert Canyon.

Section South of Revelstoke.

Wigwam. At this zinc-lead property, situated on the Akolkolex river south of Revelstoke, development-work which has been prosecuted for over six years by the Wigwam Mining Company, of Tacoma, Wash., was recently discontinued. The exploration, including a substantial aggregate amount of tunnelling, with diamond-drilling, was carried out under the direction of W. T. Dumbleton, of Tacoma.

LARDEAU MINING DIVISION.

The area formerly constituting the Trout Lake Mining Division is now included in the Lardeau Mining Division. In Geological Survey of Canada, Memoir 161, "Lardeau Map-area," and in the Annual Reports of this Department, notably that for 1914, much information has been published regarding the mineral occurrences of the Camborne, Ferguson, Trout Lake, and Poplar camps. Most of the ores contain gold, either as a principal or minor constituent, and in this connection possibilities of these areas for future production of this metal have been dealt with in the recently published Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia." During the period under review lode-mining activities in this large and potentially important area have been very slight, being chiefly restricted to minor exploratory activities at a few widely separated points. These include prospecting done: With a small crew of men at the *Snowstorm* and *Gold Quartz* groups, reached from Poplar, by W. S. Applegate and J. Gallo, of Calgary; by Mrs. Jowett, of Trout Lake, on the *Foggy Day* gold-silver-lead-zinc property on Silver Cup mountain; at the *Free Coinage*, reached from Ferguson, and the *Lucky Boy*, from Trout Lake, both high-grade silver prospects, by G. Yuill, of the latter settlement; at the *Great Northern*, near Ferguson, by H. McPherson, of Trout Lake; at the *Goldfinch* gold property, near Camborne, by C. Menhinick, of Victoria, where the old workings were reconditioned for investigation.

Foggy Day. *Samples of ore from new showings opened up at this prospect and sent to* this office for assay gave: Gold, 0.36 oz. per ton; silver, 54 oz. per ton; lead, 36 per cent.; zinc, 5 per cent.; and: Gold, 0.30 oz. per ton; silver, 94 oz. per ton; lead, 32 per cent.; zinc, 4 per cent. High gold values were associated with oxidized decomposed ore-outcrops as mentioned in G.S.C. Memoir 161 and in past Annual Reports. Some small shipments have been made at intervals.

Placer-mining.

On the Lardeau river at 28-Mile, near Gerrard, intermittent work was conducted by W. L. Oscarson, of Spokane, and associates, a drag-scraper being used in connection with trial-sluicing operations. On the same river, 1½ miles above Trout Lake, work was started during the winter by P. Hodgson, of Nelson, and associates, and sluicing done after diverting the stream. Construction is proceeding on the footing of a new dam to provide for high-water conditions.

NELSON MINING DIVISION.

Considerable interest has been manifested in gold prospects in this Division by numerous mining engineers and scouts. In this regard several new activities were initiated during the winter months, indicating that increased mining activity will occur during 1932, when prospects and dormant properties can be investigated to better advantage. A summary of gold-mining conditions, indicating probabilities and possibilities in semi-developed mines and directing attention to likely areas for prospecting and exploration, is contained in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia." This publication includes mention of activities

of varying scope which have occurred at the *Venus*, *California*, *Perrier*, *Catherine*, *St. Anthony*, *Golden Gem*, *Blue Bird*, *Euphrates*, *K. and S.*, *Rainbow* and *H.B.*, *Reah*, *Second Relief*, *Keystone*, Clubine-Comstock Gold Mines, *Alma N.*, *Royal Canadian* and *Nevada*, *Stillwater* and *Snow Water*, *Bayonne*, *Spokane*, *Ymir-Wilcox*, *Yankee Girl*, *Old Timer*, *Reno*, *Vancouver*, *Gold Queen*, Canada Smelters, Limited. Of these the *Reno* was the only one in steady production, the total value of the output for the year being $204,939, which includes nearly $14,000 premium on gold. Next comes the *Second Relief* with a production value of $4,700 from six weeks' operation of the mill. Shipments were made from the *Catherine*, *Euphrates*, *Golden Age*, *Gold King* (Gray creek), *Perrier*, and *Ymir-Wilcox*. Preparations were being made towards the close of the year to ship from the *Yankee Girl*, *Clubine-Comstock*, *Vancouver*, and other gold properties. Resumption of work is planned in connection with the *Granite-Poorman*, *Nugget-Motherlode*, and other gold properties, including the *Jumbo* group on Nevada mountain, north of Lost creek. In connection with the *Jumbo* a recent press report states that G. L. Peters, of Los Angeles, recently acquired the group and that a company is to be incorporated, work to be started in the spring. This prospect, owned by W. Grutchfield, of Salmo, and associates, is not known to have been visited by engineers of this Department or by members of the Geological Survey of Canada. The ore is said to contain values in gold and silver and the country-rocks to be metamorphosed sedimentaries of the Pend d'Oreille group north of the granite area in which the *Molly Molybdenite* deposits are situated. The present report on the Nelson Division will necessarily be brief, as most of the activities have already been described in the previously mentioned bulletin on lode-gold deposits. Much information regarding gold prospects and dormant gold properties is also contained in Annual Reports issued in past years and in the following publications of the Geological Survey of Canada: Summary Report for 1911, "Nelson Map-area"; Memoir 94, "Ymir Mining Camp"; Summary Report for 1929, Part A, "Mineral Developments in Salmo Map-area." J. F. Walker, author of the last-mentioned publication, is completing a memoir and accompanying geological map of the Salmo district comprising an area of about 400 square miles, bounded by latitudes 49° to 49° 15′ and longitudes 117° to 117° 30′. The topography shows contours at 100-foot intervals and the scale of the map will be 1 inch to 1 mile. Miscellaneous activities, excluding gold-mining information separately published, in the Nelson Division are briefly mentioned below.

Molly-Gibson.—At this silver-lead mine, on Kokanee creek, development-work was discontinued early in June by the Consolidated Mining and Smelting Company after the low-level crosscut tunnel had been driven 1,850 feet. L. W. Oughtred, of Nelson, was in charge.

Lakeview and Monarch. At these claims, half a mile north of Sanca creek, on the eastern side of Kootenay lake, E. G. Timmons, of Creston, has done an appreciable amount of superficial exploration following his recent discovery of veins containing silver-lead-zinc ore. The following assays give an idea of the values: Gold, 0.07 oz. per ton; silver, 14.96 oz. per ton; lead, 44.3 per cent.; zinc, 19.9 per cent.; and: Gold, 0.02 oz. per ton; silver, 5.38 oz. per ton; lead, 9.6 per cent.; zinc, 53.2 per cent. This prospect will be examined during the coming season.

Red Rock. At this silver-lead-zinc prospect across the Salmo river from the *Reeves-MacDonald* mine, J. W. Falls, of Waneta, and associates, worked intermittently with a view to making shipments, but this was not found to be feasible under the prevailing metal prices and having regard to the long truck-haul. A large sample sent to the Trail smelter assayed: Gold, trace; silver, 31.6 oz. per ton; lead, 69.3 per cent.; zinc, 7.7 per cent.; sulphur, 15.6 per cent.; silica, 0.9 per cent.; iron, 3 per cent.; lime, 0.5 per cent. This prospect, mentioned in the Annual Report for 1930, will warrant investigation when metal prices improve, and in this connection a detailed geological study of the *Red Rock* limestone would seem to be desirable to correlate the system of faulting and folding of the parallel limestone-bands at the *Reeves-MacDonald* mine, where concentrations of mineralizations occur in relation to these structural features.

Mt. Ararat. Late in the fall slight activity developed in connection with this group at the head of Clearwater creek, owned by J. J. Budd, of Kettle Falls, Wash. The deposits consist of quartz veins, in which gold values are associated with pyrite, cutting granitic rocks of the Nelson batholith. The old workings, which include two open-cuts and some 500 feet of crosscut tunnel, were reconditioned prior to an examination by T. Brown, mining engineer, of Nelson.

Reno. Since writing the notes on this mine for the bulletin on lode-gold deposits the Reno Gold Mining Company's mill and power plant have been destroyed by fire and production interrupted. The damage is understood to be fully covered by insurance, and while plans are being considered for a new mill and auxiliary plant development is proceeding on a reduced scale. Recent drifting on the No. 5 level is reported to have encountered sulphide ore 1,200 feet in from the portal, believed to correspond to the shoot developed at the inner end of the No. 4 tunnel.

In addition to the activities mentioned in this report, prospecting-work has been carried on by individuals at numerous points in the Nelson Division and in many cases, due to lack of other employment, men are planning to go prospecting.

TRAIL CREEK MINING DIVISION.

Consolidated Mining and Smelting Company of Canada.

Chemical Fertilizer Plant.

The year 1931 witnessed the completion and bringing into commercial operation of the first great unit of this new industry of the Consolidated Mining and Smelting Company. Every constituent section of the big plant is completed and in operation at part capacity, with a total production during this building and testing period of approximately 25,000 tons of chemical fertilizers of the three main types immediately projected, and with all preparations made for a much larger production during 1932. While the worth of the fertilizers has been demonstrated and the plant is producing in quantity, its ultimate commercial success is dependent upon the more extended market which can be expected when more settled world economic conditions return. The most comprehensive technical description of this new chemical industry yet published is contained in an article by S. D. Kirkpatrick in the November, 1931, number of *Chemical and Metallurgical Engineering*, from which the following information is quoted:—

"Success in any chemical industry is largely a matter of 'M's.' First there must be money, then men and materials, methods and machinery, and finally, if the project is to be profitable, there must be proper markets and merchandising methods. Without attempting to carry this alliteration further, it is interesting to see how the new chemical and fertilizer programme of the Consolidated Mining and Smelting Company of Canada, Limited, measures up to these requirements. For more than a year this great metallurgical organization has been engaged in the construction at Trail, B.C., of what probably is destined to be the largest co-ordinated chemical enterprise in Canada. Built around a daily production of 375 tons of 100-per-cent. sulphuric acid are complete plants to produce between 300 and 400 tons per day of ammonium sulphate, mono-ammonium phosphate, and triple superphosphate. They will cover an area of 60 acres, employ about 300 men, and require approximately 34,000 horse-power of electrical energy.

"When the project is completed it will have called for an expenditure of more than $10,000,000. This vast sum is, however, only about one-fourth of what the company has expended since 1919 on its plants and for the purchase of new properties. It is less than a seventh of the net profits accumulated during this period. Thus the matter of money has already been adequately provided. And the company is equally fortunate in the men who are to carry the responsibility for this great project. J. J. Warren, outstanding Canadian industrialist and president of Consolidated, has placed at the head of the whole chemical and metallurgical organization at Trail, Selwyn G. Blaylock, vice-president and general manager, who began his career as an assayer at the Trail smelter immediately after he was graduated from McGill University in 1899. Later he became chief chemist, then metallurgist, smelter superintendent, manager of the *St. Eugene* and *Sullivan* mines, and was assistant general manager of the Consolidated until 1919, when he became general manager and subsequently vice-president and director.

"When the plans for the chemical programme got under way, the man selected as general superintendent of the new chemical and fertilizer department was Ralph W. Diamond, graduate metallurgical engineer, who, as superintendent of concentration, had been eminently successful in carrying out some of the company's largest and most difficult technical developments. In pioneering into the new field, the management was also able to draw heavily on the experience

of another of its executives, E. M. Stiles, chief engineer, who had been responsible for much of the new expansion and construction programmes.

"In building the production organization, with which this article is chiefly concerned, Mr. Diamond has surrounded himself with a splendid group of chemical engineers, selected almost entirely from the Consolidated staff. He is directly assisted by A. L. McCallum, assistant general superintendent and superintendent of the acid department, and by C. H. Wright, superintendent of the development division. The superintendents of the principal product divisions of the chemical department are W. S. Kirkpatrick, in charge of hydrogen (who also serves as chairman of the general works committee); E. A. G. Colls, in charge of synthetic ammonia; W. D. Burgess, of the phosphate plant; and A. M. Chesser, of ammonium sulphate and storage. James Atwell, assistant superintendent, controls operations of the sulphuric-acid division under Mr. McCallum. In charge of the three important service divisions are G. H. McKay, mechanical; B. P. Sutherland, chemical; and J. F. Millican, plant testing.

"Of the materials on which the chemical project is based, sulphuric acid, made from the waste gases of the smelters, is present in most abundance. In fact, a motivating force in this whole expansion programme was the attempt to utilize as large a proportion as possible of the sulphur dioxide now liberated in its stacks. The other primary raw material, phosphate rock, is available on company property at Crowsnest, near Fernie, B.C., but better-grade material is being brought from deposits at Garrison, Mont., and near Paris, in south-eastern Idaho. About 450 tons of rock is required for a single day's operations.

"To make certain that methods and machinery are the best that modern technology has developed, Messrs. Blaylock, Stiles, Diamond, Colls, and others have fully investigated European and American practice and have had the benefit of the consultation of leading engineers and equipment manufacturers. More will be said later of the technical facilities and operating methods of the new plant.

"Of the seven 'M's,' only markets and merchandising remain, and these certainly have not been neglected. Systematic experimentation in the Prairie Provinces of Canada during the last three years has definitely shown that the use of concentrated fertilizers would be of great economic advantage to farmers of that region. In this study the company has had the co-operation of the Dominion and the Provincial Departments of Agriculture, the colleges and universities, the Canadian Pacific, the National Research Council, farm machinery groups, and various other agencies. A large staff of agronomists and agricultural specialists under Dr. R. E. Neidig's direction have supervised exhaustive field tests in thousands of experimental plots in Manitoba, Saskatchewan, Alberta, and British Columbia. Increased yields of wheat ranging from 18 to 50 per cent. were noted in some experiments in Manitoba. (The Government reports on these fertilizer trials have been reprinted in a small booklet which is available on request to the fertilizer department, the Consolidated Mining and Smelting Company of Canada, Limited, Regina, Sask.) Equally important is the earlier maturity, with consequent lessening in the loss due to frost, rust, and weeds. With this virgin domestic market and with a growing demand for concentrated fertilizers from the Orient, the company is now building a sales organization to merchandise its products either directly to the consumer or through sales-agents in various parts of the world. President Warren has a personal interest in this phase of the programme and has done a great deal to advance the agricultural research and sales-development work.

"Power, particularly if it is cheap and abundant, also is an important element in the success of any chemical venture. Consolidated is especially fortunate in this regard—in fact, cheap power largely made possible the huge electrolytic zinc-refinery at Trail. At Bonnington Falls, on the Kootenay river, the West Kootenay Power and Light Company (which is owned outright by Consolidated) has two power plants with generator capacity totalling 82,500 k.v.a. and hydro turbines developing 98,000 horse-power. At South Slocan, on the same river, the company has a generator capacity of 52,500 k.v.a. and hydro turbines of 75,000 horse-power. The latest constructional development on the river was started in 1930 at Corra Linn rapids, and when completed it will bring the total installed horse-power to 224,000. Waste-heat boilers at the slag-retreatment plant of the lead-smelters supply all of the process steam requirements of the chemical and fertilizer operations."

The following description of the fertilizer plant has been abstracted from the article by Mr. Kirkpatrick:—

In 1928 a modified Grillo type of contact sulphuric-acid plant was installed and has since produced continuously at the rate of 39 short tons of 100-per-cent. acid per day. Three new units, each of 112 short tons capacity, have just been completed to bring the total plant capacity to 375 tons. These units, using vanadium catalysts, represent the most modern practice in acid-plant construction. The acid "make" of the plant when diluted to 93 per cent. is run to one of two 2,100-ton steel storage-tanks, from where it is pumped by two small 4-stage centrifugal to the fertilizer plant 1 mile away and at 400 feet higher elevation.

Because sulphuric acid and cheap electrical energy are Consolidated's chief assets, its main objectives, from a chemical standpoint, might well be defined as an effort to sell acid in the form of phosphates and power as nitrogen compounds. Therefore it is logical that its synthetic-ammonia plant should obtain its hydrogen by the electrolysis of water. Furthermore, since this may eventually represent one of the largest installations of its kind in the world, the management has wisely decided to try out several types of electrolytic cells. This first plant is something of a test on a grand scale of the parallel operation of the Knowles, Fauser, Pechkrantz, and Stuart cells. The complete installation consists of 900 cells, 10,060 amp. each, and requiring 21,000 kw. for their operation. They have a total rated capacity of 3,148,000 cubic feet of hydrogen and 1,574,000 cubic feet of oxygen. At present the latter is wasted to the atmosphere, although eventually it may well serve as the basis for important metallurgical developments. The hydrogen from the cells is generated at a pressure equivalent to 3 inches of water, which is boosted to 10 inches by Bryan-Donkin blowers which force the gas into the hydrogen gasometer of 425,000 cubic feet capacity.

Nitrogen is produced in two Claude liquid-air units, each of which will handle 1,850,000 cubic feet of air per day, producing about 1,340,000 cubic feet of 19.9-per-cent. nitrogen. The units are connected for interchangeable operation either in their entirety or in the individual parts, otherwise the operation proceeds according to standard practice. The nitrogen is passed to the gasometer of 100,000 cubic feet capacity.

For the ammonia synthesis the well-known process developed by Dr. Giacomo Fauser, of Novaro, Italy, is being used. The plant has a rated capacity of 47 tons of anhydrous ammonia per day and a stand-by unit of the same rating also is installed. The nitrogen and hydrogen are drawn from storage in the approximate proportions of 1 to 3 and are mixed in Bryan-Donkin mixers. The mixture is analysed and the proportion corrected by a by-pass. The blower discharges to the mixed-gas gasometer, which has a capacity of 140,000 cubic feet.

Two 6-stage Canadian Ingersoll-Rand compressors are used to bring the gas to a maximum pressure of 300 atmospheres. Each will handle about 250,000 cubic feet per hour and is driven by a 2,250-horse-power synchronous motor. Gas from the sixth stage of the compressor passes through an oil separator into a common header between the two compressors and thence to the pre-catalyst group for purification. After purification in copper Raschig rings and cooling in a high-pressure water-jacketed pipe cooler, the gas enters a water separator and passes into a common header supplying the four synthesis groups.

Breda circulating-pumps send the gas at a pressure of 200 atmospheres first through another oil separator (to remove any last traces of carbon that might otherwise poison the catalyst) and then into the converters or catalyst chambers (50 feet high, 3 feet in diameter, with 6½-inch walls of nickel steel, set in pits 25 feet in depth). After conversion and condensation the liquid ammonia from the bottom of the condensers is discharged to an expander, where the pressure is released from 200 to 15 atmospheres. The liquid anhydrous ammonia is stored in a 30-foot-diameter Horton sphere.

Approximately 150 tons per day of ammonium sulphate is produced from the synthetic ammonia and contact sulphuric acid in a plant designed to use the process developed by Percy Parrish, of the Metropolitan Gas Company, of London. The salt discharged on a belt-conveyor is elevated and split into two overhead feed-bins for the two Pehrson dryers. The dried sulphate is stored in the adjoining storage-building.

The storage-building is 464 feet long, 105 feet wide, and has been excavated about 25 feet beneath the surface in order to provide storage capacity for 60,000 tons of bulk products. The building has six shipping-mills, where the bulk fertilizer, delivered from storage by a 7-ton grab-bucket electric overhead crane, is screened and, if necessary, disintegrated and bagged for shipment.

Phosphoric Acid and Phosphates.

In many ways the most interesting of the operations of the new plant centre around the production of mono-ammonium phosphate and triple superphosphate. These products are complementary to one another, since the same equipment is used for both, and accordingly the production will depend on market conditions. The Dorr-Liljenroth process used for the manufacture of phosphoric acid is that recently developed by the Dorr Company, who have served as engineers and constructors for the phosphate plant. The new process results in the direct production of acid of higher concentration than is usually obtained by the wet method. The plant consists of three units, each having a capacity to leach 150 tons of rock phosphate per day. Contiguous with the three phosphoric-acid units are three fertilizer units, each of which can be used interchangeably for either triple superphosphate or mono-ammonium phosphate.

Phosphate Rock from U.S.A.

Phosphate rock is shipped in by rail from either Garrison, Mont., or Paris, Idaho. Received at the company's coarse-crushing plant at Tadanac, it is crushed with gyratory and rolls to minus ⅝ inch. Then, in 22-ton lots, it is transported in a ten-wheel motor-truck to the stock-pile at Warfield, a mile from the crushing plant. Directly beneath the stock-pile is a tunnel with belt-conveyor into which the rock for use in the phosphate plant is caved through chutes. From the conveyor it is carried up to a bin by an 80-foot belt and bucket elevator. A Stephens-Adamson elevator and sampler then takes the rock over a Merrick scale, where it is weighed, and distributes it to the plant bins, of which there are three for each unit, each holding 150 tons.

The phosphate plant cannot as yet be described in the same detail as the acid, hydrogen, and ammonia divisions. It includes, however, many unique and intensely interesting features which, it is hoped, will be the subject of a subsequent article in *Chem. & Met.* The severe corrosion problems involved in handling the phosphoric acids of various strengths have been satisfactorily solved by the use of KA_2M alloys. Lead- and rubber-lined equipment also is used in many places.

Programme Completed in Two Years.

It is especially significant that this whole expansion programme has been carried through to completion in less than two years. To accomplish this undertaking has required not only tremendous physical and financial resources, but also great technical skill and business ability on the part of management. That it is but the beginning of a much greater chemical development in Western Canada is practically certain. In this direction the Consolidated Mining and Smelting Company of Canada, Limited, is pioneering with the same spirit and enterprise that have carried it to its leading position among the metallurgical industries of the world.

Smelter.

Housed in the copper-rod mill building, a plant for the manufacture of fertilizer-feeding attachments has been assembled which cost approximately $50,000 and employs about twenty-five men to a shift. This will assure a supply of low-cost attachments which can be used by the Prairie farmers in connection with existing seeding equipment to distribute the fertilizer in its proper position to the seed, obviating the necessity of purchasing new seeders at much greater cost. Any implement company will be allowed to manufacture the Consolidated Company's invention and market it, but to assure the desired price-level a permanent manufacture will be maintained at Tadanac, to be at all times a market factor on a factory-to-farm basis. The attachment-plant equipment includes four presses for punching and forming, the material being sheet steel; multiple-drive presses, disk-grinders, riveting-machine, spot-welder and arc-welder, band-saw for cutting steel, paint-shop, etc. Manufacture, started in December, is now in full swing, and fifty machines are being produced daily by the new plant, five car-loads already having been shipped.

Another recent development has been the manufacturing of paint from zinc-oxide fume, this plant also being housed in the copper-rod mill building. From this source practically all the paint required for the company's numerous plants at Trail, Kimberley, and elsewhere is being manufactured.

The following notes on the 1931 operations at the slag-fuming plant have been supplied by G. E. Murray, assistant smelter superintendent: "This plant operated 312 days during the

year, treating 133,373 tons of hot slag and 18,905 tons of cold slag. As the operation progressed, it became evident that the work in connection with the process could be reduced by remodelling some of the flue and boiler connections, as, under the reducing conditions obtained with the heavily laden oxide gases, the slagging action on all bricks tested was very severe. Accumulations of coal-ash fluxed by this fume were also troublesome. Many minor changes have been made in the flue system to better these slagging conditions. Failures of the outside boiler-tubes in the first pass caused worry for a time, but it is believed that this was due to the excessive erosion caused by constant cleaning, and steps have been taken to stop this. The furnace was enlarged 20 per cent. in July and now has seventy tuyeres instead of the seventy-two originally installed. The reduction is due to the installation of a vaporizer system for cooling water similar to the one in use on our No. 12 lead-furnace. This decreased the use of water considerably. The bag-house was increased by two units as the original installation would not handle a sufficient volume. Due to the increased demand for steam by the fertilizer plant, one of the two boilers used for cooling the gases was fitted with a water-cooled fire-box and equipped with burners sufficient to raise 4,000 B.H.P. As much as 90,000 lb. of steam per hour have been made from waste heat from the fuming operation. Improvements in the operating technique have increased the capacity of the furnace, so that at present we are able to produce in fume 100 tons per day of lead and zinc from slag. The process is being studied intensively with a view to improving both recoveries and capacity."

During 1931 the following important contributions to the technical literature, featuring the smelting activities of the Consolidated Mining and Smelting Company, the pioneers of metal-refining in Canada, were made: "Development of Electrolytic Metals in Canada," written by W. R. McLelland, Division of Ore Dressing and Metallurgy, Mines Branch, Ottawa, and published in the *Canadian Mining Journal;* series of five articles summarizing Consolidated Mining and Smelting Company's activities by G. J. Young in the April, May, June, July, and September issues of the *Engineering and Mining World.*

WESTERN MINERAL SURVEY DISTRICT (No. 6).

Report by George A. Clothier, Resident Mining Engineer (Headquarters, Workmen's Compensation Building, 411 Dunsmuir Street, Vancouver).

INTRODUCTION.

The Western Mineral Survey District (No. 6) includes Victoria, Alberni, Clayoquot, Quatsino, Nanaimo, Vancouver, and New Westminster Mining Divisions. They comprise the whole of Vancouver island; the islands between Vancouver island and the Mainland; and the Mainland west of the summit of the Coast range, north to Seymour inlet.

Its geographical position and conditions hold many features which make it a very attractive district for mining purposes. First, the mileage of waterways affords wonderful transportation facilities, opening up unlimited fields for cheap and comparatively handy prospecting, and providing cheap transportation for supplies and equipment, and ore to smelters; secondly, the natural conditions are favourable for mining operations and include ample water-power everywhere and an abundance of timber; and, thirdly, all-year-operation climatic conditions.

From a geological view-point the district would seem to hold every possible condition conducive to the deposition of ore-bodies. There are two great, parallel, and distinctive belts —the Coast range, which forms the west coast for several hundred miles north into Alaska, and the Vancouver range, comprising Vancouver island, separated by the great depression occupied by Georgia, Johnstone, and Queen Charlotte straits. The Coast range consists essentially of granodiorite, but contains many belts or remnants of the pre-existing formations through which it was intruded.

These remnants, up to several miles in width and length, were greatly altered during the mountain-building processes and became mineralized from the aqueous and gaseous emanations from the granodiorite body. That these belts have great ore-producing possibilities has been demonstrated in the development of the *Britannia* mine, one of the great copper-mines of Canada, in what is termed the "Britannia Belt," some 2 miles wide by over 20 miles long. The most important metallic mineral is chalcopyrite carrying small gold and silver values, and associated with pyrite, pyrrhotite, and magnetite. These ore-bodies occur as replacements in shear-zones within the belt; along or near the contact with the granodiorite; and in fissures in the granodiorite border. Some of these belts also contain gold-bearing pyritized quartz veins or lenses, which give promise of developing into profitable gold-producers.

Vancouver island is composed of the "Vancouver series," consisting of volcanics, mainly andesite and basalt, tuffs and intrusive porphyrites, sedimentaries, chiefly crystalline limestone; and schistose derivatives of both. All are underlain by the granites of the Coast range which come through to the surface in great masses and dykes, creating conditions for the deposition of ore from the granite below. The type metallic minerals of Vancouver island are copper, gold, silver, lead, and zinc. The copper-deposits are closely associated with the granite intrusions and are found chiefly in the altered volcanic or sedimentary rocks at or near the intrusive rock. The lead-zinc deposits occur mainly as replacements in the limestone on or near the granitic masses, or associated with dykes within the limestone body. The ore-deposits are irregular, but may be classed in three main types—contact deposits; replaced shear-zones in which are sometimes pyritized, gold-bearing quartz veins; and quartz veins traversing the diorite or granodiorite intrusions.

References.

The reader is referred to the Vancouver Sheet, No. 196A, issued by and obtainable from the Geological Survey of Canada, Winch Building, Vancouver; and also to a list of references on page 358, 1928 Annual Report, pertaining to the geology, etc., of the different portions of the district. To this list may be added the following Geological Survey of Canada Reports:—

Part A, 1921: Coast and Islands of B.C. between Burke and Douglas Channels, by V. Dolmage.

Part A, 1921: Copper Ore Deposits on Lasqueti Island, by J. D. McKenzie.

Part A, 1922: Alberni Area, Vancouver Island, by J. D. McKenzie; Lucky Four Mining Property, Cheam Range, by C. E. Cairnes.

Part A, 1924: Chilko Lake and Vicinity, by V. Dolmage; The Genesis of Texada Island Magnetite Deposits, by C. O. Swanson.

Part A, 1925: Tatla-Bella Coola Area, by V. Dolmage.

Part A, 1929: Geology and Mineral Deposits of Quatsino and Nimpkish Area, by H. C. Gunning.

Part A, 1930: Buttle Lake Map-area, by H. C. Gunning.

Under the heading of each Mining Division in this report a reference list of claims, other than described herein, is given.

I have thought it advisable this year to consolidate the old reports on some of the old properties of merit, so that, in future, references to such properties can be made to this report instead of to a number of old reports which may be hard to obtain. Detail descriptions of lode-gold properties contained in Bulletin No. 1, 1932, are not repeated in this report.

Prospecting.

This branch of mining is back to the standard of a few years ago before the boom period. This district has always been considered a copper-bearing area and the gold possibilities have therefore been in the background. Moreover, on account of its proximity to Vancouver and its accessibility, the impression has been that it has been pretty thoroughly prospected and consequently does not offer the possibilities of other sections of the Province. This impression is, however, far from the facts. A study of the map on which locations of the claims are marked shows that the great majority of them are at or within a comparatively short distance of tide-water and the railways. From 3 to 5 miles away from tide-water the country is practically unexplored for minerals. There is, therefore, plenty of favourable ground for the prospector and for organized prospecting by the larger companies. The time is very opportune for some "old-time grub-staking"; $50 would furnish grub for a couple of men for a month or more in the hills.

On the Mainland any of the included belts in the granodiorite, as indicated on the geological map referred to, are worthy of prospecting in the hope of finding at least another *Britannia*. In the Shoal Bay area, on the north end of Thurlow island, and adjacent Mainland, there are many quartz veins and masses carrying gold values that will bear investigation and presents a field for extended and intensive prospecting. There are similar indications in the Fire Mountain area and around Harrison lake. The borders of the diorite-mass on Pierce mountain and eastward is another promising section. The Pacific Great Eastern Railway crosses several belts showing gold possibilities, but which have had no detailed prospecting at any great distance away from the railway.

On Vancouver island there are several attractive areas. The Leech River section, which produced $100,000 of placer gold, includes a block about 40 miles long by 6 to 8 miles wide, extending from Goldstream west to the mouth of the San Juan river on the west coast. This area is, geologically, the same as the Bridge River area and has possibilities of containing profitable gold-bearing quartz veins.

North of Cowichan lake, on the main range of Vancouver island, fair gold prospects have been found and is worth prospecting through to the head of China creek, which produced considerable placer gold. The Nitinat river and lake area shows excellent indications of large deposits of chalcopyrite. The region between Kennedy lake and Sproat lake north to Bedwell river shows gold-bearing quartz veins. West of Buttle lake a wide belt of schists shows sufficient mineralization to make it a promising field. The Nimpkish Lake section and, in the northern portion of the island, the Nahwittl Lake section show large surface croppings of copper and galena-zinc respectively.

Trails have been built into several of these sections to facilitate prospecting. Sketches of trail routes and other relative information may be had at the office of the Resident Engineer in the Workmen's Compensation Building, Vancouver. A synopsis of the regulations regarding prospecting in the Esquimalt & Nanaimo Railway Belt are given in the 1930 Annual Report and Bulletin No. 1, 1932. A full copy of the regulations may be obtained from the Land Agent, Esquimalt & Nanaimo Railway, Victoria, B.C.

Placer-mining.

So far as this district is concerned, there is no placer-ground that can be worked with any degree of certainty as to making it pay. The majority of the streams, both on Vancouver island

and the Mainland, will pan colours, but apparently the source of the gold has not been sufficient to make profitable placer-ground.

Leech river in the early days produced probably $100,000 in placer gold derived from the gold-bearing quartz veins in the Leech River formation, which consists mainly of argillite. More recent sluicing up at the forks and washing on the small tributaries have not been very remunerative. (*See* hydraulicking under Sooke section.)

Some further testing has been done of the gravel-deposits at the mouth of the Loss and Sombrio rivers, but it requires a pilot hydraulicking plant to conclusively demonstrate whether or not the deposits are workable. The reader is referred to previous Annual Reports for descriptions of the property.

On Wreck bay, on the west coast of Vancouver island north of Barkley sound, three men worked part of the winter sluicing at the base of the high gravel-banks where wave concentration has been greatest. They just made a living wage from their work.

The north coast of Vancouver island above Shushartie has the same conditions, and though some gold has been recovered in past years it is an unattractive and uncertain undertaking.

Development.

Development-work this year, other than that of the *Britannia* mine, has been confined mainly to properties with gold possibilities. Work in excess of annual assessment requirements was performed on a number of prospects by the owners.

The *El Capitan*, on Cottonwood creek, on the north side of Cowichan lake, and the *Paint Pot* group adjoining had some further work done this year.

Promising discoveries of copper on Parker creek, emptying into the Nitinat river, and at the head of Klanawa river, west of Nitinat lake, had some preliminary work done by way of building cabins and trails and surface mining.

The *Ormond* group, on Flores island, was under small operation throughout the year, the work mainly done on road-construction.

Further work was done on the property of the Marks Gold and Copper Company on the Zeballos river.

The *Alice* group tunnel was continued by the owners. This property is in from Jeune Landing on the South-east arm of Quatsino sound.

Mining was suspended early in the year on the Coast Copper Company property.

The American Smelting and Refining Company continued work on the Nahwitti Lake showings until early summer.

The Alexandria, Sonora, and Thurlow Gold Mining Companies continued development during the year.

The *Geiler* group, on Quadra island, was further developed by the owner, T. A. Noble, of Quathiaski Cove.

On Texada island some exploratory work is being done by O. B. Bush and Mr. Fleming on two groups.

A little work was done early in the year on the Lasqueti Mining Company's property back of False bay.

On the Pacific Great Eastern Railway development was continued on the *McVicar*, *Manson*, and *Tocher* groups, the *Brandywine*, and the *Blue Jack*.

The *Mountain Goat* group, on Pierce mountain south of the Chilliwack river, had further exploratory work done on the surface.

Geological Survey of Canada.

The survey of the northern portion of Vancouver island, which has been under way for the past three years by H. C. Gunning was continued during 1931. The "Geology and Mineral Deposits of Quatsinò and Nimpkish Area" in Summary Report, 1929, Part A; "Buttle Lake Map-area" in Summary Report, 1930, Part A; Preliminary Report on the Nimpkish Quadrangle, Vancouver Island, B.C., Summary Report, 1931, Part A; and H.P.H. Group, Nahwitti Lake, Vancouver Island, B.C., Summary Report, 1931, Part A, give valuable information on those sections for prospector and operator. The survey so far has shown several areas with promising chances in prospecting, and its continuation to cover the northern half of the island will furnish long-needed information.

VICTORIA MINING DIVISION.

This Division comprises the south end of Vancouver island, north-west to the dividing range between Nitinat lake and Alberni canal, and south of the main range of the island lying north of Cowichan lake and extending through to the east coast below Ladysmith. There has been some mining activity this year in this Division. Placer-mining has been tried on Leech river, but with rather discouraging results. There has been some prospecting at the headwaters of the Leech and San Juan rivers, which should be an interesting section for possible placer-ground and gold-bearing quartz veins. Promising finds of copper have been made in the Nitinat River area, and some work done on the properties north of Cowichan lake.

References.—El Capitan, Bulletin No. 1, 1932; *Paint Pot*, Bulletin No. 1, 1932; *Sombrio* placers (Kootenay Central Mining and Development Company, Limited), 1930.

Sooke Section.

Leach River Placers.

Though, as stated, the efforts at placer-mining on the Leech and tributaries have not resulted in very much gold production, the hydraulicking undertaking by Macdonald & Butterworth toward testing the high gravel-banks on the east side of the river has reached a very interesting stage. Early in the year a small hydraulicking plant was installed by J. S. Macdonald and associates, giving a head of about 200 feet in a 4-inch monitor. Several thousand yards of gravel were moved in cross-trenching a gravel-bank, but no bed-rock was encountered before the water-supply played out for the season.

A winze from the bottom of the trench also failed to reach bed-rock. The monitor was then moved up-stream about 100 yards, where bed-rock was more evident, and this winter over 20,000 yards of gravel were moved. Rim-rock was picked up about 100 feet from the present river-bed, under about 40 feet of gravel forming the bench. The rim was followed on a gradual up-slope for over 200 feet to within 10 to 12 feet of the surface, where it turned and sloped down toward the hill, indicating an old channel. Further work proved this to be about 50 feet wide between rims, 10 feet wide on bed-rock, and about 8 feet deep above bed-rock.

A cut was put through the rim-rock for dumping into the present river and a cut put across the old channel, which gave promising returns of fairly coarse gold. The cut through the rim will have to be deepened, the sluices brought through on grade to bed-rock, and a considerable yardage of the old channel washed through before any definite idea can be formed of the importance of the find. It certainly looks very promising.

Willow Grouse.

This group was staked about 1901 and formerly contained eight Crown-granted claims. The three principal claims, *Willow Grouse*, *Donaldson*, and *Jack*, are now held by C. V. Brennan, Britannia Beach, the remaining claims having reverted to the Crown. They are situated on East Sooke peninsula, on the north-west slope of Mount Maguire, about 25 miles from Victoria and half a mile from tide-water at Sooke harbour.

The general rock formation of that area is the Sooke gabbro. The mineralization on this property is mainly chalcopyrite and pyrite, contained in a shear-zone in the gabbros up to 60 feet in width. The minerals occur either disseminated throughout the gangue, chiefly hornblende, or in lenses or masses up to 6 or 7 feet wide of clean chalcopyrite. An open-cut about 125 feet long shows that three lenses of chalcopyrite have been mined from the surface in this small area. Old reports state that about 1,000 tons of 6-per-cent. copper ore was shipped from these lenses, and that hand-sorting later produced another 300 or 400 tons. A shaft was sunk about 50 feet, but is full of water, and no information is available as to what was found at depth.

There are no evidences of further exploratory work anywhere along the zone, but it would seem reasonable to expect other lenses similar to those mined out, and therefore that close surface prospecting would be fully justified, and possibly diamond-drilling or sinking at the more encouraging places.

Margaret.

This group of three Crown-granted claims—*Margaret*, *Eureka*, and *Copper King Frac.*—is owned by W. H. R. and J. R. Collister, Victoria. The property is not far from the *Willow Grouse*, on the Sooke peninsula, on the south slope of Mount Maguire, about 2 miles by wagon-road from tide-water at Sooke harbour.

The mineral occurrences are very similar to those of the *Willow Grouse;* that is, chalcopyrite and pyrite replacement in a shearing of the gabbro country-rock. Comparatively little development has been done on this property, consisting of only an open-cut about 30 feet long, from which I understand some shipments of chalcopyrite were made about 1915. Apparently the only handicap this and the *Willow Grouse* property have is that they are too accessible; no doubt they would be more thoroughly developed if they were situated 40 miles from nowhere.

JORDAN RIVER SECTION.

Sunloch Mines, Ltd.

This company was incorporated in 1917 with a capitalization of $1,000,000, divided into 1,000,000 shares of $1 each. Through the acquisition of stock the Consolidated Mining and Smelting Company, Limited, owns the controlling interest in the property. The holdings comprise twenty-eight claims situated about 2 miles up the Jordan river, which empties into Juan de Fuca strait on the south-west coast of Vancouver island. They are reached by a splendid auto-road from Victoria. The property was operated from 1916 to 1920 and the reader is referred to detailed reports in the Annual Reports during that time, from which the following brief outline is taken:—

The prevailing rock formation is the Metchosin volcanics, which underlie the greater part of the Sooke area. They are mainly basalts and are intruded by the Sooke gabbros. A great amount of surface work, about a mile of underground work, and several thousand feet of diamond-drilling were done. This work shows, within a width of 600 to 700 feet, three major and several lesser shearings in the basaltic formation, mineralized with pyrite and chalcopyrite sufficient to constitute important bodies of milling-grade ore. Although the property has not been in operation for ten years, it has been developed to the extent that it could be put in working condition in a short time. This property on the south end of Vancouver island and the *Coast Copper* on the north end, both controlled by the Consolidated, are the only two developed mines on the island.

Gabbro Copper Mines, Ltd.

This company was organized in 1920 with a capitalization of $750,000, divided into 1,500,000 shares of 50 cents each, with its head office in Victoria. The holdings consist (or did) of about twenty-three claims adjoining the property of the Sunloch Mines, Limited, on Jordan river. The country-rock and ore occurrences are practically the same as on the *Sunloch*. The company did a comparatively small amount of work, consisting mainly of surface-stripping and open-cutting and two short tunnels.

In 1928 the property was bonded by the Pacific Tidewater Company, a subsidiary company of the British Metals Corporation, of London, England. A Radiore survey was made early in 1929, which succeeded in locating two areas on the *Uglow* and *San Juan* groups, which gave sufficiently favourable indications of sulphide mineralizations to justify further testing by diamond-drilling. The drilling, however, was unsatisfactory and nothing further has been done.

COWICHAN LAKE SECTION.

Alpha-Beta.

This group is comprised of three claims—*Alpha*, *Beta*, and *Taboga*—staked in 1902 and therefore carrying all mineral rights though in the Railway Belt. Three or four more claims have been added to the group by staking by the bonders, P. Pearson, Cowichan Station, and J. Long, Chemainus. The claims are situated about 6 miles up Robertson creek, which flows into the south end of Cowichan lake from the south. The logging-road of the Victoria Logging and Manufacturing Company, of Chemainus, runs from the lake to within a short distance of the camp, to which there is a good trail from the railway. The logging-road would ensure ore transportation in the event of the property developing into a shipper.

The prevailing rock formations are limestone and granodiorite. Along the contact the limestone has been altered to a wide zone of garnetite and epidote mineralized in places with pyrite, chalcopyrite, and some magnetite. On the *Alpha* claim a considerable amount of work has been done in stripping and open-cutting, exposing extensive bodies of a mixture of pyrite and chalcopyrite. The contact has a strike of probably east-west and is cut by several dykes striking about N. 75° E. It was first thought that the dykes paralleled the contact, but a tunnel started about 300 feet up Long creek, a small tributary stream, and driven across the supposed strike did not get into the contact-zone for about 100 feet. After getting the probable strike of the zone some further surface prospecting about 400 feet east of the first ore-exposures and 125

feet higher up the hill disclosed a body of disseminated chalcopyrite across a width of 100 feet between two dykes.

On the north bank of the main creek and west of the mouth of Long creek some open-cutting exposes some promising masses of chalcopyrite. On the east side of the mouth of Long creek a row of shots exposed an ore-body across 40 feet, which sampled nearly 4 per cent. copper. A short tunnel at the east end of this ore-body shows considerable chalcopyrite associated with magnetite. Ore has also been exposed on the south side of Robertson creek at that point, but apparently dips under a volcanic formation a short distance from the creek. Prospecting higher up the hill along the granite-limestone contact has exposed promising ore indications. I think it a decidedly interesting prospect with better than ordinary possibilities.

This zone will probably repay prospecting the granite borders for gold-bearing quartz veins, and the garnetite-belt for copper. The prospector should consider these contact-zones not as a continuous ore-body, but rather as a favourable formation for ore-shoots, like a vein, and prospect them accordingly.

Crown. This is a group of eight claims—*Crown* and *Crown Nos. 1* to 7, inclusive, staked and owned by P. Pearson, Cowichan Station Post-office, and associates. They are situated about a mile from the *Alpha-Beta*. The trail crossing the railway goes down to the *Alpha-Beta* and up the hill to the *Crown* group.

The American Smelting and Refining Company had an option on this property in 1930 and did extensive stripping and open-cutting. This work exposed in one place, at 2,250 feet elevation, a width of about 60 feet heavily mineralized with pyrrhotite and chalcopyrite, averaging between 3 and 4 per cent. copper. The gangue is a fine-grained greenish rock altered to bodies of garnetite, epidote, and hornblende carrying chalcopyrite and pyrrhotite. Surface work above and below this main showing shows patches of chalcopyrite in the altered masses. An open-cut 40 feet below exposes a width of 30 feet of oxidized material containing bunches of chalcopyrite. All these exposures give the impression that they are the roots of a former ore-body and that the isolated patches of chalcopyrite may not extend to any appreciable depth. However, it would be well worth while to sink on the big showing to demonstrate the possibilities of a sufficient tonnage for a milling operation.

Blue Grouse. This group of three claims on the south side of Cowichan lake, about 6 miles from the south end, is owned by the Empire Logging Company. There is a good road from the lake to the property now being used for logging purposes. The property is an old one and the reader is referred to the 1917 and 1918 Annual Reports for details of the mineral showings and workings. I examined the property this season and for that reason am referring to it again.

The ore-deposits are of the contact-metamorphic type, occurring in a zone of altered limestone along its contact with a wide body of granodiorite on the south side. The minerals are pyrite and chalcopyrite in veins and lenses in the garnetite-epidote gangue. Two large open-cuts have been made from which some 1,500 tons of 7-per-cent. copper ore are reported to have been shipped. Diamond-drilling several years ago under one of these cuts showed indications of extensive ore-bodies at a distance of 220 feet from the surface.

In 1928 the Pacific Tidewater Mines, Limited, reconditioned the camp at the mine, installed a compressor plant, and started a crosscut tunnel following the diamond-drill hole showing the ore. About 85 feet of the drivage was made when all work by the company was suspended. The company was absorbed by another and nothing further has been done on the property. I think that the tonnage shipped and the possibilities of further tonnage indicated by the diamond-drilling would strongly recommend it for extensive exploration.

Kitchener. This is a group consisting of the *Kitchener*, *Blue Grouse*, *Cascade*, *Copper King Fr.*, *Empire*, and *Forest King* claims, owned by L. A. and A. R. Sherk, of Victoria. It is an old property dating back to its location in 1902 and an appreciable amount of work was done on it in the early years. The claims are situated on the divide between the East fork of Cottonwood creek, which empties into Cowichan lake from the north, and the headwaters of the Chemainus river.

They are reached by the old trail up Cottonwood creek to the East fork, which it follows for about a mile, swinging from there up the hill on the left side and around the mountain. It is about 8 miles from the Canadian Northern Railway at Cowichan Lake to the claims. The

nearest station is Youbou, about a mile south of Cottonwood creek. The lower end of the trail was cleared out this year by a small grant from the Department of Mines.

The general rock formation of this section is the Vancouver volcanics, mainly andesites. On this property there are two wide zones of intense shearing in which stringers and small lenses of pyrrhotite and some chalcopyrite occur, mostly in garnetite and epidote.

The lowest showing seen is on the *Cascade* claim at 2,300 feet elevation, about 100 feet above the old cabin, which has seen its best days. Here a shearing probably 100 feet in width has been stripped and cross-trenched in several places, and a short tunnel driven, showing seams of pyrrhotite with a little chalcopyrite, and small lenses of mineralized garnetite, but nowhere showing a sufficient width of mineralization to indicate any ore possibilities.

The other schist-belt, on the *Blue Grouse* claim, is several hundred feet to the east and strikes into the hill at about S. 80° W. (mag.). This has had several long trenches (up to 200 feet) dug across it, opening it for several hundred feet up the hill and showing it to be about 300 feet wide. These old cuts had not been cleaned out for years and the bed-rock was therefore covered. However, the work discloses the same conditions as the west belt; that is, small isolated stringers and lenses of pyrrhotite with a small content of chalcopyrite, or mineralized garnetite.

I did not see in all this work any width of mineralization containing enough chalcopyrite to justify further work on it. The surface of the schists is soft and decomposed and has no doubt suffered from leaching, but the tunnel on the west shear and the three tunnels on this belt do not show any improvement in the depth they reached.

Tyee. This group of ten claims, situated on Mount Sicker, was the property of the old Tyee Copper Company, Limited, which produced about $5,000,000 between 1900 and 1907, shipping to the Ladysmith smelter. In 1928 the Pacific Tidewater Mines, Limited, a subsidiary of the British Metals Corporation, of London, Eng., acquired the *Tyee* group and the adjoining *Lenora* claims below. The intention was to drive a tunnel through the *Lenora* ground to ultimately connect with the old 255-foot level of the *Tyee*, and so furnish drainage and a working-tunnel for the whole property, for the exploration of the north vein.

There are two veins on the property, each filling an arm of a synclinal fold in graphitic schists. The south vein contained a high copper content and consequently was worked out, producing about 265,000 tons. The north vein, with a high zinc and low copper content, was considered unprofitable at that time and was left practically untouched.

In extending the *Lenora* tunnel it was reported that it broke into one of the old stopes on the *Lenora* boundary, from which only the sill floor had been mined. The floor and back of the stope shows a width of 8 feet of ore and before reaching it an additional 7 feet of ore was cut, which had not been previously developed.

This showing was considered very encouraging, but before any conclusive work was accomplished the affairs of the company were absorbed by the Ladysmith Tidewater Smelters Company and nothing further has been done on the property. The last company retained the lease on the *Tyee* holdings, but I believe dropped the *Lenora* and, so far as I am informed, still holds the *Tyee*. From the above it would appear that there may yet be a fair possibility of developing profitable ore on this property.

Nitinat Section.

This section is reached either from the west coast and up Nitinat lake, or by way of the Cowichan Lake–Alberni Canal trail. The trail follows the Canadian National Railway grade from the head of Cowichan lake for about 4½ miles, where the railway-grade turns south; from there it follows the old tote-road for a few hundred yards to near the Nitinat river, where it turns off to the right down to the river, which is here crossed by a cableway and cage. From the crossing the trail is slashed out straight across the country to the Canadian National Railway grade about a mile below Francis lake, where it turns south coming from Alberni canal. From there to the canal is a good foot-trail. The cabin on the *Southern Cross* group is about half-way between the two points on the grade where the trail connects with it. The railway-grade can be followed all the way round, but I understand it has grown in pretty thickly in places. Prospecting has been active in that area, resulting in the discovery of some promising copper-outcrops.

Southern Cross.

The seven claims in this group—*Southern Cross* and *Southern Cross Nos. 2* to 7, inclusive—are located on the divide between Parker and Worthless creeks, which empty into the Big Nitinat river from the north. The claims were staked last fall by Walter Harris, Port Alberni, and partners. The Alberni Canal–Cowichan Lake trail crosses the claims about 18 miles from the canal and about 8 miles from the lake. The Canadian National Railway car runs through to the end of steel at Kissinger, about a mile beyond the lake, when the logging company is operating. Going in from Cowichan lake, from the Nitinat (Big) River cable-crossing to the first divide at 850 feet elevation takes an hour. From there to Parker creek, at 325 feet elevation, about three-quarters of an hour, and from there to the camp, at 2,000 feet elevation, about two hours.

The first ore-exposure is up from Parker creek, at 1,300 feet elevation on the trail and about 300 feet above a small tributary of Parker creek. No work has been done on it, but it shows some chalcopyrite in a greenstone country-rock. From there up, the trail apparently follows the strike of a contact-metamorphic belt, as all the float is garnetite and epidote, with plenty of magnetite and chalcopyrite. The volcanic-limestone contact strikes about west (mag.). At 1,400 feet elevation is an exposure of magnetite and chalcopyrite in place, and from 1,500 feet for several hundred feet up the hill are several outcrops of magnetite and chalcopyrite, indicating a mineralized width of 200 to 300 feet to the limestone-belt on the north. No work other than a little stripping has been done on these ore-exposures, for they stand out prominently. One ridge shows a width of 30 feet of magnetite carrying a good percentage of chalcopyrite, and there are a number of small exposures of similar ore. The highest cropping shows from 3 to 4 feet of clean chalcopyrite. Samples assayed give only small values in gold and silver. It is evident that there is a section of at least 500 feet in length along the strike of the belt, with a width of a couple of hundred feet, that is very heavily mineralized. Extensive work will, of course, have to be done before any definite idea can be had as to the extent and values of the deposits, and my suggestion to the owners was that very reasonable terms be granted any one who will undertake a comprehensive exploration of the property.

There is a comfortable cabin at 2,000 feet elevation built this year, and the trail slashed out from the lake end of the grade, constituting a fair start toward opening up the property.

ALBERNI MINING DIVISION.

This Division contains the drainage areas of Barkley sound, Alberni canal, Sproat and Great Central lakes. Any part of the Division may be reached from Port Alberni, which is served by the Canadian Pacific Railway from Victoria, Canadian Pacific west-coast steamships, or stage-coaches from Nanaimo. Boats are available on Sproat and Great Central lakes; launches are obtainable at Port Alberni for down-the-canal and Barkley Sound points. There is also a mail-boat service twice a week for Barkley Sound points as far as Ucluelet, from which point one can go by auto to Tofino, though it is rather an experience.

The foot-trail from the head of Sproat lake up Taylor river, crossing the divide and down Elk (Kennedy) river to Kennedy lake, gives access to a promising gold-bearing quartz country well worth prospecting. The trail also continues on up Taylor river to the forks, opening up that area for prospecting.

References.—Alberni Mines, Ltd. (*Three Jays*), 1928; *Cascade*, 1928; *Copper King*, 1928; *Happy John*, 1916; *Monitor*, 1916; *Morning*, Bulletin No. 1, 1932; *Rainy Day*, 1928; *Regina*, Bulletin No. 1, 1932; *Sunshine*, 1928; *Thistle*, 1927; *W.W.W.*, Bulletin No. 1, 1932.

Klanawa River Section.

Klanawa and Canyon.

These claims were staked this year by Andrew Hansen and Dave Logan, of Clo-oose, and are situated at the head of Klanawa river, which empties into the Pacific ocean west of Nitinat lake. They are at present reached from the lake in about 7 miles, but the natural outlet would be north to the Canadian National grade. The owners brought in some good chalcopyrite ore and state that it occurs across a width of 30 feet.

Alberni Canal Section.

Dauntless.

This is a group of four claims—*Dauntless Nos. 1* and *2*, *Evelyn Lewis*, and *Cora*—situated about 4 miles down Alberni canal on the north side. The claims are located two along the beach and two above them, and are owned by Isaac Lewis, of Vancouver. The owner has done considerable work on the different showings,

demonstrating that there are two series of shearings in the Vancouver volcanics country-rock. The south shear, at the beach, strikes S. 30° W. (mag.) and has a dip of 60° E.; the north shear is 200 feet higher up the hill and has a strike of north-south (mag.) and dips almost perpendicularly. Two short tunnels and several open-cuts on the south zone have not given encouraging results. The upper zone, I think, deserves more exploration. An open-cut ending in a short tunnel shows a fairly well mineralized quartz vein about 6 feet wide. In the open-cut a shaft has been sunk 27 feet on a showing of solid pyrrhotite and chalcopyrite about 2 feet wide on the surface. It is full of water, but the owner claims there is good ore all the way down. The width of the quartz vein and the extent of mineralization are certainly promising indications for this type of deposit. I would therefore like to see a drift-tunnel on this shear, low enough to get well below the bottom of the shaft. The property is so favourably situated that ore could be mined cheaply and shipped at a minimum transportation cost.

Edith. This claim, about 7 miles down Alberni canal on the south side, was owned by A. E. Waterhouse, Port Alberni, and is one of the first locations in that section. From an old report I gather that the ore-showings occur along a granodiorite-limestone contact as replacements in the limestone. Several such mineralizations of pyrrhotite and chalcopyrite have been exposed, of which a typical sample assayed: Gold, trace; silver, 2.2 oz. per ton; copper, 8.2 per cent. Within the granodiorite there are also two fissures, from 1 to 2 feet wide, and traceable for a couple of hundred feet, with a siliceous filling carrying pyrite, pyrrhotite, and chalcopyrite. A sample of this assayed: Gold, 0.1 oz. per ton; silver, 4 oz. per ton; copper, 5 per cent. This report sounds interesting.

Island Copper Co., Ltd. This company was incorporated in 1929, with its head office in Port Alberni. It is capitalized at $250,000, divided into 1,000,000 shares at 25 cents each. The company acquired the two old Crown-granted claims, *Modoc* and *Kitchener*, by purchasing from the owners; the *Ogilvie* group of seven claims by purchase, and staked nine more claims. They are all adjoining and situated 12 miles down Alberni canal on the south side at what is known as the "Headquarters camp." They are located on tide-water, making an ideal situation for mining and transportation.

In 1929 extensive exploratory work was carried out by way of surface stripping and trenching and a crosscut tunnel driven 80 feet toward intersecting the ore-exposures at depth. About 163 tons were shipped from the surface work; 150 tons of run-of-mine ore assaying about 3 per cent. copper and 12 tons of sorted ore of 12.6 per cent. copper.

The general rock formation consists of alternating belts of limestone and volcanics lying south-west of a wide belt of granodiorite which extends up the south side of the canal several miles. The metallic minerals are magnetite, pyrrhotite, and chalcopyrite, occurring in a hornblende gangue along the contacts of the volcanics and limestone, several hundred feet from the granodiorite. There is little evidence of the contact-metamorphic silicates, garnetite or epidote. Ore-croppings have been exposed along three such contacts, in a width of probably 200 feet, at intervals for 600 to 700 feet. No appreciable depth has been obtained on any of them.

The crosscut tunnel would gain a depth of about 70 feet on the first "vein" and considerably more under the two upper contacts. The surface ore-exposures justify the extension of the tunnel to intersect at least the first contact and some drifting on it, further underground work depending on the results. There is a good camp at the beach and mining equipment ready for immediate use.

Great Central Lake Section.

Big Interior. The following notes are taken from the report of Wm. Brewer, Resident Engineer of the district at that time, in the Annual Report for 1916. The property was also examined and reported on by Herbert Carmichael in the 1906 Annual Report. These notes are given for readers who have not the previous reports referred to. The *Big Interior* group was staked in 1899 and is owned by the late J. Drinkwater and M. Tebo, of Alberni.

(Note.—Joe Drinkwater was found dead on the shore of Great Central lake early in 1932. Joe was a real, old-time prospector and one of the best in every respect.)

The claims are situated on Big Interior mountain, the top of Vancouver island, about 10 miles westerly from the head of Great Central lake. They are accessible from the coast by way of Bedwell sound and river, but are best reached by trail from Great Central lake, up Drinkwater river, passing Della lake at 3,325 feet elevation to the Big Interior basin at 3,525

feet elevation. The mineral-showings are in the high cliffs on the north side of the basin and accessible by going up the glacier and from there on the talus to the foot of the cliffs. The precipitous walls of the basin, 1,000 feet high, are heavily stained for a distance of 3,000 feet east-west along the strike of the mineral-belt. The width of the vein is not so evident, as it extends under the glacier.

The minerals are pyrite, pyrrhotite, and chalcopyrite in a siliceous gangue. The rim of the basin is intruded by many dykes, and thousands of tons of "vein" matter have broken down, forming immense talus-slopes at the bottom of the basin-wall and above the edge of the glacier. The westerly end of the cliffs apparently contain more copper than the eastern side, as it gradually shades out into the granitic country-rock. Attempted sampling of the talus gave a low-grade copper content up to 1 per cent., with an ounce or two of silver. Lenses of higher-grade ore, up to 5 per cent. copper, occur throughout the mineralized zone where fracturing has occurred, or at intrusions.

It seems to be the consensus of opinion of all who have examined the property that there is an immense tonnage of low-grade ore, but its location, with the consequent physical difficulties attending exploration, development, production, and transportation, has so far been the insurmountable handicap.

Barkley Sound Section.

Canadian Quicksilver Co., Ltd. This company was incorporated in 1928 with a capitalization of $250,000, divided into 1,000,000 shares at 25 cents each. The property is situated about a mile from Sechart, on Barkley sound, and is now owned by Messrs. Campbell, Lozier, and associates, of Vancouver. Surface work and a shaft 40 feet deep, now full of water, show fair mercury values in the fracture-seams of the rock across a fair width, metallic mercury being found in places. The old dump samples gave 8 lb. mercury per ton. The modern rotary furnace treats ore assaying 3 lb. per ton at a profit. In 1930 and early in 1931 Mr. Shipton constructed a furnace of his own design on the beach with the intention of treating the ore from the dump. The trail from the mine was improved for ore-hauling, but not even a test run was made. Nothing has been done since.

CLAYOQUOT MINING DIVISION.

This Division occupies the central portion of the west coast of Vancouver island from Barkley sound to Esperanza inlet and is reached only by Canadian Pacific west-coast boats from Victoria or Port Alberni. The proposed road from Alberni via Sproat lake and Kennedy river to Tofino would therefore be of inestimable benefit to the west coast, now practically isolated in the winter-time except for a ten-day boat service.

References.—Douglas (Walton claims), 1930; and the following properties described in Bulletin No. 1, 1932: *Jo Jo, Lcora,* Marks Gold and Copper Mines, Limited, *Rose Marie, Tagore,* and *You.*

Clayoquot Sound Section.

B.C. Wonder. This group, owned by J. M. Ashton, Rust Building, Seattle, Wash., is comprised of sixteen Crown-granted claims located on Clarke and Tranquil creeks at the head of the West arm of Tofino inlet. They are at an elevation of about 1,500 feet and reached by a trail, starting at the mouth of Tranquil creek, in about 2½ miles.

The minerals are pyrite, pyrrhotite, magnetite, and chalcopyrite occurring in isolated masses, lenses, and disseminations in a garnetite-epidote gangue, along a granodiorite-limestone contact. These croppings have been exposed by surface work over a length of nearly three claims or about 4,000 feet. Some underground work has been done, demonstrating the lenticular nature of the ore-bodies, but insufficient depth has been reached on any of them to prove downward continuity to any extent. Present indications are that the general ore will be low grade—probably a milling-ore. The general trend of the contact is north-westerly.

Copper King. (*See* 1928 Annual Report.) This was formerly the *Hetty Green* group, from which several hundred tons of copper ore was shipped years ago. The same ground was staked as the *Copper King* group and is owned by D. A. Grant, Tofino. The mineral-showings consist of chalcopyrite and magnetite contained in a feldspathic belt at least 100 feet wide. The magnetite, carrying a good copper content, occurs along the north side of the belt. The chalcopyrite outside of the magnetite is in small veins and masses

up to several tons throughout the lime-belt. Further development might prove a tonnage of milling-grade ore.

Craigellachie. (*See* 1928 Annual Report.) This group of claims is owned by D. A. Grant, of Tofino, and is situated on Copper river, about a mile north of the head of Tofino inlet. It was formerly the *Crow* group and had a considerable amount of development in 1916. Several tons of ore are on the dump from open-cuts and a shaft sunk on a limestone-volcanic contact. Some further drifting along the contact might encounter other ore-bodies.

Ormond. This group, consisting of two Crown-granted claims—*Ormond* and *Ormond No. 3*—is owned by James Beck, Victoria, but has been under bond to J. Hodgkinson for the past two years. The claims are situated on Matilda creek, Flores island, about 1½ miles from the beach, at 1,000 feet elevation. There is an old foot-trail from the beach to the showings. The Coast boats call at Gibson's dock, a short distance up the bay.

The prevailing rock formation here is andesite of the Vancouver volcanics, in which there is a shearing about 25 feet wide filled with a light-coloured feldspathic rock and parallel bands of hornblende. The hornblende is replaced by lenses of, and disseminated, pyrite, pyrrhotite, and chalcopyrite. Several open-cuts have been put in across the shearing in a length of a couple of hundred feet, showing, in places, especially on the top of the hill, up to a width of 4 to 6 feet of mineralization. A sample taken to get the gold and silver values, and not an average, assayed: Gold, $1.60 per ton; silver, 6.6 oz. per ton; copper, 8.8 per cent. Depth could be obtained under these ore-exposures by drifting along the shear from the south side of the hill. This work would require a few months of hand-mining without any elaborate camp or equipment, and would decide whether or not the ore-producing possibilities of the property warranted a larger camp, power plant, tram-line, etc. The old trail improved would meet all requirements for this preliminary work.

Little mining has been done in the past two years; the work being confined mainly to the construction of camp and compressor and storehouse buildings at the beach, the accumulation of power and mining equipment, and the partial construction of a tramway from the beach to the showings.

Indian Chief (Pacific Tidewater Co.). Prior to 1923 this property was operated by the Tidewater Copper Company on rather a large scale. From then it lay idle until 1928, when it was taken over by the Pacific Tidewater Company, a subsidiary of the British Metals Corporation, which proceeded to renew the dock, recondition the camps at the beach and at the mine, and put the tramway into commission. Diamond-drilling was started in November, from which satisfactory results were reported. Work was suspended later in the fall pending future plans. The company's holdings, however, were shortly absorbed by another company and nothing further was done with this property.

Nootka Sound Section.

Shannon. This property, owned by A. Parke, Nootka, is on the north side of Muchalat arm, opposite Gore island, and was described in the 1928 Annual Report. It is mentioned again to call the reader's attention to its lead-zinc possibilities. Several open-cuts between the elevations of 200 and 400 feet show from 18 inches to 5 or 6 feet of lead-zinc ore, carrying fair silver values, replacing limestone along a volcanic-limestone contact. These showings are about three-quarters of a mile from the beach on a fair foot-trail.

Star of the West. (*See* 1928 Annual Report.) This group of three claims is owned by Wm. Poole, Nootka, and situated at the head of Tasis canal. From the cabin on the beach to the cabin at the showings at 1,400 feet elevation is about a mile over a good trail. The mineralization consists of pyrrhotite, magnetite, and chalcopyrite in a belt of altered limestone along a granite-limestone contact. Much work has been done by the owners, disclosing masses of chalcopyrite and pyrrhotite in several places. The ore assays from $3 to $4 in gold; 1 to 4 oz. silver per ton; up to 12 per cent. copper; and 2 to 6 per cent. zinc. It is worth an examination.

QUATSINO MINING DIVISION.

This takes in the western half of Vancouver island from Esperanza inlet to the north coast, the more important mining activity being contiguous to Quatsino sound. The area is reached by

the west-coast boats from Victoria; or from Port Hardy, on the east side of the island, by good auto-road to Coal Harbour on Quatsino sound, from which point the mail-boat calls at several points, or launches are available. There are hotel accommodations at Coal Harbour and Quatsino village. Mining has been active in this Division for many years, mainly due to the development of the property of the Coast Copper Company. With the exception of the *Alice* group, the mineral-showings are mainly copper; consequently there has been a marked slackening of activity this year due to the copper situation.

The Geological Survey of Canada in 1929 made a preliminary survey of that portion of this Division contiguous to Quatsino sound, under the direction of H. C. Gunning.* He subdivides the ore-deposits of this section into the following five groups:—

(1.) Pyro-metasomatic (contact-metamorphic) copper and magnetite deposits, such as the *Old Sport* of the Coast Copper Company's property, the *Caledonia*, *June*, *Yreka*, and others. These copper and magnetite deposits are found in the neighbourhood of the larger Coast Range intrusives. They have been formed by replacement of some host-rock, generally limestone, either immediately adjoining the intrusive contact or at some structurally favourable horizon which may be a considerable distance from the exposed intrusion. The copper values are generally distributed rather erratically in a zone or zones of contact-metamorphic silicates (garnetite, epidote, etc.) and oxides which may, in large part, be barren or sparingly mineralized.

(2.) Gold-quartz veins, such as the *Quatsino King* (Teta River Gold). Such deposits are found in fissuring within the granodiorite itself.

(3.) Quartz-carbonate veins with sulphides, such as the *Blue Ox*. These are small deposits of irregular veins of quartz and calcite found in sheared argillite and calcareous argillite.

(4.) Lead-zinc replacements in limestone, such as *Alice Lake* group; Nahwitti lake deposits. The sulphides occur as irregular bodies in the limestone and have been formed by replacement. The continuity of the mineralization in any direction is nearly always doubtful. The deposits are believed to have been formed by vapours or solutions arising from deep-seated magmas of the Coast Range intrusives, but they are a lower-temperature type than the pyro-metasomatic copper-deposits of the district, and consequently may be expected at a greater distance from the exposed intrusives of granitic rock.

(5.) Copper-deposits in basic lavas, such as the *Millington*, Marble creek. The most generally accepted theory of origin is that the deposits have been formed as an after-effect of eruptive action by circulating waters which produced a concentration of copper from minute amounts of that metal that are generally present in basic lavas, and that the temperature of formation is low, thus no deep-seated origin is assigned to them.

Gunning in his conclusions points out that an area of some promise to the prospector lies on the continuation of the Quatsino limestone-belt south-east of Elk lake. This limestone-belt, in all probability, continues from Elk lake up the Raging-Tahsish valley and on to Zeballos and Tasis rivers. Between the Quatsino limestone and Nimpkish valley is a great assemblage of volcanic rocks which, so far as he knows, does not appear to offer much encouragement for prospecting.

References.—Canada Copper Company, Limited, 1930; Copper Cup Mines, Limited, 1930; *Alice*, Bulletin No. 1, 1932; Marble creek, 1930; *Yreka*, 1928, and Summ. Rept., G.S.C., 1929, Part A; *Millington*, 1927–28–29, and Summ. Rept., G.S.C., 1929, Part A.

Coast Copper Co., Ltd.†

This company was incorporated in 1916 with a capitalization of $1,000,000, divided into 200,000 shares of $5 each, with its head office at Trail, as it is a subsidiary of the Consolidated Mining and Smelting Company of Canada. The holdings consist of probably seventy claims on the south side of Elk lake. The company has been very active in "trying out" other prospects in the northern part of the island, but so far has not been successful. The property is reached from Jeune Landing, a port of call of the Canadian Pacific Railway west-coast boats, by truck-road to Alice lake, by boat to the foot of the lake, by truck-road to Kathleen lake, by boat to foot of lake, and by road to mine; a total distance of about 14 miles.

The mineralization, consisting of pyrite, pyrrhotite, chalcopyrite, and bornite, occurs in a belt averaging about 60 feet wide, at the contact of limestone and volcanics. The minerals are

* Geo. Surv. Canada, Summ. Rept., 1929, Part A, p. 94.

† *See* Geol. Surv. Summ. Rept., 1929, Part A.

found in veins, lenses, and disseminations in the garnetite-epidote-magnetite gangue and vary from bodies of low-grade ore to lenses of clean chalcopyrite and bornite.

The mine has been opened by seven levels—three from the surface, the fifth, seventh, and eighth, and four lower ones at intervals of 200 feet, from a 3-compartment shaft from the lowest surface level, the eighth level. This work gives a depth of approximately 2,000 feet on the dip of the mineral-belt and is 300 feet below sea-level. Nearly 6 miles of underground work has been done and thousands of feet of diamond-drilling.

The property is well equipped. An hydro-electric power plant at the mouth of Raging river furnishes about 500 horse-power for electric lighting and power throughout the mine and camp; compressor plant; machine and blacksmith shop; electric hoist on the eighth level and electric haulage on the eighth and tenth levels; local telephone and to Jeune Landing and Vancouver. The camp has a tennis-court and a recreation-hall.

Development-work has been carried to the stage where an ample tonnage of milling-grade ore is indicated to justify the installation of a concentrator when copper-market conditions improve. The company therefore decided to discontinue underground work early in 1931 and take advantage of the opportunity to improve the transportation facilities between the dock and the mine. This summer the road from the mine end was continued around the north-east side of Kathleen lake about 2 miles to connect with the road to Alice lake. Later in the season the work was started to continue the road around the south end and south-west side of Alice lake to connect with the road from Jeune Landing. When completed this will give an all-land road of about 14 miles from the dock to the mine. C. A. Seaton has been superintendent in charge throughout the development of the mine.

June.* This group was located about 1900, of which four claims are Crown-granted. Considerable work was done up to 1916. Later the Crown grants reverted to the Government and were leased in 1928 by the Coast Copper Company, which did several thousand feet of diamond-drilling preliminary to rebuilding the old camp and installing a portable compressor plant, etc. Over 600 feet of drifting and 500 feet of crosscutting were done, when conditions became such that further work was not warranted at that time. The work disclosed important bodies of pyrrhotite carrying some copper and appreciable values in gold and silver. Bodies of disseminated chalcopyrite were found where metamorphism was greatest, and altogether the results were sufficiently encouraging to warrant further work when general conditions improve.

Quatsino Gold-Copper Mines, Ltd. This company was incorporated in 1928 with a capitalization of $3,000,000, divided into 3,000,000 shares of $1 each. Its registered office is 432 Standard Bank Building, Vancouver. The company's holdings consist of about fifty mineral claims south of and adjoining the property of the Coast Copper Company and are reached by trail from the end of that company's road at the mine. The property was fully described in the Annual Reports for 1928, 1929, and 1930, and the reader is also referred to Geol. Surv. Summ. Rept., 1929, Part A, p. 125.

Quatsino King (Teta River Gold). This claim is owned by Geo. Nordstrom, of Quatsino, and is one of the oldest claims in this section, having been staked in 1898. Considerable work was done by the owners up to 1910, when it was taken over by the Teta River Gold Mining Company, of Vancouver, and a few thousand dollars spent in further development for a year or two. In 1917 the Granby Company optioned the property, did some diamond-drilling, and then relinquished the option.

The "vein" consists of feldspar in which are small stringers and lenses of pyritized quartz, following along the foot-wall of a feldspar-porphyry dyke. At 1,350 feet elevation in the creek an open-cut shows a little mineralization, but not sufficient to indicate any possibilities. The Granby Company put a drill-hole down through the dyke to the hanging-wall of the vein.

A crosscut tunnel from the creek cuts the "vein" at a depth of 60 feet, but nothing of importance was found. At 1,150 feet elevation a tunnel was driven 60 feet, starting on the vein, but leaving it at about 30 feet in the tunnel. At 1,050 feet elevation the main tunnel was driven 300 feet, starting on the contact; the last 50 feet swung off to the left in a broken-up granite formation. Small quartz veins were encountered in the brecciated gangue, but nothing with any promise of making ore.

* Geol. Surv. Summ. Rept., 1929, Part A, p. 120.

NANAIMO MINING DIVISION.

This Division occupies the eastern half of Vancouver island and the west coast of the Mainland from Texada island north to Seymour inlet. Its recording office is at Nanaimo. It is the largest Division of the district and, because of its diversity of products, one of the most important in the Province. It contains all the coal-mining on Vancouver island; distributed iron-ore deposits; lead and zinc mainly in the northern portion of Vancouver island; distributed gold, silver, and copper ores; and distributed non-metallic products, such as lime, cement, brick, sand and gravel, crushed rock materials, building-stone, etc.

References (Vancouver Island).—*Big G.*, 1916; *Caledonia*, 1927–28–29, and C.G.S. Summ. Rept., 1929, Part A, p. 122; *Jubilee*, 1930; *Kinman* group, 1929–30; *Lucky Jim*, Bulletin No. 1, 1932; *Lynx*, 1927–30; *Maple Leaf*, 1930; Paramount Mining Company, 1920; *P.D.*, 1927; Price Creek Mining Company, 1929; Robbins, 1930; *Silver Leaf*, Bulletin No. 1, 1932; *Sumpter*, 1929.

References (Mainland and Islands).—Alexandria Gold Mines, Limited (Alexandria Mining Company, Limited), Bulletin No. 1, 1932; B.C. Gold Mines, Limited, Bulletin No. 1, 1932; *Blue Bells*, Bulletin No. 1, 1932; Cambria Copper Company, Limited (*Princess* group), 1928–29; Central Copper and Gold Company, Limited, 1928–29; *Colossus*, 1929; *Copper Bowl*, 1928; *Doratha Morton*, Bulletin No. 1, 1932; *Douglas Pine*, 1930; *Geiler*, Bulletin No. 1, 1932; *Inca*, 1929–30; *John Bull*, 1926; *Julie-Enid*, Bulletin No. 1, 1932; *Juncau*, Bulletin No. 1, 1932; Lasqueti Mining Company, Limited, Bulletin No. 1, 1932; *Lucky Jim*, 1916, and Bulletin No. 1, 1932; Malaspina Mines, Limited, 1927–28; *Marjorie*, Bulletin No. 1, 1932; *Nancy Bell*, 1927; Romana Copper Mines, Limited, 1928–29–30; Santanna Copper Syndicate, 1929–30; *Solyman* and *Freya*, 1930; Sonora Gold Mines, Limited, Bulletin No. 1, 1932; *Stromberg*, 1927; Tatlayoko Lake Gold Mining Company, Limited, Bulletin No. 1, 1932; Thurlow Gold Mines, Limited, Bulletin No. 1, 1932; *White Pine*, Bulletin No. 1, 1932; *Wyho*, 1927.

Nahwitti Lake Section.

H.P.H. (*See* 1930 Annual Report.) This group was staked in June, 1930, by S. S. Pugh, Meade Hepler, and Frank Hicklenton, of Port Hardy, on the discovery of lead-zinc mineralization. Shortly afterward Henry Lee, representing the American Smelting and Refining Company, examined the showings and procured an option on the property. Two other adjoining groups were staked and included with the original group. The property is situated about 2 miles south of Nahwitti lake, on the south side of a creek flowing into the lake. It is reached by an old foot-trail from Port Hardy to the foot of Kains lake, about 12 miles; then up to the head of the lake by boat 3 miles, and from there by a slashed-out trail about 6 miles to the camp on the claims.

The mineralization, consisting principally of zinc-blende and galena, with some pyrite, pyrrhotite, and chalcopyrite, occurs in a siliceous gangue filling fissures or shears in a belt of limestone said to be about a mile wide. The limestone is bordered on the south by a belt of granodiorite and on the north or valley side by probably volcanics. The mineral-croppings lie on or near the volcanic-limestone contact, the fissuring or shearing striking almost at right angles from it into the limestone.

The fissures or "veins" are parallel and occur in series; that is, there are a number of parallel fissures contained in a certain width of limestone before another similar series occurs. The series vary in width from 50 to 140 feet, and the "veins" themselves from a foot to 18 inches of clean galena and (or) zinc-blende to 12 or 14 feet of mixed ore probably of milling grade. When development was started there were about twelve such series found in a distance of over 4,000 feet along the contact, any one of which would be considered a promising surface showing. Further prospecting, I understand, discovered other croppings for several thousand feet farther east.

Development-work carried out by H. Lee consists of numerous strippings and open-cuts, two shafts, and a crosscut tunnel. The west shaft was sunk on the "discovery" showings and the east shaft on the "high-grade" cropping, about 75 feet apart. Each shaft obtained a depth of about 25 feet; the east was in good ore for about 18 feet, when a seam coming in on the east side crowded the ore out, and near the bottom another seam on the other side cut the ore down to a 6-inch seam in the bottom of the shaft, which Mr. Lee suggests may be the feeder from a deeper ore-body. The west shaft was sunk 12 feet in ore and then on an incline for 30 feet more, encountering an open cave about 2 feet wide which was followed another 30 feet.

The incline portion showed only stringers and patches of ore, and patches were also found along the walls of the cave. The crosscut tunnel was started at the foot of a steep bluff and obtained a depth of about 25 feet below the bottom of the shaft. No ore of importance was found in this work until near the face, where a width of 2 to 4 feet of fair galena and zinc-blende came in across the back and part way down the side.

The work at the small depth obtained proved so disappointing that nothing was done on the other ore-croppings, and the option on the property was dropped when it was decided that present conditions did not give much encouragement for a geophysical survey.

H. C. Gunning, of the Geological Survey of Canada, who spent some time this season in that section, in a personal communication, questions in this case the generally accepted theory of ore replacements along the cracks and joints in the limestone, and rather favours the Mexican "Manto" explanation. This, in brief, is a chimney or pipe of ore forced up in a molten state, replacing the limestone as it works its way upwards, and assuming almost any attitude, from horizontal to vertical, depending on the degree of resistance encountered in the limestone. Lateral shoots or fingers may be thrust out along lines of least resistance as the ore advances in a diminishing amount until it dies out. This theory applied in the present instance would mean that this pipe or "worm" of ore was deflected from the vertical and extended, on a slight incline, eastward for several thousand feet, as indicated by the croppings. Erosion has removed the overlying rock and portions of the "Manto" in places; the remaining portions of the "Manto" forming the ore-croppings. Development or exploratory work should therefore be carried out to the west of the surface ore-exposures with the objective of locating the downward extension of the ore-chimney. Judging from the size of the croppings and the length of the ore-pipe as indicated by the distribution of the croppings, there must have been a generous source of ore and a large cross-section of pipe to start with.

There is an extensive area north and west of Nahwitti lake consisting of volcanics and limestone-belts, intruded by bodies of granodiorite, which, from a geological standpoint, is a very favourable prospecting-field. This area is accessible as yet only by trail to Nahwitti lake; from Port Hardy to Kains lake, up the lake to its head, and from there by trail to the *H.P.H.* camp, and 2½ miles from there to the lake. Later, if prospecting results in anything encouraging being found, other trails will be put in from the north coast and the West arm of Quatsino sound.

Nimpkish Lake Section.

This section is reached from Englewood, on the east coast of Vancouver island, by means of the logging-road of the English-Wood Company to the north end or outlet of Nimpkish lake. This year a foot-trail was built from the south end of Nimpkish lake up the Nimpkish (Klaanch) river for about 12 miles. H. C. Gunning, of the Geological Survey of Canada, is of the opinion that there are many localities along the Nimpkish river, between the Nimpkish river and the north-east coast of the island, and on both sides of the main range of the island south to Buttle lake in which are excellent chances in prospecting. As prospecting warrants, the main Nimpkish River trail will be extended through to the summit at the headwaters of the river, and ultimately down Gold river to the west coast. Also a cross-trail from the north-east coast up the Tsitika river to later connect with the main trail. Several claims have been staked up the Tsitika river during 1931.

The Nimpkish Lake area was brought into prominence a couple of years ago when extraordinary surface showings of chalcopyrite, galena, and zinc-blende were discovered about 4½ miles up Lime creek, which flows into the lake about a mile from the south end, from the east. The mineral-showings occur as replacements in limestone along and within a distance of 400 feet of a granodiorite-limestone contact. The limestone is underlain by andesite and basalt flows. For details of the ore-showings the reader is referred to the Annual Reports for 1929 and 1930 and H. C. Gunning's report in the Geological Survey Summary Report, 1929, Part A, p. 127.

Smith Copper. This group consists of the eight claims, *Smith Copper Nos. 1* to *8*, inclusive, situated up Smith creek and about 2 miles by good foot-trail from the south end of the lake. They are owned by the estate of Alex. Smith and his partner, G. K. Storey, Englewood. The Consolidated Mining and Smelting Company bonded the property in 1930 after finishing at the *Kinman* showings, and did a considerable amount of surface work in stripping and trenching along a granodiorite-volcanic contact, where encouraging outcrops of chalcopyrite had been found. The results, however, did not meet the company's needs and the bond was released.

In the meantime the owners had been working across the gulch on the west side of a belt of limestone along its contact with volcanics. Several open-cuts were put in along the steep side-hill, exposing very promising showings of galena and zinc-blende with pyrite, pyrrhotite, and chalcopyrite. The first open-cut is about 300 feet below the cabin and down the creek. Here a nice body of galena and zinc-blende about 4 feet wide has been exposed for about 20 feet long to a fault which throws the upper portion of the contact down the hill about 20 feet. A sample taken across 4 feet here assayed: Gold, trace; silver, 1.6 oz. per ton; lead, 20 per cent.; zinc, 14 per cent. The limestone along the fault is altered to 4 to 6 feet of epidote. An open-cut at the bottom of the fault exposes 2 feet of fair ore assaying: Copper, 2.5 per cent.; zinc, 22 per cent.

Down the hill from the first cut mentioned another open-cut shows nearly 6 feet in width of ore assaying: Gold, $144 per ton; silver, 11 oz. per ton; copper, 3.4 per cent.; lead, 15 per cent.; zinc, 20 per cent. The remarkable value in gold is hard to account for. No particular attention was given the ore in sampling and it is not known just what may carry such gold values.

Several small cuts trace the contact down toward the creek and show varying amounts of mineralization. The strike of the contact is N. 60° to 70° E. up the hill and probably meets the granite at a large outcrop of massive pyrrhotite carrying a fair percentage of chalcopyrite. A tunnel was driven 25 feet in the sulphide-body. It is probably a replacement of the apex of the limestone-body where it contacts with the granodiorite on the north and volcanics on the east. Further surface work should be done on the limestone-volcanic contact above the fault to the pyrrhotite-mass and, if justified, some underground work undertaken. Further exploration in the gold cut and vicinity should certainly be done.

VANCOUVER MINING DIVISION.

This Division includes the drainage areas of Jervis inlet, Howe sound, and Burrard inlet. It is therefore wholly in the Coast Range granodiorite batholith, in which are many belts and masses of mineral-bearing metamorphosed sedimentaries and volcanics. The potentialities of these belts are evidenced in the *Britannia* mine on Howe sound, one of the great Canadian copper-producers.

References.—*Astra* and *Doffofy*, 1930; *Blue Jack*, 1927–30, and Bulletin No. 1, 1932; Bowena Copper Mines, Limited, 1929; *Brandywine*, 1927, and Bulletin No. 1, 1932; *Fitzsimmons*, 1928; *Golden Coin*, 1930, and Bulletin No. 1, 1932; *London*, 1930; *McVicar*, *Manson*, and *Tocher* (Goat creek), 1929, 1930; Radiant Copper Company, Limited, 1928–29.

Jervis Inlet Section.

Britain River Mining Co., Ltd.

This company was incorporated in 1928 with a capitalization of $1,000,000, divided into 1,000,000 shares at $1 each, and acquired the *Red Mountain* group of twelve claims from Phil. White and T. Groven, of Vancouver. The claims are situated up Britain river, which empties into Jervis inlet from the north at the head of Prince of Wales reach. A fair foot-trail was built by the Department of Mines from the camp at the beach, giving access to the showings between 3,000 and 4,000 feet elevation and making the whole belt accessible for prospecting. The camp is at 2,750 feet elevation, but the trail has to cross a summit of 3,250 feet where it branches up to the showings. These have been described in the 1928 Annual Report.

Mount Diadem Mines, Ltd.

This company was organized in 1928 with a capitalization of $400,000, divided into 4,000,000 shares at 10 cents each. It acquired the three claims, *Diadem Nos. 1* and *2* and *Alice*, situated adjoining the claims of the Britain River Company on the north-east and in the same zone of altered rocks. A small showing of galena has been exposed at one place, the straight galena assaying 80 oz. silver per ton, 68 per cent. lead, and 7 per cent. zinc. The few assessments done have, however, not been sufficient to open up the showing to any extent or expose any extensive amount of ore.

Pacific Copper Mines, Ltd.

This company was organized in 1928 with a capitalization of $1,000,000, divided into 4,000,000 shares at 25 cents each, and took over an old property situated up from the head of Salmon arm off Seechelt inlet, on which early reports claimed high-grade ore in quantity. A considerable amount of money was raised from the sale of treasury stock. Work on the old showings and subsequent electrical prospecting proved altogether disappointing and nothing further was done.

The company has since endeavoured to procure other properties worth developing. A property in Camp McKinney was bonded and a considerable amount of development done, which, however, did not result favourably. Later a bond was taken on the Thurlow Gold Mines property on Thurlow island up the coast. A shaft was sunk and drifting done on the vein, with encouraging results until a zone of cross-fracturing was encountered. Further work which failed to reach the vein exhausted the treasury and the bond was released. (*See* Thurlow Gold Mines, Limited, Bulletin No. 1, 1932.) The affairs of the company have apparently been handled in a creditable manner. I think the officials have made an honest endeavour to find and develop a mine and have given their shareholders a good run for their money.

Howe Sound Section.

Britannia Mining and Smelting Co., Ltd.

(*See* previous Annual Reports.) This company has a capitalization of $2,500,000, divided into 100,000 shares at $25 each. It is a subsidiary of the Howe Sound Mining Company, Limited, which is capitalized for 600,000 shares of no par value. The Britannia holdings consist of about 25,000 acres of mineral claims situated on the east side of Howe sound on Furry creek, about 35 miles from Vancouver, from which there is a daily boat service by the Union Steamship Company. This year the company has kept its crew and organization intact notwithstanding the curtailment of output and operations.

The outlook for copper is certainly anything but encouraging. The *Britannia* and every other copper-producer has made a drastic reduction of output through the year, yet the demand has reached such a low point that the price dropped to the record low of 5⅞ cents per pound and the world's surplus is increasing.

The company this year mined 2,022,321 tons, a decrease of about 200,000 tons from last year. Of this, 1,968,494 tons were milled, producing 57,258 tons of concentrates, giving a return of: Copper, 27,944,024 lb.; gold, 5,315 oz.; silver, 135,954 oz.; which is a considerable decrease for each metal from 1930, showing that a much lower grade of ore is being milled. Iron pyrites amounting to over 34,000 tons with a sulphur content of approximately 34,000,000 lb. were shipped to Japan. Additions to the concentrator and improved milling practice has brought its capacity well over 6,000 tons per day. During the year the concentrator has not been operated full time, but has been run to capacity on operating days.

The present main haulage of the mine is the 1,700-foot level, to which ore is delivered from all parts of the mines by a series of raises. The ore is here reduced to 6-inch size and dropped down an incline raise to the mill haulage-level, the 4,100, which is 300 feet above tide-water. This spring the advancement of the 4,100 level was undertaken with the objective of driving it about 10,000 feet, which will put it under the main mine-workings. From this level raises will be put up to the different mines and thus afford direct haulage to the mill.

Some electrical prospecting was done this year on the company's south valley area and the exploration department has been on the lookout for attractive properties. The personnel of the staff is: C. P. Browning, general manager; C. V. Brennan, assistant general manager; E. F. Emmons, mine superintendent; A. C. Munro, general superintendent of mills; W. A. Matheson, purchasing agent and secretary-treasurer: Ed. C. Gillingham, chief accountant.

The excellent record made at *Britannia* in 1931 in the low-cost handling of very low-grade ore was suitably recognized by the Canadian Institute of Mining and Metallurgy in awarding the Randolph Bruce gold medal for that year to C. P. Browning, general manager of the company. This medal is awarded for the most distinguished service to the mining industry of Canada. The committee's recommendation of Mr. Browning was based on the following accomplishments:—

"(1.) Successfully mining, even under the present extremely difficult copper-market conditions, an ore of approximately 1 per cent. copper content. To accomplish this Mr. Browning has, through his organizing genius, maintained his costs for the year 1931 at a little under 75 cents per ton for all mining and milling operations. This is not only important in itself, but it should give tremendous encouragement to the development of low-grade ore-bodies in Canada. While it is difficult to say just how much of the credit for any mining accomplishment is due to the ability and efforts of the general manager, those who are closely in touch with the situation are unanimously of the opinion that in this case the credit should be given to Mr. Browning for his remarkable organizing abililty, his inspiring leadership, and his technical skill.

"(2.) During the present severe depression and in spite of the necessity for reducing costs to a minimum, Mr. Browning has so managed the work that the community at Britannia Beach has been supported so effectually that there has been no reduction in the number of families in the community.

"(3.) Mr. Browning has always been an active and consistent supporter of our Institute, of its British Columbia Division, of community life at *Britannia*, and of all things tending to promote the welfare of our industry and of our country."

Indian River Section.

This is an old prospected section at the head of Indian river, which empties into the head of the North arm of Burrard inlet. At one time there was a fine trail from the mouth of the river through to Squamish, but I judge that the Indian River end of it is badly out of repair after many years of disuse. From the summit, at 2,200 feet elevation, to Squamish the trail has been kept passable by S. A. Habrich, of Squamish, who has a group of claims at the head of Indian river.

Belle. This is a group of five Crown-granted claims—*Ethel*, *Rose*, *Irish Molly*, *Lucky Jack*, and *Jenny*—owned by S. A. Habrich, of Squamish. The following notes are taken from W. M. Brewer's report in the 1917 Annual Report:—

There is a cabin on the claims at 2,150 feet elevation on the Indian River slope. The minerals, pyrite and chalcopyrite, are found in sheared zones in one of the belts included in the Coast Range granodiorite similar to the Britannia belt. About 150 feet above the cabin there is an outcrop of fair chalcopyrite ore about 10 feet wide. A tunnel has been started 60 feet lower than this and driven 100 feet toward intersecting its downward extension, but is not yet far enough to reach its objective. There are several such surface ore-exposures, on an east-west course, in a distance of about 850 feet. One of these shows a width of 25 feet for a length of 50 feet well mineralized with chalcopyrite. Other outcrops are mentioned occurring in different places and altogether give the impression that the property has copper possibilities.

Bullíondale. This group, owned by Robt. Mungall, of Vancouver, is situated on the west side of the head of Indian river, adjoining the *Belle* group, and is reached by trail from Squamish. The following is taken from W. M. Brewer's report in the 1917 Annual Report:—

The formation is probably the continuation of the shear-zone from the *Belle*, or a parallel one. There is an extensive outcrop on the *Lady of the Lake* claim, of disseminated pyrite with some chalcopyrite, at about 600 feet above the main trail. At the head of a gulch which is a small tributary of Mungall creek, at 800 feet above the trail, a tunnel has been driven 100 feet on a S. 75° W. (mag.) bearing, which crosscuts three bodies of low-grade copper ore. Only the apex of the first body is exposed near the portal of the tunnel. The second body comes in at about 60 feet from the portal and shows a width of about 10 feet, on which a short drift was driven south. A sample across the face of the drift gave only low values in gold, silver, and copper. A third body was cut near the face and the tunnel still in it showing low-grade ore.

NEW WESTMINSTER MINING DIVISION.

This Division is comprised of the drainage area of the Fraser river to near Hope, on the north side including the Pitt, Stave, and Harrison lakes areas and on the south to the International boundary.

References.—Barkoola, 1930; *Blue Lead*, 1930; Cox claims, 1928; *Dandy* (*Mayflower*), 1930; *Faith* (Silver Chief Mining Company, Limited), 1923, 1930; Harrison Gold Mining and Development Company, Limited, Bulletin No. 1, 1932; *Money Spinner*, 1930; *Mountain Goat*, Bulletin No. 1, 1932; Pitt Mining Company, Limited, 1930; Sleese Creek Mining and Development Company, Limited, 1929; *Wissota* and *Zenith*, 1929.

Lucky Four. This group consists of eleven Crown-granted claims and fractions, situated on the summit of the Cheam range, from 5,000 to 6,000 feet elevation, which lies north of the Chilliwack river. The claims are reached by trail from Cheam View, a station on the Canadian National Railway, via Wahleach (Jones) lake and up Wahleach creek. They were staked about 1915 and the following year purchased by A. H. Sperry and E. F. White, of Seattle, Wash. In 1917 some diamond-drilling was done, proving the continuation of the ore-zone underneath the glacier toward the summit. Later prospecting on the

south slope of the range discovered copper-croppings and a camp was built about 1,200 feet down from the summit.

From old reports I gather that the important mineral is chalcopyrite contained in a zone of metamorphosed argillites lying in the granodiorite country-rock. The chalcopyrite is carried in a network of quartz veins in altered argillite. The mineral-belt evidently extends through the mountain, as open-cuts and stripping on the south slope have exposed some very promising showings of chalcopyrite. One such showing is described by W. M. Brewer in the 1918 Annual Report as an open-cut 20 feet wide, with a depth of 10 feet in the face in good-grade chalcopyrite. A sample across the full width gave assay returns of a trace of gold, 2 oz. silver per ton, and 7.6 per cent. copper. The surface showings are said to compare favourably with the Anyox and *Britannia* showings.

It was proposed to make the property accessible from the Chilliwack River trail by a branch trail up Ford creek to Granite creek and up Granite creek to the camp, but nothing has been done on the property since about 1918.

Stave River. This is an old group, mentioned in the 1918 Annual Report, situated about 6 miles north-westerly from the head of Stave lake. The mineralization consists of molybdenite described by Brewer as occurring scattered through a belt or zone of sheared granite and varying in width from 15 to 75 feet. The general run of the ore would be low grade so far as indicated, but not enough work had been done to show whether or not lenses of higher grade might be expected or a possibility of a sufficient tonnage of milling-grade ore to justify a concentrator. This may possibly be the same belt on which the Cox claims are located, up from the head of Pitt lake, on which there are showings of molybdenite. These showings are mentioned for the reason that before the depression there were inquiries from British steel-manufacturers for molybdenum or molybdenum prospects, and no doubt the metal will again be in demand when normal conditions return.

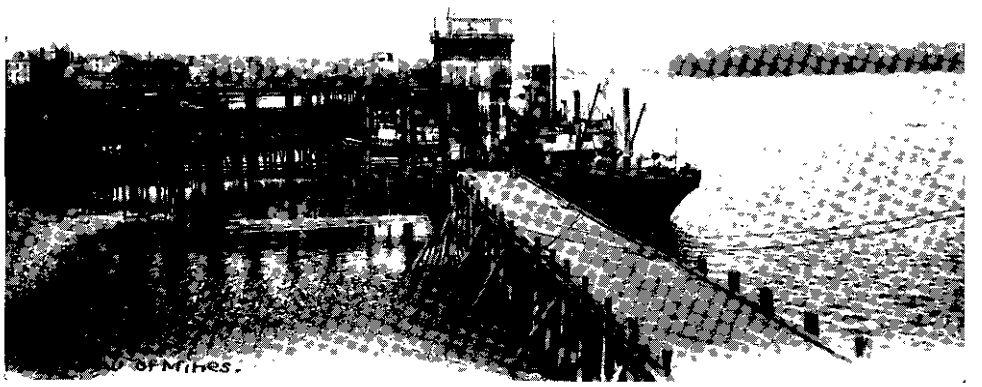
Empress. I have had several inquiries about this old property; therefore the following description: The group consisted originally of four Crown-granted claims—*Empress Nos. 1* to *4*—situated east of Agassiz, opposite Seabird island, and about half a mile by road from Cunningham's ranch to the old camp. In 1915–16 five car-loads of ore were shipped totalling 200 tons, which netted about $40 per ton at that time. This was obtained mainly from an open-cut a short distance up the hill above the old blacksmith-shop. The ore mined from the higher showings was let down to the foot of the hill on a cableway and hauled on double-enders to the main road.

The minerals are chalcopyrite and iron sulphides occurring in metamorphosed limestone along a granodiorite-limestone contact. The altered limestone, garnetite and epidote, varies from 10 to 30 feet in width and contains masses of sulphides mainly chalcopyrite. The remainder of the zone is very sparsely mineralized; that is, nothing that would indicate possibilities of milling-ore. The sulphide-masses have apparently occurred on or near the surface, as none of the further underground work shows any signs of ore. Judging by the width mined out in places, the original ore-exposures must have been exceptionally attractive, but they proved both shallow and short.

The contact strikes north-south directly into the hill and the upper workings are therefore straight up the hill from the lower cut and tunnel. The old trail is obliterated and the workings very obscure. The lower works consist of a large open-cut and a 60-foot tunnel. The tunnel had to swing to the right near the face to cut the contact, which is here shown to be about 12 feet wide but carrying no mineral.

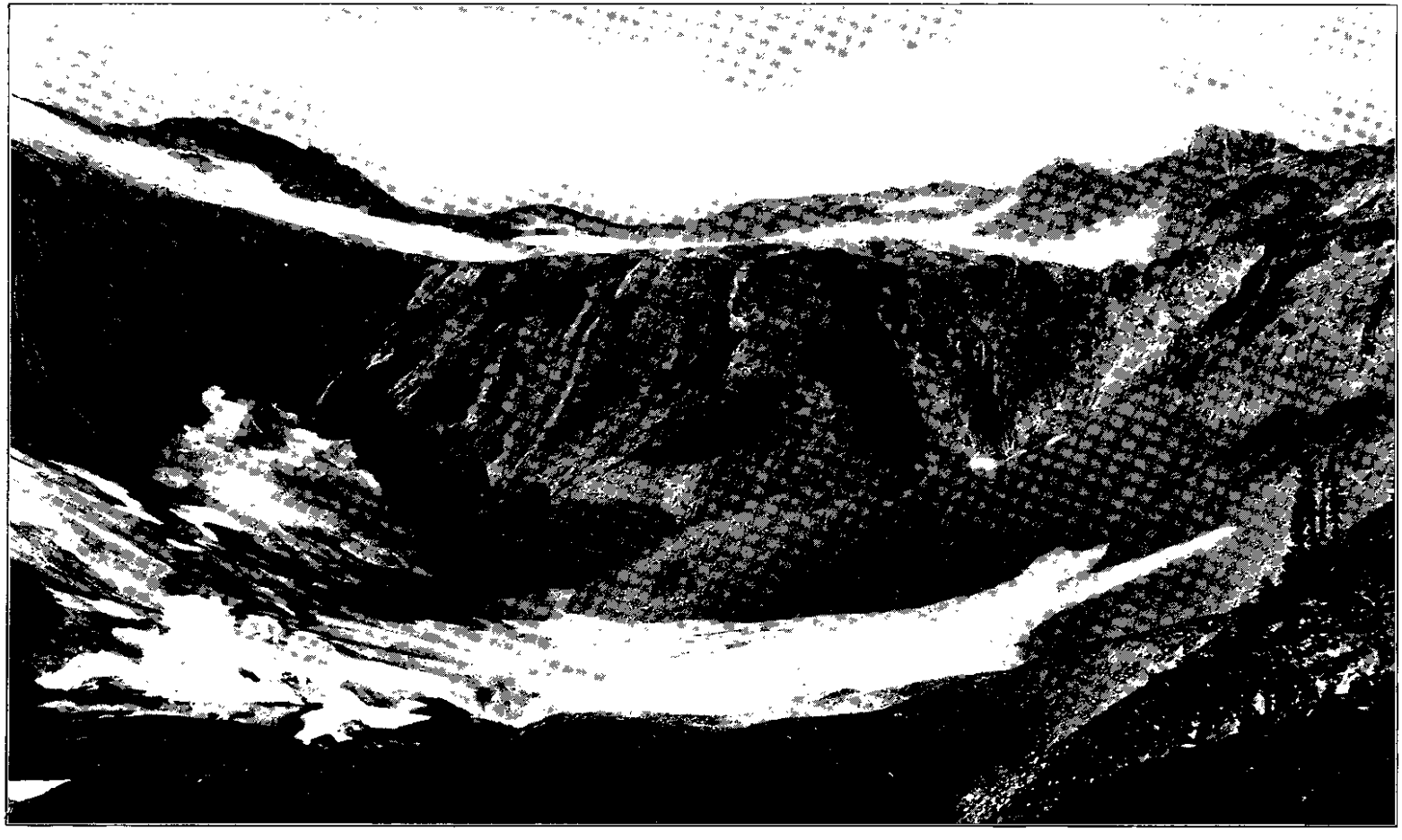
At the upper workings, at 1,000 feet elevation and about 500 feet higher than the lower cut, three tunnels were driven within a vertical distance of 75 feet. The highest one was driven 125 feet on what proved to be a small belt of garnetite paralleling the main contact a few feet to the right. At 30 feet in from the portal later work opened up the main contact-belt to a width of 30 feet. A tunnel 10 feet lower was driven under this ore-body and the ore stoped out. About 50 feet lower another tunnel was driven a short distance along the contact, showing no ore.

The recurrence of ore-bodies could be expected along the contact, but it would probably cost more to find them than they would be worth, unless some electrical-prospecting method could be used.



Canadian Collieries (Dunsmuir), Ltd.—Loading Coal at Nanaimo.

Britannia Mining and Smelting Co., Ltd.—Multiple Drill at Face of 4,100 Tunnel.



Basin at Big Interior Mine, Alberni M.D.

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 and Quarries for the year ended December 31st, 1931.

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.
John MacDonald	Inspector, Fernie.
Henry E. Miard	Inspector, Fernie.
H. H. Johnstone	Inspector, Rossland.
Geo. O'Brien	Inspector, Nanaimo.
Thomas R. Jackson	Inspector, Nanaimo.
John G. Biggs	Inspector, Princeton.
Thomas J. Shenton	Inspector, Prince Rupert.

Instructors, Mine-rescue Stations.

John D. Stewart	Nanaimo Station.
John Thomson	Cumberland Station.
Wm. C. Stone	Middlesboro Station.
Alfred Gould	Princeton Station.
John T. Puckey	Fernie Station.

Board of Examiners for Coal-mine Officials.

James Dickson	Chairman, Victoria.
James Strang	Secretary, Victoria.
H. 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 Districts.
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.
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 the coal-mines, metalliferous mines, and quarries in their respective districts.

PRODUCTION.

The total tonnage produced by the coal-mines of the Province for the year ended December 31st, 1931, was 1,707,590 tons, being a decrease of 179,540 tons or 9.5 per cent. below the production of 1930.

The Coast District, which includes Vancouver Island, Nicola-Princeton District, and Northern District, produced 1,046,164 tons, a decrease of 151,730 tons or 12.6 per cent. from 1930. Vancouver Island Collieries produced during 1931 831,925 tons, a decrease of 156,880 tons or 15.8 per cent. from 1930. The Northern District produced 2,395 tons, an increase of 1,366 tons over 1930. The Nicola-Princeton District produced 211,844 tons, an increase of 3,784 tons or 1.3 per cent. over 1930. The East Kootenay District produced 661,426 tons, a decrease of 27,810 tons or 4 per cent. under 1930.

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.
No. 1 mine, Nanaimo	314,618	225	912	1.53	345	627	2.23	502
No. 5 mine, South Wellington	147,391	232	313	2.02	470	243	2.61	606
Extension Colliery	34,699	56	279	2.23	125	198	3.12	175
Comox Colliery	210,785	244	550	1.57	383	416	2.07	506
Granby Consolidated M.S. & P. Co.	113,995	183	207	3.00	550	146	4.27	780
Lantzville Colliery	4,974	268	20	0.92	248	15	1.23	331
Fiddick mine	1,584	274	6	0.96	264	4	1.45	396
Little Ash mine	2,136	160	8	1.67	267	6	2.22	356
Richardson mine	117	34	7	0.47	16	5	0.69	23
Biggs' mine	1,536	189	6	1.35	256	4	2.03	384
Little Jingle Pot mine	90	18	4	1.22	22	3	1.66	30
Middlesboro Colliery	28,748	205	102	1.37	281	72	1.94	399
Sunshine Coal Co.	130	.....	3	.....	.....	3	.....	.....
Coalmont Colliery	99,811	196	219	2.32	455	144	3.53	693
Tulameen Coal Mines, Ltd.	57,921	276	123	1.70	470	85	2.46	681
Pleasant Valley Coal Mines	12,921	161	68	1.18	190	46	1.73	280
Blue Flame Colliery	12,313	183	33	2.03	373	22	3.04	557
Bulkley Valley Colliery	2,395	298	11	0.72	217	9	0.89	266
Coal Creek Colliery	156,708	118	475	2.79	330	359	3.69	436
Michel Colliery	247,515	167	459	3.22	539	335	4.42	738
Corbin Colliery	257,203	225	277	4.12	928	215	5.31	1,196

Collieries of Vancouver Island Inspection District.

The output of the Vancouver Island collieries was 831,925 tons. Of this amount, 77,312 tons or 9.29 per cent. was lost in preparation for the market, 83,922 tons or 10.08 per cent. was consumed by producing companies as fuel, and 634,545 tons or 76.27 per cent. was sold in the competitive markets.

Of the amount sold in competitive markets, 596,771 tons or 94.04 per cent. of the amount sold and 71.73 per cent. of the total output mined was sold in Canada, 21,683 tons or 3.41 per cent. of the amount sold and 2.60 per cent. of the total amount mined was sold in the United States, and 16,091 tons was sold in other countries.

Collieries of Nicola-Princeton Inspection District.

Of the gross output of 211,844 tons produced by the collieries of the Nicola-Princeton District, 22,243 tons or 10.50 per cent. was consumed by the producing companies as fuel and 188,923 tons or 89.50 per cent. was sold in the competitive markets.

Of the amount sold in the competitive markets, 188,713 tons was sold in Canada and 210 tons was sold in the United States.

Collieries of the East Kootenay Inspection District.

The output of the collieries of the East Kootenay District was 661,426 tons. Added to this was 15,236 tons taken from stock, making a total tonnage of 667,672 tons handled for the year. Of this amount, 32,377 tons or 4.79 per cent. was lost in preparation for the market, 21,800 tons or 3.32 per cent. was consumed as fuel, 98,411 tons or 14.54 per cent. was made into coke, and 524,074 tons or 77.44 per cent. was sold in the competitive markets.

Of the amount sold in the competitive markets, 481,051 tons or 91.79 per cent. of the amount sold and 71.09 per cent. of the total output was sold in Canada, and 43,023 tons or 8.20 per cent. of the amount sold or 6.35 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 five years. Similar figures for years prior to 1927 are available in previous Annual Reports.

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.
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
1929	East Kootenay District	886,706	1,503	589	1,116	794
	Coast District	1,364,546	3,525	387	2,559	533
	Whole Province	2,251,252	5,028	447	3,675	612
1930	East Kootenay District	689,230	1,252	550	931	740
	Coast District	1,197,894	3,393	353	2,458	487
	Whole Province	1,887,130	4,645	406	3,389	556
1931	East Kootenay District	661,426	1,211	546	909	727
	Coast District	1,046,164	2,871	364	2,048	510
	Whole Province	1,707,590	4,082	419	2,957	577

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, 1931.

MINE.	SOLD. In Canada.	SOLD. In U.S.A.	SOLD. Elsewhere.	Total Sales.	Lost in Washing.	Used in making Coke.	Used under Companies' Boilers, etc.	Total for Colliery Use.	STOCKS. First of Year.	STOCKS. Last of Year.	DIFFERENCE. Added to.	DIFFERENCE. Taken from.	Output for Year 1931.
Vancouver Island District.	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	100,847	9,638	3,093	113,578	21,205	.....	6,608	27,813	.....	6,000	6,000	.....	147,391
Extension Colliery	26,599	.....	.....	26,599	6,737	.....	3,506	10,243	2,143	.....	.....	2,143	34,699
Comox Colliery	178,755	.....	4,958	183,713	18,375	.....	7,031	25,406	5,872	7,538	1,666	.....	210,785
Western Fuel Corporation of Canada, Ltd.—													
No. 1 mine	186,475	11,112	8,040	205,627	14,441	.....	59,819	74,260	6,851	41,582	34,731	.....	314,618
Granby Consolidated M.S. & P. Co., Ltd.	94,823	933	.....	95,756	16,554	.....	5,793	22,347	4,331	223	.....	4,108	113,995
Lantzville Colliery	3,943	.....	.....	3,943	.....	.....	1,031	1,031	.....	.....	.....	.....	4,974
Fiddick mine	1,584	.....	.....	1,584	.....	.....	.....	.....	.....	.....	.....	.....	1,584
Little Ash mine	2,002	.....	.....	2,002	.....	.....	134	134	.....	.....	.....	.....	2,136
Richardson mine	117	.....	.....	117	.....	.....	.....	.....	.....	.....	.....	.....	117
Biggs' mine	1,536	.....	.....	1,536	.....	.....	.....	.....	.....	.....	.....	.....	1,536
Little Jingle Pot mine	90	.....	.....	90	.....	.....	.....	.....	.....	.....	.....	.....	90
Totals, Vancouver Island District	596,771	21,683	16,091	634,545	77,312	.....	83,922	161,234	19,197	55,343	42,397	6,251	831,925
Nicola-Princeton District.													
Middlesboro Collieries, Ltd.	27,636	.....	.....	27,636	.....	.....	1,264	1,264	205	53	.....	152	28,748
Sunshine Coal Co.	130	.....	.....	130	.....	.....	.....	.....	.....	.....	.....	.....	130
Coalmont Collieries, Ltd.	89,000	.....	.....	89,000	.....	.....	10,811	10,811	.....	.....	.....	.....	99,811
Tulameen Coal Mines, Ltd.	51,600	.....	.....	51,600	.....	.....	6,321	6,321	.....	.....	.....	.....	57,921
Pleasant Valley Coal Mining Co.	9,829	.....	.....	9,829	.....	.....	3,092	3,092	.....	.....	.....	.....	12,921
Blue Flame Colliery	10,518	210	.....	10,728	.....	.....	755	755	.....	830	830	.....	12,313
Totals, Nicola-Princeton District	188,713	210	.....	188,923	.....	.....	22,243	22,243	205	883	830	152	211,844
Northern District.													
Bulkley Valley Colliery	2,395	.....	.....	2,395	.....	.....	.....	.....	.....	.....	.....	.....	2,395
Totals, Northern District	2,395	.....	.....	2,395	.....	.....	.....	.....	.....	.....	.....	.....	2,395
Grand totals, Coast District	787,879	21,893	16,091	825,863	77,312	.....	106,165	183,477	19,402	56,226	43,227	6,403	1,046,164
East Kootenay District.													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek Colliery	77,389	27,354	.....	104,743	.....	44,942	7,172	52,114	695	546	.....	149	156,708
Michel Colliery	184,775	.....	.....	184,775	.....	53,469	9,600	63,069	738	409	.....	329	247,515
Corbin Collieries, Ltd.	218,887	15,669	.....	234,556	32,377	.....	5,028	37,405	63,252	48,494	.....	14,758	257,203
Totals, East Kootenay District	481,051	43,023	.....	524,074	32,377	98,411	21,800	152,588	64,685	49,449	.....	15,236	661,426
Coal.													
Grand totals for Province	1,268,930	64,916	16,091	1,349,937	109,689	98,411	127,965	336,065	84,087	105,675	43,227	21,639	1,707,590
Coke.													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek Colliery	11,564	16,672	.....	28,236	.....	.....	.....	.....	241	268	27	.....	28,263
Michel Colliery	37,028	.....	.....	37,028	.....	.....	.....	.....	203	312	109	.....	37,137
Total coke for Province	48,592	16,672	.....	65,264	.....	.....	.....	.....	444	580	136	.....	65,400

Collieries of British Columbia—Men employed, 1931.

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 District.																																	
Canadian Collieries (D.), Ltd.—																																	
South Wellington, No. 5 mine	13	5	18	163	.....	163	2	.....	2	59	32	91	6	14	20	.....	17	17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	2	243	70	313
Extension Colliery	13	13	26	134	.....	134	.....	.....	.....	43	13	56	8	10	18	.....	12	12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	33	33	198	81	279
Comox Colliery	19	12	31	142	.....	142	.....	.....	.....	65	48	113	41	52	93	10	.....	10	.....	.....	.....	65	.....	65	38	.....	38	36	22	58	416	134	550
Western Fuel Corp. of Canada, Ltd.—																																	
No. 1 mine	34	29	63	197	.....	197	.....	.....	.....	247	81	328	100	63	163	49	34	83	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	78	78	627	285	912
Granby Cons. M.S. & P. Co., Ltd.	7	5	12	104	.....	104	33	.....	33	.....	41	41	2	11	13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	4	146	61	207
Lantzville Colliery	2	1	3	11	.....	11	2	.....	2	.....	.....	.....	.....	3	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	15	5	20
Fiddick mine	.....	.....	.....	4	.....	4	.....	.....	.....	.....	2	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	2	6
Little Ash mine	.....	.....	.....	4	.....	4	1	.....	1	1	1	2	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	2	8
Richardson mine	1	1	2	3	.....	3	.....	.....	.....	1	1	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	2	7
Biggs' mine	.....	.....	.....	2	.....	2	2	.....	2	.....	2	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	2	6
Little Jingle Pot mine	1	.....	1	2	.....	2	.....	.....	.....	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	1	4
Totals, Vancouver Island District	90	66	156	766	.....	766	40	.....	40	416	222	638	157	154	311	59	63	122	.....	.....	.....	65	.....	65	38	.....	38	36	140	176	1667	645	2312
Nicola-Princeton District.																																	
Middlesboro Collieries, Ltd.	7	2	9	36	.....	36	13	.....	13	16	10	26	.....	12	12	.....	6	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	72	30	102
Sunshine Coal Co.	.....	.....	.....	3	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	.....	3
Coalmont Collieries, Ltd.	12	12	24	79	.....	79	.....	.....	.....	46	38	84	1	24	25	6	.....	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	144	75	219
Tulameen Coal Mines, Ltd.	4	2	6	30	.....	30	45	.....	45	.....	20	20	3	10	13	3	6	9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	85	38	123
Pleasant Valley Coal Mining Co.	2	.....	2	17	.....	17	13	.....	13	10	19	29	4	2	6	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	46	22	68
Blue Flame Colliery	1	2	3	8	.....	8	9	.....	9	.....	4	4	4	5	9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	22	11	33
Totals, Nicola-Princeton District	26	18	44	173	.....	173	80	.....	80	72	91	163	12	53	65	9	13	22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	372	176	548
Northern District.																																	
Bulkley Valley Colliery	1	1	2	3	.....	3	3	.....	3	2	.....	2	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	2	11
Total, Northern District	1	1	2	3	.....	3	3	.....	3	2	.....	2	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	2	11
Grand totals, Coast District	117	85	202	942	.....	942	123	.....	123	490	313	803	169	208	377	68	76	144	.....	.....	.....	65	.....	65	38	.....	38	36	141	177	2048	823	2871
East Kootenay District.																																	
Crow's Nest Pass Coal Co., Ltd.—																																	
Coal Creek Colliery	16	10	26	195	.....	195	.....	.....	.....	31	39	70	112	61	173	5	6	11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	359	116	475
Michel Colliery	24	28	52	179	.....	179	18	.....	18	21	34	55	81	58	139	12	4	16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	335	124	459
Corbin Collieries, Ltd.	11	12	23	108	.....	108	44	.....	44	45	40	85	7	10	17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	215	62	277
Totals, East Kootenay District	51	50	101	482	.....	482	62	.....	62	97	113	210	200	129	329	17	10	27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	909	302	1211
Grand totals for Province	168	135	303	1424	.....	1424	185	.....	185	587	426	1013	369	337	706	85	86	171	.....	.....	.....	65	.....	65	38	.....	38	36	141	177	2957	1125	4082

NOTE.—U=Underground; A=Above ground; T=Total.

LABOUR AND EMPLOYMENT.

During the year 1931 there were 4,082 persons employed in and about the coal-mines of the Province, a decrease of about 12.1 per cent. compared with 1930. The collieries were practically free from labour disputes during the year, the only loss of time being through lack of trade.

Taking the average of all the mines in Vancouver Island District, about 25 per cent. of the working-days were lost through lack of trade. In the Nicola-Princeton District the different collieries worked from 65 to 90 per cent. of the working-days, averaging for the district about 72 per cent. of the working-days. In the East Kootenay District the mines worked from 40 per cent. at the lowest to 75 per cent. at the highest of the working-days during the year, and worked for an average for the whole district about 45 per cent. of the time.

The table on page 181 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.

FUEL-OIL COMPETITION.

For a number of years all fuel-oil used in British Columbia was directly imported as fuel-oil, but with the establishment of refining of crude oil in British Columbia most of the fuel-oil now used is produced from this refining. There is a Dominion import duty of ½ cent per gallon on fuel-oil imported as such, but crude oil imported by the oil-refining companies is not subject to any import duty, with the result that most of the fuel-oil at present displacing British Columbia coal in the home market is duty-free. This fuel-oil, including duty, is valued, for import purposes, at 2.9 cents per gallon in British Columbia, while the crude oil is valued at 2.7 cents.

The following table shows the amount of fuel-oil imported and an estimate of the amount produced in British Columbia :—

	Imported Fuel-oil subject to ½ Cent Gallon Duty.	Fuel-oil produced in B.C. from Duty-free Crude Oil.
	Gallons.	Gallons.
1924	98,351,000	.....
1925	108,836,000	.....
1926	62,214,000	42,000,000
1927	42,954,000	79,000,000
1928	38,124,000	96,000,000
1929	35,697,000	140,000,000
1930	34,560,000	137,000,000
1931	27,794,000	118,000,000

The fuel-oil ex-warehoused, duty-free, in British Columbia ports for shipping during the year totalled 27,000,000 gallons, as compared with 21,195,000 gallons in 1930, so that while the dutiable fuel-oil imported decreased by 6,700,000 gallons, the imported duty-free fuel-oil increased by 6,400,000 gallons; so that the total fuel-oil, imported as such, was practically unchanged, except that some additional 6,700,000 gallons escaped the duty.

COMPETITION OF COALS PRODUCED OUTSIDE BRITISH COLUMBIA.

During 1931 the imports from United States into British Columbia consisted of 33 tons of anthracite, 2,298 tons of bituminous coal, and 6,387 tons of lignite, or a total of 8,718 tons, as compared with 27,941 tons in 1930.

The following table shows the amount of Alberta coal sold in British Columbia since 1924:—

	Short Tons.		Short Tons.
1924	114,186	1928	262,198
1925	117,037	1929	247,060
1926	127,858	1930	227,385
1927	187,028	1931	193,060

There was also 4,758 tons of lignite from Saskatchewan sold in British Columbia in 1930. The total tonnage of coal brought into British Columbia during 1931 was 206,536 tons.

HYDRO-ELECTRIC DEVELOPMENT.

At the end of 1931 the hydro-electric horse-power in use amounted to 623,912, with a further 113,000 horse-power under construction. The steadily increasing development of hydro-installations in British Columbia is shown in the following table:—

	Water-power developed. Horse-power.		Water-power developed. Horse-power.
1900	9,366	1924	355,718
1905	29,334	1925	414,702
1910	64,474	1926	460,562
1915	254,065	1927	473,142
1920	309,184	1928	523,902
1921	309,762	1929	559,792
1922	329,057	1930	630,792
1923	355,718	1931	623,912

For purposes of comparison it may be stated that 1 developed horse-power per year is equivalent to the power value of 6 tons of coal.

ACCIDENTS IN AND AROUND COAL-MINES.

During 1931 there were 4,082 persons in and around the coal-mines. Five fatal accidents occurred during the year, as compared with fifty-four for 1930.

The ratio of fatal accidents per 1,000 persons employed was 1.22, as compared with 11.62 in 1930. In 1929 the ratio was 2.38; in 1928, 2.64; in 1927, 2.10; in 1926, 1.88; in 1925, 1.10; in 1924, 1.66; in 1923, 7.32; in 1922, 4.66; the average for the ten-year period being 3.70.

The number of fatal accidents per 1,000,000 tons produced during 1931 was 2.81; during 1930 the fatalities per 1,000,000 tons mined was 28.61; in 1929, 5.33; in 1928, 5.54; in 1927, 4.48; in 1926, 4.3; in 1925, 2.45; in 1924, 4.52; in 1923, 1.76; in 1922, 12.01; the average for the ten-year period being 8.67 per 1,000,000 tons of coal mined.

The following table shows the collieries at which the fatal accidents occurred during 1931 and comparative figures for 1930:—

Name of Company.	Name of Colliery.	1931.	1930.
Western Fuel Corporation, Ltd.	No. 1 mine	1	2
Canadian Collieries (D.), Ltd.	Extension	....	1
Canadian Collieries (D.), Ltd.	No. 5 mine, South Wellington	1	....
Canadian Collieries (D.), Ltd.	Comox	1	1
Coalmont Collieries, Ltd.	No. 4 mine	....	45
Tulameen Collieries, Ltd.	No. 2 mine	1	1
Crow's Nest Pass Coal Co.	Michel	....	4
Corbin Collieries, Ltd.	No. 6 mine	1	....
Totals		5	54

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for 1930:—

Cause.	1931.		1930.	
	No.	Per Cent.	No.	Per Cent.
By falls of roof and coal	2	40.0	6	11.11
By mine-cars and haulage	3	60.0	2	3.71
By blasting	....	.....	1	1.85
By explosion of gas	....	.....	45	83.33
Totals	5	100.0	54	100.00

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the years 1931 and 1930:—

Cause.	1931.		1930.	
	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 falls of roof and coal	2	853,795	6	314,521
By mine-cars and haulage	3	569,196	2	943,565
By blasting	....	.....	1	1,887,130
By explosions of gas	....	.....	45	41,936
Totals	5	341,518	54	34,947

The number of tons mined per fatal accident during 1931 was 341,518 tons, compared with 34,947 tons for 1930. The average for the last ten years was 115,290 tons.

The following table shows the fatalities from various causes in coal-mines during the year 1931, compared with 1930, according to Inspection Districts:—

District.	Number of Deaths from Accidents.						Total.		Accident Death-rate.			
	Explosions of Fire-damp.	Falls of Roof and Coal.	Mine-cars and Haulage.	Blasting.	Miscellaneous (Underground).	On Surface.	1931.	1930.	Per 1,000 Persons employed.		Per 1,000,000 Tons of Coal mined.	
									1931.	1930.	1931.	1930.
Vancouver Island	....	2	1	....	....	....	3	4	1.29	1.44	3.60	0.04
Nicola-Princeton	....	....	1	....	....	....	1	46	1.82	76.15	4.72	24.09
East Kootenay	....	....	1	....	....	....	1	4	0.82	3.19	1.51	5.80
Northern	....	....	....	....	....	....	....	....	.....	.....	.....	.....
Province (1931)	....	2	3	....	....	....	5	....	1.22	.....	2.81	.....
Province (1930)	....	....	....	....	....	....	....	54	.....	11.62	.....	28.61

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, 1931:—

District.	No. of Fatalities.	Accident Death-rate.	
		Per 1,000 Employees.	Per 1,000,000 Tons of Coal mined.
Coast	174	4.40	11.37
East Kootenay	23	1.63	3.12
For Province	197	3.70	8.67

The details regarding the occurrences of the fatal accidents in coal-mines during 1931 are as follows:—

The fatal accident which occurred to Andrew Parker, miner, No. 5 mine, Wellington-Extension Colliery, on August 8th was due to a fall of a piece of centre rock from the coal-face; both legs were broken and deceased died from shock on the following day; proper spragging would probably have averted this accident.

The fatal accident which occurred to John Matachuk, mule-driver, No. 6 mine, Corbin Colliery, on September 5th was due to a cave of timbers and coal. Deceased was taking out a trip, consisting of three loaded cars drawn by a horse, when the trip was derailed; the derailed cars displaced a post which supported a bridge-timber and caused a cave which caught deceased, with immediate fatal results.

The fatal accident which occurred to Joseph Moric, miner, No. 1 mine, Western Fuel Corporation of Canada, Limited, on October 8th was due to a fall of rock which fell on him and caused death by suffocation. Deceased had apparently been taking extra precautions to secure this rock when it fell on him.

The fatal accident which occurred to Thomas Slater, rope-rider, No. 2 mine, Tulameen Coal Mines, Limited, on November 29th was due to being crushed between the trip on which he was riding and the roof-timber. This was Slater's first day on this rope, and another employee who saw the accident impending called a warning to Slater and signalled the hoistman to stop the trip, but too late to prevent the accident. Slater appeared to be recovering from the accident, but died from an embolus on the brain on December 7th.

The fatal accident which occurred to Young Mow, Chinese timberman's helper, No. 4 mine, Comox Colliery, on December 11th was due to his being run over by a trip on No. 2 slope. All travel is prohibited on this slope while the trips are in motion and deceased was walking on the slope in violation of the special rules.

EXPLOSIVES.

The following table shows the quantity of explosives used in coal-mines during 1931, together with number of shots fired, how shots were fired, tons of coal produced per pound of 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	93,508	314,618	156,934	3.36	0.59
South Wellington, No. 5 mine	54,899	147,391	70,016	2.68	0.78
Extension Colliery	7,960	34,699	9,916	4.36	0.82
Comox Colliery	85,091	210,785	109,030	2.47	0.78
Granby Consolidated M.S. & P. Co.	33,127	113,995	33,211	3.44	0.99
Lantzville mine	5,650	4,974	6,300	0.88	0.89
Fiddick mine	200	1,584	1,584	7.42	0.12
Little Ash mine	600	2,136	400	3.56	1.50
Richardson mine	10	117	20	11.70	0.50
Biggs' mine	900	1,536	600	1.70	1.50
Little Jingle Pot mine	30	90	70	3.00	0.42
Totals for district	281,975	831,925	388,081	1.37	0.72

Nicola-Princeton District.

Middlesboro Collieries	3,880	28,748	7,825	7.40	0.49
Sunshine Coal Co.	200	130	350	0.65	0.57
Coalmont Collieries, Ltd.	14,682	99,811	20,500	6.79	0.71
Tulameen Coal Mines, Ltd.	10,950	57,912	10,950	5.19	1.00
Pleasant Valley Coal Mining Co.	2,500	12,921	6,550	5.16	0.38
Blue Flame Colliery	4,000	12,313	8,000	3.07	0.50
Totals for district	36,212	211,844	54,275	5.85	0.66

Northern District.

Bulkley Valley Colliery	1,250	2,395	1,580	1.11	0.79

East Kootenay District.

Coal Creek Colliery	373	156,708	460	420.12	0.81
Michel Colliery	12,274	247,515	17,922	20.16	0.68
Corbin Colliery	23,750	257,203	26,117	10.83	0.90
Totals for district	36,397	661,426	44,499	18.17	0.81
Totals for Province	355,834	1,707,590	488,435	4.79	0.70

QUANTITIES OF DIFFERENT EXPLOSIVES USED.

	Lb.
Monobel of different grades	317,959
Miners' Friend	.....
Permissible rock-powder	37,875
Total	416,232

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":—

Polar Monobel No. 4.
Polar Monobel No. 6.
Polar Monobel No. 12.
Polar CXL-ite No. 2.

MACHINE-MINED COAL.

During the year 1931 mining-machines produced approximately 288,203 tons of coal, or about 16.8 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.	Mavor and Coulson.	Little Hardy.	Siskol.	Sullivan.	Ingersoll-Rand.
Vancouver Island	1	24	9	....	12	3	....
Nicola-Princeton	....	21	....	....	9	....	12
East Kootenay	....	1	....	1	....	....	....
Northern	....	....	....	....	....	....	....
Totals	1	46	9	1	21	3	12

SAFETY-LAMPS.

There were 3,716 safety-lamps in use in the coal-mines of the Province. Of this number, 298 were flame safety-lamps of the Wolf type and 3,418 were electric lamps of various makes, as follows: Edison, 3,132; Wheat, 246; and Wolf electric, 40.

The following table shows the distribution of lamps by district, method of locking, and 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	44	690	44	690
South Wellington, No. 5	12	232	14	230
Extension Colliery	14	211	14	211
Comox Colliery	20	425	20	425
Granby Cons. M.S. & P. Co.	7	152	7	152
Lantzville Colliery	2	24	2	24
Fiddick mine	2	11	2	11
Little Ash mine	1	8	1	8
Extension Colliery	6	.....	6	.....
Biggs' mine	2	.....	2	.....
Little Jingle Pot mine	3	.....	3	.....
Totals for district	113	1,753	115	1,751

NICOLA-PRINCETON DISTRICT.

Colliery and Mine.	Method of Locking Lamp.		Illuminant used.	
	Magnetic Lock.	Screw or Automatic Clip.	Naphtha Gasoline.	Electricity.
Middlesboro Collieries	7	80	7	80
Sunshine Coal Co.	.....	3	3	.....
Coalmont Collieries	12	257	12	257
Tulameen Coal Mines, Ltd.	4	132	4	132
Pleasant Valley Coal Mining Co.	5	72	5	72
Blue Flame Colliery	3	36	3	36
Totals for district	31	580	34	577

NORTHERN DISTRICT.

Bulkley Valley Colliery	9	.....	9	.....

EAST KOOTENAY DISTRICT.

Coal Creek Colliery	70	480	70	480
Michel Colliery	52	442	52	442
Corbin Colliery	18	168	18	168
Totals for district	140	1,090	140	1,090
Totals for Province	293	3,423	298	3,418

APPROVED SAFETY-LAMPS, ELECTRIC AND FLAME.

A list of the approved safety-lamps, both electric and flame, was published in the 1930 Annual Report. The following lamps, all electric, are now also approved:—

No. 8.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 18 of the United States Bureau of Mines. The only bulb approved for use in this lamp carries the symbol BM-18 and is manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio.

No. 9.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 18F of the United States Bureau of Mines. This model of Edison lamp in reality represents an extension of the lamp approval given under Approval No. 18. The only bulb approved for use with this lamp carries the symbol BM-18F and is manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio.

No. 10.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 18H of the United States Bureau of Mines. This lamp represents an extension of the No. 18 approval of the United States Bureau of Mines. The only bulb approved for use with this lamp carries the symbol BM-18H and is manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio.

No. 11.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 24 of the United States Bureau of Mines. The only bulb approved for use with this lamp carries the symbol BM-24 and is manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio. This lamp is known as the Edison Model J lamp.

No. 12.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 25 of the United States Bureau of Mines. The only bulb approved for use with this lamp carries the symbol BM-25 and is manufactured by the

National Lamp Works of the General Electric Company, Cleveland, Ohio. This lamp is known as the Edison Model K lamp.

(Unless otherwise specified, all lamps are cap-lamps.)

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 and in such cases as it is considered advisable to provide flame safety-lamps in addition to the electric safety-lamps.*

ELECTRICITY.

Electricity is used for various purposes on the surface at fourteen mines and underground at eight mines. 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	1,906
Ventilation	2,635
Haulage	290
Coal-washing	1,225
Miscellaneous	5,176
Total horse-power	11,232
Underground—	
Haulage	2,090
Pumping	2,220
Coal-cutting	50
Miscellaneous	70
Total horse-power	4,430
Total horse-power above and under ground	15,662

Of the above amount, approximately 2,522 horse-power was operated as direct current and 13,140 horse-power as alternating current.

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 298 samples were collected in the various coal-mines of the Province; of this number, thirty-nine 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-inflow is much higher than in other mining districts of the Province. In Vancouver Island and also the Crowsnest Pass Districts a large number of samples were taken in old workings and near the seat of fires. Analyses of mine-air samples taken throughout the coal-mines of the Province during 1931 are on file in the office of the Chief Inspector of Mines and copies will be furnished to any one interested.

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 is acknowledged of many of the inspection committees in forwarding copies of their reports to this office. 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 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. During the year 1,520 samples were taken in the different mines in the Province, and where the analysis showed less than 50 per cent. of incombustible content the area from which the sample was taken was immediately retreated.

DANGEROUS OCCURRENCES.

During the year the following fourteen dangerous occurrences were reported from the different coal-mines under the requirements of section 71, subsections (*d*), (*e*), and (*h*), as follows:—

On January 6th a severe "bump" occurred in No. 3 mine, Coal Creek Colliery, and did considerable damage to the area affected; no person was injured.

On January 24th a serious fire was discovered in No. 3 South level, No. 6 mine, Corbin Colliery; this fire originated in the abandoned and caved part of the workings and entailed much work to bring it under control.

On January 24th the hoisting-rope in No. 6 shaft, Comox Colliery, broke; the hoisting equipment at this shaft is used for the dewatering of Nos. 5 and 6 mines by hoisting the water in large buckets. On this occasion the bucket had caught on some obstruction in the sump and caused sufficient strain to break the rope; this rope had been put into service on April 27th, 1930, and no broken wires had been detected prior to rope breaking.

On January 25th spontaneous heating was discovered in the heading section of the Blue Flame Colliery; this area was sealed off and remained sealed until October, when the section was reopened. The area appeared to be cool and free from fire, but heating again developed within three weeks and the section was resealed.

On February 17th fire was discovered in the main pumping-station near the bottom of No. 5 shaft, Comox Colliery. This fire originated in the fusing of an electrical compensator and spread to some of the mine timbering; the pump-house was faced with granite, but the fire penetrated this inadequate protection. Crews equipped with the oxygen apparatus and Burrell all-service gas-masks did valuable work in the extinguishing of this fire.

On May 5th a severe "bump" occurred on the main haulage-tunnel of No. 1 East mine, Coal Creek Colliery, and wrecked 300 feet of the tunnel; no person was injured.

On May 11th a small fire was caused near the bottom of Protection shaft, No. 1 mine, Nanaimo, due to the short-circuiting of electric cables; this was dealt with before material damage was done.

On June 2nd a severe "bump" occurred on the main level and adjacent area, No. 3 mine, Coal Creek Colliery, and damaged 425 feet of the main tunnel; no one was injured.

On June 14th spontaneous heating was discovered in the waste-workings at the inner end of No. 15 West level, No. 4 mine, Coalmont Collieries; this area was immediately sealed off.

On October 26th, while a cage-load of men was descending Protection shaft, No. 1 mine, Western Fuel Corporation of Canada, Limited, one of the chains on the safety-catches broke, permitting one of the "dogs" to dig into the cage-guides at intervals until the bottom of the shaft was reached; no person was injured and the damage was slight.

On December 17th the top of the fan-shaft of No. 5 and Alexandra mines, South Wellington, caved in and wrecked the fan; a temporary fan was immediately installed at another opening and a new permanent fan-installation at a different shaft was in operation at the end of the year.

While the above occurrences, all of potential danger, did not cause injury to any person, the information regarding them is of the utmost value to all interested in taking steps, where possible, to prevent recurrences.

"BUMPS" IN COAL CREEK COLLIERY.

Coal Creek Colliery has over a long period of years suffered seriously from "bumps" and during the year three serious "bumps" occurred, one being of sufficient violence to be felt at Fernie, some 6 miles from the area affected; fortunately no lives were lost due to above "bumps," although they wrecked part of the main travelling roadways.

In an attempt to gain more information concerning "bumps" and to obtain, if possible, some preliminary warning of an impending "bump," the Honourable W. A. McKenzie, Minister of Mines, has arranged to have a seismograph installed at or in Coal Creek Colliery; this seismograph will provide a continuous photographic record of any earth-movements and will be installed early in 1932.

The machine has been designed and built by Mr. Napier Denison, who is in charge of the Dominion Meteorological Station in Victoria.

PROSECUTIONS.

During 1931 there were six prosecutions made for infractions of the "Coal-mines Regulation Act" and special rules, all of which resulted in convictions.

GOVERNMENT RESCUE-STATIONS.

The Department of Mines has now four mine-rescue stations in different parts of the Province and centrally located in the mining districts—namely, at Nanaimo, Cumberland, Princeton, and Fernie. During the year many requests were received from medical men for oxygen and the inhalators for use in emergencies, and immediate service was rendered in every case. In the larger coal-mining districts of Crowsnest, Cumberland, and Nanaimo experienced teams maintain a regular schedule of training throughout the year and so keep ready for any emergency calls.

Members of several fire brigades in different parts of the Province have taken the full training course at the stations, as practically all up-to-date fire brigades are now equipped with gas-masks and oxygen apparatus of the type used in mines. The possibility of having to deal with fires in buildings or plants, such as refrigerators, which may produce or release poisonous gases makes such apparatus a necessity in modern fire-fighting.

The preliminary training course consists of twelve two-hour lessons in the actual use of the oxygen apparatus and Burrell all-service gas-masks in an irrespirable atmosphere and instruction on the approved method of dealing with mine fires and recovery-work.

The training itself is strenuous work, and all candidates have to undergo a special physical examination before starting training and must be under 45 years of age.

In addition to the regular teams in training during the year, thirty-eight new men took the full training and were granted certificates of competency:—

Cert. No.	Name.	Where trained.	Cert. No.	Name.	Where trained.
700	John Cartwright	Princeton.	719	Walter Pearse	Cumberland.
701	John C. H. Davies	Princeton.	720	Edward H. Cook	Princeton.
702	Harry Hopkins	Princeton.	721	Robt. M. Gellatly	Princeton.
703	Robt. John Pollock	Princeton.	722	Ivor Knudson	Princeton.
704	Valdemar Peterson	Princeton.	723	Gordon H. Cornish	Princeton.
705	Wilfred Valentine	Princeton.	724	Clarence A. Pease	Princeton.
706	Wm. Edward Waller	Princeton.	725	John Milne	Princeton.
707	Frank McVeigh	Princeton.	726	Mike Oreskovich	Princeton.
708	William H. Lewis	Princeton.	727	Harry Bainbridge	Nanaimo.
709	William Tymchuk	Princeton.	728	Robt. H. Bamford	Nanaimo.
710	Antony Ambrosi	Princeton.	729	Walter E. Hutchinson	Nanaimo.
711	Robt. M. Mitchell	Princeton.	730	Cliffard W. Hardy	Nanaimo.
712	John C. Cherkosh	Princeton.	731	Harry Hayes	Nanaimo.
713	Ralph Larner	Fernie.	732	Robt. McAllister	Nanaimo.
714	Frederick G. Hatherhill	Princeton.	733	Joseph J. Wilson	Nanaimo.
715	Geo. Raga	Cumberland.	734	Earl A. Moore	Nanaimo.
716	Charles Sutton	Cumberland.	735	Fred Wilson	Nanaimo.
717	Joseph Frelont	Cumberland.	736	Jas. H. Watson	Nanaimo.
718	Tony Rossimel	Cumberland.	737	Edward Webb	Nanaimo.

FIRST-AID AND MINE-RESCUE WORK AND COMPETITIONS.

In all the main mining districts of the Province First-aid and Mine Safety Associations carried on valuable work throughout the year by carrying on classes of instructions and by the trained members rendering first aid in actual accidents in mines.

The East Kootenay Mine Safety Association, the Vancouver Island and Coast District Branch of the British Columbia Mine Safety Association, and the Princeton and District Mine Safety Association have all carried on district activities in this work, while the employees of the Britannia Mining and Smelting Company at Britannia and the employees of the Consolidated Mining and Smelting Company at Kimberley have taken very active interest in first-aid, safety-first, and welfare work during the year.

While first aid is presumed to deal with accidents after they occur, it is found that in a very short time the main efforts of such organizations become directed to the still greater work of accident-prevention.

When it is pointed out that the great majority of accidents in mines are due to an act of omission or commission on the part of some one, however inadvertently, it will be realized that the work of above associations, in making all mine-workers conscious of the value of safe *methods of working, is of the utmost value.*

During the year demonstrations and competitions in first aid, safety methods, and mine-rescue work were held at Britannia, Cumberland, Nanaimo, Bamberton, Kimberley, Princeton, and Fernie, and while the majority of those taking part were coal and metalliferous miners, there were a number of well-trained men from quarries and logging camps, and in most competitions there were also a number of women and a large number of young people from school age upwards. The total number taking part in the above demonstrations in the mining districts during the year was over 800.

The work is actively supported by the management and officials of the different industries and members of the Inspection Branch of the Department of Mines, which also manifests its support in the shape of financial grants to raise this work to the greatest possible efficiency.

SUPERVISION OF COAL-MINES.

During 1931 eighteen coal companies operated twenty collieries, with forty mines, employing 2,957 men underground. In the supervision of underground employees there were fifteen managers, two safety engineers, twenty-three overmen, 131 firebosses and shotlighters, a total of 171, or one official for every seventeen persons employed underground.

"COAL SALES ACT."

As the result of numerous complaints regarding the misrepresentation of coals sold in British Columbia, particularly for household use, the "Coal Sales Act" was passed on April 1st and proclaimed on July 1st, 1931. In accordance with the requirements of this Act all the coals now produced in British Columbia have been registered by the different producing companies, as follows:—

LIST OF REGISTERED NAMES OF BRITISH COLUMBIA COALS, APPROVED BY THE CHIEF INSPECTOR OF MINES, IN ACCORDANCE WITH THE PROVISIONS OF THE "COAL SALES ACT."

Registered Name.	District and Colliery.	Producing Co.
Comox Coal	Nos. 4 and 5 mines, Comox Colliery (Cumberland)	Canadian Collieries, Ltd.
Old Wellington	No. 9 mine (Wellington)	Canadian Collieries, Ltd.
Ladysmith-Wellington	No. 5 mine (South Wellington)	Canadian Collieries, Ltd.
Ladysmith-Extension	No. 8 mine (Extension)	Canadian Collieries, Ltd.
Nanaimo-Douglas	No. 1 mine (Upper seam) (Nanaimo)	Western Fuel Corporation, Ltd.
Nanaimo	No. 1 mine (Lower seam) (Nanaimo)	Western Fuel Corporation, Ltd.
Nanaimo-Reserve	Reserve mine (Nanaimo)	Western Fuel Corporation, Ltd.
Nanaimo-Wellington	Blend of No. 1 mine, Nanaimo, and No. 5 mine, South Wellington	Western Fuel Corporation, Ltd.
Cassidy-Wellington	Cassidy Colliery (Cassidy)	Granby Cons. M.S. & P. Co.
Lantzville-Wellington	Lantzville Colliery (Lantzville)	Lantzville Collieries, Ltd.
Biggs-Wellington	Biggs' mine (Wellington)	Biggs' Mine.
Fiddick-Douglas	Fiddick mine (South Wellington)	Fiddick Mine.
Little Ash, Wellington	Little Ash mine (Wellington)	Little Ash Mine.
Jingle Pot, Wellington	Jingle Pot Colliery (Nanaimo)	Jingle Pot Mining Co., Ltd.
Middlesboro	Middlesboro Colliery (Merritt)	Middlesboro Collieries, Ltd.
Nicola Sunshine Coal	Sunshine Colliery (Merritt)	Sunshine Coal Co.
Coalmont Coal	Coalmont Colliery (Coalmont)	Coalmont Collieries, Ltd.
Princeton Blue Flame	Blue Flame Colliery (Princeton)	Economy Production Co., Ltd.
Tulameen Coal, Princeton	Tulameen Colliery (Princeton)	Tulameen Coal Mines, Ltd.
Diamond, Princeton District, B.C.	Diamond Colliery (Princeton)	Pleasant Valley Mining Co., Ltd.
Sunrise, Princeton District, B.C.	Sunrise Colliery (Princeton)	Pleasant Valley Mining Co., Ltd.
Pleasant Valley, Princeton District, B.C.	Diamond and Sunrise Collieries Blended (Princeton)	Pleasant Valley Mining Co., Ltd.
Bulkley Valley	Bulkley Valley Colliery (Telkwa)	Bulkley Valley Mining Co., Ltd.
Crow's Nest, Coal Creek	Coal Creek Colliery (Coal Creek)	Crow's Nest Pass Coal Co., Ltd.
Crow's Nest, Michel	Michel Colliery (Michel)	Crow's Nest Pass Coal Co., Ltd.
Corbin Washed	Corbin Colliery (Corbin)	Corbin Collieries, Ltd.

Numerous inspections of coal-dealers' books and invoices have been made by the different Inspectors of Mines, and at the end of the year all the larger dealers, and most of the smaller ones, had been visited and made familiar with the requirements of the Act.

In most cases full co-operation was given, although there appeared to be many of the sub-dealers, particularly in Vancouver, who, having no regular coalyard, buy from the larger dealers or wholesalers and simply peddle the coal around the city until they find a purchaser, and there is no doubt that, in many cases, the buyer may ask for some particular coal and be assured by the peddler that this is the coal he has on his truck and ready for immediate delivery.

The range of prices is sufficient to make it very profitable to substitute an inferior coal for a higher-priced coal with certain dissatisfaction to the buyer and probably cause him to turn to other fuels, with a consequent loss to the coal-mining industry of British Columbia.

METALLIFEROUS MINES.

PRODUCTION.

The output from the metalliferous mines for 1931 was 5,549,103 tons, a decrease of 1,254,743 tons from the tonnage of 1930. This tonnage was produced from forty-four mines, of which twenty-two shipped 100 tons or more.

Accidents.

There were six fatal accidents in and about the metalliferous mines in 1931, being thirteen less than the figures for 1930. There were 2,297 persons employed in and about the metalliferous mines in 1931. The ratio of fatal accidents was 2.61, compared with 5.31 in 1930. The ratio for the last ten-year period was 2.60. The tonnage mined per fatal accident was 924,580, compared with 358,097 tons per fatal accident in 1930. The tonnage mined per fatal accident for the last ten-year period was 451,036 tons.

The following table shows the mines at which fatal accidents occurred during 1931 and comparative figures for 1930:—

Mining Division.	Mine.	No. of Accidents.	
		1931.	1930.
Vancouver	Britannia	....	2
Fort Steele	Sullivan	3	4
Similkameen	Copper Mountain	....	6
Nass River (Northern)	Hidden Creek	2	1
Nass River (Northern)	Bonanza	....	1
Portland Canal (Northern)	Silverado	....	1
Portland Canal (Northern)	Porter-Idaho	1	....
Grand Forks	Union	....	1
Greenwood	Bell	....	1
Golden	Monarch	....	2
Totals		6	19

The following table shows the causes and the percentage to the whole of the fatal accidents, with comparative figures for 1930:—

Causes.	1931.		1930.	
	No.	Percentage.	No.	Percentage.
By blasting	....	.....	1	5.26
By gases following blasting	....	.....	4	21.05
By moving ore in stopes and raises	....	.....	4	21.05
By falling in chutes, raises, and shafts	2	33.33	3	15.80
Haulage	....	.....	2	10.52
By falls of ground	3	50.00	5	26.32
By fall of ore from face	1	16.67	....	.....
Totals	6	100.00	19	100.00

The fatal accident which occurred to Ernie Bernardo, miner, *Porter-Idaho* mine, on February 24th was due a fall of ground while deceased was drilling.

The fatal accident which occurred to Steve Franovich, miner, *Hidden Creek* mine, on June 11th was due to a fall of ground after deceased had cleaned down his place and was setting his machine to drill.

The fatal accident which occurred to Mark R. Coon and William T. Hawke, barmen, *Sullivan* mine, on August 27th was due to a fall of ground. The men were engaged in barring down loose pieces of ground and had fired a shot to dislodge a slab. On returning after the shot they were testing the ground with a pinch-bar when another slab broke from directly above them; Hawke was killed instantly and Coon died the following day.

The fatal accident which occurred to John Osterbeck, chuteman, *Sullivan* mine, on October 14th was due to his falling down a raise, into which he had gone to recover a pinch-bar; this was against the established rules of the company.

The fatal accident which occurred to Vincent S. Goodeve, electrician, *Hidden Creek* mine, on October 30th was due to his falling down a stope while engaged in inspection of the electrical wiring prior to a large blast; deceased appeared to be recovering, but complications developed from which he died on November 5th.

Mine-air Sampling.

During 1931 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.

All the larger metalliferous mines have mine-rescue equipment, mostly consisting of the Burrell all-service gas-mask, and at the *Sullivan* mine a fully equipped rescue-station is maintained by the Consolidated Mining and Smelting Company; the main part of the equipment consisting of twelve sets of the McCaa two-hour oxygen apparatus and eighteen sets of the Burrell gas-mask. Several teams of men at this mine have taken the full mine-rescue training course and obtained certificates of proficiency in this work.

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 of 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. The year just finished showed the lowest accident ratio for many years and there can be little doubt that this was due largely to safety-first consciousness.

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.

QUARRIES.

The "Quarries Regulation Act" was passed in 1929 and regulations pursuant to section 6 of the Act were made effective by the Lieutenant-Governor in Council on January 1st, 1931. Both the Act and regulations thereunder were printed in the 1930 Annual Report. The regulations were deemed to be the most necessary to meet the conditions found affecting the safety of persons engaged in quarrying operations, and particularly in incidental operations as apart from actual quarries.

Many of the operations have been of an intermittent nature, with consequently many changes in the personnel of the crews, which in turn makes it difficult to establish the discipline necessary for the general safety of the men employed. During the year inspections have been made at all the larger operations and many of the smaller ones and the different superintendents have been made familiar with the "Quarries Regulation Act" and regulations.

Among the larger incidental operations were the excavations for the new hydro-electric installation of the West Kootenay Power Company on the Kootenay river and the works of the Greater Vancouver Water Board in tunnelling under the First Narrows at Vancouver for the installation of a new water-main. The excavation-work for the West Kootenay Power project employed several hundred men and used a large amount of explosives, and the work was carried on with a high efficiency and a low accident ratio for this class of work.

The tunnelling of the First Narrows by the Northern Construction Company, under contract with the Greater Vancouver Water Board, can for all practical purposes be considered a mining project with some some exceptional difficulties added. This work is in charge of W. Smaile, directing engineer, and H. E. Carlson, superintendent, with Mr. Edwards and C. B. North in charge at the north and south shafts respectively. The tunnel is approximately 400 feet below high-water mark and this elevation is reached by a shaft of this depth in Stanley Park; this shaft has been sunk and is concreted from top to bottom with a finished diameter of 13 feet and at the end of the year the tunnel had been driven some 1,200 feet. As this work is carried on in coal-bearing measures, this suggested that precautions be observed regarding

the possible danger of explosive gas being found, and as a result frequent examinations of the air are made underground by means of the Wolf flame safety-lamp, with a special examination before shots are fired. The shot-firing is all done electrically from a 110-volt line, and in addition to three switches placed at intervals on the firing-line, and kept open until the shots are to be fired, the firing-line itself is disconnected at each switch-box and taken back several feet. When a round of shots is ready for firing the switches are closed and the firing-line reconnected by the man in charge on his way out, so that the final connection is not made until the outside switch is closed. This precaution was adopted to prevent stray electrical currents, or lightning, causing a premature blast while the men were still at the face. All other electrical power near the face of the tunnel is cut off while explosives are being handled. The shaft on the north shore is being sunk by caisson as there is approximately 100 feet of water-logged sand and gravel before solid rock is reached; at the end of December the caisson had been sunk to within a few feet of the rock. The above operations have been carried on throughout the year without any serious accidents. Air samples taken in the tunnel showed that the ventilation was very satisfactory. The new railway-tunnel under the City of Vancouver was also inspected and the operations showed every indication that they were carried on with every regard to the safety of the workmen.

ACCIDENTS.

Six fatal and a number of serious accidents were reported from quarrying operations during the year and investigations made in each case. Details of the fatal accidents in quarries are as follows:—

The fatal accident which occurred to Edward Driver, locomotive-driver, Granite Road quarrying operation, in January was due to his gas-driven locomotive overrunning its stopping-place and running into a loaded car attached to another locomotive; he was fatally crushed. The tracks were icy at the time and it is probable that on this account the brakes failed to stop the locomotive.

The fatal accident which occurred to O. Godfrey, labourer, Cora Linn construction-works, West Kootenay Power Company, on March 6th was due to his clothing being caught by a projecting set-pin on a revolving shaft while he was oiling moving machinery; he had started this work only on the previous day and had been particularly warned to stop the machinery while oiling. He was drawn round the shaft and was dead when discovered.

The fatal accident which occurred to Edward Kemp, labourer, Royal Bay gravel-pit, Pioneer Sand and Gravel Company, on May 20th was apparently due to his falling on some timbers which he was spiking on the loading-wharf; he was found lying beside the timber into which he had driven a spike and had apparently hit his head in falling.

The fatal accident which occurred to Charles Milstead, labourer, Peerless Sand and Gravel Company, Limited, Lynn creek, on August 5th was due to his being struck by a clevis-pin which was forced out under strain. Deceased was standing some 55 feet away and to one side from a stump which was being pulled out by means of a steam-winch; the pin entered his mouth and caused instant death.

The fatal accident which occurred to Ray Melville, labourer, Coast Quarries, Limited, Blubber bay, Texada island, on September 19th was due to his being crushed by the dipper of a steam-shovel which was being repaired at the time; the dipper was held in midair by the brake and apparently another workman had accidentally released the brake, allowing the dipper to descend and crush the deceased's leg. Deceased was taken to Powell River Hospital and appeared to be recovering. On September 29th, while in the hospital, he was seriously burned owing to a lighted match which he threw away falling on and igniting his bedclothes; he died on November 18th.

The fatal accident which occurred to Jerry Semac, plugger, Coast Quarries, Limited, Granite falls, on December 29th was due to his being crushed by a rock which moved down the rock-pile at the quarry-face and pinned him against another rock which he was drilling. Deceased and another employee had just finished two hours' work of barring down all rocks which they thought dangerous; he started drilling with his back to the rock-pile and, due to the noise of his machine, he had no chance to hear the rock moving down towards him. The danger of men drilling with their backs to the quarry-face has been brought to the attention of all quarry managers.

In many instances the better protective fencing of moving machinery and approaches to quarry operations has been secured and a better supervision in the care of explosives and blasting has been insisted on by the Inspection staff. In practically every case where the attention of the quarry superintendents was directed to some practice that was unnecessarily dangerous the matter complained of was remedied at once, and in general they were found to be in favour of the regulations.

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.

REPORTS OF METALLIFEROUS MINES INSPECTORS.

Throughout the Province many metal-mines formerly operating were closed down during 1931. No mention is made in the Inspectors of Mines' reports of properties formerly operated, but temporarily closed owing generally to metal-price conditions. Many of these properties are in charge of watchmen and in a few instances a little exploration or development has been carried on.

NORTHERN INSPECTION DISTRICT.

REPORT BY THOS. J. SHENTON, INSPECTOR.

Conditions generally at the various mines and prospecting operations in this district were found to be satisfactory and in compliance with the provisions of the "Metalliferous Mines Regulation Act." In some instances certain matters were not quite satisfactory, but in such cases ready compliance was made with requests for changes or improvements.

ATLIN MINING DIVISION.

TAKU ARM SECTION.

Engineer.—This mine is operated by the Engineer Gold Mines, Limited. Operations at this mine ceased on October 15th for the year, since which date the work has not been resumed. Two men are stationed at the mine to take care of the property until operations are recommenced. General conditions were found to be satisfactory.

Atlin-Ruffner.—Operated by the Atlin-Ruffner Mines, Limited. It is located on Leonard mountain, a distance of 14 miles from the city of Atlin, and at the time of my inspection twenty-two men were employed. During the year a new powder-magazine, situated at a safe distance from the camp, was constructed and a new Petter compressor was put into operation. The timbering and ventilation were found to be in fair condition and all matters with respect to safety of operations in good order.

Placer properties that were in operation on Ruby, Boulder, Wright, Otto, Spruce, and McKee creeks were all inspected. Conditions in general were found to be good, with some of the larger operations providing first-class camp accommodation. Regulations regarding powder were generally well observed. In some places there is telephone communication with Atlin, so that any medical help needed is available. Ventilation in some of the underground workings is only fair. As a class, placer-miners are experienced and generally understand adequate timbering in bad ground.

SKEENA MINING DIVISION.

PORCHER ISLAND SECTION.

Surf Point.—Owned by J. B. Woodworth and N. Timmins. Twelve men were employed in this mine until the end of March, when operations ceased for the year; 431 tons of ore was shipped from this mine to the Granby Company's smelter at Anyox. During my inspections operations were found to be conducted in compliance with the "Metalliferous Mines Regulation Act."

KHUTZE INLET SECTION.

Khutze Inlet.—Operated by the Revenue Consolidated Mines, Limited; E. G. Davis, superintendent. Work commenced here on June 11th and continued until August; nineteen men being employed. During my inspection conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

NASS RIVER MINING DIVISION.

ANYOX SECTION.

Hidden Creek.—Owned by the Granby Consolidated Mining, Smelting, and Power Company; C. Bocking, president and general manager; W. R. Lindsay, general superintendent; G. Maxwell, assistant superintendent; F. S. Nicholas, mine superintendent. Operations have been continuous

throughout the year. No men were discharged, but were given idle days in turn; the mine worked 271 days during the year and used 1,579,000 lb. explosives, 412,000 detonators, 2,900,000 feet of fuse, and 23,000 electric detonators. The continuous employment of the men has been and still is a very great benefit to the country under the aggravated condition of unemployment existing.

The company has a large staff of officers employed in supervising the safe operation of the *Hidden Creek* mine; the character of the work and the large scale of the operation makes it necessary to maintain safe conditions. During the present year I regret to say that the number of serious accidents has slightly exceeded the average of previous years. A large percentage of the accidents is due to individuals ignoring rules made for their own safety. Meetings to study accident causes and prevention are held twice a month by men from all sections of the mine, and all suggestions respecting the remedying of any possible dangers are fully considered in the interests of safety. Men are also trained in rescue-work with oxygen helmets; this work is under the supervision of S. Murray, safety-first inspector. Hoisting-cages for men are equipped with safety-catches and frequent tests are made of these, allowing the cage to be disconnected from the main hoisting-cable and to drop sufficiently far to bring the catches into play; in each test the appliances have acted and sustained the cage. The hoisting machinery is equipped with an overwinding device and the cables are given a limited life.

In my different inspections of this large mine I have always received the co-operation of the official staff in the application of the "Metalliferous Mines Regulation Act," and have found the mine in each instance to be carried on in accordance with the above Act.

Bonanza.—Owned by the Granby Company; W. R. Lindsay, general superintendent; G. Maxwell, assistant superintendent; H. E. Doelle, mine superintendent. This mine operated 279 days during the year with a crew of forty-two men and produced 97,000 tons, which required the use of 114,000 lb. explosives, 23,600 detonators, 212,000 feet of fuse, and 1,000 electric detonators. The men here also were given idle days in relays during the year, which did much to prevent any general unemployment in the district. For the year it is pleasing to report that there were no serious accidents. In all my inspections operating conditions were found to be in accordance with the "Metalliferous Mines Regulation Act."

Alice Arm Section.

Tidewater.—The property of the Tidewater Molybdenum Mines, Limited, under option by the Dalhousie Mining Company, Limited; A. McLeod, mine superintendent. Operations were carried on here until the end of April, when the mine closed and did not reopen during the year. Ten men were employed during the period of operation. During my inspection the camp accommodation was found to be adequate and sanitary, the timbering and ventilation good, and all matters in general were in fair compliance with the "Metalliferous Mines Regulation Act."

PORTLAND CANAL MINING DIVISION.

Salmon River Section.

Unicorn.—Owned by the Unicorn Mines, Limited; J. Hovland, manager, Stewart. Operations were continuous throughout the year until November 25th, when the mine closed down. During my inspection of the property the timbering and ventilation was found to be in good order, provisions for first aid made, powder and blasting material properly stored, and all matters in accordance with the "Metalliferous Mines Regulation Act."

Big Missouri.—Operated by the Buena Vista Mining Company; M. M. O'Brien, general superintendent; D. Campbell, mine superintendent; B. Raymond, mine foreman. The new mill began operations about the middle of December, 1930, and continued until September, 1931. During this time an average of 85 tons per day was milled. Since September the mine has been idle, except for some diamond-drilling which was being carried on at the end of the year. An average of sixty-five men was employed during the period of operation, and in my different inspections I found the mine well timbered, ventilation fair, explosives properly cared for, camp conditions good, and all matters in general in fair compliance with the "Metalliferous Mines Regulation Act."

B.C. Silver.—Owned by the B.C. Silver Mines, Limited; C. Banks, general manager; D. Rae, mine superintendent. This property was worked until May, when operations ceased; the average employment for this period was eighteen men, the work up to this time consisting of develop-

ment of the ore-body. The property is at present being cared for by a watchman. In my varied inspections I found conditions to be in accordance with the "Metalliferous Mines Regulation Act."

Premier.—Owned by the Premier Gold Mining Company, Limited; D. L. Pitt, general manager, Premier; B. Smith, assistant general manager; G. Anderson, mine superintendent. Operations have been continuous throughout the year with an average crew of 230 men and a gross production of 242,317 tons. During the year 343,000 lb. explosives were used, with 847,000 feet of fuse, 61,500 No. 8 detonators, and 78,000 No. 6 detonators, without an accident of any kind due to explosives, nor were there any accidents of a serious nature in any of the operations in this mine during the year, which reflects much credit on the management and employees alike. Another creditable matter is the fact that wages have not been reduced at this mine during the depression that has been general. In my varied inspections of this mine conditions were found to be in accordance with the "Metalliferous Mines Regulation Act."

Marmot River Section.

Porter-Idaho and Prosperity.—Owned by the Premier Gold Mining Company, Limited; D. L. Pitt, general manager; B. Smith, assistant general manager; G. Anderson, manager. This property operated from January until the end of April, when work ceased due to the low price of silver. An average of seventy-five men was employed and 28,400 lb. of explosives, with 14,300 detonators and 106,000 feet of fuse, were used during the period of operation. Approximately 100,000 feet of timber is used each month in this operation. In each of my visits during the winter I have travelled by the specially designed carriers on the aerial tram-line. These carriers were designed originally for the transport of any one who sustained injuries, as practically all other means of travel is impossible in winter. During my inspections this operation was found to be conducted in accordance with the "Metalliferous Mines Regulation Act."

Georgia River Section.

Georgia River.—Owned by the Georgia River Gold Mines, Limited (N.P.L.); W. Beaton, manager, 850 Hastings Street West, Vancouver; F. B. Shearme, superintendent; R. Boscence, mine foreman. Operations began on September 22nd, employing eight men, and ceased before the end of the year. The timbering of the mines was found to be good, ventilation fair, and all other conditions in compliance with the "Metalliferous Mines Regulation Act."

OMINECA MINING DIVISION.

Usk Section.

Lucky Luke.—Owned by the Gold of Usk Company, Incorporated; G. Glover, superintendent, Usk. Work commenced during the month of March and was carried on somewhat spasmodically until the end of October, when the mine was shut down for the year. This is a new operation and employed three men. A compressor is being installed and it is expected that it will be in operation early in the new year. During my inspection timbering was found to be good, ventilation fair, camp accommodation good, and sanitary and all other matters to be in fair keeping with the "Metalliferous Mines Regulation Act."

Diadem.—Owned by the American Copper Company, Limited. This property was operated for about three months, commencing in April and closing again in August. At the time of my visit there were five men employed, and the timbering and ventilation were found to be in good order, camp accommodation ample and sanitary, and all other matters in compliance with the "Metalliferous Mines Regulation Act."

Valhalla.—Operated by the Columario Gold Mines, Limited; J. Willman, general manager, Usk. Twelve men were employed in this mine from February until July, when operations were suspended. During my different inspections conditions were found to be in accordance with the "Metalliferous Mines Regulation Act."

Babine Range Section.

Babine-Bonanza.—Operated by the Babine Bonanza Mining and Milling Company, Limited; G. McBean, superintendent. Operations during the year were continuous from January until December 1st, at which date work was suspended. During the year a compressor of 70 horse-

power and a Sullivan steel-sharpener were put into service at this property. During my visit of inspection there were five men employed. The mine was found to be well timbered, ventilation good, powder properly cared for, provisions for first aid made, and all other matters in reasonable compliance with the "Metalliferous Mines Regulation Act."

SIBOLA SECTION.

Emerald.—Under option to the Consolidated Mining and Smelting Company; J. Cehovin, mine foreman; H. R. Hughes, superintendent. The mine closed down in the early part of the year and operations were not resumed; twenty men being employed during the period of operation. During my inspection general conditions were found to be in accordance with the "Metalliferous Mines Regulation Act."

QUEEN CHARLOTTE MINING DIVISION.

GRAHAM ISLAND SECTION.

Sunrise.—Operated by the Kitsault Eagle Mining Company, Limited; W. G. McMorris, manager; N. McMillan, superintendent. Operations were continuous until the end of July, when active mining was suspended and the crew of nine men was reduced to three; these men carried on development-work until the end of the year. The mine is entered by a vertical shaft 100 feet deep; this was the only means of communication at the time of my visit and a request was made that the main south drift be continued until a second shaft, some 500 feet distant, was connected. This has been accomplished, so there are now two openings to the workings; the ventilation and safety of the operation being secured. General conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

SOUTHERN COAST INSPECTION DISTRICT.

REPORT BY JAMES 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; C. V. Brennan, assistant general manager; E. F. Emmons, superintendent of mines; C. G. Dobson, assistant mine superintendent; M. J. Curran, mine foreman of *Bluff* mine; T. C. Curnow, mine foreman of *Fairview* mine; G. C. Lipsey, mine foreman of *Victoria* mine; J. Sleeman, mine foreman of 4,100-foot Extension; N. D. Bothwell, safety engineer. This mine operated 290 days during the year with an average output of 7,000 tons per day. There was 2,022,321 tons of ore mined during the year, as compared with 2,215,600 tons for 1930.

During the year a number of changes have taken place in mining methods and in the work of co-ordinating the various departments, and considerable additions to and improvements have been made in the fire-fighting equipment at the various camps.

In the early part of the year it was decided to extend the 4,100 haulage-level, which goes into the mountain from the head of the mill, some 10,000 feet easterly to develop the downward extension of the *Bluff* mine. Inasmuch as the entire mine production comes out of this tunnel, it was necessary to drive a long by-pass in order to avoid interfering with haulage conditions. A total advance of 2,103 feet had been made up to December 31st, the face now being 6,018 feet from the portal. To ventilate this tunnel a fan was installed inby the 4,100 chute. Galvanized pipes of 20-inch diameter conveys the ventilating air-current within a reasonable distance of the face.

The compressed-air main pipe-line is 6 inches in diameter and carries air at 100 lb. per square inch, but by the time it reaches the face of the tunnel for drilling it is reduced down to about 80 lb. per square inch. Water for the drills is carried to the face by means of a 2-inch diameter pipe-line.

Fan, air, and water pipes are fastened firmly to the roof by means of iron bands. It makes not only a first-class job, but looks well. The tunnel is lighted throughout by means of electricity, thus increasing the margin of safety by increasing the visibility for any workman who may have to go in or out of the tunnel during the time trips are in motion. The tunnel is three-shifted and employs from twenty-five to thirty men; having had a face advance of from 12 to 14 feet per day. It is planned to use a large mucking-machine in this tunnel early in the new year. The workmen employed at this tunnel are housed and fed at Britannia Beach, where accommodation in both respects are to be highly commended.

The different operations comprise the *Fairview*, *Bluff*, *Barbara*, *Empress*, and *Victoria* mines. For a description of these mines *see* previous Annual Reports.

The third annual indoor first-aid meet was held in the gymnasium, Tunnel camp, on the evening of April 16th. Five teams, consisting of five men each, competed for the Britannia Mines cup. The cup was won by a team from the mines, with a mill team winning second place. There was also a competition for women. Three women's teams competed, with five women to each team. Four first-aid instructors demonstrated the proper way to handle a patient in the Stokes basket stretcher. One of the mine first-aid teams showed what can be done by experienced first-aiders when no standard equipment is at hand. This first-aid meet brought to an end the course of training for 1931 in first aid. Nineteen women and sixty-one men successfully passed their examinations during the year.

A new poster service was secured from the Elliott Service Company, of New York. A five-panel cabinet is installed at the Beach and a similar one at the Tunnel camp. *Victoria* and *Barbara* camps are each provided with a three-panel cabinet. The central panel of each cabinet displays a world news photograph which is changed daily. The other panels show posters dealing with safety and efficiency. Safety posters from the National Safety Council, Chicago, have been posted throughout the year. Seventy-five posters are received each month. In order to promote the use of safety-hats in the mine the price of the hats at Britannia stores was cut 50 per cent. to workmen, the company absorbing the other 50 per cent.

Workmen's safety meetings were held at two-week intervals in each section of the mines and for each of the surface departments. At these meetings the effort to develop a safety consciousness in each individual workman was continued. Where it had been impossible to remove the hazard, an attempt was made to point out the dangers and so promote personal caution.

The whole supervision and management of the housing, feeding, washing, and keeping clean and sanitary the various camps is in charge of Mr. Sinclair, who resides at the 2,200 tunnel, and who very ably sees that his working staff carries out their duties in a satisfactory manner. In addition to the camp at the Beach and the one at the 2,200 tunnel, there is one at the *Victoria* mine, one at the *Barbara* mine, and another at the *Empress* mine.

For recreation there is a gymnasium, a reading-room, library, tennis-courts, and swimming-pool. The company also maintains two hospitals—one at the Beach and the other at the Tunnel camp. These are under the supervision of two doctors and a nursing staff. The injured and sick are treated in these institutions; serious cases are immediately sent for treatment to the Vancouver General Hospital.

During the visits of inspection I found the general welfare of the various camps to be good. The conditions of the mines were, generally speaking, good. Ventilation generally was fairly good and the timbering well carried out. The use of caps and powder were well handled and looked after and the mining regulations relating to safe blasting were carefully attended to. Only a few incidental blasting and blasters' certificates were issued during the year.

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-book every broken wire found in any hoist-rope, together with its exact location. The "fencing-off" of bulldoze chambers, old roadways, and floor-holes have been generally well adhered to. The rules governing the use of safety-ropes have been well maintained.

Generally speaking, the provisions of the "Metalliferous Mines Regulation Act" were well adhered to during the year. No fatal accidents occurred during the year and only two serious ones were reported to this office.

REPORT BY JAMES STRANG, INSPECTOR.

Clayburn Co., 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 plant at Clayburn has now been dismantled and all operations are carried on at the new factory at Kilgard. *Straiton* mine is now closed and the mines operating are all at Kilgard, and are conveniently close to the factory. The mines operating are Nos. 4 and 5 B North, No. 9, and Kilgard Fireclay, and at the top of the hill above the clay-deposits the company operates a shale-quarry, men being taken from the mine to work this when necessary. The mines are well timbered and worked on the regular room-and-pillar system, all work being in the solid. The mines are ventilated naturally, except the Kilgard Fireclay, where a small fan is installed at the entrance to the tunnel. This fan gives a good ventilating-current throughout the mine. A storage-battery locomotive hauls the material from the faces right to the factory. No serious accident occurred at any of the mines during the year. The total tonnage of all clays mined underground for the year ended December, 1931, was 16,084 tons and from open-work 771 tons. This is only about 50 per cent. of last year's output. The number of men employed averaged sixteen, against twenty-five last year.

NANAIMO MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

PHILLIPS ARM SECTION.

Alexandria Mining Co.—T. S. Davey, mining engineer in charge. This company's property is situated on Phillips arm. The shaft from the lower tunnel on this property is now down to a depth of 268 feet, with two levels broken away; one at 100 feet and one at 200 feet, both going west into the hill. The 100-foot level is now in about 500 feet, work being carried on all year, with the exception of a few intervals. The equipment on the surface consists of a good compressor plant, having a 125-horse-power Crossby engine and 150 Sullivan compressor, and a blacksmith-shop. When working regularly ten men are employed. General conditions were found to be satisfactory and the regulations of the "Metalliferous Mines Regulation Act" well adhered to.

Thurlow.—This property, on the east side of Thurlow island, was taken over by the Pacific Copper Mines, with Seymour Campbell in charge. There is one tunnel about 100 feet long, mostly in the vein, and about 200 feet back from the mouth of this tunnel there is an old shaft which was cleaned out and sunk to the 70-foot level. A crosscut was driven from this point to the vein and this drifted on for 70 or 80 feet. There were eight men employed. At present this property is closed down. Conditions were found to be satisfactory and regulations well carried out.

QUATSINO MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Coast Copper Company, Ltd.—This company operates the *Old Sport* mine; C. A. Seaton, superintendent. The mine is situated on the south-west shore of Elk lake, in the Quatsino Mining Division. It was closed down early in the year and on the last visit of inspection the only work being done underground was diamond-drilling. The total number of men employed then was twenty-seven. Every effort was made to strictly adhere to the regulations at this property.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS AND THOS. R. JACKSON, INSPECTORS.

REPORT BY JOHN G. BIGGS, INSPECTOR.

The low price of metals that has prevailed throughout the year resulted in several of the mining companies suspending operations, and has further retarded the development of prospects and new developments in this district during the year. However, the same cannot be said about the placer operations, and there can be no doubt that the present depression has been the cause of a more active interest being taken in the placer deposits of the different creeks and rivers

in the Similkameen district, where gold is widely distributed in the gravels; and while we do not hear of any one making a "rich strike," yet there must be a fair number of men taking out enough gold in the gravels to carry them along during the hard times, a matter that is so desirable to the average miner. There has been no accident of any description reported to this office during the year.

The *Copper Mountain* mine, operated by the Granby Consolidated Mining, Smelting, and Power Company, Limited, was closed down all year. This was the largest and most important mining operation in the district.

Nickel Plate.—Operated by the Hedley Gold Mining Company. There was no production at the mine during the year, but a rather vigorous programme of diamond-drilling was carried out during the year by this company.

Planet.—This mine is situated in the Stump Lake district. Operations ceased at this mine during February and there has been nothing done at the mine since that time. Operations were found to be in accordance with the requirements of the "Metalliferous Mines Regulation Act."

Silver King.—Operated by the Silver King Mining Company, Limited; Wallace Fraser, mine superintendent. This mine is situated on Treasure mountain, 25 miles south of the Tulameen Station. It is accessible by a fairly good wagon-road following the left bank of the Tulameen river to the camp, where provision has been made for a fairly large number of employees.

The mine may be generally said to consist of three adit-levels, known as the Nos. 1, 2, and 3 tunnels, driven into the side of the mountain, where the vein system has been intersected. The No. 1 tunnel is by far the longest, the portal being situated a short distance below the camp buildings; this has not been in operation for several years. The No. 2 tunnel is some distance above the camp and has provided the larger part of the ore-supply at this mine; a fair amount of stoping has been done above this level. The No. 3 tunnel is situated some distance above the No. 2 tunnel and is somewhat limited in extent. The chief values in the ore are silver and lead.

The power plant, situated at the camp, consists of an 80-horse-power Diesel engine used for operating a single-stage air-compressor which delivers this power to the mine through a 3-inch diameter pipe-line and is used chiefly for the air-drills; the mine is situated on a flat at the foot of the mountain near Amberty creek and the ore is conveyed from the No. 2 tunnel by means of an overhead gasoline-driven tramway passing down the side of the mountain.

This mine was operated a limited time during the summer. During my last visit of inspection there were nine men employed underground; the mine was in good working condition and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

Dawson.—Operated by the Dawson Gold Mines, Limited; Arthur Ward, superintendent. This mine is situated on the north side of the mountain at Verona, a flag-station on the Kettle Valley Railway, and has been operated intermittently for a number of years. Work during the year has been chiefly confined to a section of high-grade ore in the small "dyke" vein some 300 feet back from the face of the No. 2 adit. During my last visit of inspection there were three men employed underground; the mine was in good working-order and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

Aurum.—Arthur Ward, superintendent. This mine is situated about 6 miles from Jessica, a small flag-station on the Kettle Valley Railway, and on the South fork of Ladner creek. It is accessible by a fair wagon-road built from Dawson camp around the side of the mountain. Developments may be generally stated to consist of five adit-levels of different length driven into the side of the mountain, and during the present year operations have been confined chiefly to a little stoping above the No. 1 level, situated at an elevation of 2,999 feet. During my last visit of inspection there were four men employed at this camp, all of whom were engaged in exposing the formation below the lower level. Mining operations above the No. 1 level were found to be in good working condition, well timbered, and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

Slate Creek.—Norman McCormick, superintendent. This operation is situated near the east bank of the Tulameen river, where a large amount of work has been done in the past. Work was discontinued at the upper tunnel and continued again at a much lower elevation near the entrance of the creek to the Tulameen river, where the camp is at present located. An adit-level was driven into the side of the hill in close proximity to the "rim-rock," a distance of

approximately 300 feet. Operations here have been very intermittent and during the fall of the year work was discontinued. During my last visit of inspection there were six men employed underground; the adit-tunnel was found to be well timbered with "framed sets" and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

Granite Creek.—This operation is situated at the fork of Granite creek and Tulameen river. It has been the scene of active "placer" operations in the past. The great problem appears to be dealing with the large boulders lying in the bed of the creek, and this has resulted in one of the most interesting operations, something entirely new in this district, and may be described as a floating pontoon. This pontoon is situated at the entrance to Granite creek and carries most of the necessary equipment, consisting of a centrifugal gravel-pump, belt-driven from a Diesel engine, with the suction-pipe resting on the gravel in the bed of the river. While the pump is in operation, men provided with regular divers' equipment are working below the water, loosening the gravel in close proximity to the suction-pipe, and the material is pumped to a long sluice-box above; after the gravel has been pumped out of the creek-bed the large boulders exposed below the water are then lifted out by means of a large cable, which is attached to a "high-line" aerial powered by a gasoline-driven hoist, and carried over the line to the tailing-dump. This operation worked continuously throughout the summer, but work ceased during the fall when the river began to freeze. Conditions in the above operation were found to be in accordance with the "Metalliferous Mines Regulation Act."

REPORT BY THOS. R. JACKSON, INSPECTOR.

LILLOOET MINING DIVISION.

Pioneer.—David Sloan, general manager; Robert Sloan, mine superintendent; Robert Ecklof, foreman. The most important work undertaken was the sinking and raising of a new vertical shaft. This shaft will be the main working-shaft. It is of the 3-compartment type and will be equipped with a first-class powerful electric hoist capable of hoisting 300 tons of ore material in eight hours. It will be provided with automatic loading and dumping devices. This shaft, from the present workings, was within 50 feet of completion at the end of the year and it is planned to continue sinking to the 2,000-foot level. Levels are being established at 125-foot intervals and a loading-pocket placed below each level; the main shaft is at present 170 feet below the 900-foot level and a new level has been started at 1,025 feet.

Quite a lot of timber is used in stoping, and where the vein thins the management generally leaves in a pillar, the dimension of which varies, but usually about 12 by 14 feet in area. This helps to steady the ground being stoped. When stoped the cavities are filled tightly with muck.

Opposite the shaft on the 500-foot level there is a large air-storage chamber with cement retaining front. The quantity of air contained is sufficient to keep the drilling units operating for about three hours in the event of the air-compressor breaking down.

The present shaft has been equipped with armoured cable and up-to-date switches installed on each level. The main parts of the mine are lighted by electricity.

The No. 3 shaft will be carried through to the surface, where a 60-foot gallows-frame for the mine-head will be constructed. Ore-bunkers will be built and from there the ore will be delivered to the mill by a tramway of about 300 feet in length and of the 2-bucket variety. The ore will be crushed and screened and the plus ½-inch product will be delivered to a No. 7 Newhouse crusher, which will further reduce the mill-feed to minus ½-inch product.

To keep pace with mine developments the mill is being increased by an up-to-date 200-ton unit, which will consist of a 64-inch Marcy ball-mill, a 6 by 7 tube-mill, a large duplex and bowl Dorr classifier in closed circuit with the mills, three 22- by 24-foot diameter agitators, four 30- by 14-foot thickeners, and two 10- by 12-foot filters of the Dorr type, with all the necessary pumps, repulpers, tanks, etc. It is the intention of the management to have the new mill unit ready for operating before the mine is ready to deliver ore through the new shaft. For power-plant information *see* the 1930 Annual Report.

Improvements in camp accommodation are being steadily made. In addition to the former bunk-house No. 1 and two-story office building, the upper part of which contains sleeping accommodation for the staff and other mine officials, a new double-story unit No. 2, of similar dimensions to No. 1, has recently been completed and is now occupied. Like No. 1 unit, the workmen's change-room and clothes-drying place is in the basement, but with added improve-

ments as to appearance and comforts. The heating system in No. 1 unit is accomplished by a hot-air furnace, where No. 2 unit is heated by a hot-water furnace.

The first-aid room is housed on the first floor of the main office building. It is furnished with a bed, stretcher, splints, bandages, and all other necessary equipment for rendering first aid to the injured. A qualified and experienced first-aid man is in charge and available at all times; he is also giving instructions in first aid to employees. There is at present no medical man within easy reach of this mine and the *Lorne* mine, but with the rapid increase in the number of men employed in the district it is anticipated that the services of a resident doctor will be justified at an early date.

No accident reports were received from this mine, which is very satisfactory when it is considered that seventy-two men are employed underground. During my different inspections general conditions were found to be satisfactory and at all times immediate co-operation was received from the officials on any points taken up with the view of increasing the safety and efficiency of the operation.

Lorne.—Operated by the Bralorne Mines, Limited; Richard Basustow, manager; T. C. Chenoweth, mine superintendent. The *Lorne* camp is situated on the south-east bank of Cadwallader creek. Bunk-house accommodation is good. Several houses belonging to the company are occupied by families. There is a large building, the under-part of which comprises a store-room, manager's office, draughting-room, and clerk's office, and the upper part is divided into a kitchen, dining-hall, reading and recreation room. The whole of the property is illuminated by electricity produced by the generator located near the creek. Fire-fighting equipment and other means of escape should a fire occur in the building are in evidence.

The mine is delevoped by a tunnel which cuts the vein at a distance of about 2,000 feet from the portal. A raise from this level has been recently put through to the surface, which is about 800 feet vertically. An interior shaft (No. 1) is being sunk to explore the mine below the level and is now down about 100 feet.

When inspected there were sixty-five men on the pay-roll, fifty of whom were employed in constructing a 100-ton mill, which is being built near the portal of the tunnel. In addition to above-mentioned mine-workings, there are around 10,000 feet of drifting and about 1,000 feet of raises and winzes, all of which are naturally ventilated. The second outlet to the mine was completed the latter part of the year. Electric-battery locomotives are employed in the main tunnel haulage. All other transportation will be done by hand. The winch, situated at the top of No. 1 shaft, is operated by means of compressed air. The power plant (situated near the creek) is about 6,500 feet away from its initial source of water-supply in Cadwallader creek. This water is conveyed through a 30-inch diameter wood-stave pipe-line along the side of the mountain to the plant. Head of water about 250 feet.

During my visit of inspection general conditions were found to be satisfactory, timbering good, first-aid provisions made, explosives properly cared for, and all other matters to be in compliance with the "Metalliferous Mines Regulation Act."

CARIBOO MINING DIVISION.

Consolidated Gold Alluvials of B.C., Ltd.—N. C. de Ronne, mine manager; J. E. McAlpine, foreman. This property is reached on the road to Barkerville and is about 35 miles from Quesnel. Operations during the year consisted of reopening an old shaft (No. 2) sunk some years ago. Mr. de Ronne and I descended No. 2 shaft until we reached the water. It is a 3-compartment and substantially timbered. The stairway is in good condition. Fencing and covering of shafts good. Housing accommodation for the men was good and cook-house clean and sanitary. No explosives were used during the year and there were ten men employed.

Lowhee Mining Co., Ltd.—Alfred F. Eastman, managing director; T. A. Harman, mine superintendent. This hydraulic-placer operation is situated on Lowhee creek. During my visit of inspection in November I found the operation being carefully worked. The top of the pit was well cleared back of obstruction in the form of growing trees, old tree-stumps, and heavy brush-wood. Inspection of top and sides of gravel-pit is made three times daily by the superintendent. I found detonating-caps and explosives close beside each other and under the same roof. The management agreed to see that this practice was immediately discontinued. Camp accommodation was also found to be good and cook-house clean and in good condition. There were eleven men employed.

Cariboo Gold Quartz Mining Co., Ltd.—Fred Wells, superintendent; Leslie Walker, mine foreman. This property is situated near Lowhee creek and is about 4 miles distant from Barkerville. At the time of my inspection there were sixteen men employed. Camp accommodation was found to be good, provisions for first aid made, timbering good, mine ventilation fair, being naturally produced, and all other matters to be in compliance with the "Metalliferous Mines Regulation Act." A new concrete building had been completed to store explosives, with iron doors, padlocked and danger-sign above doors, and sufficiently far away to comply with the regulations.

EAST KOOTENAY, WEST KOOTENAY, AND BOUNDARY INSPECTION DISTRICTS.

REPORT BY ROBT. STRACHAN, SENIOR INSPECTOR.

The Kootenay-Boundary district includes the Ainsworth, Arrow Lakes, Fort Steele, Golden, Grand Forks, Greenwood, Lardeau, Nelson, Revelstoke, Slocan, Slocan City, Trail, Trout Lake, and Windermere Mining Divisions. Owing to the scattered nature of the district the work of inspection is rather difficult and many of the small mines and prospects are situated in isolated positions. To provide for this Inspector H. H. Johnstone, with office in Rossland, carries out the work of inspection in the West Kootenay and Boundary districts, except for the mines situated in and around Kaslo and Sandon, these being looked after by Inspector H. E. Miard. Mr. Miard also inspects some of the metal-mines in the East Kootenay district, while the writer supervises the whole district.

Our work of inspection could be greatly facilitated if those opening new mines, or reopening old mines, or in the event of closing down, would notify us as provided for by section 20 of the Act. Under the Blasting Regulations, magazines and underground storages for explosives are required to be approved in writing by the Inspector of Mines, and it would greatly facilitate this work if such notices were immediately forwarded. The sections relating to those using and handling powder, under the Blasting Regulations requiring them to have either provisional or permanent blasters' certificates, are also all too often overlooked in many of the smaller mines. There has been a considerable falling-off in the activities in practically all the districts, due to low prices for metals.

In the Sandon district only three mines were working—the *Silversmith*, with four men; the *Ruth*, with four; and the *Black Colt*, with three. The first two were under lease to the workmen; the latter operated by Clarence Cunningham. During our inspection of these we found everything in good condition and the Act very well complied with.

In the Ainsworth and Kaslo districts there were practically no mines working. The report by H. H. Johnstone covers the West Kootenay and Boundary districts more in detail and is attached. In the East Kootenay district the *Sullivan* mine operated during the entire year, although on short time during a portion of the year, and there was no active mining at either the *Giant* at Spillamacheen or the *Monarch* mine at Field. The phosphate-mines at Crowsnest operated by the Consolidated Mining and Smelting Company of Canada were closed down early in January and had not resumed at the end of the year.

During the year over forty mines were visited and 146 visits of inspection made. Many of the larger operations were visited regularly every month; in many of the smaller mines the visits were less regular, but the conditions prevailing during our inspection of the mine generally determined the number of inspections. We generally find that in the larger mine the regulations and rules, both with regard to the mine and to explosives, are very well complied with and every effort made to make conditions safe and healthy for the workmen. Where conditions have not exactly complied with the "Metalliferous Mines Regulation Act," the Blasting Regulations, and good mining practice, attention has been drawn to this, and we have generally found them very ready to comply with our wishes in the matter. Owing to the reduction in the mining forces and the closing-down of many of the smaller mines, the number of workmen has been greatly reduced as compared with previous years, and would only average about 900, as compared with 1,400 in 1930.

ACCIDENTS.

Six accidents were reported as occurring under the above section, involving death or serious injury to an equal number of workmen. All of these accidents came under subsection (*b*), and no accidents were reported under subsection (*a*), explosions of gas, powder, or steam-boilers. All of these accidents were investigated, and where death occurred the inquest was attended. All the accidents occurred in the *Sullivan* mine; all underground, and three of these resulted in death. This is a better record than in 1930. Much time, effort, and work are devoted at the *Sullivan* mine to accident-prevention, and if the individual workman would give further study to taking care, still better results would be attained in the future.

VENTILATION.

A large ventilating-fan has been installed at the *Sullivan* mine and is used to great advantage in maintaining ventilation during the summer, when atmospheric temperatures fluctuate and interfere with natural ventilation; in winter the difference in temperature between the mine-workings and the outside atmosphere provides efficient ventilation. I am sure it is very gratifying to have the mine operators interest themselves in the question of better ventilation, and I feel that it will amply repay all the trouble and expense by providing greater health and efficiency in their working forces. Samples of mine-air have been taken during the year at several of the mines, where conditions seemed to indicate that this was not just as good as it should be. In every case the result showed well above 20 per cent. of oxygen and no excessive amount of dangerous or deleterious gases present.

WELFARE-WORK.

The only mine maintaining this work is the *Sullivan*, at Kimberley; here a regular safety-first staff is maintained. Over 90 per cent. of the workmen are trained in first aid, two teams of men are trained in mine-rescue work, and a mine-rescue station, second to none in the Province, is maintained. These men are also trained in the use of the all-service mask, as well as the McCaa self-contained breathing apparatus, and, I feel, will be a great asset in the event of any accident where their service will be required. A constant campaign is maintained in safety first; every accident is investigated with a view to preventing its repetition, and the result is shown in the great reduction of the number of accidents. One feature I should like to mention is the work of the safety committee, consisting of the officials and a select number of workmen, who regularly meet every two weeks to discuss accidents that have occurred, sources of danger, and suggestions for improving the conditions with regard to safety and health. We feel very much indebted to this committee for its interest in the welfare and safety of the workmen, and would like to see this work extended into every mine.

Fire-hazards are eliminated to a great extent in this mine by a rule requiring that not more than one day's supply of timber or other inflammable material be maintained underground at one time, and this applies to mine timbers, planking, etc. In addition to these precautions, fire hose and hydrants are installed at all strategic points throughout the mine, while drinking-water is supplied underground, being piped through bore-holes from the surface and regular tests made as to its purity. Magazines for explosives, both above ground and underground, are well isolated and maintained in first-class condition.

I again wish to thank the workmen, the officials, and the companies for their assistance and co-operation in our work during the year, and trust to a continuation of the same in the year we are now entering on. We realize it is only through such co-operation that we can expect to see a reduction in the number of accidents and maintain safer and healthier conditions in and around our mines.

EAST KOOTENAY DISTRICT.

REPORT BY H. E. MIARD, INSPECTOR.

In the course of inspections sixty-seven certificates of competency as blaster were granted under the provisions of the "Metalliferous Mines Regulation Act," four of these being issued as substitutes. In addition, sixteen certificates of the same class were granted from this office

under the provisions of the "Quarries Regulation Act," the applicants for these being at the time employed as follows: Two in quarrying operations, thirteen on road-work, and one on power-line construction.

FORT STEELE MINING DIVISION.

Sullivan.—Consolidated Mining and Smelting Company of Canada, Limited; general superintendent, E. G. Montgomery; mine superintendent, William Lindsay; assistant mine superintendent, D. L. Thompson; safety and efficiency engineer, Jos. L. Giegerich. The lack of demand for metals, incident to the present economic depression, from which the mining industry of the Kootenays has suffered so acutely during the last two years, has been responsible for the curtailment of the output of this gigantic operation, even the concentrator remaining idle for one or two days each week during a part of the last six months. At the mine the average working force throughout the year numbered 576—399 underground and 177 on the surface.

Mining and Development Work.—The method of mining followed is that known as open stope and pillar. It has been thoroughly described in preceding reports, particularly in that for the year 1928. Development-work proceeds according to a well-defined system, an essential of success in operations of such magnitude.

The most important feature of the programme of development carried out during the year was the progress made with the slope intended to open the ore-body below the 3,900-foot level. This new opening, known as the 3,901 winze, is driven in the ore on a dip of about 30° and advanced 250 feet during the year. The first station has been cut and the work of concreting the entire section of the slope driven so far was almost completed at the time of the last inspection, in December. The manway is separated from the hoisting compartments by a reinforced-concrete wall 6 inches thick, reaching up to the roof for the lower 50 feet, but only anchored to it at suitably spaced points for the balance of its length. A midwall, likewise 6 inches in thickness, separates the two hoisting compartments, but is only of sufficient height to carry the skip-guides. The tracks will consist of 45-lb. rails, resting on creosoted 8- by 10-inch sawn timbers running longitudinally and supported by transverse concrete blocks built 6 feet apart. The manway is discontinued above the 3,900-foot level and the hoisting compartments there are protected by heavily reinforced-concrete arches, 14 inches thick, that will probably be banked over with loose muck later. The sheaves are reached from the hoist-room by means of a steel ladder. The hoist-room is gunited and the electrically driven hoist is set on a concrete bed, the whole giving the impression of a thoroughly finished piece of work. Outside the runners aforesaid, the guides, and probably the stairway in the travelling compartment, no material, either combustible or subject to decay, will be found in the slope when completed. Even the barriers at the first station are supported by concrete pillars, in the moulding of which attention has been paid to appearance as well as to utility.

Early in the summer one of the watercourses occasionally encountered in the ore-body was met by the slope and the rate of advancement suffered a considerable decrease thereby. However, the flow of water has now subsided to little more than a trickle and it will interfere much less seriously with the progress of operations when the driving of the slope is resumed.

The construction of concrete pillars in the upper mine has been continued and is greatly simplified by the use of the steel forms introduced last year. The work of removing the small pillars of ore left behind in the course of former operations was begun shortly before the end of the year. The method followed, in the case of the smaller ones, consists in taking off a slice of moderate height over their entire cross-section, under the hanging-wall, which is carefully trimmed while it is still possible to stand close to it. The remainder of the pillar is benched out afterwards. All necessary precautions are taken to assure the safety of the miners engaged in this class of work, the most essential of these measures being, naturally, a judicious choice of the men to whom it is entrusted; the chief danger to be guarded against is of course that of falls.

The possibility of filling worked-out areas with gravel run in from the surface is still being studied, and a thorough survey of the available supply of material suitable for the purpose has been completed. However, some features of the problem will require further investigation.

Independently of the regular daily and weekly inspections, the man-train and the ropes, cages, and safety appliances in use in the shaft are examined at least once every fortnight by a machinist.

Ventilation.—Since the fan has been installed the ventilation has presented very little difficulty, even in midsummer. In winter the difference in temperature existing between the mine-workings and the surface, assisted by a vertical distance of some 800 feet between inlet and outlet, is sufficient to assure the circulation of an adequate current of air through the mine.

Explosives.—Underground, 35, 50, and 60 per cent. Polar Forcite gelatine is used exclusively for blasting purposes. Every case of explosives is opened in a building separate from the storage-magazine, the sawdust is taken out, and the powder is replaced in the boxes. All explosives are taken in the mine at night, in a special car fitted with insulated couplings, and are distributed between several underground magazines, from which they are issued to the miners. These underground magazines fulfil all requirements as to location and construction and are kept remarkably clean at all times.

Plans and Model of Workings.—While a very elaborate set of plans is always kept up to date, the easier way by far to acquire an intimate acquaintance with the workings is to study the model described in the report for 1930. This, although perforce not representing the most recent phases of the operations, is kept as close to the latest surveys as may be reasonably expected by S. Alexander and R. Robson, who have had charge of it practically since it was started. The sum of information obtainable from this model has been increased during the year by an accurate representation of the depth of gravel found on every part of the surface above the workings. This feature may assume considerable importance should a waste-filling system be eventually adopted.

Safety and First-aid Work.—The fact that the safety of the operations is the chief concern of the official staff was again amply demonstrated in the course of the year just ended. In pursuance of this policy, two strong committees, known respectively as the "accident-prevention" and the "safety-first" committees, were organized and function upon lines suggested by the general manager of the company, S. G. Blaylock, who gave the matter his personal attention. The accident-prevention committee meets once each month and its membership includes all mine officials, from the general superintendent to the shiftbosses. The safety-first committee meets every fortnight and is composed of fourteen day-wage and contract men, two of them automatically retiring and being replaced every month, with the rock-house foremen and mucker-bosses as permanent members.

A set of "safety rules" has been published by the mining department of the company in booklet form for distribution among the employees. Each rule conveys an appropriate admonition, expressed by one, or two, clear and crisp sentences, the meaning of which no one can fail to grasp. While there are a few repetitions, these are amply justified, for thereby each section is made to cover entirely the phase of the operations that it is intended to govern. The preamble deserves to be quoted *in extenso*, as it sets out, in the clearest possible manner, the chief means of promoting safety and efficiency in mining operations:—

"It is the earnest desire of the officials of the Consolidated Mining and Smelting Company that preventable accidents be entirely eliminated in the operations of this company.

"The object of this book is to bring to your attention your responsibility for your own safety as well as that of your partner's and other workmen near you, and to assist you in preventing accidents on or about the company's property.

"Safety devices required by law, or installed through recommendation of officials and employees, can do little to prevent accidents without your direct co-operation. Personal interest in your own safety and that of your fellow-workmen is essential.

"Remember that while accidents can be shown in dollars and cents on our operating statements, a life cannot be returned or members of the body replaced, nor can insurance repay the widow and orphan for their suffering and misery; we ask your co-operation in the safe performance of all our mining operations."

As a result of the classes held last year, 444 certificates of training in first aid were granted to employees of *Sullivan* mine by the St. John Ambulance Association. Classes are being held again this winter for the benefit of those who have not yet qualified for their first-year certificate, or desire to extend further their knowledge of the subject.

As stated in the report for 1930, the wearing of hard-boiled hats is compulsory underground, as is also the use of goggles wherever there is the slightest risk of eye-injury; safety-belts are provided at all grizzlies and open chutes, and all men whose duty may expose them to the risk of falling are required to use the belts.

Two fully trained mine-rescue teams of five men each are maintained. These men are required to put in a two-hour practice at least once a month, so as to maintain their familiarity with the work. The management has considered fitting up an abandoned stope in the upper mine as a training-gallery, in order to give the teams the advantage of practices carried on under actual underground conditions, but as this arrangement entailed certain inconveniences it has not yet been put into effect.

Towards the end of the year all workmen employed underground were brought to the safety engineer's office in groups of fifteen for a lecture on essential precautions to be taken by themselves in order to assure their own safety.

Accidents.—Two fatal accidents, resulting in the death of three men, and three cases of serious injuries to employees of the *Sullivan* mine were reported during the year. Two of these occurrences belonged to the class of unpreventable mishaps; one was apparently due to a slight error of judgment on the part of the victim; and one must be ascribed to the assumption of a needless risk, which fact in itself constituted a serious breach of discipline. In the remaining case it was difficult to ascertain the respective importance of the rôles played by fortuitous circumstances on the one hand and the human factor on the other.

The other three accidents reported resulted in fractured limbs and were all due to pieces of ore rolling down unexpectedly on muck-piles or in chutes. Those injured were a loading-machine operator and two chute-loaders. Two of these mishaps may safely be considered as having been unavoidable. In the third case the man injured had climbed into a chute, in which the ore hung up about 5 feet above the door, in order to plant a bulldozing shot. A large piece of ore rolled down from above and pinned him against the chute door. While he could probably place his charge of powder more effectively by going into the chute, he was assuming a certain amount of risk in doing so, a fact but too clearly demonstrated by the immediate sequel.

Additions to Plant and Equipment.—The most important and interesting single addition to the mine equipment brought into service in the course of the year was probably the dust-controlling system installed in the coarse-crushing plant and put in operation during the month of February. This consists essentially of a No. 80 Sturtevant, slow-speed, mill-type exhausting-fan, with overhung wheel and horizonal discharge, its capacity at 420 r.p.m. being 28,500 cubic feet, against a 3½-inch water-gauge. The fan is driven by a 30-horse-power, 550-volt, 900-r.p.m., totally enclosed induction-motor. Besides these essential members, the system includes the necessary piping, a cyclone-tank, a spray-tank, and a slime-dewatering device.

The primary header, 36 inches in diameter, discharges into a dry collector or cyclone, 7 feet in diameter and 4 feet high. It is estimated that 80 per cent. of the collected dust is thrown down there. Afterwards the air is drawn through the wet collector, or spray-tank, 11 feet in diameter and 12 feet high, to the bottom of which about 98 per cent. of the fine dust remaining in suspension is washed down after having been caught by impact on wet surfaces. The cleaned air, containing probably less than 0.5 per cent. of the volume of dust that it carried originally, passes then upwards to the fan, the latter being set above the spray-tank, and is discharged in the atmosphere. The primary header is connected to two secondary headers, from which smaller pipes lead to the various points, from which the dust-laden air is drawn off. Practically all piping is carried under the gyratory feed-floor in order to avoid interference with the operation of the crane.

The water and slimes in the bottom of the spray-tank feed by gravity to a No. 1½ Cameron centrifugal pump and are raised to a settling-cone, 6 feet 8 inches in diameter, placed directly over the conveyor delivering the crushed ore to the railway storage-bins. The slime is discharged on the belt once a shift, or oftener if necessary, as is also the dust collected in the cyclone. The water from the settling-tank is run to waste.

The spray-tank was originally fitted with a cut flight conveyor, but this arrangement did not work satisfactorily, and a test made during the month of August showed that an excessive quantity of material was going out in the overflow. The screw conveyor was therefore discarded and was replaced by the aforementioned settling-tank, while the flow of water in the spray-tank was increased from 15 to 25 gallons per minute. Samples taken since then have shown that the quantity of solids lost in the overflow is quite small.

A new underground drill and car repair shop has been built in the upper mine and the necessity of sending such equipment outside when it requires attention has thus been obviated. The interior of this shop, like that of any other underground room used permanently, either

for similar purposes or as hoist-room, generating-station, etc., has been coated with a mixture of lime, cement, and salt, the glossy surface of which not only adds greatly to the appearance of the locality so treated, but increases considerably the effectiveness of the means of lighting in use.

As the handling of a comparatively large quantity of lubricating-oil is rendered necessary underground by the extensive mechanical equipment in use, the question of providing for the distribution of this class of supplies in the safest and most convenient manner has received careful consideration. While care has been heretofore exercised in this matter, it has now been decided to set all oil-drums on concrete platforms with raised borders, as an additional precaution.

Living Accommodation and Welfare-work.—The efforts of the operating company towards providing satisfactory living conditions for its employees have been mentioned in previous reports, and little can be added to the well-deserved eulogies of which they were the object. It will suffice to say that, notwithstanding the unfavourable economic conditions against which the mining industry is at present struggling, this care has not abated.

Conclusion.—That the past year marked another forward step in the furtherance of safety in the operations concerned may be gathered from the foregoing details. The writer finds it his pleasant duty to express once more his appreciation of the sincere efforts made by the staff of the *Sullivan* mine in this respect, as well as of their endeavours to promote the general welfare of the men under their charge. The gradually expanding degree of understanding displayed by all employees towards matters pertaining to individual and general safety reflects careful teaching.

Phosphate-mines.

Consolidated Mining and Smelting Co. of Canada, Ltd.—Superintendent, Leo Telfer; engineer in charge, C. White. Operations at the *Marten* mine, on the South fork of Michel creek, were suspended early in the year, the desired information having been obtained at that point. The *Crow* mine was operated until the beginning of May with a force of nineteen men, thirteen of whom were employed underground. The traces of inflammable gas that had been found, almost constantly, in the mine-air during the greater part of the preceding year, disappeared with the driving of a raise to the surface and the transfer of the gasoline-driven air-compressors to the north side of the tunnel. Only one sample, taken in a poorly ventilated blind end, did show a trace of unidentified paraffin hydrocarbons. Whether this had been given off by the rock or was a product of the combustion of explosives could not be ascertained. All other samples sent to Ottawa showed that the mine-air was remarkably good, in general.

WEST KOOTENAY DISTRICT.

Report by H. H. Johnstone, Inspector.

This report does not include properties in the Kaslo and Sandon districts, which are inspected from the office in Fernie. Owing to the universal depression, mining in this district has fallen off to a considerable extent. Many of the silver-lead properties that in former years were producers were compelled to cease operations, and other properties under development were forced to close, being unable to raise the necessary capital to continue development.

TRAIL CREEK MINING DIVISION.

The following small properties were operated near Rossland: *I.X.L.*, *Midnight*, *O.K.*, *Snow Drop*, *Golden Drip*, *Rubenstein*, *Christine*, and *Golden Butterfly*. On Norway mountain the *Cascade* and *Huckleberry* were operated for a few months. These are all small operations, several by leasers, searching for stringers and pockets of rich gold ore.

NELSON MINING DIVISION.

The *Reno*, situated on Reno mountain at an elevation of 6,200 feet, owned and operated by the Reno Gold Mines, Limited, was worked continuously throughout the year with an average crew of thirty-five. R. V. Neily was superintendent. Conditions in and around the mine were

excellent and every effort made by the management to comply fully with the requirements of the "Metalliferous Mines Regulations Act." A rotary snow-plough was employed to keep the road open between the mine and Salmo through the winter.

The *Queen*, situated on Sheep creek at an elevation of 3,250 feet, was operated for a few months by the Queen Mines, Limited. H. A. Lavigne was in charge of the work. Two of the old tunnels were cleaned out and retimbered and some development-work done. An average crew of nine men was employed.

The *Euphrates*, situated on Elsie mountain, owned and operated by the Euphrates Mines Company, was worked for the greater part of the year. The work consisted of driving a crosscut from the main tunnel and some stoping in the main tunnel. An addition was made to the ventilating plant, which was of great assistance in the driving of the long crosscut. An average crew of nineteen men was employed.

The *California*, on Toad mountain, owned by the Hillside Mining Company, was operated for a short time. Six men were employed. Work was discontinued early in the year. F. T. Harbour was superintendent.

The *Wilcox*, situated on Ymir creek, a tributary of Wild Horse creek in the Ymir district, was operated by the Ymir-Wilcox Mining Company for part of the year. An average crew of nine men was employed. F. Hibbard was in charge of the work. Work was suspended in September.

The *Goodenough*, in the Ymir camp, was operated for a few months by the owners. Four men were employed. A. McDonald was in charge of the work.

The *Second Relief*, on Erie creek, was worked during part of the year by the Relief-Arlington Mines, Limited. A. Sostad was superintendent. Work consisted of the extraction and milling of ore from the old workings. A crew of twelve men was employed.

The *Molly Gibson*, located on Kokanee mountain, is owned by the Consolidated Mining and Smelting Company. The work was in charge of J. Hawes. It consisted of driving the long lower crosscut tunnel and work on the vein. Work was discontinued in July. Eighteen men were employed.

The *Perrier*, situated near Apex, on the Nelson & Fort Sheppard Railway, was reopened on October by the British-American Explorers Syndicate (F. J. S. Sur, superintendent). The shaft was unwatered and ore-extraction was carried on from the first and second levels. The mill is being remodelled. Eight men were employed.

GRAND FORKS MINING DIVISION.

The *Union*, situated in Franklin camp, was operated throughout the year. Byron Wilson was superintendent. A large amount of ore was extracted and milled and development-work kept well in advance. Buildings for the accommodation of the crew and staff were commodious and well kept up. An average crew of fifty-six was employed.

The *Molly Gibson*, in the Burnt basin, was worked by the owning company. The work consisted of development. Three men were employed. J. Singer was in charge of the work.

GREENWOOD MINING DIVISION.

The most of the work in this Division was carried on at Wallace mountain, near Beaverdell. Notwithstanding the low price of silver, some of these mines have been able to keep operating, paying expenses and making a profit.

The *Waterloo*, situated at Lightning peak, on the headwaters of the Kettle river, was operated by the Waterloo Consolidated Mines, Limited. R. L. Clothier was superintendent. Work was stopped in November. Nine men were employed.

The *Bell*, operated by the Bell Mine, Limited, was worked throughout the year with an average crew of seventeen men. Development-work and extraction of ore was carried out in a workmanlike manner under the direction of J. Matson. The old compressor building has been torn down and a new one that is practically fire-proof replaced it.

The *Highland Lass*, adjoining the *Bell*, was operated by the Highland Lass, Limited. It is under the same management as the *Bell*. Air is supplied from, and steel sharpened at, the *Bell*, and the crew live at the *Bell* boarding-house. Five men were employed.

The *Sally* was operated in a small way by a syndicate headed by R. H. Stewart. Three men were employed, principally in development-work. J. A. Hanna was in charge of the work.

The *Wellington*, owned and operated by the Beaverdell-Wellington Syndicate, was worked throughout the year. Development-work has kept well ahead of ore-extraction. A shaft is to be started from the lower tunnel to develop the downward continuation of the ore. A crew of eight men was employed under A. J. Morrison, superintendent.

The *Tiger* was worked under lease by Louis Nordman. The work consisted of surface-stripping and a short tunnel. Two men were employed.

Gold Drip.—Work was started on this property, which is situated at Jewel lake, near Greenwood, in December. At the time of my visit ten men were employed in installing machinery. R. L. Clothier is superintendent for the Gold Drip Syndicate.

The *Mogul*, situated on Horseshoe mountain, on the main Kettle river, about 25 miles north of Westbridge, was operated. The work, which was contracted, consisted of a crosscut tunnel which tapped the bottom of an old shaft and some drifting on the vein. Five men were employed.

There were no fatal accidents in these districts during the year. Conditions in and around the mines have been found to be good and the requirements of the "Metalliferous Mines Regulation Act" well lived up to. I wish to express my thanks to the management of the different properties for their hearty co-operation in carrying out the provisions of the Act.

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. Tables showing coal production and men employed in collieries are shown on pages 180 and 181.

VANCOUVER ISLAND INSPECTION DISTRICT.

REPORT BY GEO. O'BRIEN, INSPECTOR.

Western Fuel Corporation of Canada, Ltd.

Head Office—Nanaimo, B.C.

Lieut.-Col. C. W. Villiers, Vice-President and Managing Director, Nanaimo, B.C.;
John Hunt, General Manager, Nanaimo, B.C.

The only producing mine operated by this company during 1931 was the Nanaimo Colliery; the Reserve mine was kept dewatered throughout the year, but apparently market conditions did not warrant production.

NANAIMO COLLIERY.

Arthur Newbury, Mine Manager; A. W. Courtney, Overman, North Side;
John Sutherland, Overman, South Side.

A detailed description of the power-installation, plant, and equipment has been given in former Annual Reports. No additions have been made this year.

The output from No. 1 mine, which is approximately 1,400 tons per day, is prepared for the market as follows: All the coal hoisted from No. 1 shaft is dumped as mine-run coal into revolving dumps and thence on to a shaker screen, where the lump sizes are separated and pass on to a loading-boom and then loaded into railway-cars. The smaller sizes from 2-inch down are passed on to a conveyor-belt and conveyed to a Jeffrey-Robinson cone washer. The smaller sizes are separated at this point as follows: No. 1 nut, plus 1½ to 2 inches; No. 2 nut, plus 1 to 1½ inches; pea coal, plus ¼ to 1 inch; slack coal, minus ¼ inch. The slack is passed on to nine Plato vibrating tables by bucket elevators, where it receives its final preparation for the market. Practically all refuse is washed out of the slack on these tables. All the mine-water that is pumped out of the mine is used at the washery, in addition to a considerable amount of salt water which is pumped out of the gulf by two 40-horse-power d.c. motors operating two centrifugal pumps at 1,740 r.p.m.; the total quantity of water used at the washery being approximately 2,000 gallons per minute. There are in use around the washery plant thirty-two belt drives varying in size from 4- to 20-inch. The commercial sizing of the coal is as follows: Lump, 45 per cent.; No. 1 and No. 2 nut, 13 per cent.; pea, 11 per cent.; slack, 23 per cent.; total, 92 per cent. The remainder is lost in washing. Steam-power for operating the screening and washing plants is supplied by three engines of 96 horse-power, 35 horse-power, and 30 horse-power respectively.

Practically the whole of the underground workings in No. 1 mine are submarine areas, having an average cover of approximately 450 feet. The workmen employed in the North side of the mine are transported by ferry to Protection island, a distance of about 1¼ miles from No. 1 shaft, where they descend the Protection shaft, which is situated on Protection island and which is the downcast shaft and main intake airway for the North side of the mine. The workmen employed in the South side of the mine descend No. 1 shaft, which is situated on the Esplanade and is close to the City of Nanaimo. There is also an upcast shaft known as No. 2 shaft in close proximity to No. 1 shaft and is the main return airway for the South side of the mine and part of the North side. Newcastle shaft, which is situated on Newcastle island, is the upcast shaft and main return airway for the North side. It is also an escape-way, being provided with a ladder-way which affords a third means of ingress or egress from the workings. This shaft is approximately 3 miles from No. 1 shaft. The depth of the four shafts is approximately 600 feet.

All the North side output, which is about 800 tons per day, is brought to the bottom of No. 1 shaft by electric locomotives of the overhead-trolley type. Both the Douglas and New-

castle seams are operated, the Newcastle seam being reached by rock-drifts from the Douglas seam. Most of the output from the North side is machine-mined, the exceptions being a few small pillar sections in the Douglas seam. The Newcastle seam, which is a thin seam, is operated on the long-wall system, with pan-conveyors in use on the face-line The conveyor-faces average about 300 feet in length, and with the conveyor system it is possible to eliminate a very large percentage of costly brushing that would be necessary under the old system of long-wall operations.

The South side output of approximately 700 tons per day is brought to the bottom of No. 1 shaft by a combination of overhead-trolley electric locomotive and direct rope-haulage up the Main slope. The electric locomotive operates on the No. 3 Motor level from the top of Puyallup slope out to the Main slope, a distance of approximately 6,000 feet. Both the Douglas and Newcastle seams are operated in the South side, the Douglas seam operations being confined to pillar-extraction, while the Newcastle seam operations are worked on the long-wall system with pan-conveyors on the face-line, the conveyor-faces being about 300 feet long. The average output during the year was about 1,400 tons per day. The average number of men employed underground per day of twenty-hours was 630. It will be noted that, including the safety engineer, there are thirty-five mine officials, or one official for every 40 tons produced and for every eighteen men employed, which may be considered as close supervision. The workings in No. 1 mine are very widely scattered, being in some cases a distance of 3½ miles apart, which accounts for the large number of underground officials required.

No. 10 South District (Douglas Seam), North Side.—The operations in this district are confined to pillar-extraction, the coal being hand-pick mined and loaded by hand. The ventilation was good and no explosive gas or CH_4 gas-caps were found. The roadways and working-places were well cogged and packed. There was 10,080 cubic feet of air per minute passing into the district for twenty-five men and four mules.

Protection Pillars (Douglas Seam), North Side.—This is a comparatively small area of pillars and will soon be extracted. The coal is hand-pick mined and loaded by hand. The ventilation was good and no explosive gas or CH_4 gas-caps were found. Roadways and working-places were well timbered and the waste well cogged. Only six miners are employed per shift in this section.

No. 1 Incline Pillars (Douglas Seam), North Side.—The chain pillars of the old No. 1 Incline haulage-road are now being taken out. The coal is hand-pick mined and loaded by hand. The ventilation was good and no explosive gas or CH_4 gas-caps were found. Roadways and working-places were well timbered and cogged and the waste well packed.

IIa IIa District (Douglas Seam), North Side.—This was an area of about 5 acres of good coal averaging about 6 feet in thickness. During the year a fairly good output was maintained from this area. The boundary has now been reached and pillar-extraction has commenced. The ventilation was good and no explosive gas or CH_4 gas-caps were found. Roadways and working-places were well timbered. There was 12,000 cubic feet of air per minute passing for thirty-five men and four mules.

No. 5 Wall District (Newcastle Seam), North Side.—This is the largest district operating in No. 1 mine. It is entirely machine-mined and worked on the long-wall system, with conveyor-faces in most cases. There are a few exceptions where the face-line is not adaptable for conveyors, and these faces are worked on the old system of gateways every 30 or 40 feet. The efficiency of the conveyor-faces is very noticeable and fairly cheaply operated. Only two roadways are necessary for each conveyor-face, thus eliminating a large part of the costly brushing which would otherwise be necesssary. The ventilation was good and no explosive gas or CH_4 gas-caps were found. Roadways and working-places were well timbered and the waste well cogged and packed. I measured 18,000 cubic feet of air per minute passing into the district for eighty-five men and eleven mules. This quantity is divided into two splits.

No. 6 Wall (Newcastle Seam), North Side.—This district was closed down early in the year and has not been in operation since.

No. 7 Wall (Newcastle Seam), North Side.—This district was closed down in the month of October and has not been in operation since. It was operated on the long-wall system with conveyor-walls. The coal-seam averaged about 22 inches in thickness. The area may be reopened in the future from the No. 5 Wall district.

North-east Slope District (Newcastle Seam), North Side.—No coal was produced from this district during the year, the operations being confined to the driving of a rock-drift about 1,000

feet long and diamond-drilling operations. Up to the time of writing the coal-seam had not been located.

Diagonal Slope District (Douglas Seam), South Side.—This district is reached by a slope approximately 4,000 feet long. The main haulage is direct rope-haulage, the hoisting-engine being located near the bottom of No. 1 shaft and is steam-driven. Steam is supplied from the surface. The whole of this district is confined to pillar-extraction, the coal being mined and loaded by hand. The coal is of a very friable nature and is subject to spontaneous combustion. Great care is exercised in preventing the possibility of mine fires and the several sections are arranged in such a manner that they can be sealed off in a very short time should it become necessary. Very little explosives are used as an added precaution. At the time of my inspection in December the district was closed down, the coal being so friable that no market existed for the quantity of small-sized coal produced in this area. The roadways were standing well and the section can be put on a producing basis in a very short time. There was 11,550 cubic feet of air per minute passing into the district.

No. 2 North Level (Douglas Seam), South Side.—This is a small section of pillars left by former operations some thirty years ago and is now being reopened. The output from this section is small at the time of writing. The ventilation was good and no explosive gas or CH_4 gas-caps were found. Roadways and working-places were well timbered and waste well cogged and packed. There was 3,000 cubic feet of air per minute passing into the section for the use of five men and one mule.

No. 4 North Level (Douglas Seam), South Side.—This is a small area of very friable coal and is worked chiefly to supply the boiler plant with fuel. At the time of inspection in December this section was closed down, there being a large supply of boiler-fuel on hand.

Puyallup Slope District (Douglas and Newcastle Seams), South Side.—This is the largest district in the South side of the mine. Both the Douglas and Newcastle seams are operated. A slope some 3,000 feet long extends from the inby end of No. 3 Motor level to the workings. Levels are turned off the slope at intervals, right and left, in the Newcastle seam, the Douglas being reached by rock-drifts from the Newcastle seam. The workings in the Douglas are chiefly extraction of pillars left by former operations. The coal is mined and loaded by hand. The coal in the Newcastle seam is mined by coal-cutting machines and the system of working is long-wall, with pan-conveyor faces about 300 feet in length. During my inspection in December the ventilation was good and no explosive gas or CH_4 gas-caps were found. Roadways and working-faces were well timbered and the waste well cogged and packed. There was 22,400 cubic feet of air per minute passing in the district for sixty-eight men and six mules.

There is very little evidence of dangerous coal-dust accumulations in No. 1 mine; most of the workings are naturally damp, the haulage-roads especially in many cases being wet and muddy. Where there is any dryness on the main haulage-roads lime-rock dust is applied by a rock-dusting machine. During the year 1931, 27 tons of lime-rock dust was applied, covering 7,530 lineal feet of haulage-roadways, or an average application of about 7 lb. of rock-dust per lineal foot.

All shot-firing is done by certificated officials, using a Wolf flame safety-lamp for gas-testing and electric shot-firing battery and cable for blasting. Permitted explosives only are used throughout the mine. All workmen are equipped with electric cap-lamps of the Edison and Wheat type.

Most of the machine-mining is done by compressed-air-driven coal-cutting machines. There is only one electrically driven coal cutting machine in use in this mine. The machine-mining is done in the dirt-bands in the seam and in some cases in the under clays of the seam.

Development.

The chief development during the year was in No. 4 Left level, Puyallup Slope district, where a rock-drift several hundred feet in length is being driven for the purpose of opening up a virgin territory in the Newcastle seam. A rock tunnel 1,000 feet long was driven in the North-east slope, and another rock tunnel about 500 feet long was driven in No. 5 Wall district to open a section now known as the North slope, and several small air-shafts were put through as upraises from the Newcastle seam to the Douglas for ventilation purposes.

While the coal trade felt the depression to a great extent, the mine worked fairly regularly, the last half of the year especially so, and hoisted coal on 225 days. One fatal and four serious

non-fatal accidents occurred in No. 1 mine during the year, all of which were caused by falls of rock and coal at the working-face. No accidents were reported from any other cause.

Canadian Collieries (Dunsmuir), Ltd.

WELLINGTON EXTENSION MINES.

This division of the Canadian Collieries (Dunsmuir), Limited, mining properties comprises Nos. 1 and 2 mines, Extension Colliery; No. 5 and the Alexandra mine, South Wellington Colliery; No. 9 mine, Old Wellington. Nos. 3, 7, and 8 mines and the Vancouver slope did not operate during the year. On April 10th, 1931, the whole of the Extension Colliery was closed down and permanently abandoned.

WELLINGTON EXTENSION No. 5 MINE, SOUTH WELLINGTON.

Wm. Wilson, Manager; Jos. Wilson, Overman.

This colliery is situated in the Cranberry district, near the South Wellington Station of the Esquimalt & Nanaimo Railway, and is in a first-class location so far as shipping facilities are concerned. The Douglas seam is operated in this area and is variable in thickness and fairly friable. Most of the output is shipped over the Esquimalt & Nanaimo Railway to the Nanaimo wharves, which is the shipping centre for the Western Fuel Corporation of Canada, Limited, though part of the output is shipped direct in C.P.R. cars and transported to the mainland on barges. A small quantity is still shipped to the Ladysmith wharves for use of steam-tugs, etc.

The No. 5 mine and the Alexandra mine are both connected and ventilated by the same fan and supervised by the same officials. Considerable development-work was done in both mines during the year. Two rock tunnels are now being driven for the purpose of connecting the face of the Alexandra slope to No. 5 mine workings. A large field of unworked territory will be available for development when this connection is made. Eventually the main operation of this colliery will be from the Alexandra slope, which is situated about three-quarters of a mile from the tipple and is connected to the tipple by a narrow-gauge railway. An electric locomotive of the overhead-trolley type is used for hauling the coal from the mine to the tipple. At the present time the coal is mined and loaded by hand, but it is expected that some form of machine-mining will be adopted later when conditions are favourable.

During my inspection in December I found the ventilation good and no explosive gas or CH_4 gas-caps were found. Roadways and working-places were well timbered. The mine-workings are fairly damp, the haulage-roads especially, and there are no dangerous accumulations of coal-dust. There was 24,000 cubic feet of air per minute passing down the Alexandra slope for sixty-five men and five mules. There was 20,000 cubic feet per minute passing down No. 5 slope for forty-five men and three mules. In the main return airway I measured 49,000 cubic feet of air per minute.

Subsequent to my inspection a mishap occurred to the fan-shaft, which caved in and closed the main return airway, thereby destroying the ventilation system of both mines. A temporary fan was immediately installed and both the mines were in operation the next day. A new permanent fan is now under construction in a new location at the Alexandra mine, the old location being at No. 5 mine.

All shot-firing is done by certificated officials, using Wolf flame safety-lamps for gas-testing and electric shot-firing batteries and cable for blasting. Permitted explosives only are used. All workmen are equipped with electric cap-lamps of the Edison type.

The average number of men employed per day of twenty-four hours is 225, and the mine worked 248 days during the year. The daily output is about 600 tons, or one mine official for every 40 tons produced and for every fifteen men employed. This may be classed as close supervision.

One fatal and three serious non-fatal accidents occurred at this colliery during the year, the one fatal and two serious non-fatal accidents being caused by falls of rock and coal at the working-face, the other serious non-fatal accident being caused by mine-cars and haulage. No accidents of a serious nature were reported from any other cause.

No. 9 MINE, OLD WELLINGTON.

Robert Laird, Manager.

This mine is situated about 6 miles north of Nanaimo. The seam is the well-known Upper Wellington, is of excellent quality, and is of a fairly hard nature. The average thickness of the seam is about 22 inches, with a soft-dirt band averaging about 2 feet in thickness lying directly on the coal-seam. The roof is conglomerate and the floor is a hard sandy shale. The production from this mine during the year was small, the only work being done was developing a new system of long-wall for the purpose of eliminating the costly brushing formerly necessary under the old system.

During my examination in December the ventilation was good and no explosive gas was found. Roadways and working-places were well timbered and the waste was well cogged and packed. The mine is very damp and there are no accumulations of dangerous coal-dust.

There was 12,000 cubic feet of air entering the mine for fourteen men and one mule. All shot-firing is done by certificated officials, using Wolf flame safety-lamps for gas-testing and electric shot-firing batteries and cable for blasting. Permitted explosives only are used. All workmen are equipped with electric cap-lamps of the Edison type. No accidents were reported from this mine during the year.

Granby Consolidated Mining, Smelting, and Power Co., Ltd.

Head Office—Vancouver, B.C.

Charles Bocking, President, Vancouver, B.C.; Robert Henderson, Superintendent, Cassidy, B.C.; Fritz John, Overman.

Nos. 1 and 2 mines at Cassidy are being operated and these have been fully described in previous Annual Reports. Pillar-extraction is common throughout both mines, with the operation retreating to the outcrop. All employees underground use approved electric safety cap-lamps and the firebosses use the Wolf flame safety-lamp for gas-testing purposes. Only permitted explosives are used underground. The gas committee reports received at this office each month showed quite satisfactory conditions throughout the mines. Found ventilation in both mines fairly good generally during my last visits of inspection in December. Timbering and roadways in good condition. Found no explosive gas and got no gas-cap in air-current. Found the coal-dust conditions of the mines to comply favourably with the provisions of the "Coal-mines Regulation Act." Record-books required to be kept at the mine were examined by me and found to be satisfactory.

FIDDICK MINE, SOUTH WELLINGTON.

Richard Fiddick, Operator.

The operation consists entirely of recovering pillars left by the former operators. The seam is the well-known Douglas seam and is of very good quality. The coal is mined and loaded by hand. All shot-firing is done by certificated officials, using Wolf flame safety-lamps for gas-testing and electric shot-firing batteries and cable for blasting. Permitted explosives only are used. All workmen are equipped with electric cap-lamps of the Edison type. During my inspection in December the ventilation, which is by natural means, was good and no explosive gas or CH_4 gas-caps were found. Roadways and working-places were well timbered and cogged. The mine is very damp and there are no accumulations of dangerous coal-dust. No accidents were reported from this mine during the year.

BIGGS' MINE, WELLINGTON.

James Biggs, Operator.

The operation consists entirely of recovering the outcrop pillars left by the former operators. The seam is the well-known Wellington seam and is of excellent quality. The output is small and sold locally. All shot-firing is done by a certificated official, using a Wolf flame safety-lamp for gas-testing and electric shot-firing battery and cable for blasting. Permitted explosives only are used. All workmen are equipped with electric cap-lamps of the Edison type. The ventilation was good, roadways were well timbered, and there were no accumulations of dangerous coal-dust. No accidents were reported from this mine during the year.

LITTLE ASH MINE, WELLINGTON.

R. H. Chambers & Co., Operators.

This mine is situated about a mile from Wellington and was formerly known as the Jordan mine. The seam worked is the well-known Wellington seam and is of excellent quality. The area which the lease covered and owned by the present operators is now exhausted, all the available coal being recovered. A new lease, however, has been acquired in another area a short distance away from the old area and test bore-holes are now being put down. Most of the output from the Little Ash mine was sold in Vancouver. No accidents were reported from this mine during the year.

JINGLE POT MINE, EAST WELLINGTON.

Robert Sinclair, Operator.

This mine is situated on the original Jingle Pot mining property at East Wellington and about 3 miles from Nanaimo. The operation will consist of recovering some outcrop pillars that were left by the former operators. This operation was idle during the greater part of the year, but toward the end of the year a lease was acquired by Mr. Sinclair and preparations were made to put the property on a producing basis. At the time of writing a small steam plant is being installed and a small output will be available early in 1932.

RICHARDSON MINE, SOUTH WELLINGTON.

Richardson Bros., Operators.

This mine is situated on the site of the Pacific Coast Coal Company's former operations, near the South Wellington Station on the Esquimalt & Nanaimo Railway. The operation consists entirely of recovering pillars left by the former operators. A little work was done in this mine in January and February and a little over 100 tons was produced. No further work was done during the year. I found ventilation, which is by natural means, to be good. No explosive gas or CH_4 gas-caps were found. The mine is naturally damp and very little evidence of coal-dust could be found. All shot-firing was done by certificated officials with shot-firing battery and cable, and permitted explosives only were used. No accidents were reported from this mine during the year.

MORDEN MINE, SOUTH WELLINGTON.

The only work done at this property during the year was the taking of the hoisting-ropes out of No. 1 shaft and putting them in safe storage.

Lantzville Collieries, Ltd., Lantzville.

Leased by J. A. Challoner and J. Michek and Associates; Arthur Challoner, Overman.

This mine (No. 1) is situated on Nanoose bay, about 9 miles north of Nanaimo. The seam is the Upper Wellington seam and is of very good quality and averages about 22 inches in thickness. The system of working is a semi-longwall method. Very little development-work was done during the year, the active workings being confined to a small area. An inclined rock-drift was driven at the face of the Main level a distance of about 250 feet to penetrate the "fault" and the coal-seam was located. Nothing further was done with regard to the development of the area. During my inspection in December the ventilation was good and no explosive gas or CH_4 gas-caps were found. Roadways and working-places were well timbered and cogged. The mine-workings are very damp and there are no accumulations of dangerous coal-dust. There was 4,500 cubic feet of air per minute passing for the use of thirteen men. No mules or horses are used in the mine. All shot-firing is done by certificated officials, using Wolf flame safety-lamps for gas-testing and electric shot-firing batteries and cable for blasting. Permitted explosives only are used. All workmen are equipped with electric cap-lamps of the Edison type. No accidents were reported from this mine during the year.

REPORT BY THOS. R. JACKSON, INSPECTOR.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

Lieut.-Col. Chas. W. Villiers, General Manager, Nanaimo, B.C.; John Hunt, General Superintendent, Nanaimo, B.C.

This company operated the following mines during 1931: The Comox Colliery, Nos. 4, 5, and 6 mines and Scott slope, situated in the vicinity of Cumberland; the Wellington Extension Colliery, Nos. 1 and 2 mines (permanently abandoned in April), situated at Extension; No. 5 and Alexandra mines, situated at South Wellington; and No. 9 mine, situated at Wellington.

COMOX COLLIERIES.

The mines worked are Nos. 4, 5, 6, and Scott's slope. No. 6 shaft is used as a means of drainage if the pumping system at No. 5 mine should become deranged. It is also an intake airway to 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 and No. 6 is close to the city.

The hydro-electric plant of this company, which has been described in previous Annual Reports, has been in constant operation during the year. Sufficient electricity is generated at this plant to supply motive power for all the collieries, the wharf at Union Bay, and for the lighting of Courtenay, Union Bay, Happy Valley, and Cumberland.

No. 4 MINE.

John S. Williams, Manager; A. W. Watson, Overman, No. 2 Slope.

The workings have been described in previous Annual Reports. Extraction of pillars was continued in No. 1 and No. 2 slopes, the working area of which has been further reduced during the past year.

Preparations are being made for the development of the area of coal east of No. 4 mine workings and bounded by old workings from Nos. 1, 5, and 6 mines. This area is being approached from No. 6 East level, off No. 2 slope. At the present time No. 6 East level and counter are being driven through faulted ground below which No. 4 mine workings had formerly been successfully worked. For ventilation purposes a shaft has been sunk in the vicinity of Round lake, reaching the underground workings at a depth of 100 feet. A new intake airway from this shaft is being driven through solid ground measures to connect the shaft with the area under development, the return air being passed through the old airways to the existing fan ventilation, No. 2 Slope district. The active workings are confined to the following levels: Nos. 4 and 11 West levels in No. 1 slope, No. 4 West level section, and Nos. 3, 3½, 4, 5, and 6 East levels in No. 2 slope.

Electric head-lights of the Edison "H" storage-battery type are used by the workmen and the flame safety-lamps of the Wolf type are used by the firebosses for gas-testing purposes. First-aid equipment is kept underground in suitable boxes located in handy places in different parts of the mine. The main station is situated just outside the portal of No. 4 mine and has all the equipment necessary for first-aid treatment.

The daily output of this mine is 1,000 tons, divided as follows: No. 1 slope produces 250 tons, No. 2 slope produces 400 tons, and Scott slope produces 350 tons. The mine has been operating all the year and, despite trade depression, has produced 200,000 tons of coal in the 200 days the mine worked.

There are three sets of 2,200–400 volt transformers to serve the different sections of the mine, and the three main pumps, two rated at 75 horse-power and one at 150 horse-power, are powered from the 2,200-volt system. The other motors, twelve in number and rated from 10 to 30 horse-power, are on the 440-volt system and used for haulage, district pumping, and one for running an underground compressor; the batteries of two storage-battery locomotives are also charged underground by a charging set 440 a.c. to 110 d.c.

Gas committee reports regarding conditions of the whole of No. 4 Comox mine have been received at this office every month; these reports were generally of a satisfactory nature. Air samples taken at the fans showed there was no methane in the air. One fatal and one serious accident were reported and investigated during the year.

Scott's Slope (No. 4 Mine).

During the year the new slope, known as Scott's slope, situated near Whites bay, was completed, reaching the coal-seam on a pitch of 22° in a distance of 630 feet. All coal mined in this area is hauled up this slope and conveyed to No. 4 mine tipple over the narrow-gauge railway. The hoist, installed above ground, is 150 horse-power, driven by two 75-horse-power motors in tandem. The equipment originally in use at the sub-station at No. 7 mine has been transferred and put into service at a new sub-station erected at the Scott slope. While this slope, in some ways, is part of No. 4 mine, it has an entirely separate haulage and ventilating system. This operation is ventilated by a 90-inch Sirocco fan, located at the air-shaft, driven by a 75-horse-power motor which delivers about 85,000 cubic feet of air a minute, against a 3-inch water-gauge.

The workings in Scott slope are still forging ahead in the solid area. This area is bounded by a natural barrier-line on the left of No. 2 West level and the old abandoned workings to the right. These old workings have been tapped at intervals by means of bore-holes as a means of ascertaining their exact position and generally a 50-foot barrier-pillar is maintained between the present workings and the abandoned section. It is contemplated utilizing coal-cutting machinery in these workings at an early date.

During December the management split the total quantity of air passing into the mine. Examination was made of all the working-parts of Scott slope, and the ventilation, timbering, and roadways were found to be in satisfactory condition. No explosive gas or gas-caps were found and the different sections were found to comply with the provisions of the "Coal-mines Regulation Act." The mine is naturally damp, with much mud and water prevailing on the roadways. I measured 83,468 cubic feet of air per minute passing into the slope, divided as follows:—No. 1 split: There was 42,000 cubic feet of air per minute passing for the use of twenty-three men and three mules. No. 2 split: There was 40,000 cubic feet of air per minute passing for the use of fifteen men and two mules. Mine-air samples taken at the old and new fan show only a trace of fire-damp to be present in the air.

The electrical equipment consists of one 30-horse-power 440-volt motor for pumping on the Main slope. Compressed air is supplied to the rotary type of drill for shot-holes in coal and the percussive type of drill for rock.

No. 5 Mine.

Robert Laird, Manager; Cliff Dickinson, Overman.

Production was suspended at this mine in April and had not been renewed at the end of the year. Ventilation and dewatering have been maintained, so that the mine can be put on a producing basis immediately the market offers. Periodical inspections and analysis of the air have been made during the period of suspension and general conditions remain favourable; 47,000 cubic feet of air per minute passes through the mine, divided into two separate splits. All the underground equipment in this mine is electrical and has been fully described in previous Annual Reports.

NICOLA-PRINCETON INSPECTION DISTRICT.

Report by John G. Biggs, Inspector.

The coal companies operating in this district during the year were as follows: The Coalmont Collieries, Limited; Middlesboro Collieries, Limited; Pleasant Valley Mining Company, Limited; the Tulameen Coal Mines, Limited; the Blue Flame Coal Mines, Limited; and a small company known as the Sunshine Coal Company. There were no new operations in the district during the year. Prospecting, however, has been fairly active in the Princeton field, and while at least one of these prospects appears to be fairly good, none were brought into active production during the year.

Coalmont Collieries, Limited, and the Middlesboro Collieries, Limited, to a great extent depend upon the railway trade in this part of the Province; this has been far from active during the year and is reflected by the reduced production at these mines. The mines operating in the Princeton district depend to a great extent upon the domestic trade, which is very seasonal; the mines being worked to capacity during the winter months and working with reduced crews during the rest of the year.

Accidents.

One fatal accident and four others of a serious nature were reported to this office during the year, resulting in the same number of injuries; three of these accidents happened in the No. 2 mine of the Tulameen Coal Mines, Limited, and the other two in the mines of the Coalmont Collieries, Limited; three occurred at the working-faces and two to rope-riders. There has been no serious accident at the Middlesboro Collieries, Limited, since 1924, which is a very commendable record.

Inspection on behalf of the Workmen.

Inspections on behalf of the workmen have been well attended to at all the larger operations in the district and were made every month throughout the year, the members of the mine committee being given every facility for making these inspections. Reports of same were sent to this office and showed general conditions to be good.

Dangerous Occurrences.

Three cases of spontaneous heating were reported during the year—one at Blue Flame Colliery and two in No. 4 mine, Coalmont Collieries—and in each instance the affected areas were sealed off. Spontaneous heating is one of the greatest hazards encountered in operating coal-mines in this district and every caved area is a potential fire-hazard; the only safeguard, particularly in pillar-extraction, is to be ready to seal off suspected areas immediately. The efficiency in dealing with the fire-hazard in the laying-out of the workings is an important factor in successfully operating mines in this district.

Coalmont Collieries, Ltd.

W. J. Blake-Wilson, President, Vancouver, B.C.; George Murray, Superintendent, Blackeburn, B.C.

This colliery has been well described in previous Annual Reports. The company is at present operating the No. 3 and No. 4 mines, which have been developed by adit-levels driven into the side of the mountain, and, with the exception of a small section in the No. 3 mine, all the mining operations are conducted to the dip of these main adit-levels and in the same seam of coal. The No. 3 mine is the oldest operation and is situated on the same elevation, 1,000 feet west of the top terminal of the tramway; from the entrance to the No. 3 mine a light electric railway connects with No. 4 mine, which is the most important operation of this company at the present time.

The seam worked is from 8 to 12 feet thick and there are other seams of inferior coal immediately above and below. The ground generally is subject to "swelling" and requires to be heavily timbered. It is a hard matter to maintain roads; the measures have an angle of inclination from 17° to 30°, and as a result chutes are used in the headings and the raise working-places for conveying the coal from the faces to the main levels, below where it is loaded into the mine-cars.

It is only on rare occasions that methane gas is found in these mines and I have not detected any during my inspections in 1931.

Rock-dusting has been well attended to during the present year and has displaced the watering system formerly in use. The management located a deposit of gypsite in close proximity to the main highway near the town of Coalmont, and when dry this material is in the form of a fine powder. This is applied by means of a rock-dusting machine and is found to adhere well to the roof, sides, and the timbers, and, being light-coloured, greatly assists the illumination on the roads of these mines. Analyses of the material taken at different portions of the roads of these mines every month show them to be in accord with the requirements of the Coal-dust Regulations.

There has been no change made in the power plant, which has been fully described in previous reports.

The future developments at the Coalmont Collieries will, to a great extent, depend upon the new operations situated 2,800 feet north of the entrance to the No. 4 mine and at an elevation of 4,075 feet, where the power-lines with the necessary transformers have been installed. A large

slope-hoist and an electric-driven air-compressor has been erected, the track graded, and the steel laid between the entrance to the mine and the No. 4 mine, with a view of developing a large operation in this section of the Coalmont field. This is known as the No. 5 mine.

No. 3 MINE.

All work in No. 3, which has been producing for eleven years, consists of the extraction of pillars in the No. 1 slope above the No. 2 West level. Ventilation is produced by a 5-foot electric-driven mine-fan situated near the entrance to the counter-level, and during my last inspection ventilation measured showed 12,000 cubic feet of air per minute passing into this mine for the use of twenty-one men. The air was well conducted around the working-faces, the brattice and stoppings being in fairly good order. The mine is free from methane and during the past year I have not been able to find any trace of this gas. 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; well treated with "inert dust," and analysis of material taken from the same show them to be in accord with the requirements of the Coal-dust Regulations. All the coal is mined by hand; little blasting is done, but when required is under the supervision of certificated officials appointed for this purpose. Permitted explosives are used and all shots fired by electric detonators.

No. 4 MINE.

Harry Hopkins, Overman.

This, the largest and the most important operation of the Coalmont Collieries, Limited, has been described in previous Annual Reports.

This mine has been developed by a well-maintained cross-measure drift 1,600 feet in length, cutting across the measures, and encounters the main haulage-slope, driven from the surface some 200 feet in elevation above, at the No. 6 level; this main slope has a general pitch of 17° and is at the present time operating from the lowest or the No. 15 West level, all the work below being abandoned and filled with water to a point where it is necessary to hold the same by means of pumps.

All the work consists of the extraction of pillars in the Nos. 7, 12, and 15 West levels, the chief operations being in the extraction of pillars between the Nos. 12 and 15 West levels, where a large barrier-pillar was left intact. The mine is operated on a modification of the "panel" system, generally faulted areas being used as the barrier, and as soon as any section of the mine has reached certain limits, which as a rule are determined by some major faulting, the pillars are extracted and the areas sealed off. On No. 15 West level drag-line scrapers are used where the inclination is insufficient for the coal to run in the chutes by gravity; these scrapers are operated by double-drum Sullivan tugger hoists.

Ventilation is produced by an 84-inch double-inlet belt-driven Sirocco reversible fan, driven by a 75-horse-power constant-speed electric motor, and during my last visit of inspection the ventilation measured showed 24,500 cubic feet of air a minute passing into this mine for the use of sixty-two men. There was 22,800 cubic feet of air a minute passing into the return below the No. 7 West level and 13,000 cubic feet of air a minute passing into the No. 15 West level; the air was fairly well conducted around the working-faces, the brattice and stoppings in fairly good order, and while there was a little black-damp showing at the gob on the inside working-place on the No. 7 West level, the mine was quite clear of methane.

No. 5 MINE.

This is a new operation situated 2,800 feet north of the entrance to the No. 4 mine and at an elevation of 4,075 feet. It consists of a 9- by 9-foot well-timbered slope, having an average pitch of 20°, driven in the measures immediately above the coal-seam for the purpose of exploiting the Coalmont seam lying to the west of the No. 4 mine operations.

This slope has reached a distance of 750 feet from the portal and has entered the regular seam of coal at the face. Preparations will be made shortly for driving a crosscut off to the west side of this slope and will be continued as a raise through the measures to the surface for the purpose of ventilation; counters will be driven parallel to this main haulage-slope, it being the intention to continue these slope operations as far as possible before commencing any lateral operations.

Ventilation is at present produced by an electric-driven enclosed-type mine-fan situated near the entrance to the mine, the air being conducted to the face of the slope by means of vent-tubes of liberal size. The ventilation is very good and the mine free from any trace of gas. The slope is heavily timbered by framed sets and, being naturally wet, is free from dangerous coal-dust. Three men are employed underground in this operation .

Middlesboro Collieries, Ltd.

E. W. Hamber, President, Vancouver, B.C.; Robert Fairfoull, Superintendent, Merritt, B.C.

MIDDLESBORO COLLIERY.

Middlesboro Colliery, operated by this company, has been well described in previous Annual Reports. It is situated 1 mile from Merritt and has access to the Kettle Valley Railway by a branch line passing through the valley to the mine-tipple. The power plant and other surface equipment is situated at the foot of the hill, which rises to the south at a fairly high angle of inclination to 400 feet above. All the underground operations are generally exposed or come to within close proximity to the surface. The seams are lying at a high angle of inclination and the measures have a general pitch south-east towards the valley below.

The present mining operations are being conducted 300 feet above and from 2,000 to 3,000 feet south of the mine-yard and are known as the No. 2 East, 3 North, 2 South, and the Prospect mines. The coal from all the mines is lowered to the mine-yard by means of a surface gravity-plane in 6-car trips.

There have been no new mining developments at this colliery during the present year. With the extraction of the pillars in No. 2 North and No. 2 East mines, the underground operations are now limited to Nos. B North, 2 South, and Prospect mines.

Approved electric safety cap-lamps are in use by all the employees underground, while flame safety-lamps of the Wolf type are in use by the officials for inspection purposes. With the exception of the No. 2 South mine, which is naturally wet, all the mines have been well treated with rock-dust during the year. Analysis of material taken from the roads of these mines during each month have shown them to be in accord with the requirements of the Coal-dust Regulations. During the year no explosive gas was found.

Practically all the coal is mined by machines of the post-puncher type, and to further reduce the use of explosives compressed-air picks of the Hardy type are in general use for taking the coal down, after being mined, with the object of producing as high a grade of coal as possible.

No. 2 South Mine.

This mine is situated on the same elevation west of the entrance to the No. 3 mine and was developed by an adit-level driven in the seam; the level-face at present being 2,400 feet from the portal. The seam is 6 to 8 feet thick, highly inclined, and forms a basin similar to No. 3 North mine. Raises have been driven from the Main level to the apex of the hill, while similar raises have been driven to the Main level from the developments below, making a difference in altitude between the lower operations and the apex of the hill above some 600 feet, which causes a good natural current of air to pass through this mine.

During my last visit of inspection ventilation measured showed 15,000 cubic feet of air per minute passing into this mine for the use of twenty-one men. The air was well conducted around the working-faces; the brattice and stoppings being 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. The roads were well timbered, in good condition, and, being naturally wet, were free from dangerous coal-dust. The mine was found to be entirely free from any trace of gas.

No. 2 East Mine.

This is a small mine, situated 300 feet below the top terminal of the surface tramway, consisting of an adit-level driven in the coal-seam, which is about 6 feet in thickness, extremely faulted, and lying at a high but varying inclination. All the work done consists of extracting pillars in close proximity to the surface, so that the life of this operation is very limited. Natural ventilation is produced by the difference in elevation between the surface openings and is fairly good, the mine being found free from any trace of explosive gas at all inspections.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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 fairly good condition, and well treated with rock-dust. Analyses of material taken from same show them to be in accord with the requirements of the Coal-dust Regulations. Five men were employed underground during the year.

No. 3 North Mine.

Alex. M. Allen, Overman.

This is the most important producing mine of the Middlesboro Colliery at the present time. It is situated a short distance west of the top terminal of the surface incline and has been developed by an adit-level driven in the seam, which is from 6 to 8 feet thick. This area is a well-defined basin and the adit-level describes the large part of a circle in a length of 2,000 feet.

Headings were driven from the Main level on the full pitch of the seam to the surface, which naturally provide the necessary ventilation. Near the entrance to the mine slopes were driven to the dip a distance of some 700 feet for the purpose of recovering the coal lying to the dip of the Main level and at the foot of the basin. The mine is operated on the usual pillar-and-stall system. Owing to the high inclination, chutes are in use for conveying the coal from the faces of the headings and the workings above to the Main levels.

During my last visit of inspection ventilation measured showed 15,000 cubic feet of air per minute passing into this mine for the use of twenty-eight men. The mine was free from any trace of gas and the brattice and stoppings were in fairly 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 fairly good condition, and well treated with inert dust. Analyses of material taken from the same show them to be in accord with the requirements of the Coal-dust Regulations.

Prospect Mine.

James Fairfoull, Overman.

This is a small mine situated to the east and 100 feet above the No. 2 South mine. It works a seam of coal lying between the No. 2 North and No. 2 South mines and is developed by an adit-level for a distance of 400 feet, from which point a 20° slope is driven 400 feet on the same line as the level. The seam is very irregular and "pockety," some sections showing unusual thickness, while in other sections the coal is very thin. The underground operations are entirely of an exploratory nature and done with the hope that the seam may take on more regularity as the work is advanced; eight men are employed underground.

During my last inspection 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 analyses of material taken from same were found to be in accord with the requirements of the Coal-dust Regulations. The mine was entirely free from any trace of gas.

Tulameen Coal Mines, Ltd.

Robert Dixon, Managing Director, Vancouver, B.C.; John Bennett, Superintendent, Princeton, B.C.

No. 2 MINE.

William Westnedge, Manager; William Strang, Overman.

This mine is situated about 2 miles west of Princeton and has been the scene of active developments, both on the surface and underground, during the present year. The new installations on the surface consist of a modern screening plant, large mine-fan, hoisting equipment, a new air-compressor, and the addition of one new return-tubular boiler to the power plant.

The underground operations are at present conducted in the No. 2 mine, where the seam worked is from 6 to 7 feet in thickness and, being a good domestic coal, this finds a ready market. The mine has been developed by an 8- by 14-foot 20° slope driven from the surface, with the necessary counter for ventilation, through the measures, which encountered the seam of coal at a distance of some 600 feet from the portal. The seam has been developed on the strike for a distance of 1,400 feet, and a limited amount of work has been done to the raise of

the main haulage-level, while the major operations are being conducted to the dip of the Main level by means of two sets of Main slopes which have reached a distance of 700 feet.

The operations are conducted on the usual pillar-and-stall system, with the pillars 75 to 100 feet square, the roads being generally driven 12 feet wide. All the coal is mined by machines of the post-puncher type and the use of explosives avoided as much as possible with the object of producing as small amount of slack coal as possible.

During my last visit of inspection ventilation measured showed 16,000 cubic feet of air per minute passing into this mine for the use of thirty-six men. The mine was free from any trace of gas and the brattice and stoppings were found to be in fairly 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 fairly good condition, and, being naturally wet, were free from dangerous coal-dust. Approved Edison electric head-lamps are in use by all the employees underground, while safety-lamps of the Wolf type are in use by the officials for the purposes of inspection.

Pleasant Valley Mining Co., Ltd.

W. R. Wilson, President, Vancouver, B.C.; C. Stubbs, Superintendent, Princeton, B.C.

This operation is situated 2 miles west of Princeton, on the south side of the Tulameen river, and is close to the main line of the Kettle Valley Railway, with which it is connected by a spur. The mine-tipple, power plant, and other surface equipment is situated on the river-flats, while the mining operations are conducted on the south side of the hill, which rises to an elevation of some 600 feet above the valley. The measures are found to be fairly uniform for a considerable distance and have a general pitch south-east into the hill. Three seams of coal have been exposed and are known as the No. 1, No. 2, and No. 3 seams, but only Nos. 1 and 2 have been worked. Work was suspended at these mines during the early summer and recommenced in the No. 1 mine during October, while preparation has been made for the reopening of No. 2 mine.

No. 1 MINE.

The entrance to this mine is situated 900 feet east of the mine-tipple and development is by a pair of 8- by 8-foot adit-levels cutting across the measures and encountering the seam, which is exposed at a higher elevation on the side of the hill, at a distance of 700 feet from the portal. The Main level continues on the strike of the seam a further distance of 2,000 feet, from which five sets of headings have been driven up the full pitch of the seam towards the surface, which is reached at a distance of approximately 1,000 feet. The greater developments have been in the No. 1 headings, which have been holed through to the surface for the purpose of facilitating the ventilation of the mine; levels have been driven from each side of these headings and the seam blocked out into pillars. At the present time pillar-extraction is being carried on in the upper sections of the two outer pair of headings.

The seam has an average pitch of from 12° to 20° and does not provide sufficient grade for the use of chutes from the headings to the main haulage-level below, with the result that the McGinty system of haulage is used on the inside headings for the transportation of the coal, while on the outside heading a Meco compressed-air-driven conveyor is in use and appears to be giving satisfaction.

Owing to the difference in elevation between the main haulage-level and the surface opening in the No. 1 heading, ventilation at present is produced naturally. During my last visit of inspection ventilation measured showed 10,000 cubic feet of air per minute passing into this mine for the use of thirty-five men. The brattice and stoppings were in fairly good condition and the mine free from explosive gas.

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 coal is mined by machines of the post-puncher type with the object of producing as large amount of big coal as possible. Edison electric head-lamps are used by all the employees underground, while safety-lamps of the Wolf type are used by the officials for inspection purposes. Permitted explosives are used underground, all shots being fired by electric batteries by officials appointed for that purpose.

Blue Flame Collieries, Ltd.

Geo. C. Blonden, President, Vancouver, B.C.; Robert Alstead, Superintendent, Princeton, B.C.

No. 1 MINE.

Robert Alstead, Overman.

This mine is situated 10 miles west of Princeton, on the right bank of Lamont creek, and is accessible by following the Hope–Princeton highway a distance of some 9 miles, where a private road branches off, then a further distance of 1 mile to the mine. Large motor-trucks having a capacity of 5 tons are used for transporting the coal to the bunkers, situated on the Kettle Valley Railway, 1 mile west of the Princeton Railway Station.

This mine was opened during the year 1927 and has been developed by a 13° slope following the full pitch of the seam a distance of some 600 feet, where the contour of the measures changed, and extended a further distance of 750 feet on a level course, making a total distance of 1,350 feet from the face of the main entry to the portal of the mine.

Headings were driven, following the pitch of the seam, a distance of 450 feet to the surface croppings, opened up on the usual pillar-and-stall system, and a small area developed to the dip of the main entry. The Main level encountered a disturbed area at the face, and as a result it was decided during the year 1930 to extract the pillars in this section of the mine. It has been from this pillar section that the greater percentage of the production has been produced during the past two years. Mining is confined to the upper 7 feet of the seam; this gives a good domestic coal which finds a ready market, particularly during the winter demand. The present pillar section is very limited and the future of this mine will to a great extent depend upon the dip section, where a Main slope was commenced 400 feet from the portal. This has now reached a distance of 400 feet.

This mine is operated on the usual pillar-and-stall system and, in common with most mines in this district, has had considerable trouble with spontaneous combustion. In January the heading section was sealed off on account of heating and was reopened in October. When ventilation was restored in this section everything was found to be cool, but within twenty days heating again started and the section was resealed.

Ventilation is produced by a 4-foot, high-speed, direct-driven, enclosed-type fan situated near the entrance to the counter-slope. During my last visit of inspection ventilation measured showed 8,000 cubic feet of air per minute passing into this mine for the use of twenty-one men. The brattice and stoppings were in fairly good condition, the air well conducted around the working-faces, and the mine free from any trace of explosive gas.

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, in good condition, and treated with inert dust, analyses of which showed it to be in accord with the requirements of the Coal-dust Regulations. Edison electric head-lamps are used by all employees underground, while flame safety-lamps of the Wolf type are used by the officials for inspection purposes.

The power plant consists of a 66-inch by 16-foot return-tubular boiler which provides power for the Main slope hoist, fan-engine, electric-lighting plant, and the screens; while a single-stage, steam-driven air-compressor, having a capacity of 400 feet of free air per minute, provides power for the mine-pumps, mining machines, and underground hoist. A bunk-house with dining-room and wash and change room is provided at the mine for the use of the employees who so desire, while a number of the employees travel to and from Princeton by means of cars. During the present year a number of log houses have been built near the mine and are at present occupied by families.

Sunshine Coal Co.

M. McKibbon, Secretary, Merritt, B.C.; D. R. Fairley, Manager, Merritt, B.C.

This is a small mine (No. 1) situated on the foot-hills, 2 miles north of Merritt, where a coal-seam was found a few years ago; since that time mining has been carried on at intervals. This mine is operated by a few local miners and the coal sold locally. The seam is highly inclined and is considerably "pinched" in places, but work is being carried on in the hope that

improved conditions may be obtained farther in. The coal from this mine finds a ready market in Merritt, which is accessible by a good wagon-road. During the year a small coal-bunker and bar-screening plant were erected near the entrance to the mine.

The mine is in good working condition, well timbered, free from any trace of explosive gas, and the roads, being naturally wet, are free from dangerous coal-dust. Electric head-lamps of the Wolf type are used by the men underground, and a flame safety-lamp is used by the fireboss for inspection purposes.

NORTHERN INSPECTION DISTRICT.

REPORT BY THOS. J. SHENTON, INSPECTOR.

Telkwa Collieries, Ltd.

No operations carried on in 1931 and mine now full of water.

Bulkley Valley Colliery.

F. M. Dockrill, Operator, Telkwa, B.C.; Asa Robinson, Fireboss.

This mine is situated several miles south of Telkwa and a 12-foot seam of good coal is worked. The output is hauled to the Canadian National Railway at Telkwa by sleighs in winter and by motor-truck during the rest of the year. An average of seven men was employed throughout the year, except for a short shut-down in February. The mine is ventilated by natural means and during my different inspections I have always found the ventilation to be fair and the working-places and roadways well timbered. No explosive or inflammable gas has been detected by means of the flame safety-lamp to date, and a laboratory analysis of a sample of air showed 0.03 per cent. methane. There are now three openings to this mine.

EAST KOOTENAY INSPECTION DISTRICT.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

Three collieries were in active operation during the year—namely, Coal Creek and Michel, owned and operated by the Crow's Nest Pass Coal Company, Limited, with head office in Fernie; and the Corbin Colliery, owned and operated by the Corbin Collieries, Limited, with head office in Vancouver. Work has been very irregular at all the collieries during the year owing to lack of demand for coal and coke. At two of the collieries, Coal Creek and Michel, some of the small-sized coal or slack is used for the production of coke, which is made in coke-ovens of the bee-hive type, and no attempt is made to recover by-products; only a small percentage of the coke-ovens is in operation. There was no labour trouble during the year and agreements between the workmen and the companies were renewed early in the year covering wages and conditions.

ACCIDENTS.

Twelve accidents were reported to this office under section 71 of the "Coal-mines Regulation Act," involving twelve workmen; of the twelve accidents, ten of these occurred at Corbin Colliery and included the only fatal accident in the district. One non-fatal accident was reported from Coal Creek Colliery and one from Michel Colliery. Ten of these accidents occurred underground and two outside the mine. According to occupation, the accidents occurred to: Miners, 3; drivers, 6; labourers, 2; and mine overman, 1. Falls of roof or sides were responsible for five accidents, haulage five, and miscellaneous two.

Many of the non-fatal accidents occurred very simply and a great number of these could be avoided by a little more care on the part of the workmen themselves. All the accidents were investigated and in the case of the fatal accident the inquest was attended, and we are very much indebted to the Coroner for his courtesy in allowing us to question the witnesses with a view to try and solve the cause.

Dangerous Occurrences.

Three "bumps" occurred in Coal Creek Colliery during the year and were immediately reported to this office; two of the "bumps" occurred in No. 1 East mine and the other in No. 3 mine; the latter also damaged the workings in No. 1 East mine, which are 200 feet above the seam which is worked by No. 3 mine. All of these "bumps" occurred a long distance back from the working-faces and it was very fortunate that there were no workmen in the immediate vicinity. All of the "bumps" caused the mine affected to be idle until the damage was repaired.

Mine Fires.

No new mine fires have been reported during the year; the one reported last year in No. 6 mine at Corbin is still being dealt with and has been kept very well under control. It has been very well isolated and streams of water are maintained to prevent it spreading; all approaches are well treated with non-combustible dust. This fire is in an isolated portion of the seam, separated from the main portion of the mine by dykes or intrusive walls of shale in an abandoned portion, and the work is meant to cut it up and deal with it in sections.

Ventilation.

The general conditions with respect to ventilation have been very well maintained during the year and are dealt with in more detail in the report made by Inspector MacDonald. Advantage was taken, as in previous years, of the facilities afforded by the Department of Mines, Ottawa, to have analyses made of the mine-air. The percentage of methane in the air-currents varied very much during the year, owing, no doubt, to the irregular workings of the mines.

No. 1 East mine at Coal Creek provides the highest percentages as in previous years, and every split shows from 1 per cent. upwards; No. 3 ventilating-current, averaging 1.5 per cent., being the highest; No. 1 showing 1.09 per cent.; No. 2 split, 1.05 per cent.; and No. 4 split, 1 per cent. This mine has the record of being the most gaseous mine in the district and the ventilation is a serious problem. In No. 3 mine, Coal Creek, the No. 2 ventilating-current also showed over 1 per cent., while the No. 1 current showed 0.87 per cent. At all the other mines at Coal Creek the percentage of methane was low, being well under 1 per cent.

At Michel Colliery the conditions with respect to the percentage of methane in the air-current were very good, being well under 1 per cent., and only in one case was explosive gas reported. At Corbin Colliery also the conditions were very good, although at the end of the year a sudden rise is shown in the percentage of methane in No. 4 mine, showing slightly over 1 per cent., a rather unusual condition for Corbin mines.

Regulations for Precautions against Coal-dust.

The conditions with respect to this danger have been very well kept during the year, and we consider it is very important that the work of treating the coal-dust should be fully maintained. The principal means of dealing with this danger in this district is to use non-combustible dust, finely crushed lime rock, purchased from the Summit Lime Works, situated east of Crowsnest in Alberta; this firm makes a specialty of providing rock-dust for coal-mines and supplies a great number of the Alberta coal-mines.

In Coal Creek Colliery there were 603 dust samples taken, 337 in Michel Colliery, and 143 in Corbin Colliery; all but 47 of the samples showed over 50 per cent. incombustible content and the areas giving the said 47 samples were immediately re-treated with rock-dust.

Inspection on behalf of the Workmen.

This inspection has been made regularly at all the mines in the district at least every month, and is of great value in maintaining safer and healthier conditions in and around the mines.

We are very much indebted to the workmen's committee for their interest in this work of inspection, and conditions were generally found very satisfactory, and no reports were received at this office complaining of either dangerous or unhealthy conditions.

Searches for matches and other articles contrary to Rule 9, section 101, of the "Coal-mines Regulation Act" were made regularly during the year, and in two cases where men were found to have matches in their possession prosecution and conviction followed.

Explosives.

At Michel and Corbin Collieries explosives are used to bring down the undermined coal; no explosives are used for this purpose at Coal Creek. At all the collieries explosives are used for rock-work where necessary. The use of explosives in coal-mines is subject to Rules 11 and 12, section 101, of the "Coal-mines Regulation Act," and these rules have been fairly well complied with during the year.

Coal-cutting Machinery.

Only one coal-cutting machine was in use in the district, driven by compressed air, which produced 2,995 tons of coal. A number of pneumatic picks were in use at both Coal Creek and Michel for digging down the coal.

Mine-rescue and First Aid.

In the work of first aid to the injured, classes were held at all the collieries for the training of new men, and these classes were attended by many who had previously qualified for certificates in this work. The amount of mine-rescue apparatus, all of the self-contained breathing type, at the collieries is similar to last year, there being six maintained at Coal Creek Colliery, six at Michel, and five at Corbin, and all of the Gibbs type. First-aid rooms are maintained at all the collieries, equipped with adequate supplies of first aid and all maintaining pulmotors; all being kept in fairly good condition. The equipment maintained at the Mine-rescue Station in Fernie is similar to last year and has also been maintained in good condition.

Report by John MacDonald, Inspector.

Crow's Nest Pass Coal Co., Ltd.

Head Office—Fernie, B.C.

W. R. Wilson, President, Fernie, B.C.; H. P. Wilson, General Manager, Fernie, B.C.; Robt. Bonar, Superintendent, Michel, B.C.; Bernard Caufield, Superintendent, Coal Creek, B.C.

The above company operated, during 1930, 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 connections from the colliery are 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.

COAL CREEK COLLIERY.

B. Caufield, Manager.

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 operating during the year were No. 1 East, No. 1 South and Prospect, No. 2, and No. 3 on the south side of the valley; No. 9 was the only mine operated on the north side, where a small crew of men has been fairly steadily employed repairing the main roads and airways. Owing to the general depression in the coal trade, all mines at Coal Creek Colliery have been working very slack 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. 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 near the mines, while a good train service is maintained to Fernie, where the majority of the workmen reside.

No. 1 East Mine.

J. Caufield, Overman.

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., produces an average quantity of 167,000 cubic feet of air per minute, under a water-gauge of 3.4 inches. The ventilation is divided into four splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—23,800 cubic feet of air per minute for the use of forty-two men and ten horses. Burrell gas-detector, 1.1 per cent. methane.

No. 2 Split.—25,600 cubic feet of air per minute for the use of forty-six men and six horses. Burrell gas-detector, 1.1 per cent. methane.

No. 3 Split.—30,800 cubic feet of air per minute for the use of twenty men and three horses. Burrell gas-detector out of order; safety-lamp indicated 1.6 per cent. methane.

No. 4 Split.—16,800 cubic feet of air per minute for the use of fifteen men and three horses. Burrell gas-detector, 1.1 per cent. methane.

North Return.—112,500 cubic feet of air per minute for the use of seventy-seven men and fifteen horses. Safety-lamp indicated 0.6 per cent. methane.

East side of fan-shaft, 64,000 cubic feet of air per minute; west side of fan-shaft, 110,500 cubic feet of air per minute; total return air, 174,500 cubic feet of air per minute.

While explosive gas has been found several times in the course of inspection, ventilating conditions have been generally good in all districts of the mine; Burrell readings taken regularly in the return air-currents have varied from 0.5 per cent. methane in No. 4 split to 2.2 per cent. in No. 3 split. Considering existing circumstances, roadways and timbering have been kept in a fairly good state of repair, a good supply of timber being provided for the purpose, and the requirements of the various systematic timbering orders fairly well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust and sprinkling systems. Two hundred and sixty-six samples of dust were taken, all of which were well above the standard set by the regulation.

No. 1 South Mine.

F. Landers, Overman.

This mine operates the upper and western portion of No. 1 seam and is 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 120,000 cubic feet of air per minute, under a water-gauge of 4.5 inches. This fan ventilates Nos. 2 and 1 South mines and is still being operated as a single-inlet unit. This mine is all on one split, the quantity passing at the last inspection measuring as follows:—

No. 2 Mine, Main Return.—100,000 cubic feet of air per minute for the use of sixty-three men and nine horses. Safety-lamp indicated a slight trace of methane.

No. 1 South, Intake.—16,800 cubic feet of air per minute for the use of fourteen men and five horses.

Fan-drift, Nos. 2 and 1 South Mines.—117,000 cubic feet of air per minute for the use of seventy-seven men and fourteen horses.

No explosive gas was found during the course of inspection, while the methane content in the return air-current has always been kept well under 0.5 per cent. This mine has operated steadily during the year with a crew of fourteen men engaged in repairing main roads and airways and making permanent return airways for No. 2 mine, as these roadways pass through the No. 1 South workings.

Roadways and timbering have been kept in fairly good shape, a good supply of timber being provided for the purpose. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. Thirty-six samples of dust were taken, all but three of these being well above the standard set by the regulation.

A careful watch has been kept on all the old fire areas during the year, no signs of any fresh outbreaks being discovered in any of the suspected districts. These places are frequently treated with crushed limestone-dust and water.

No. 1 South Prospect.

F. Landers, Overman.

This is a new seam which was opened up in 1930 by means of a pair of parallel drifts which are being driven for the purpose of providing new return airways for No. 2 mine in the event of any serious trouble developing in the old workings of No. 1 South, through which the present return airways of No. 2 mine are maintained. A small crew of men has been steadily engaged in this operation during the year. It is ventilated by an electrically driven 4½- by 2-foot Sheldon fan, which produced at the last inspection a quantity of 21,660 cubic feet of air per minute for the use of nine men and one horse. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose. All roadways and working-places are treated regularly with crushed limestone-dust.

No. 2 Mine.

C. McNay, Overman; from November, E. Morrison.

This mine is situated on the level of the tipple and operates the upper and western portion of No. 2 seam. It is ventilated by an electrically driven 11- by 7½-foot Sirocco fan, particulars of which are to be found in the report dealing with 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.—34,000 cubic feet of air per minute for the use of twenty-two men and three horses. Safety-lamp indicated a trace of methane.

No. 2 Split.—82,500 cubic feet of air per minute for the use of forty-four men and five horses. Safety-lamp indicated a trace of methane.

While explosive gas has been found on several occasions during the course of inspection, ventilating conditions in general have been fairly good all over the mine; Burrell readings taken regularly in the return air-currents have varied from 0.3 per cent. methane in No. 1 split to 0.5 per cent. in No. 2 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 various systematic timbering orders fairly well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. Seventy samples of dust were taken, all but seven of these being well above the standard set by the regulation.

No. 3 Mine.

J. Worthington, Overman.

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 166 r.p.m., produced an average quantity of 61,800 cubic feet of air per minute, under a water-gauge of 4.8 inches. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—8,400 cubic feet of air per minute for the use of nineteen men and four horses. Burrell gas-detector, 0.9 per cent. methane.

No. 2 Split.—16,000 cubic feet of air per minute for the use of forty men and ten horses. Burrell gas-detector, 1 per cent. methane.

Main Return.—72,000 cubic feet of air per minute for the use of fifty-nine men and fourteen horses. Safety-lamp indicated 1 per cent. methane.

Explosive gas has been found on a few occasions during the course of inspection, mostly in cavities in the roof at the working-faces, while Burrell readings taken regularly in the return air-currents have varied from 0.6 per cent. methane in No. 1 split to 1.3 per cent. in No. 2 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 systematic timbering orders well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust and sprinkling systems. Two hundred and thirty-one samples of dust were taken, all of which were well above the standard set by the regulation.

No. 9 Mine.

Robt. Fowler, Fireboss.

As in previous years, a small crew of men has been fairly steadily employed repairing the main roads and airways. This mine is ventilated by a small blower-fan which produced an average quantity of 9,000 cubic feet of air per minute. This mine is all on one split, the quantity passing at the last inspection measuring as follows:—

Main Return.—12,900 cubic feet of air per minute for the use of seven men and two horses. Safety-lamp indicated a slight trace of methane.

Explosive gas was found on three occasions in cavities in the roof during the course of inspection, while the methane content in the return air-current has always been kept well under 0.5 per cent. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose. All roadways and working-places, where required, are treated regularly with crushed limestone-dust.

MICHEL COLLIERY.

Robt. Bonar, 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.

An important departure in mining coal in this district has been effected by the development and operation of two long-wall conveyor faces in B seam of No. 1 mine. This seam is reached by means of an inclined rock tunnel driven from the inby end of the main rock tunnel in No. 3 mine, which intersects practically all of the coal-measures on the No. 3, or south, side of the valley of Michel creek and is the uppermost seam being operated at present. It averages from 5 to 5½ feet in thickness, with a strong shale roof in which "pots" or "bells" are frequently encountered. This seam was systematically planned from the commencement with the view of introducing a retreating long-wall method of working. Inclines were driven to the rise off the main East and West levels on the full pitch of the seam (15°) to a predetermined boundary-line, leaving a substantial barrier-pillar along the line of outcrop. These inclines were set off in pairs every 300 feet and were connected by wide rooms driven every 150 feet off the haulage-incline of each pair. Operations on these walls in general have been fairly successful, although the general depression in the coal trade, with the resultant intermittent operation of the mines, has in a measure prevented the management from securing the highest possible efficiency from this new method of working. The Meco type of shaker-conveyor is used on the faces and has given every satisfaction; the conveyors are advanced every 8 feet of travel and are protected on the gob side by a double row of cogs and heavy breaker-posts, one row of cogs being moved forward every shift of the conveyor. The general method of timbering is by post and cap-piece, posts being set 4 feet apart in any direction, and closer if required. When sufficient ground has been extracted the timbers are withdrawn in the gob and the roof allowed to break behind the cogs.

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.

No. 3 Mine.

Robt. McFegan, Overman.

This mine operates the upper No. 3 seam 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 122,000 cubic feet of air per minute, under a water-gauge of 2.9 inches. The ventilation is divided into four splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—5,000 cubic feet of air per minute for the use of twelve men and two horses. Safety-lamp indicated a trace of methane.

No. 2 Split.—20,000 cubic feet of air per minute for the use of thirty men and five horses. Safety-lamp indicated a trace of methane.

No. 3 Split.—7,200 cubic feet of air per minute for the use of fifteen men and one horse. Burrell gas-detector, 0.4 per cent. methane.

No. 4 Split, Intake.—10,500 cubic feet of air per minute for the use of twelve men and one horse.

Main Return.—125,000 cubic feet of air per minute for the use of sixty-nine men and nine horses. Safety-lamp indicated 0.5 per cent. methane.

Explosive gas has been found on several occasions during the course of inspection, mostly in cavities in the roof at the working-faces, while Burrell readings taken regularly in the return air-currents have varied from 0.3 per cent. methane in No. 3 split to 0.6 per cent. in No. 2 split. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose, and the requirements of the various systematic timbering orders fairly well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. One hundred and twenty-one samples of dust were taken, all being well above the standard set by the regulation.

A considerable amount of development-work has been carried out in the new district through the fault in the main West level; Nos. 11, 12, 13, and 14 inclines off the North and South levels are being vigorously pushed ahead with the view of developing this important district. In No. 8 Incline pillar district, which is almost finished, a very high percentage of recovery has been secured in the extraction of the pillars; this reflects great credit on both workmen and officials when one considers the exceptionally difficult roof conditions met with in this particular district.

No. 1 Mine.

D. James, Overman.

This mine is reached by a crosscut tunnel from the upper No. 3 seam of No. 3 mine which intersects Nos. 2, 1, A, and B seams, of which Nos. 1 and B only are operated at present. It is ventilated by No. 3 East mine-fan, particulars of which may be found in the report dealing with the latter mine. This mine is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Seam, Intake.—19,600 cubic feet of air per minute for the use of fifty-three men and five horses.

B Seam.—36,000 cubic feet of air per minute for the use of thirty-seven men and two horses. Safety-lamp indicated 0.4 per cent. methane.

Main Return.—67,500 cubic feet of air per minute for the use of ninety men and seven horses. Safety-lamp indicated a trace of methane.

Explosive gas was found a few times in the course of inspection, mostly in cavities in the roof at the working-faces, while Burrell readings taken in the return air-currents have varied from 0.3 per cent. to 0.5 per cent. methane. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose, and the requirements of the various systematic timbering orders fairly well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. One hundred and twenty-one samples of dust were taken, all but three of these being well above the standard set by the regulation.

No. 8 Mine.

Robt. Taylor, Overman.

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 58,250 cubic feet of air per minute, under a water-gauge of 2.8 inches. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—16,200 cubic feet of air per minute for the use of forty-five men and nine horses. Safety-lamp indicated a trace of methane.

No. 2 Split.—16,200 cubic feet of air per minute for the use of forty men and eight horses. Safety-lamp indicated a trace of methane.

Main Return.—55,000 cubic feet of air per minute for the use of eighty-five men and seventeen horses. Safety-lamp indicated a slight trace of methane.

No explosive gas was found in this mine during any of our inspections, while the methane content in the return air-currents has always been kept well under 0.5 per cent. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose, and the requirements of the various systematic timbering orders well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust and sprinkling systems. Ninety-five samples of dust were taken, all but one of these being well above the standard set by the regulation.

No. 3 East Mine.

This mine is supervised by the officials of No. 1 mine 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 98,000 cubic feet of air per minute, under a water-gauge of 2.1 inches. This fan ventilates both Nos. 1 and 3 East mines, the quantities passing at the last inspection measuring as follows:—

No. 1 Mine, Main Return.—67,500 cubic feet of air per minute for the use of ninety men and seven horses. Safety-lamp indicated a trace of methane.

No. 8 West Return.—12,000 cubic feet of air per minute for the use of three men and one horse.

Main Return.—80,000 cubic feet of air per minute for the use of ninety-three men and eight horses. Safety-lamp indicated a slight trace of methane.

As in the past few years, operations in this mine have been confined to keeping the main roads and airways in a good state of repair, together with occasional flushing of the old lower No. 3 works with water and non-combustible dust. While slight evidence of heating still exists at what is termed the top-west stopping, conditions in this area may be said to be normal; a careful inspection is made daily in this district, no evidence of any further heating being observed during the year.

Corbin Collieries, Ltd.

Austin Corbin, President, Spokane, Wash.; E. L. Warburton, Manager, Corbin, B.C.

CORBIN COLLIERY.

E. L. Warburton, Manager; J. Taylor, Assistant 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. As in former years, the whole of the output was produced at Nos. 4 and 6 mines, no work of any description being done in No. 5 mine.

A general description of the method of working, system of haulage in and around the mine, and surface plant has appeared in previous Annual Reports. A considerable amount of development-work has been carried out during the year in both mines, an important modification of the ordinary method of working being introduced at No. 6, where several raises were driven through to the surface for the purpose of extracting the pillars from the outcrop downward, the coal being conveyed down easy-grade chutes to the main haulage-level, where it is then loaded into the mine-cars. As far as this method has been tried, it has proved to be quite an improvement over the old system of extracting the seam by means of the block caving and heavy lifts, both as regards the percentage of recovery and quantity of lump coal produced.

A short distance to the north of No. 6 main portal a new tunnel is being driven to develop the southern portion of the field; while this will eventually form the main haulage-roadway for the whole of this mine, it is the intention of the management to develop the new district in such a manner that it may be safely and speedily isolated from the older workings of the mine in the event of trouble developing in the fire area of A Level district.

Edison electric cap safety-lamps are used exclusively by the workmen, while Wolf safety-lamps are used by the bratticemen and officials 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 for the purpose of detecting lower percentages of methane than that usually found by the ordinary safety-lamp.

No. 4 Mine.

W. Commons, Overman.

This mine operates the No. 4 seam and is ventilated by an electrically driven single-inlet fan of the Guibal type, which, running at a speed of 130 r.p.m., produced an average quantity of 15,800 cubic feet of air per minute, under a water-gauge of 1.2 inches. The ventilation is all on one split, the quantity passing at the last inspection measuring as follows:—

A Level Return.—18,000 cubic feet of air per minute for the use of twenty-four men and three horses. Safety-lamp indicated 0.6 per cent. methane.

Explosive gas was found on three occasions during the course of inspection, while Burrell readings taken regularly in the return air-current have varied from 0.5 per cent. to 1.3 per cent. methane. Roadways and timbering have been kept in fairly good condition, a good supply of timber being provided for the purpose, and the requirements of the various systematic timbering orders well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. Seventy-three samples of dust were taken, fifty-three of which were above the standard set by the regulation. In all cases where dust samples show any roadway to be under the standard *re* non-combustible material, further applications of rock-dust are given these particular places and additional samples taken. This practice is generally carried out in all mines in this district.

No. 6 Mine.

W. Almond, Overman.

This mine operates the No. 6 seam and is ventilated by an electrically driven 4½- by 3-foot Sirocco fan, which, running at a speed of 280 r.p.m., produced an average quantity of 51,000 cubic feet of air per minute, under a water-gauge of 0.6 inch. With the exception of the old workings in Nos. 3 South and 3½ levels, the ventilation is practically all on one split, the quantity passing at the last inspection measuring as follows:—

Main Return.—48,000 cubic feet of air per minute for the use of fifty-six men and three horses.

Explosive gas has only been found on one occasion during the course of our inspections, while the methane content in the return air-current has always been kept well under 0.5 per cent. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose, and the requirements of the various systematic timbering orders well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. One hundred and three samples of dust were taken, ninety of these being in keeping with the standard set by the regulation.

Conditions are generally good in the fire area in A Level district, a careful watch being maintained on all suspicious places, while liberal quantities of crushed limestone-dust are constantly distributed in and around the heated area; water-lines are laid to all points in the old works, while Burrell all-service masks and canaries are available in case of emergency.

REPORTS OF INSPECTORS OF QUARRIES.

REPORT BY JAMES STRANG, INSPECTOR.

VANCOUVER MINING DIVISION.

Coast Quarries Co., Ltd.—The operations of this company are situated at Granite Falls, Burrard inlet, about 18 or 20 miles from Vancouver. Granite rock is quarried here, crushed and screened to various sizes for general construction-work. Auto-trucks are used to convey the material from the quarry-face to the bunkers and two power-shovels handle the material at the face of the quarry. On my last inspection in December eighteen men were employed here. I regret to report a fatal accident to Jerry Semac, Granite Falls, on December 29th. With the exception of this, conditions at the quarry were satisfactory and the regulations well adhered to.

Kilgard Red-shale Quarry.—This quarry is the property of the Clayburn Company, Limited, and worked in conjunction with its clay-mines. The men are drawn from the mine to work in the quarry as required.

NEW WESTMINSTER DIVISION.

Gilley Bros.' Quarry.—This property is situated at Silver Valley on the Pitt river. Great improvements have been made here to the screening and loading equipment. A total of forty-one men is employed at the quarry and the screening and loading plant. Every effort is made to conduct operations in a safe and satisfactory manner. No serious accidents occurred during the year.

Maryhill Sand and Gravel Pit.—This plant is situated on the Fraser river, below the junction of the Pitt and Fraser rivers, and is operated by Gilley Bros., of New Westminster. A complete new electrical equipment for screening and loading has been installed here and in every particular is one of the best protected plants in quarry operations. Sixteen men are employed here.

Port Haney Brick and Tile Co.—Situated at Port Haney. This company operates a clay-bank for the purpose of manufacturing brick, tiles, etc. One power-shovel handles all the material necessary for the factory.

VICTORIA DIVISION.

B.C. Cement Co., Ltd.—This company operates a large limestone-quarry at Bamberton. Adjacent to the quarry they have a very up-to-date plant for the manufacture of cement. At the quarry power-shovels load the material into cars and gasoline-locomotives transport the material to the bunkers. Every precaution is taken for the safety of workmen, first-aid classes and meetings being held regularly to discuss safety methods. Thirteen men are employed at this quarry, and the whole plant is under the supervision of H. Anderson, manager.

Rosebank Lime Co.—This company operates a small quarry at Colwood, a few miles from Victoria. Conditions here were found to be satisfactory.

Pioneer Sand and Gravel Co.—This company operates a sand and gravel pit at Songhees Reserve, a few miles from Victoria. The sand and gravel is washed from the bank by the hydraulic method and carried by flume to the screening plant, where it is screened to various sizes. I regret to report a fatal accident to Ernest Kemp on May 20th which occurred at this plant. There are regularly eight men employed here.

Producers Sand and Gravel Co.—Royal bay, near Victoria. This operation is carried on in a similar manner to that of the above, with ten men regularly employed.

NANAIMO MINING DIVISION.

TEXADA ISLAND SECTION.

Pacific Lime Co.—A large limestone-quarry is owned and operated at Blubber bay by this company. About 150 men are employed at the quarry, lime-kilns, and sawmill when they are working full time, about fifty men being engaged in quarrying operations. Conditions here were found to be satisfactory.

B.C. Cement Co.—This company operates a quarry on the opposite shore of Blubber bay from the Pacific Lime Company. The material is loaded into cars by a 70-horse-power gasoline electric shovel and transported to the bunkers by gasoline-locomotives. The rock after passing through the crusher is conveyed to the loading-wharf by a 32-inch conveyor-belt. On my last visit seven men were employed here and general conditions were found to be very satisfactory.

Petrie Lime Co.—This company's quarry, situated on Blubber bay between the properties of the Pacific Lime Company and the B.C. Cement Company, has been worked intermittently and during the summer was leased for a few months by the Coast Quarries, Limited, of Vancouver. I regret to report that during that time one blasting accident and one fatal accident to workmen assisting in the repair of the power-shovel occurred.

Marble Bay Quarry, Vananda.—This property is operated by the Powell River Paper Company. Seven men are employed in getting out limestone for the pulp-mill. General conditions were found to be satisfactory.

NELSON ISLAND SECTION.

Vancouver Granite Co.—Quarry bay, Nelson island. A dimension-stone quarry employing nine men is operated here. The stone is used for building and monumental purposes. Every effort is made to comply with the "Quarries Regulation Act" and conditions were found to be satisfactory.

HADDINGTON ISLAND SECTION.

Haddington Island Quarry.—This quarry was leased by the M. J. Ryan Company for the purpose of getting out building-stone for the new Royal Bank Building and the Canadian National Hotel, Vancouver. Twenty-nine men are employed and conditions in general were found to be good.

REPORT BY THOS. R. JACKSON, INSPECTOR.

VANCOUVER MINING DIVISION.

Deeks Sand and Gravel Pit.—North Vancouver; F. O. Burgess, superintendent. This quarry is some 3 miles above Second Narrows bridge. It is a hydraulic operation, the monitors working at 100-lb. pressure, all other power being electrical. The plant has a capacity of 100 tons per hour and gives employment to fourteen men. The general condition of the quarry and machinery was good and safe working conditions maintained.

Cascade Sand and Gravel Quarry.—North Vancouver; Wm. Hills, superintendent. This operation recovers sand and gravel from the bed of Seymour creek by means of a large-capacity power-shovel. This plant did not operate to capacity during the year and only eight men were employed. The conditions of the plant and machinery were found to be good and care taken for the safety of employees.

Peerless Sand and Gravel Quarry.—North Vancouver; F. Hughes, superintendent. This operation commenced in August with eight men, following a great amount of land-clearing and other preparatory work. There was a fatal accident in this quarry during the preparatory period, due to a shackle-pin flying out, under strain, while a stump was being pulled by a donkey-engine. During the last inspection in December safe conditions were found to prevail.

Hillside Sand and Gravel Quarry.—West Howe sound; John Campbell, superintendent. This plant is on the beach and is at present carrying a 50-foot face operated by a gasoline-driven shovel which delivers to a large truck, which transports the gravel to the screening and washing plant. Camp accommodation consists of living-quarters, cook-house, and dining-room, all of which are reasonably good. The quarry and machinery were found to be in safe working condition.

B.C. Sand and Gravel Quarry.—Lynmour; W. Monks, foreman. This operation did not operate to capacity during the year; at last inspection in December only four men were at work. The better protection of employees from moving parts of machinery was secured at this plant and at the last inspection general working conditions were good.

Britannia Sand and Gravel Quarry.—Britannia Beach; J. Bissett, superintendent. Very little work was carried on at this operation during the year, only three men being employed. General conditions were found to be safe.

REPORT BY GEO. O'BRIEN, INSPECTOR.

NANAIMO AND ALBERNI MINING DIVISIONS.

McDonald Cut-stone Operators.—This operation is situated on Newcastle island in the strait of Georgia. From eight to twelve men were employed during part of the year getting out cylindrically cut stone for pulp-grinding mills, etc. The grindstones are cut out *in situ*, and when a sufficient depth has been reached by the rotary cutter the stone is detached at the base by a small charge of gunpowder and the stone then raised by a hoist. Blasting operations are under the direct supervision of a certificated blaster.

Gabriola Shale Products, Ltd.—This operation is situated near the southerly end of Gabriola island in the strait of Georgia and the method of operation is the open-quarry system. The product is a good grade of shale and is used in the brick-making plant on the property. The overburden averages from 15 to 20 feet in thickness and is removed by hand. The operations are under the direct supervision of Mr. DeLong and every precaution is taken with regard to safety. Blasting operations are under the direct supervision of a certificated blaster. No accidents were reported from this operation during the year. The quarry and plant have been closed down for a few months in the latter half of the year, due to lack of orders.

REPORT BY H. H. JOHNSTONE, INSPECTOR.

GRAND FORKS MINING DIVISION.

Corra Linn Dam.—This was the principal operation in this district during the year and is situated on the Kootenay river, about 9 miles west of Nelson; being constructed by the West Kootenay Power and Light Company. It was divided into three different operations—namely, the work at the site of the dam; the operation at Mile 8.1, which was under contract to the General Construction Company; and the work at Granite. The whole work was under the supervision of Fred Chapman. An average of 545 men was employed, of whom 110 were working at rock or quarry work. At the Mile 8.1 operation an average of 265 men was employed on rock-work and excavation. It was at this operation that the big blast was set of. Using 15 tons of Polar Forcite Gelatin, 30,000 cubic yards of rock was broken. At the Granite operation an average of ninety-six men was employed, all on rock and excavation work. Considering the amount of work done and the number of men employed, accidents were few. Every precaution was taken to prevent accidents to the workmen and the public. Accommodations for the men were excellent and the commissary all that could be desired.

Fife Quarry.—This is an operation conducted by the Consolidated Mining and Smelting Company to supply limestone to the smelter. The work is done under contract. The quarry itself is a large glory-hole, the broken rock going through a raise to the tunnel, from where it is drawn off and run to surface. Ten men were employed. Conditions were good.

Big Bend Road.—This is road-work being done by the British Columbia Government north of Revelstoke, along the Columbia river, to connect with work being done by the Federal Government from the Golden end. An average of 175 men was employed. Working conditions were good and living-quarters for the men as good as could be expected.

Camps 15, 16, and 18.—These were camps started by the British Columbia Government for road-work between Castlegar and Rock Creek. I found living conditions to be good and those in charge of the work to be capable. There was, however, an inclination to have the powder-magazines too close to the highway and not sufficiently protected. This matter was taken up.

REPORT BY THOS. J. SHENTON, INSPECTOR.

BELLA COOLA MINING DIVISION.

Cuningham Island Quarry.—F. J. Beale, manager and owner. This is an open-surface quarry and at the time of inspection eight men were employed. The work is performed with every possible care and in accordance with the "Quarries Regulation Act"; the camp accommodation is adequate and sanitary and suitable provision is made for first aid to the injured.

King Island Quarry.—Two men were employed here in the preliminary development of operations on a larger scale; general conditions were found to be satisfactory and in accordance with the requirements of the "Quarries Regulation Act."

GOVERNMENT MINE-RESCUE STATIONS.

MINE-RESCUE STATION, NANAIMO.

REPORT BY J. D. STEWART, INSTRUCTOR.

There were no emergency calls from any of the mines in this district during the year, but there were twelve emergency calls for oxygen administration by medical men in Nanaimo and Qualicum and also from Nanaimo General Hospital; these calls were responded to immediately. Eleven new men underwent the full training course at this station and gained certificates of competency in mine-rescue training, and a number of teams of formerly trained men carried out an intensive practice schedule during the year. The main equipment at this station consists of six sets of the McCaa two-hour oxygen apparatus; six sets of the Gibbs two-hour oxygen apparatus; twelve sets of the Burrell all-service gas-masks; eighty-five M.S.A. self-rescuers; and one H.H. inhalator; with adequate supplies to maintain the above in service for a considerable time. During the year 2,500 cubic feet of oxygen was used in training.

MINE-RESCUE STATION, CUMBERLAND.

REPORT BY JOHN THOMSON, INSTRUCTOR.

On February 17th an emergency call was received at 5 a.m. from No. 5 mine, Comox Colliery; and in response took out twelve sets of the oxygen apparatus and twelve sets of the Burrell all-service gas-masks. Fire had been discovered near the bottom of the shaft and was quickly and satisfactorily dealt with by the trained teams using the Burrell all-service gas-masks. During the year thirty employees of the Comox Colliery maintained constant practice at this station, and five new men completed the training course and obtained Government certificates of competency in mine-rescue work. The equipment at this station consists of eleven sets of Paul oxygen apparatus; six sets of McCaa two-hour oxygen apparatus; twelve sets of the Burrell all-service gas-masks; and twenty-five self-rescuers. In addition, four sets of the Paul apparatus, owned by the Canadian Collieries (Dunsmuir), Limited, are maintained at this station. Adequate stocks of supplies for above machines are maintained at all times. Three teams from this district competed at the mine-rescue competition held in Nanaimo on June 13th, 1931.

MINE-RESCUE STATION, MIDDLESBORO.

REPORT BY WILLIAM C. STONE, INSTRUCTOR.

No emergency calls were received during the year. Instruction in mine-rescue work has been given individually to men who have shown interest. The equipment at this station consists of five sets of Paul two-hour oxygen apparatus; four sets of the Gibbs two-hour oxygen apparatus; and three Burrell all-service gas-masks. An adequate supply of materials is kept on hand. At the end of the year arrangements were made whereby the future supervision of this station was undertaken by the management of the Middlesboro Collieries, Limited.

MINE-RESCUE STATION, FERNIE.

REPORT BY JOHN T. PUCKEY, INSTRUCTOR.

Two teams from Coal Creek Colliery maintained training throughout the year, and fourteen new men from the *Sullivan* mine and nine from Corbin Colliery were ready to take the final examinations for certificates of training in mine-rescue work at the end of the year. An emergency call from No. 6 mine, Corbin Colliery, for the use of the Burrell all-service gas-masks was responded to on January 24th. This was in connection with a mine fire and part of the equipment was maintained in the vicinity of the fire for the remainder of the year. Calls for the use of the oxygen inhalator by medical men for patients in extremity were also

responded to without delay. The members of the local fire brigade underwent a course of training with the gas-masks in the smoke-chamber and all showed an efficient knowledge in the application of this aid to fire-fighting. The general interest in mine-rescue work and first-aid work was well maintained throughout the year and 123 first-aid certificates were granted to members of the local first-aid class. The equipment at this station consists of eleven sets of the McCaa two-hour oxygen apparatus; six sets of the Gibbs two-hour oxygen apparatus; twelve sets of the Burrell all-service gas-masks; forty M.S.A. self-rescuers; and adequate supplies to maintain the equipment in service for a considerable time. The machines are tested every week and kept in readiness for any emergency calls.

MINE-RESCUE STATION, PRINCETON.

REPORT BY ALFRED GOULD, INSTRUCTOR.

This station was completed in the early spring and officially opened on June 27th, the date of the annual field-day of the Princeton Ambulance and Mine-safety Association. One of the principal events of the day was a competition in rescue-work, in which five teams took part, showing some very good work; the winning team, Pleasant Valley Coal Mining Company, Limited, gaining a mark of 99 per cent. During the year fourteen men were trained and granted certificates of competency. Eight members of the Princeton Volunteer Fire Brigade underwent a complete course of training in the use of the McCaa apparatus and the Burrell all-service gas-mask. The mine-rescue equipment at this station consists of eleven sets of the McCaa two-hour oxygen apparatus; eleven sets of the Burrell all-service gas-masks; seventeen M.S.A. self-rescuers; a M.S.A. high-pressure pump for recharging oxygen cylinders; one H.H. inhalator; and an adequate supply of all necessary materials for the maintenance of the machines is kept on hand. No emergency calls for mine-rescue apparatus were made during the year 1931.

PROSECUTIONS.

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

Colliery.	Occupation of Defendant.	Offence charged.	Judgment.
Western Fuel Corp. of Canada, Ltd.—			
No. 1 mine	Fireboss	Having more than three shot-holes charged (General Rule No. 12)	$10 and costs.
No. 1 mine	Miner	Drilling with percussive air-drill without being equipped with water-jet (General Rule No. 14)	$50 and costs.
Canadian Collieries (D.), Ltd.—			
No. 4 mine	Miner	Walking up slope at prohibited time of day (Special Rule No. 77)	$10 and costs.
No. 4 mine	Timberman's helper	Ditto	$10 and costs.
Crow's Nest Pass Coal Co.—			
Michel Colliery	Miner	Having matches in his possession	$5 and costs.
Corbin Collieries, Ltd.—			
No. 4 mine	Miner	Having matches in his possession	$10 and costs.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

FIRST-, SECOND-, AND THIRD-CLASS CERTIFICATES AND MINE-SURVEYORS' CERTIFICATES.

REPORT BY JAMES STRANG, SECRETARY TO THE BOARD.

The Board of Examiners, which was formed on July 10th, 1919, at present consists of James Dickson, Chief Inspector of Mines, as Chairman; Henry E. Miard, member; and James Strang, member and Secretary to 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 amended rules made by the Provincial Board of Examiners and approved by the Minister of Mines on September 28th, 1929. Two examinations were held in 1931. The first was held on May 20th, 21st, and 22nd, and the second on November 18th, 19th, and 20th.

The total number of candidates at the examinations were as follows: For First-class Certificates, 1 (1 passed conditionally with supplementals); for Second-class Certificates, 4 (4 passed); for Third-class Certificates, 15 (3 passed, 12 failed); for Mine Surveyors, 7 (2 passed, 5 failed).

The following is a list of the candidates who successfully passed in the various classes:—

First-class Candidates.—William Frew (with supplementals).

Second-class Candidates.—Daniel M. Waddington, Robert Pettigrew, William Gregory, and Edward R. Hughes.

Third-class Candidates.—George Guy, Andrew Patrick, and Munro Gibson.

Mine Surveyors.—John Stropkay and Munro Gibson.

The work of most of the candidates in the Third-class examinations was disappointing; they do not seem to realize how important it is for the fireboss, in modern mining, to be well equipped, both theoretically and practically, for his work. The attention of mining students who have not the opportunity of attending schools where the subject of mining is taught is directed to the Correspondence Course in mining provided by the Department of Education.

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 underground 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 the mining districts and 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 1931 examinations have been held for candidates for certificates of competency as coal-miners in the various coal-mining districts of the Province.

One hundred and thirty-one candidates presented themselves for examination; ninety-three passed and thirty-eight failed to qualify. In addition to the above, a number of duplicate certificates were issued to coal-miners who had lost their original certificates. 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 the "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.

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402 Pender Street West Vancouver, B. C.

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VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1932.

6,325-332-8651

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Annual Report of the Minister of Mines for the year ended 31st December, 1931, being an account of mining operations in the Province. John D. Galloway, Provincial Mineralogist. 254 pp., plates, maps, 1931.

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