ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1933

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
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1934.

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 Mineral Industry of the Province for the year 1933 is herewith respectfully submitted.

G. S. PEARSON,
Minister of Mines.

Minister of Mines' Office,
April 30th, 1934.

Bralorne Mines, Ltd., Cadwallader Creek, Lillooet Mining Division.

ANNUAL REPORT OF THE MINISTER OF MINES, 1933.

OFFICE OF THE PROVINCIAL MINERALOGIST,
PARLIAMENT BUILDINGS,
VICTORIA, B.C., April 28th, 1934.

To the Honourable G. S. Pearson,
Minister of Mines, Parliament Buildings, Victoria, B.C.

SIR,—In accordance with your instructions of February 28th, 1934, I have the honour to submit the Annual Report on the Mineral Industry of the Province for the year ended December 31st, 1933.

STATISTICAL SUMMARY AND GENERAL REVIEW OF THE MINERAL INDUSTRY OF BRITISH COLUMBIA IN 1933.

STATISTICAL SUMMARY.

The gross value of the mineral production of the Province for 1933 was $30,674,486, an increase of $2,432,868, or 8.61 per cent., over $28,241,618, the value of the output for 1932. This substantial increase was due to a material increase in the production of lode and placer gold, slight increases in the production of lead and zinc, and to the generally higher prices which prevailed for silver, copper, lead, and zinc during 1933. There was a serious decline in the production of coal, and, as was to be expected, the structural-mineral output declined, due to the difficulties attendant upon financing new building ventures. The general trend has been upward in both production and in market prices, and it would appear that the value of the mineral production should increase steadily during the next few years.

The following table shows the 1933 increase or decrease in the value of the production in the principal components of the mineral industry of the Province. Table I. in the main statistical section of this Annual Report gives detailed information respecting the dollar and percentage increases or decreases in the 1933 mineral-output as compared with the 1932 mineral production :—

Class.	Dollar Increases and Decreases, 1933 Production, as compared with 1932.		
	Increase.	Decrease.	Percentage.
Gold, lode	$867,493	.....	+ 23.11
Gold, placer	59,976	.....	+ 17.29
Silver	392,267	.....	+ 17.32
Copper	.....	$3,615	— 0.11
Lead	1,116,853	.....	+ 20.74
Zinc	1,669,775	.....	+ 36.12
Coal	.....	1,148,473	— 17.60
Structural materials	.....	674,794	— 39.72
Miscellaneous metals and minerals	153,386	.....	+ 31.94
Net increase	2,432,868	.....	+ 8.61

The value of the metallic mineral production (lode and placer gold, copper, silver, lead, and zinc mining output) was $23,641,738, or $4,102,749 (21 per cent.) larger than it was in 1932. This increase is due primarily to the materially increased market prices received for lead and zinc, as well as to the decided increase in the quantity production of gold.

The tonnage of metalliferous ores mined in the Province in 1933 was 4,030,778 tons, as compared with 4,340,158 tons in 1932. This is a decrease of 309,380 tons, or 7.1 per cent., from the 1932 tonnage, but due to the increased tonnage of comparatively high-grade gold ores mined in 1933 the average value of all the ore mined was $5.87 per ton, as compared to $4.50 per ton in 1932. The substantial decrease in tonnage mined at the *Britannia* mine was offset in part

by increased production at the *Sullivan* mine, renewed production in the later part of the year from the *Monarch* mine at Field, and new and increased production from several gold-mines.

For the purposes of the statistical tables in this Annual Report the mineral production of the Province is divided into four main divisions—metal minerals, coal, structural materials, and miscellaneous metals and minerals. Metal-mine production, valued at $23,641,738 in 1933, is the most important of the four divisions. Coal-output valued at $5,375,171, structural materials valued at $1,024,045, and miscellaneous metals and minerals valued at $633,532 follow in order of value importance.

By value, the various products of the mineral industry are ranked in the following order in 1933: Lead, zinc, coal, gold, copper, silver, structural materials, miscellaneous metals and minerals.

Lode-gold output, valued at $4,620,754 (gold at $20.67 per fine ounce), shows the substantial increase of $867,493, or 23.11 per cent., as compared with the production in 1932. Thus in the past two years lode-gold production has increased from $3,018,894 to $4,620,754, equivalent to 53 per cent. The increased output in 1933 was due to the larger production from the *Pioneer*, *Bralorne*, *Reno*, and *Yankee Girl* mines, renewed production from the Rossland mines by lessees, and by new production from the *Cariboo Gold* and many smaller mines. The increases by these mines were offset to some extent by decreased production from the *Premier* and *Union* mines. *Pioneer* mine replaced the *Premier* as the leading gold-producing mine in British Columbia, the first five lode-gold producers in point of production being the *Pioneer*, *Premier*, *Bralorne*, *Reno*, and *Cariboo Gold* mines.

The value of the placer-gold production for 1933 was $406,776, an increase of $59,976, or 17.29 per cent., as compared with the output for 1932. Many individuals were at work and several large development operations have been brought to the point of production, so that in 1934 an appreciably increased output may be expected.

This year, as in 1932, the assistance given by the branch banks and merchants throughout the Province in making a monthly return of gold passing through their offices has been and is of much value in obtaining a record of the placer-gold recoveries. The Department of Mines appreciates the excellent co-operation received in this respect.

In 1933 the silver-output was 7,006,406 oz., valued at $2,650,720. This is a slight decrease (1.7 per cent.) in quantity, but a 17.3-per-cent. increase in value, due to the higher average price received for silver. The *Sullivan* and *Premier* mines remained the principal producers of this metal, but an increased output was made by the mines of the Beaverdell area, where several small, but high-grade, silver-mines continued production. Should the price for silver be advanced to 50 or 60 cents per ounce in conjunction with increased lead and zinc prices, expansion in the silver-mining industry would materialize quickly.

Copper production in 1933 was 42,608,002 lb., valued at $3,176,341, a decrease of 7,233,007 lb. and $3,615 from 1932 figures. The small decrease in value is due to better copper prices. The principal production was made at the *Hidden Creek* mine of the Granby Consolidated Mining, Smelting, and Power Company, Limited: their *Copper Mountain* plant remaining closed during 1933. The other important producer of copper, the Howe Sound Company, operated their *Britannia* property at about 20 per cent. of normal capacity during 1933.

Lead production in 1933 was 271,606,071 lb., valued at $6,495,731. This is an increase of 6.7 per cent. in quantity and 20.7 per cent. in value over figures for the 1932 production. The bulk of the lead produced comes from the *Sullivan* mine of the Consolidated Mining and Smelting Company of Canada, but their output was supplemented by the renewal of production at the *Monarch* mine of the Base Metals Corporation at Field in August of 1933. There should be an important production from this property in 1934, as it is being operated at a capacity of 300 tons of ore per day. The Slocan and northern producers of lead-zinc-silver ores are still inactive for the most part, although the gradual betterment in metal prices is having a tendency to stimulate operations by leasers and small companies. Much of the betterment in lead prices is due to the favourable position of the exchange markets between Canada and Great Britain.

The 1933 zinc-output of 195,963,751 lb., valued at $6,291,416, is 2 per cent. greater in quantity and 36.1 per cent. greater in value than for 1932. The increase in value is due in small part to gradually increasing metal prices, but mainly to the favourable money-market situation of Canada in respect of Great Britain, wherein most of the zinc-metal production is marketed. The main production was from the *Sullivan* mine. The *Monarch* mine, also an important producer

of zinc, was operated for the last four or five months of 1933. Production of zinc concentrates was started during 1933 at the *Britannia* mine.

The coal production for 1933 was 1,264,746 long tons, valued at $5,375,171, as compared with an output of 1,534,975 long tons, valued at $6,523,644, in 1932. Coal is valued for statistical purposes at $4.25 per ton in both 1932 and 1933. This serious decline in both quantity and total dollar value of production is better stressed when it is stated that the 1933 production is the lowest in value since 1906 and 58.6 per cent. below the maximum output reached in the year 1920. The decrease was general in all but the northern coal-producing district of the Province and reflects a generally lessened demand for fuel by industries and domestic users throughout the Province. The importations of coal into the Province were about the same as in 1932, while the importation of fuel-oil dropped about 14.3 per cent. These figures indicate that the British Columbia coal-mines are getting a larger share of the available market through attention to marketing practice.

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

	1930.	1931.	1932.	1933.
Vancouver Island mines .....tons, 2,240 lb.	988,805	831,925	749,006	613,203
Nicola-Princeton mines ..... ,,	208,060	211,844	195,312	170,463
Crowsnest mines ..... ,,	689,236	661,426	587,875	477,677
Northern District ..... ,,	1,029	2,395	2,782	3,403
Total quantity of coal mined.....	1,887,130	1,707,590	1,534,975	1,264,746

The production of structural materials in 1933 was valued at $1,024,045, as compared to $1,698,839 for the 1932 output. This decline of $674,794, or 39.72 per cent., indicates the continued decline of the building industry in the year just closed. No major building or construction projects of importance were undertaken in 1933, the bulk of the structural materials production being used in maintenance and renewal work.

The output of miscellaneous metals and minerals showed a sharp increase in 1933 to have a total value of $633,532, or $153,386 more than in 1932. This increase is due principally to an increased production of cadmium and bismuth and fluxing materials, such as limestone and quartz. A small production of phosphate rock from the Crowsnest section of British Columbia was shipped to the fertilizer plant at Warfield, near Trail, B.C.

METAL PRICES.

Metal prices during 1933 were generally improved over prices prevailing in recent years, as the table below indicates. Silver prices increased 19.5 per cent.; copper prices increased 16.8 per cent.; lead prices increased 13.1 per cent.; and zinc prices increased 33.4 per cent. for British Columbia producers. For statistical purposes the standard value of gold ($20.671834 per ounce) is used; but due to the higher world price established by the action of the United States devaluing their dollar, the Canadian gold-producer in 1933 received an average price of $28.60 per ounce for his gold in terms of Canadian funds. This is a "premium," so called, of 38.35 per cent. over the standard gold price.

AVERAGE METAL-MARKET PRICES FOR 1929, 1930, 1931, 1932, AND 1933.

Year.	Silver (New York).	Copper.		Lead.		Zinc.	
		London.	New York.	London.	New York.	London.	St. Louis.
	Cents per Oz.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.
1929.....	* 52.993	.....	* 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
1932.....	* 31.671	* 6.3802	5.555	* 2.1136	3.180	* 2.4056	2.876
1933.....	* 37.8328	* 7.4548	7.025	* 2.3916	3.869	* 3.2105	4.029

* Prices used in compiling total metal valuations in 1929, 1930, 1931, 1932, and 1933 Annual Reports.

Figures used in compiling 1932 and 1933 valuations are corrected for Canadian funds at par by applying the average exchange prevailing.

PROSPECTING AND DEVELOPMENT.

The reports of the Resident Mining Engineers indicate that a greatly increased number of prospectors were in the hills during 1933. Most of the prospecting was directed towards the discovery of lode- and placer-gold deposits, and while naturally the major activity was in the Bridge River, Cariboo, and Nelson areas, much useful work was done in many other parts of the Province, with, in some instances, interesting discoveries being made. As a result of this re-examination and reprospecting of many areas, renewed activity in 1934 seems assured in the northern, south-central, and Vancouver Island sections of the Province, while an expansion of activities in the Bridge River, Cariboo, Nelson-Salmo, and Kamloops areas is already well advanced.

Development-work during 1933 resulted in promising discoveries at several gold properties. The decision to proceed with mill expansion at the *Bralorne* and *Pioneer* mines, new mill-construction at the *Wayside* and *Dentonia*, and several other small properties came as a result of favourable underground developments at the several properties.

The most prominent development during 1933 was, of course, that which changed the *Bralorne* from a mine of doubtful life to one with an assured tonnage of mill-feed ore sufficient for several years' operation and numerous possibilities for finding a decidedly important tonnage of gold-ore reserves with additional development-work.

The *Pioneer* mine also responded well to development and a very rich and persistent ore-body in the eastern section of the mine was opened up between the fifth and tenth levels. A high-grade ore discovery was also made on the fourteenth level of the mine.

At the *Cariboo Gold* developments are considered distinctly satisfactory by the Resident Engineer for the district; important widths of ore being disclosed in the lowest level, and at the downward extension of the *Rainbow* vein system as intersected by the main crosscut tunnel at a depth of 600 feet below the surface. Many surface improvements and plant additions were made at this property.

The reopening of the Rossland properties of the Consolidated Mining and Smelting Company to leasers resulted in a production of over 7,000 oz. of gold from unworked stope and shaft pillars in the old *Le Roi*, *Centre Star*, *Josie*, *War Eagle*, and other mines. Other gold developments, including those at the *Engineer*, *Dunwell*, *Surf Point*, *Vidette*, *Windpass*, *Nicola*, *Union*, *Dentonia*, *Grandoro*, *Home*, *Morning Star*, *Midway*, *Meridian*, *Monarch*, *Second Relief*, *Kootenay Belle*, *Reno*, *Venus-Juno*, *Queen*, *Enid Julie*, *Wayside*, etc., are described in detail in the reports of the Resident Mining Engineers.

Increased attention was paid to silver-lead properties in 1933 by prospectors and leasers in the Slocan and Portland Canal sections because of the higher metal prices and improved conditions. There are several properties in both these camps which could resume operations on short notice with increased market prices for silver and lead.

GOLD-MINING.

In 1933, as in 1932, gold-mining activity was the brightest phase of British Columbia's mining industry. The increase in the world price of gold to approximately $35 per fine ounce (the average price for 1933 was $28.60 per fine ounce), with only a comparatively small increase, if any, in the production costs of the metal, enormously increased the profit chances in this form of mining, with the result that many prospects, properties, and mines have been reopened, and the established producers have been enabled to materially expand their operations by including in their ore reserves much tonnage which formerly could not be profitably mined and milled. Added to this established and expanding mining activity there has been extreme activity in searching for and acquiring gold properties in all parts of the Province by representatives of capital, new companies, and small development syndicates.

It is recognized that the majority of the new developments may not make profitable dividend-producing mines, but there is, nevertheless, little doubt that several new gold-mines will result from the extensive and widespread developments at present under way and planned for the 1934

season. The net result is that employment has been materially increased in 1933, and gold production has increased by 22.6 per cent., with indications that it will considerably expand during 1934.

It should be remembered that the substantial increase in the output of both lode and placer gold during the past two years is only a very slight indication of the activity taking place in this form of mining. The gold-output for 1933, valued at $5,027,530, is an increase of 22.6 per cent. over the 1932 production and 51.9 per cent. over the 1931 production. By agreement with the Dominion Bureau of Statistics, gold production in fine ounces is valued in Canadian dollars for statistical purposes as standard money rather than as a commodity. The value used for statistical purposes is therefore the statutory value of $20.671834 per fine ounce. However, during 1933 the average selling-price of gold in terms of Canadian funds was $28.60 per fine ounce, and as the gold produced was sold through the Dominion Mint at the best world price obtainable, the mine operators received the benefit of this so-called "premium." This premium, representing the difference between $28.60 and $20.67, amounted to 38.35 per cent. of the former selling-price, with the result that British Columbia gold-producers received a premium of $1,928,186 for their output, making their total return in Canadian funds $6,955,716. This is an increase of 107.5 per cent. over the value received in 1931 calculated in the same way; the premium in 1931 was quite small.

The following table shows the gold-output (lode and placer) as valued for standard statistical purposes and the returns in Canadian funds for the years 1931 to 1933, inclusive. The figure for the year 1913, the year of maximum quantity gold production, is included for comparative purposes.

Year.	Standard Statistical Value of Gold Production.	Value of Gold Production in Canadian Funds.
1913	$6,137,490	$6,137,490
1931	3,310,886	3,351,000
1932	4,100,061	4,656,000
1933	5,027,530	6,955,716

The figures show the 1933 production to be the highest in value, in Canadian funds, ever recorded in British Columbia and establish gold as the leading mineral product of the Province. A still better year for 1934 is forecast, as increased production is expected to come from the *Pioneer*, *Bralorne*, *Reno*, *Cariboo Gold*, *Vidette*, *Yankee Girl*, Rossland properties, *Goodenough*, *Second Relief*, *Dentonia*, *Grange*, *Dunwell*, and many other smaller producers. It is estimated that a production of lode and placer gold valued at $6,800,000 is quite likely in 1934. To this an additional return of $4,700,000 as "premium" may be received by the producers, making the gross value of the 1934 gold-output $11,500,000 in terms of Canadian dollars.

Many placer prospectors and miners were in the field during 1933, with the result that placer-gold production increased in value by $59,976, or 17.3 per cent., from 1932 to $406,776 in 1933. The Atlin and Cariboo camps were responsible for most of the increase, and in both these fields the possibilities are for a continued increase in output for some years to come. In a number of other camps scattered throughout the Province large placer operations are expected to get into production in the 1934 season, and this will possibly be reflected in an increased production in 1934.

Placer-testing and small-scale operations in the past have not been conclusive in many placer properties, and as better technical control and study is brought to bear on this type of mining, the industry is regaining some of its former importance. By this statement it is not desired to convey the impression that there is not much interest or activity in placer-mining, for quite the contrary is the case, and many hundreds of placer prospectors spent the 1933 season in the hills, along the streams and rivers, looking for, and in many instances earning, a grubstake.

Many uninformed people believe that it is possible to recover good wages by small-scale placer-mining in almost all the streams of the Province. There is a good field for experienced placer prospectors and for others who provide themselves with some training and an experienced partner, but those contemplating this work, and there is room for quite a large number of willing, trained, hard-working, conscientious men, should realize the fact that returns are liable to be small, and that every creek does not carry gold. Those with little or no experience should team up with an experienced partner, and obtain some instruction in the rudiments of bushcraft and placer-mining before venturing forth into the field. For those interested in placer-mining and

the opportunities which exist therein in various parts of the Province, attention is directed to Bulletin No. 1, 1933, "Placer-mining in British Columbia" (25 cents). This book, issued by the Department of Mines, contains notes on elementary methods of prospecting and working placer deposits in addition to detailed information respecting the placer possibilities of the various Mineral Survey Districts of the Province.

The incorporation of 145 new companies during 1933 for the purpose of developing gold properties indicates the decided interest being taken by the public in the gold-mining phase of British Columbia's mining industry. It should be remembered, as stressed heretofore, that only a small percentage of this number of companies will succeed in developing dividend-paying mines, but nevertheless some new mines are assured, and a considerable amount of employment and circulation of capital for mining necessities has been and is circulating on account of this intense activity.

During 1933 activity was general throughout the Province, with particular attention being devoted to the Bridge River, Cariboo, and Nelson-Salmo areas. In 1934 it is already indicated that increased activity in the Bridge River, Nelson-Salmo, and Penticton-Rock Creek-Greenwood areas will take place. In these, as well as in many other mining camps scattered throughout the Province, prospectors and scouting engineers are re-examining old properties and new discoveries in the light of recent price developments for gold, and many new developments have been planned for 1934.

As at all other times when prosperity reaches any branch of the mining industry, the imagination of the general public is excited to a point beyond reason by tips, rumours, gossip, and so-called inside information, the sources of which are legion. In the present gold boom very few misstatements of fact have been put out by the mining companies, but the public is warned that some of the so-called informative articles appearing in the press, brokerage sheets, and mining papers are often inspired, and for their own protection the public can profitably make use of the information service supplied by the Department of Mines, through its numerous publications on mining in the Province. Reliable facts are presented about practically all of the mining properties and prospects in British Columbia in these reports, which are free for the asking.

Many of the new company promotions have been made simply for the purpose of acquiring properties in the fashionable Bridge River and Cariboo areas, and some of these, being only mountainous real estate, have very little, if any, present or prospective value from the mineral standpoint. Intelligent investigation must still be used before investing or speculating.

Through the operations of the "Securities Act" the public is now given a more legitimate financial set-up in the newly incorporated companies than was the case in companies promoted in former years. Adequate provision is made that a fair percentage of the money raised from the public is spent in developing the ground, but this in no way guarantees the property is a reasonable speculation from the mining standpoint, and the public must do its own investigating by reference to reliable sources of information regarding the mineral possibilities of the company property.

METALLURGICAL FEATURES OF THE YEAR.

During 1933 no important plant-construction was under way at any of the major metallurgical plants in British Columbia, but increased recoveries and reduced costs were obtained by all-round efficiency in the operation of the existing plants.

The *Bralorne* mill capacity was increased from 120 to 200 tons per day. The old *Motherlode* mill, acquired by the Reno Gold Mines, was reconstructed and brought into full production on a 75-ton-per-day basis. The small pilot-mill at the *Vidette* mine was reconstructed during 1933, the new plant being capable of treating 40 tons per day. A 30-ton-per-day mill was constructed at the *Surf Point* mine and production commenced. At the *Second Relief* mine, near Nelson, the milling plant was reconstructed and increased to handle 40 tons per day. Small milling plants of a few-tons-per-day capacity were under construction at various places in British Columbia during the year.

In 1934 it is expected that several mills for gold-mines will be built, including one at the *Wayside* in the Bridge River district and one for the Dentonia Mining Company near Greenwood, both of 100 tons daily capacity. Other smaller mills are planned, including partial re-equipment of the *Dunwell* mill to have a capacity of 25 tons a day.

Progress was made at the large mining company operations of the Province—Consolidated, Granby, Britannia, and Premier Companies—in improving metallurgical practice with increased efficiency and lowered costs.

At Anyox the average net cost of producing copper is shown in the following extract from the 1933 annual report of the Granby Consolidated Mining, Smelting, and Power Company, Limited:—

"The net cost per pound of refined copper produced, after allowing credits for gold and silver values and miscellaneous income, but exclusive of depreciation and depletion, was 6.74 cents."

The ore reserves of this company are shown in the following excerpt from the annual report:—

"Recalculations of the ore reserves of the *Hidden Creek* and *Bonanza* mines were made during the year. The reserves at the end of the year, compared with the previous year, were as follows:—

	Dec. 31, 1932. Tons.	Dec. 31, 1933. Tons.
Anyox—*Hidden Creek* mine	3,870,365	3,426,700
Anyox—*Bonanza* mine	307,327	138,131
Allenby—*Copper Mountain* mine	9,885,069	9,885,069

"The net decrease in the ore reserves in the *Hidden Creek* and *Bonanza* mines during the year amounted to 612,861 tons.

"As forecast in last year's report, at the present rate of extraction and unless new ore is found, the recoverable ore reserves of the Anyox mines will be exhausted in about two years."

The work done by the concentrating plant at Anyox is shown by this excerpt from their annual report:—

Anyox Mill.	Ore milled.		Concentrates.		Tailings.	Per Cent. Copper recovered.
	Tons.	Per Cent. Copper.	Tons.	Per Cent. Copper.	Per Cent. Copper.	
1932	1,740,300	1.27	118,870	17.12	0.114	92.16
1933	1,584,200	1.31	109,008	16.50	0.147	89.58

From the annual report of the Consolidated Mining and Smelting Company the following excerpts of interest, covering operations at Trail and the *Sullivan* mine, have been taken from the report by the general manager, S. G. Blaylock:—

"The cost of producing lead and zinc in 1933 in each case made an all-time low record. Costs for each metal during the last quarter of the year averaged lower than any previous month, and December's costs in each metal were the lowest ever obtained, in spite of the fact that the efficiency bonuses were re-established in the last half of November. Several factors have contributed to make these low costs. Large reductions in the cost of mining, concentration, smelting, and refining over the last four or five years have all played their part. Increased recoveries in concentration and smelting have contributed; while perhaps the greatest single factor during the year under review has been a slight increase in the silver content of the ore and the appreciation of the metal itself.

"The price received for the silver recovered from the *Sullivan* ore is credited on the cost of producing lead and zinc. As silver is still much below the average price, it is not unreasonable to expect further reductions from this source in future. Cadmium and bismuth sales are not credited to the cost of lead and zinc.

"*The Sullivan Mine.*—Mining costs in 1933 have set a new low record, beating the previous record, which was made in 1932, by about 7 per cent. As mentioned in the report of the vice-president in charge of mines, the diamond-drill holes from the winze below the 3,900 tunnel-level and through the ore-body have proved the continuance of rich ore in large quantities.

"*The Kimberley Concentrator.*—With the moderate increase in the price of metals, recoveries again became the important item in the control of the concentration. The low costs reached when costs were the predominating factor have not only been maintained, but lowered, making

a new low record of 14 per cent. below the former record, which was made in 1932. The 1933 recoveries also establish a new record. The grade of the lead concentrates remained substantially the same, while the grade of the zinc concentrates was increased.

"*The Lead-smelting Plant.*—New low records were again established both per ton of ore smelted and per ton of lead produced. The lead recoveries were down by three-quarters of 1 per cent., due mainly to smelting Rossland ore in the lead-furnaces, as insufficient Rossland ore was produced to run a copper-furnace.

"*The Slag-fuming Plant.*—Costs in the slag-fuming plant were higher at the first of the year, but much lower in the latter part, making a slight reduction for the whole year. The last three months were over 10 per cent. lower than 1932.

"*The Lead, Silver, and Gold Refineries.*—Record costs were made in this plant in 1933. Towards the end of the year a change in the system was made which will result in making the Tadanac pig-lead even higher grade than formerly. There are indications that there will also be a further reduction in costs when the full effect of these changes is obtained.

"*The Zinc Plant.*—In the early part of the year production in this plant was cut to 45 per cent. capacity, and costs were adversely affected. During the last quarter production was slightly increased and costs were reduced, making the year's average cost the same as for 1932.

"*The Cadmium Plant.*—This plant was run intermittently to suit the market.

"*The Fertilizer Group.*—These plants operated at a profit during 1933, including all sales expense, allowance for bad debts, etc., but exclusive of fixed charges. The account shows a loss on the books, due to the writing-off of all development charges in connection with the fertilizer attachments and all costs for servicing these machines and rebuilding all the first models sold.

"It would appear that we would not have to make any more drill attachments. Our demonstrating the possibilities in this connection has convinced all the implement-makers of the advisibility of making equipment for their own machines.

"*Sulphuric-acid Plants.*—These plants have worked very satisfactorily throughout the year, both as to cost of operation and capacity.

"*The Hydrogen Plant.*—The troubles experienced with the electrical equipment have been overcome. These rectifiers are now giving satisfactory service.

"Continued service indicates a very heavy upkeep cost on hydrogen-cells; consequently a reserve is being created by charging a fixed amount per month for future repairs.

"The nickel-plating on the electrodes of the cells made in England, and also some made in Canada, was not satisfactory. This nickel-plating is one of the most important steps in the cell-construction and the most difficult to check. It was decided that we should prepare to do this work in our own shops. A nickel-plating expert was retained, a nickel-plating plant built in one end of the copper-refinery, and a crew of our men was trained to do this work. The entire Knowles' plant was replated. We are now in a position to make our own cells for renewals or extensions.

"*The Ammonia Plant.*—This plant operated satisfactorily throughout the year.

"*The Phosphoric-acid and Phosphate Plants.*—These plants were completed by our own staff and give every indication that they will be able to make the estimated production within the estimated cost.

"*The Ammonium-sulphate Plant.*—This plant has operated successfully throughout the year. The grade of the product, the capacity of the plant, and the cost of operation have all been good.

"*The Research Department.*—The research department had a busy year. The closing of the cycle of impurities by passing the zinc-plant rejects through the fuming plant resulted in building up these impurities in the plants to proportions not experienced before. New elements also were introduced from the lead-smelter and lead-refinery, fluorine in particular giving a great deal of trouble. These problems have been successfully handled.

"The lead-refinery electrolyte, which had been running for thirty years without purification, suddenly showed serious accumulations of impurities which needed special treatments to be worked out. This problem is only partly worked out to date.

"The most notable work is the advance towards the economic recovery of sulphur dioxide from gases carrying low concentrations of that gas. Patents have been granted in Canada and

notice of allowance of the main claims has been received from the United States Patent Office. A 3-ton-a-day unit is under construction and should be operating before the end of March, 1934. This plant will yield 3 tons of sulphur and 6 tons of ammonium sulphate per day from gases containing about six-tenths of 1 per cent. of sulphur dioxide."

Operating costs at the *Premier* mine are shown in that company's annual report as $3.21 per ton, as compared with $3.19 per ton in 1932. Due to a considerably smaller tonnage of ore handled, this figure represents an excellent increase in operating efficiency.

At the *Bralorne* mine conditions were decidedly improved, as the following excerpts from that company's annual report for 1933 show:—

"*General.*—During the year the mill tonnage was increased from 100 to 150 tons daily average. Toward the latter part of the year a new crushing plant was installed, and since October the mill has been treating an average of 200 tons daily.

"The increase in tonnage was made possible by the discovery of exceptionally good ore-bodies west of No. 1 fault. A new vein was also discovered on the eighth level, with a strike nearly at right angles to the main or King vein. This is known as the 'C' vein.

"Both of these veins have yielded remarkably well to development-work, and widths of good-grade ore of 50 feet or more have been found on the King vein, and up to around 15 feet on the 'C' vein.

"*Exploration.*—Most of the development-work was carried out west of No. 1 fault, principally on the seventh, eighth, and tenth levels. About one-fifth of the tonnage milled came from development-work, not including ore derived from work done preparatory to stoping operations, such as chute raises and slabbing of the wide ore where the vein was much wider than the drift.

"Sinking was again resumed toward the latter part of the year from the tenth level, and the objective of 200 feet of greater depth should be reached early in 1934. During the time necessary to sink the shaft no other operations can be conveniently conducted below the eighth level on account of the limited hoisting facilities.

"*Ore Reserves and Grade.*—A conservative estimate of our reserves at the close of the year indicate 230,000 tons, averaging around 0.60 oz. gold. This is an increase during the year of 200,000, plus 54,283 milled, making a total increase of 254,283 tons.

"*Mill.*—The average assay of our mill-head samples was 0.4767 oz. gold per ton, or 0.0302 oz. lower than the calculated figure. One thousand six hundred and thirty-six tons of concentrates were produced during the year of an average assay of 4.2924 oz. gold per ton. Net returns for silver amounted to $0.0517 per ton of ore milled.

"The tonnage of ore milled was steadily increased during the year from an average of 125 tons per day to 200 tons. In order to increase to such an extent it was necessary to install a new crushing plant. The new crushing plant, however, will permit a further increase of at least 50 or 60 tons per day without more grinding or classifying equipment. With the addition of another ball-mill, classifier, and more flotation-cells, it will easily permit of a further increase of 150 or 200 tons, or, in other words, a mill capacity of at least 400 tons per day.

"*Power Plant and Equipment.*—A new 500-k.v.a. generator was added to the power plant, bringing the total plant capacity up to 1,100 horse-power. A 500-cubic-foot compressor was also added to the compressor plant, making a total capacity of 2,190 cubic feet, sea-level rating.

"A 3½-ton battery locomotive was also put in service on the main tunnel-haulage system. Also a new air-hoist was installed in the incline shaft. In addition to the above-mentioned equipment, a number of other pieces of machinery were purchased, including drill-sharpener and rock-drilling material.

"The entire plant and equipment are in excellent condition, and no heavy expenditure will be necessary to handle the present mill capacity of 250 tons.

"*Conclusion.*—Although our hopes were high in anticipation of the results of the development programme for the year, the results actually obtained from the work far exceeded our expectations, as it was not generally conceded that veins of relatively great width existed in the district. With the extremely good results obtained from a relatively small development footage, and over a comparatively short period, the future development programme is almost assured of yielding as much ore per foot of work done as realized in the past. It is very interesting to note that practically none of the development-work done during the year was completed with negative results."

PROFITS OF MINING COMPANIES.

The following table shows the dividends declared by companies engaged in the mineral industry in the Province during 1932 and 1933:—

Company.	1932.	1933.
The Consolidated Mining and Smelting Co. of Canada, Ltd.	$1,478,275*	$975,807
Premier Gold Mining Co., Ltd.	691,535	650,985
Howe Sound Co.†	253,405	562,749
Granby Consolidated M.S. and P. Co., Ltd.	52,949	.....
Bell	.....	13,800
Crow's Nest Pass Coal Co., Ltd.	248,272	12,091
Pioneer Gold Mines of B.C., Ltd.	210,210	735,735
Highland Lass, Ltd.	9,242	21,564
Others	96,475	61,753
Totals	$3,040,363	$3,034,484

* Ten per cent. stock dividend, no cash.

† 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.

OUTLOOK FOR 1934.

With the close of 1933, it is quite definite that the mineral industry of the Province has entered upon a period of renewed activity and that the decline of the depression years has given way to a distinct upward trend. The chief cause of this uptrend is the greater production of gold and the extensive exploration and development-work being done in connection with the search for gold-mines. Other forms of mining, however, are beginning to show renewed activity, and the stepping-up of production from the *Sullivan* and the reopening of the *Monarch* mine will materially increase the outputs of lead and zinc in 1934. Leasers and some companies are devoting attention to silver properties. The copper industry, which has developed extremely low costs and remarkably efficient mining and metallurgical practice during the lean years, is in an excellent position to take advantage of any slight increase in the market prices received for copper.

Therefore, in view of the above, the mineral production in 1934 should considerably exceed that recorded for 1933. Employment in the mines, smelters, and concentrators, which increased 8 per cent. in 1933 as compared with 1932, should continue to increase during 1934. A great deal of indirect employment will also be provided in the industries intimately associated with the mining activity, and in the aggregate much new wealth will be produced and a large part of it will be retained and circulated throughout the Province for the purchase of labour, supplies, transportation, and miscellaneous services. In the aggregate the mining plants and personnel of the industry are efficient and advantage is being quickly taken of the distinct upward trend now apparent in metal prices.

The statistical tables which immediately follow this section of the Annual Report are designed to give the total mineral production of the Province to date, and they show by Districts and Divisions the output and value of the various metals and minerals for the year 1933 in comparison with output figures for previous years.

The reports of the Resident Mining Engineers, which follow the statistical section, give much information about the progress of prospecting, development, and mining throughout the Province during 1933. The reports of the Chief Inspector and Inspectors of Mines cover fully the inspection of mines in British Columbia.

All of which is respectfully submitted.

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

A. M. RICHMOND,
Resident Mining Engineer.

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 the 1925 Annual Report have been followed in subsequent Annual Reports.

For 1933 a new table, entitled "Table I.—British Columbia Mineral Production for 1932 and 1933," has been prepared. This table shows in summary form the mineral statistics of the Province in a form that permits ready comparisons being made with tables of similar design presented annually by the Dominion Bureau of Statistics and other Provincial Statistical Bureaus.

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 is 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; and for zinc, the average London metal-market price for the year. As in 1932, copper in 1933 is valued at the average London metal-market price. Prior to 1932 copper was valued at the average New York price. The change was made because very little copper was being marketed in the United States on account of high tariff charges against importations from foreign countries. 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, St. Louis, and Montreal lead- and zinc-market prices differ materially from the London prices of these metals and are not properly applicable to the valuing of the British Columbia production. By agreement with the Dominion Bureau of Statistics and the Provincial Statistical Bureaus, the following procedure of taking care of the exchange fluctuations has been agreed upon for the 1933 production:—

(*a*.) Gold to be valued as usual in Canadian funds, without the addition of any premium, as gold is considered standard money rather than a commodity. However, the premium, or exchange equalization, which is the difference between the value of gold computed at the standard rate ($20.671834) per fine ounce and the value computed at the 1933 average price of gold in Canadian funds ($28.60) per fine ounce, has been calculated and is shown at the foot of Table I.

(*b*.) Silver to be valued at the average New York price, adjusted to Canadian funds at the average exchange rate.

(*c*.) Lead, zinc, and copper to be valued at London prices, adjusted to Canadian funds at the average exchange rate.

(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.

From 1918 to 1930 coal production was valued at $5 per long ton. In 1931 the price used was $4.50 per long ton. In both 1932 and 1933 slightly lower prices prevailed and $4.25 per long ton has been used. In making comparisons with former years the decline in dollar value is accentuated by this lowered price.

STATISTICAL TABLES.

TABLE I.—British Columbia Mineral Production, 1932 and 1933.

	1932.		1933.		Per Cent. Increase (+) or Decrease (−).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
METALLICS.		$		$		
Bismuth	.....	48	.....	77,796	.....	.....
Cadmium	.....	26,824	.....	78,733	.....	+193.5
Copper ..... lb.	49,841,009	3,179,956	42,608,002	3,176,341	− 14.5	− 0.1
Gold, lode, at $20.671834 ..... oz.	181,564	3,753,261	223,529	4,620,754	+ 23.1	+ 23.1
Gold, placer, at $17 ..... oz.	20,400	346,800	23,928	406,776	+ 17.3	+ 17.3
Lead ..... lb.	254,488,952	5,378,878	271,606,071	6,495,731	+ 6.7	+ 20.7
Platinum ..... oz.	59	2,372	40	1,400	− 32.2	− 40.9
Silver ..... oz.	7,130,838	2,258,453	7,006,406	2,650,720	− 1.7	+ 17.3
Zinc ..... lb.	192,120,091	4,621,641	195,963,751	6,291,416	+ 2.0	+ 36.1
Totals	.....	19,568,233	.....	23,799,667	.....	+ 21.6
NON-METALLICS.						
Fuel.						
Coal (2,240 lb.) ..... tons	1,534,975	6,523,644	1,264,746	5,375,171	− 17.6	− 17.6
Other Non-metallics.						
Diatomite	.....	440	.....	410	.....	− 6.8
Fluxes—limestone, quartz .. tons	30,789	45,749	63,954	130,818	+107.7	+186.0
Gypsum products, gypsite .. tons	10,921	85,628	.....	46,004	.....	− 46.3
Iron oxide	.....	2,000	.....	1,485	.....	− 25.8
Mica	.....	1,080	.....	853	.....	− 21.0
Phosphate	.....	.....	.....	4,670	.....	.....
Slate (crushed), talc ..... tons	289	4,452	317	4,572	+ 9.7	+ 2.7
Sodium carbonate ..... tons	755	8,513	378	3,350	− 50.0	− 60.7
Sulphur* ..... tons	31,888	302,864	30,010	282,078	− 5.9	− 6.9
Totals	.....	450,726	.....	474,240	.....	+ 5.2
CLAY PRODUCTS AND OTHER STRUCTURAL MATERIALS.						
Clay Products						
Brick—						
Common ..... No.	2,413,929	39,661	2,449,386	32,866	+ 1.5	− 17.1
Face, paving, sewer brick .. No.	395,058	12,089	290,547	8,626	− 26.5	− 28.6
Firebrick, blocks	.....	63,418	.....	69,094	.....	+ 8.9
Fireclay ..... tons	480	6,479	1,024	7,993	+113.3	+ 23.4
Structural tile—hollow blocks ..	.....	11,737	.....	6,824	.....	− 41.9
Drain-tile, sewer-pipe ..... No.	646,989	79,740	603,115	41,335	− 6.8	− 48.2
Pottery—glazed or unglazed	.....	7,726	.....	5,680	.....	− 26.5
Bentonite; other clay products	.....	2,035	.....	2,390	.....	+ 17.4
Totals	.....	222,885	.....	174,808	.....	− 21.6
Other Structural Materials.						
Cement	.....	536,528	.....	225,342	.....	− 58.0
Lime and limestone ..... tons	35,590	189,074	49,787	189,116	+ 39.9	+ 0.02
Sand and gravel	.....	459,586	.....	261,313	.....	− 43.2
Stone—building, grindstones ..... tons	5,610	48,079	2,337	38,414	− 58.4	− 20.1
Rubble, riprap, crushed rock ..... tons	321,043	242,863	150,086	136,415	− 53.3	− 43.8
Totals	.....	1,476,130	.....	850,600	.....	− 42.4
Grand totals	.....	28,241,618	.....	30,674,486	.....	+ 8.61
Exchange equalization on gold ...	.....	556,788	.....	1,928,186	.....	+246.2
Total value in Canadian funds	.....	28,798,406	.....	32,602,672	.....	+ 13.2

* Sulphur content of pyrites shipped and estimated sulphur contained in sulphuric acid made from waste smelter-gases.

TABLE II.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1933.

Gold, placer	$79,634,517
Gold, lode	152,260,920
Silver	109,591,734
Copper	277,517,188
Lead	182,234,664
Zinc	103,922.767
Coal and coke	349,876,658
Structural materials	68,815,017
Miscellaneous minerals, etc.	7,793,667
Total	$1,331,647,132

TABLE III.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1933 (INCLUSIVE).

1852 to 1895 (inclusive)	$94,547,241	1916	$42,290,462
1896	7,507,956	1917	37,010,392
1897	10,455,268	1918	41,782,474
1898	10,906,861	1919	33,296,313
1899	12,393,131	1920	35,543,084
1900	16,344,751	1921	28,066,641
1901	20,086,780	1922	35,158,843
1902	17,486,550	1923	41,304,320
1903	17,495,954	1924	48,704,604
1904	18,977,359	1925	61,492,242
1905	22,461,325	1926	67,188,842
1906	24,980,546	1927	60,729,358
1907	25,882,560	1928	65,372,583
1908	23,851,277	1929	68,245,443
1909	24,443,025	1930	55,391,993
1910	26,377,066	1931	34,883,181
1911	23,499,072	1932	28,241,618
1912	32,440,800	1933	30,674,486
1913	30,296,398		
1914	26,388,825	Total	$1,331,647,132
1915	29,447,508		

TABLE IV.—QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1931, 1932, AND 1933.

Description.	1931.		1932.		1933.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer ..... oz.	17,176	$291,992	20,400	$346,800	23,928	$406,776
Gold, lode ..... oz.	146,039	3,018,894	181,564	3,753,261	223,529	4,620,754
Silver ..... oz.	7,524,320	2,247,514	7,130,838	2,258,453	7,006,406	2,650,720
Copper ..... lb.	63,194,299	5,289,363	49,841,009	3,179,956	42,608,002	3,176,341
Lead ..... lb.	248,783,508	6,742,282	254,488,952	5,378,878	271,606,071	6,495,731
Zinc ..... lb.	205,071,247	5,237,520	192,120,091	4,621,641	195,963,751	6,291,416
Coal ..... tons, 2,240 lb.	1,707,590	7,684,155	1,534,975	6,523,644	1,264,746	5,375,171
Structural materials		3,553,300		1,698,839		1,024,045
Miscellaneous metals and minerals		818,161		480,146		633,532
Totals		$34,883,181		$28,241,618		$30,674,486

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

Names.	Divisions.			Districts.		
	1931.	1932.	1933.	1931.	1932.	1933.
	$	$	$	$	$	$
North-western District (No. 1)	.....	.....	.....	5,594,130	4,895,770	4,576,758
Atlin, Stikine, and Liard	177,220	152,944	202,003	.....	.....	.....
Nass River	3,101,811	2,600,927	3,844,067	.....	.....	.....
Portland Canal	2,233,739	2,098,713	1,459,119	.....	.....	.....
Skeena, Queen Charlotte, and Bella Coola	81,360	43,186	71,569	.....	.....	.....
North-eastern District (No. 2)	.....	.....	.....	165,662	185,595	356,409
Cariboo and Quesnel	141,010	147,910	307,670	.....	.....	.....
Omineca and Peace River	24,652	37,685	48,739	.....	.....	.....
Central District (No. 3)	.....	.....	.....	1,072,034	289,084	232,226
Nicola and Vernon	166,605	120,692	131,516	.....	.....	.....
Yale, Ashcroft, and Kamloops	292,604	156,234	96,235	.....	.....	.....
Lillooet and Clinton*	612,825	12,158	4,475	.....	.....	.....
Southern District (No. 4)	.....	.....	.....	1,593,272	1,517,603	1,039,128
Grand Forks, Greenwood, and Osoyoos	747,648	759,803	406,299	.....	.....	.....
Similkameen	845,624	757,800	632,829	.....	.....	.....
Eastern District (No. 5)	.....	.....	.....	17,054,049	14,487,063	17,608,731
Fort Steele	16,644,950	13,834,116	15,951,647	.....	.....	.....
Windermere and Golden	8,900	18,323	424,635	.....	.....	.....
Ainsworth	33,647	21,761	21,214	.....	.....	.....
Slocan and Slocan City	35,286	9,883	30,051	.....	.....	.....
Nelson and Arrow Lake	283,115	267,132	573,854	.....	.....	.....
Trail Creek	8,490	303,348	594,730	.....	.....	.....
Revelstoke, Trout Lake, and Lardeau	39,661	32,500	12,600	.....	.....	.....
Western District (No. 6)	.....	.....	.....	9,404,034	6,866,503	6,861,234
Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria (Vancouver Island)	5,475,619	4,015,717	3,042,605	.....	.....	.....
Vancouver, New Westminster, and Lillooet (Mainland)	3,928,415	2,850,786	3,818,629	.....	.....	.....
Totals	34,883,181	28,241,618	30,674,486	34,883,181	28,241,618	30,674,486

* Lillooet Mining Division included in No. 6 District (Mainland section) from and including 1932.

TABLE VI.—Yield of Placer Gold to Date.

1858	$705,000	1878	$1,275,204	1898	$643,346	1918	$320,000
1859	1,615,070	1879	1,290,058	1899	1,344,900	1919	286,500
1860	2,228,543	1880	1,013,827	1900	1,278,724	1920	221,600
1861	2,666,118	1881	1,046,737	1901	970,100	1921	233,200
1862	2,656,903	1882	954,085	1902	1,073,140	1922	364,800
1863	3,913,563	1883	794,252	1903	1,060,420	1923	420,000
1864	3,735,850	1884	736,165	1904	1,115,300	1924	420,750
1865	3,491,205	1885	713,738	1905	969,300	1925	280,092
1866	2,662,106	1886	903,651	1906	948,400	1926	355,503
1867	2,480,868	1887	693,709	1907	828,000	1927	156,247
1868	3,372,972	1888	616,731	1908	647,000	1928	143,208
1869	1,774,978	1889	588,923	1909	477,000	1929	118,711
1870	1,336,956	1890	490,435	1910	540,000	1930	152,235
1871	1,799,440	1891	429,811	1911	426,000	1931	291,992
1872	1,610,972	1892	399,526	1912	555,500	1932	346,800
1873	1,305,749	1893	356,131	1913	510,000	1933	406,776
1874	1,344,618	1894	405,516	1914	565,000		
1875	2,474,004	1895	481,683	1915	770,000	Total	$79,634,517
1876	1,786,648	1896	544,026	1916	580,500		
1877	1,608,182	1897	513,520	1917	496,000		

TABLE VII.—PRODUCTION OF LODE GOLD, SILVER, COPPER, LEAD, AND ZINC.

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	47,612	16,475,461	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	44,396,346	1,709,259	8,500,000	400,000	14,191,141
1910	267,701	5,533,380	2,450,241	1,245,016	38,243,934	4,871,512	34,658,746	1,386,350	4,184,192	192,473	13,228,731
1911	228,617	4,725,513	1,892,364	958,293	36,927,656	4,571,644	26,872,397	1,069,521	2,634,544	129,092	11,454,063
1912	257,496	5,322,442	3,132,108	1,810,045	51,456,537	8,408,513	44,871,454	1,805,627	5,358,280	316,139	17,662,766
1913	272,254	5,627,490	3,465,856	1,968,606	46,460,305	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
1932	181,564	3,753,261	7,130,838	2,258,453	49,841,009	3,179,956	254,488,952	5,378,878	192,120,091	4,621,641	19,192,189
1933	223,529	4,620,754	7,006,406	2,650,720	42,608,002	3,176,341	271,606,071	6,495,731	195,963,751	6,291,416	23,234,962
Totals	7,376,860	152,260,920	193,137,421	109,591,734	1,815,611,680	277,517,188	3,898,290,622	182,234,664	2,102,723,243	103,922,767	825,527,273

TABLE VIII.—PRODUCTION IN DETAIL OF PLACER GOLD, LODE

DISTRICTS AND DIVISIONS.	YEAR.	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
				$		$		$
North-western District (No. 1)								
Atlin	1932	30	8,040	136,680	218	4,507	86	27
	1933	**30**	**11,299**	**192,083**	**103**	**2,129**	**64**	**24**
Stikine	1932		37	629				
	1933		**251**	**4,267**				
Liard	1932		357	6,069				
	1933		**200**	**3,400**				
Nass River	1932	1,740,300			3,323	68,693	255,940	81,061
	1933	**1,540,187**			**4,382**	**90,584**	**257,854**	**97,553**
Portland Canal	1932	221,828			76,049	1,572,072	1,580,305	500,508
	1933	**187,164**			**50,089**	**1,035,432**	**1,029,806**	**389,529**
Skeena	1932	6	36	612	3	62	2	1
	1933	**1,629**	**76**	**1,292**	**1,298**	**26,832**	**357**	**135**
Queen Charlotte	1932		18	306				
	1933	**400**	**65**	**1,105**	**53**	**1,096**	**25**	**10**
Bella Coola	1932		3	51				
	1933		**2**	**34**				
North-eastern District (No. 2)								
Cariboo	1932		4,155	70,635				
	1933	**19,769**	**4,897**	**83,249**	**7,660**	**158,346**	**823**	**311**
Quesnel	1932		3,338	56,746				
	1933		**2,772**	**47,124**				
Omineca	1932	8	627	10,659	7	145	3	1
	1933	**26**	**699**	**11,883**	**82**	**1,695**	**15**	**6**
Peace River	1932		588	9,996				
	1933		**300**	**5,100**				
Central District (No. 3)								
Nicola	1932							
	1933	**9**			**34**	**703**	**1,053**	**398**
Vernon	1932		55	935				
	1933	**390**	**63**	**1,071**	**119**	**2,459**	**18**	**7**
Yale	1932	148	224	3,808	344	7,111	79	25
	1933		**105**	**1,785**				
Ashcroft	1932		128	2,176				
	1933	**657**	**320**	**5,440**	**330**	**6,822**	**638**	**241**
Kamloops	1932		83	1,411				
	1933	**43**	**249**	**4,233**	**194**	**4,010**		
Clinton	1932	25	199	3,383	28	579		
	1933		**225**	**3,825**				
Southern District (No. 4)								
Grand Forks	1932	26,456			19,218	397,271	131,713	41,716
	1933	**3,720**			**3,144**	**64,992**	**3,005**	**1,137**
Greenwood	1932	3,412	180	3,060	414	8,558	595,470	188,595
	1933	**3,627**	**250**	**4,250**	**427**	**8,827**	**558,472**	**211,286**
Osoyoos	1932	386	2	34	1,367	28,258	203	64
	1933	**2,605**			**1,799**	**37,189**	**2,695**	**1,020**
Similkameen	1932	529	270	4,590	1	21	14,461	4,580
	1933		**300**	**5,100**				
Eastern District (No. 5)								
Fort Steele	1932	1,440,520	543	9,231			4,418,852	1,399,523
	1933	**1,401,101**	**652**	**11,084**	**12**	**248**	**4,021,950**	**1,862,112**
Windermere	1932							
	1933		**35**	**595**				
Golden	1932		6	102				
	1933	**35,612**	**11**	**187**			**53,846**	**20,371**
Ainsworth	1932	43	28	476	2	41	8,168	2,587
	1933		**32**	**544**				
Slocan	1932	248			6	124	18,845	5,968
	1933	**783**			**12**	**248**	**47,240**	**17,872**
Slocan City	1932	30			17	351	1,370	434
	1933	**23**			**19**	**393**	**638**	**241**
Nelson	1932	13,740	153	2,601	9,631	199,091	33,535	10,621
	1933	**44,051**	**152**	**2,584**	**23,289**	**481,427**	**48,334**	**18,286**
Arrow Lake	1932		4	68				
	1933		**7**	**119**				
Trail Creek	1932	505	7	119	1,489	30,780	641	203
	1933	**11,960**	**71**	**1,207**	**9,313**	**192,517**	**12,273**	**4,643**
Revelstoke	1932		908	15,436				
	1933		**281**	**4,777**				
Lardeau	1932	13	76	1,292	13	269		
	1933	**1**	**50**	**850**	**2**	**41**	**2**	**1**
Western District (No. 6)								
Nanaimo	1932	2			8	165	7	2
	1933	**2**	**4**	**68**	**2**	**41**	**7**	**3**
Alberni	1932		1	17				
	1933		**25**	**425**				
Clayoquot	1932	8	18	306	13	269	28	9
	1933	**29**	**15**	**255**	**49**	**1,013**	**31**	**12**
Quatsino	1932							
	1933							
Victoria	1932		2	34				
	1933		**6**	**102**				
Lillooet	1932	82,657	293	4,981	60,540	1,251,473	11,778	3,730
	1933	**154,242**	**407**	**6,919**	**108,298**	**2,238,718**	**24,668**	**9,333**
New Westminster	1932		21	357				
	1933		**107**	**1,818**				
Vancouver	1932	809,264			8,873	183,421	59,352	18,798
	1933	**622,718**			**12,819**	**264,992**	**42,792**	**16,189**
Totals	1932	4,340,158	20,400	346,800	181,564	3,753,261	7,130,838	2,258,453
	1933	**4,030,778**	**23,928**	**406,776**	**223,529**	**4,620,754**	**7,006,406**	**2,650,720**

GOLD, SILVER, COPPER, LEAD, AND ZINC IN 1932 AND 1933.

COPPER.		LEAD.		ZINC.		TOTALS FOR DIVISIONS.		TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1932.	1933.	1933.
	$		$		$	$	$	$
								4,430,975
						141,214		
							194,236	
						629		
							4,267	
						6,069		
							8,400	
38,293,437	2,443,198					2,592,952		
34,416,459	2,565,678						2,753,815	
35,933	2,293	1,127,932	23,840			2,098,713		
28,749	2,218	731,435	17,493	2,400	77		1,444,749	
						675		
53	4						28,263	
						306		
							2,211	
						51		
							34	
								307,714
						70,635		
							241,906	
						56,746		
							47,124	
						10,805		
							13,584	
						9,996		
							5,100	
								31,284
		7,762	186	1,206	38		1,326	
						935		
							3,537	
						10,944		
							1,765	
						2,176		
158	12						12,515	
						1,411		
848	63						8,306	
						3,962		
							3,825	
								360,196
13,402	855	198,955	4,205	402,479	9,682	453,729		
		7,215	172	16,498	529		68,830	
1,349	86	303,950	6,424	482,626	11,129	217,852		
		381,175	9,116	516,262	16,575		250,054	
		131,581	2,781			31,137		
		112	3				38,212	
				22,458	540	9,731		
							5,100	
								15,109,680
		251,308,444	5,311,655	190,427,427	4,580,922	11,301,331		
		260,369,484	6,226,996	180,116,639	5,782,645		13,383,085	
							595	
						102		
		8,108,250	193,917	6,270,700	201,321		415,796	
		20,949	443	8,661	209	3,756		
							544	
		116,146	2,455	22,892	551	9,098		
		329,095	7,871	106,716	3,426		29,417	
						785		
							634	
		616,145	13,023	773,548	18,608	243,944		
		698,904	16,715	987,070	31,689		550,701	
						68		
							118	
						31,102		
331,514	24,713	486	12	825	27		223,119	
						15,436		
							4,777	
						1,561		
		46	1				893	
								3,401,879
						167		
							112	
						17		
							425	
						584		
							1,280	
						34		
							102	
						1,260,184		
							2,254,970	
						357		
							1,819	
11,496,888	733,524	664,850	14,052			949,795		
7,829,221	583,653	972,107	23,249	7,945,435	255,088		1,143,171	
49,841,009	3,179,956	254,488,952	5,378,878	192,120,091	4,621,641	19,538,989		
42,608,002	3,176,341	271,606,071	6,495,731	195,983,751	6,291,416		23,641,738	23,641,738

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

	Tons (2,240 lb.)	Value.		Tons (2,240 lb.)	Value.
1836–1885	3,029,011	$9,468,557	1911	2,193,062	$7,675,717
1886	326,636	979,908	1912	2,628,804	9,200,814
1887	413,360	1,240,080	1913	2,137,483	7,481,190
1888	489,301	1,467,903	1914	1,810,967	6,338,385
1889	579,830	1,739,490	1915	1,611,129	5,638,952
1890	678,140	2,034,420	1916	2,084,093	7,294,325
1891	1,029,097	3,087,291	1917	2,149,975	7,524,913
1892	826,335	2,479,005	1918	2,302,245	11,511,225
1893	978,294	2,934,882	1919	2,267,541	11,337,705
1894	1,012,953	3,038,859	1920	2,595,125	12,975,625
1895	939,654	2,818,962	1921	2,483,995	12,419,975
1896	896,222	2,688,666	1922	2,511,843	12,559,215
1897	882,854	2,648,562	1923	2,453,223	12,266,115
1898	1,135,865	3,407,595	1924	1,939,526	9,697,630
1899	1,306,324	3,918,972	1925	2,328,522	11,642,610
1900	1,439,595	4,318,785	1926	2,330,036	11,650,180
1901	1,460,331	4,380,993	1927	2,453,827	12,269,135
1902	1,397,394	4,192,182	1928	2,526,702	12,633,510
1903	1,168,194	3,504,582	1929	2,251,252	11,256,260
1904	1,253,628	3,760,884	1930	1,887,130	9,435,650
1905	1,384,312	4,152,936	1931	1,707,590	7,684,155
1906	1,517,303	4,551,909	1932	1,534,975	6,523,644
1907	1,800,067	6,300,235	1933	1,264,746	5,375,171
1908	1,677,849	5,872,472			
1909	2,006,476	7,022,666	Totals	81,882,862	$324,203,058
1910	2,800,046	9,800,161			

* 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 X.—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	Totals	4,393,255	$25,673,600
1912	264,333	1,585,998			

TABLE XI.—Coke and By-products Production of British Columbia, 1932 and 1933.

Description.	1932.		1933.	
	Quantity.	Value.	Quantity.	Value.
Coal used in making coke, long tons	135,513	$710,432	95,907	$554,152
Coke made in bee-hive ovens, long tons	29,549	$247,615	5,445	$44,813
Coke made in by-product ovens, long tons	22,714	217,221	21,667	213,750
Coke made in gas plants, long tons	39,815	236,574	30,802	214,454
Total coke made, long tons	92,078	$701,410	57,914	$473,017
Gas produced	.....	1,589,663	.....	1,473,433
Tar produced	.....	22,140	.....	11,270
Other by-products	.....	37,282	.....	38,006
Total production value of coke industry	.....	$2,350,495	.....	$1,995,726

TABLE XII.—PRODUCTION IN DETAIL OF STRUCTURAL MATERIALS, 1933.

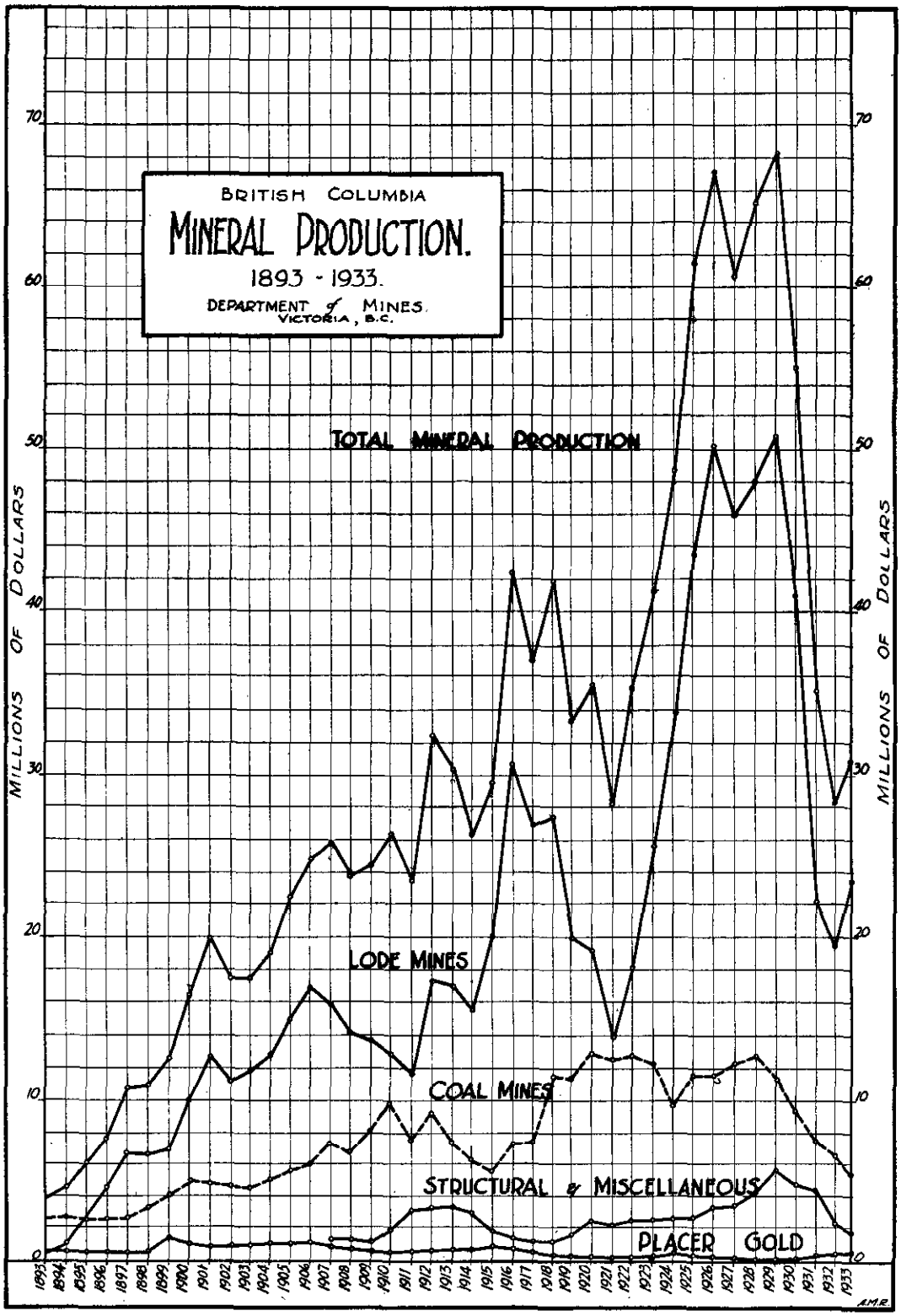
District and Division.	Cement.	Lime and Limestone.	Building-stone.	Riprap and Crushed Rock.	Sand and Gravel.	Pottery and Tile.	Clay.	Fire-brick.	Face, Paving, and Sewer Brick.	Red Brick.	Totals, Divisions.	Totals, Districts.
	$	$	$	$	$	$	$	$	$	$	$	$
North-western District (No. 1)												55,531
Atlin, Liard, and Stikine					100						100	
Nass River												
Portland Canal												
Skeena and Queen Charlotte				3,138	11,232						14,370	
Bella Coola		38,422		300	2,339						41,061	
North-eastern District (No. 2)												33,822
Cariboo and Quesnel				300	15,963		1,719			248	18,230	
Omineca and Peace River				4,370	11,222						15,592	
Central District (No. 3)												40,565
Nicola and Vernon			2,900		8,875	636			38	3,336	15,785	
Yale, Ashcroft, and Kamloops				863	23,917						24,780	
Clinton												
Southern District (No. 4)												28,697
Grand Forks and Greenwood					6,226					2,386	8,612	
Osoyoos					9,010						9,010	
Similkameen				8,100	2,975						11,075	
Eastern District (No. 5)												97,735
Fort Steele				22,857	10,908						33,765	
Windermere and Golden				2,244	6,000						8,244	
Ainsworth			2,547	4,689	13,434						20,670	
Slocan and Slocan City												
Nelson		1,800	4,589	1,060	15,585						23,034	
Trail Creek					5,092						5,092	
Revelstoke				3,387	3,543						6,930	
Western District (No. 6)												767,695
Nanaimo and Alberni		138,936	5,000*	2,100	18,893					3,604	168,533	
Victoria and Quatsino	197,230	9,958		4,316	25,078	8,829				8,927	254,338	
Lillooet				625	10,878						11,503	
Vancouver	28,112		23,378	48,712	27,302						127,504	
New Westminster				29,354	32,741	44,374	7,301	69,094	8,588	14,365	205,817	
Totals	225,342	189,116	38,414	136,415	261,313	53,839	9,020	69,094	8,626	32,866	1,024,045	1,024,045

* Estimated.

TABLE XIII.—Production in Detail of Miscellaneous Metals and Minerals, 1933.

District and Division.	Bentonite.	Bismuth.	Cadmium.	Diatomite.	Flux (Limestone and Quartz).	Gypsum and Gypsite.	Iron (Bog).	Mica.	Phosphate.	Platinum.	Crushed Slate.	Soda.	Sulphur Content of Pyrite and Sulphuric Acid manufactured.	Talc.	Division Totals.	District Totals.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
North-western District (No. 1)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	90,252
Atlin, Liard, and Stikine	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nass River	.....	.....	.....	.....	90,252	.....	.....	.....	.....	.....	.....	.....	.....	.....	90,252	.....
Portland Canal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Skeena and Queen Charlotte	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bella Coola	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
North-eastern District (No. 2)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	410
Cariboo and Quesnel	.....	.....	.....	410	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	410	.....
Omineca and Peace River	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Central District (No. 3)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50,207
Nicola and Vernon	.....	.....	.....	.....	.....	.....	.....	853	.....	.....	.....	.....	.....	.....	853	.....
Yale, Ashcroft, and Kamloops	.....	.....	.....	.....	.....	46,004	.....	.....	.....	.....	.....	2,700*	.....	.....	48,704	.....
Clinton	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	650	.....	.....	650	.....
Southern District (No. 4)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	35,927
Grand Forks and Greenwood	.....	.....	.....	.....	33,164	.....	.....	.....	.....	.....	.....	.....	.....	.....	33,164	.....
Osoyoos	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Similkameen	1,363	.....	.....	.....	.....	.....	.....	.....	.....	1,400	.....	.....	.....	.....	2,763	.....
Eastern District (No. 5)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	371,189
Fort Steele	.....	.....	.....	.....	.....	.....	.....	.....	4,670	.....	.....	.....	.....	.....	4,670	.....
Windermere and Golden	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ainsworth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Slocan and Slocan City	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nelson and Arrow Lake	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Trail Creek	.....	77,796	78,733	.....	.....	.....	.....	.....	.....	.....	.....	.....	209,990	.....	366,519	.....
Revelstoke	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Western District (No. 6)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	85,547
Nanaimo	.....	.....	.....	.....	7,402	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,402	.....
Victoria and Quatsino	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,750	.....	.....	550	4,300	.....
Lillooet	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	272	272	.....
Vancouver	.....	.....	.....	.....	.....	.....	1,485	.....	.....	.....	.....	.....	72,088	.....	73,573	.....
New Westminster	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	1,363	77,796	78,733	410	130,818	46,004	1,485	853	4,670	1,400	3,750	3,350	282,078	822	633,532	633,532

* Estimated.


BRITISH COLUMBIA
MINERAL PRODUCTION.
1893 - 1933.
DEPARTMENT of MINES.
VICTORIA, B.C.
TOTAL MINERAL PRODUCTION
LODE MINES
COAL MINES
STRUCTURAL & MISCELLANEOUS
PLACER GOLD
MILLIONS OF DOLLARS
MILLIONS OF DOLLARS
0
10
20
30
40
50
60
70
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
1932
1933
AMR

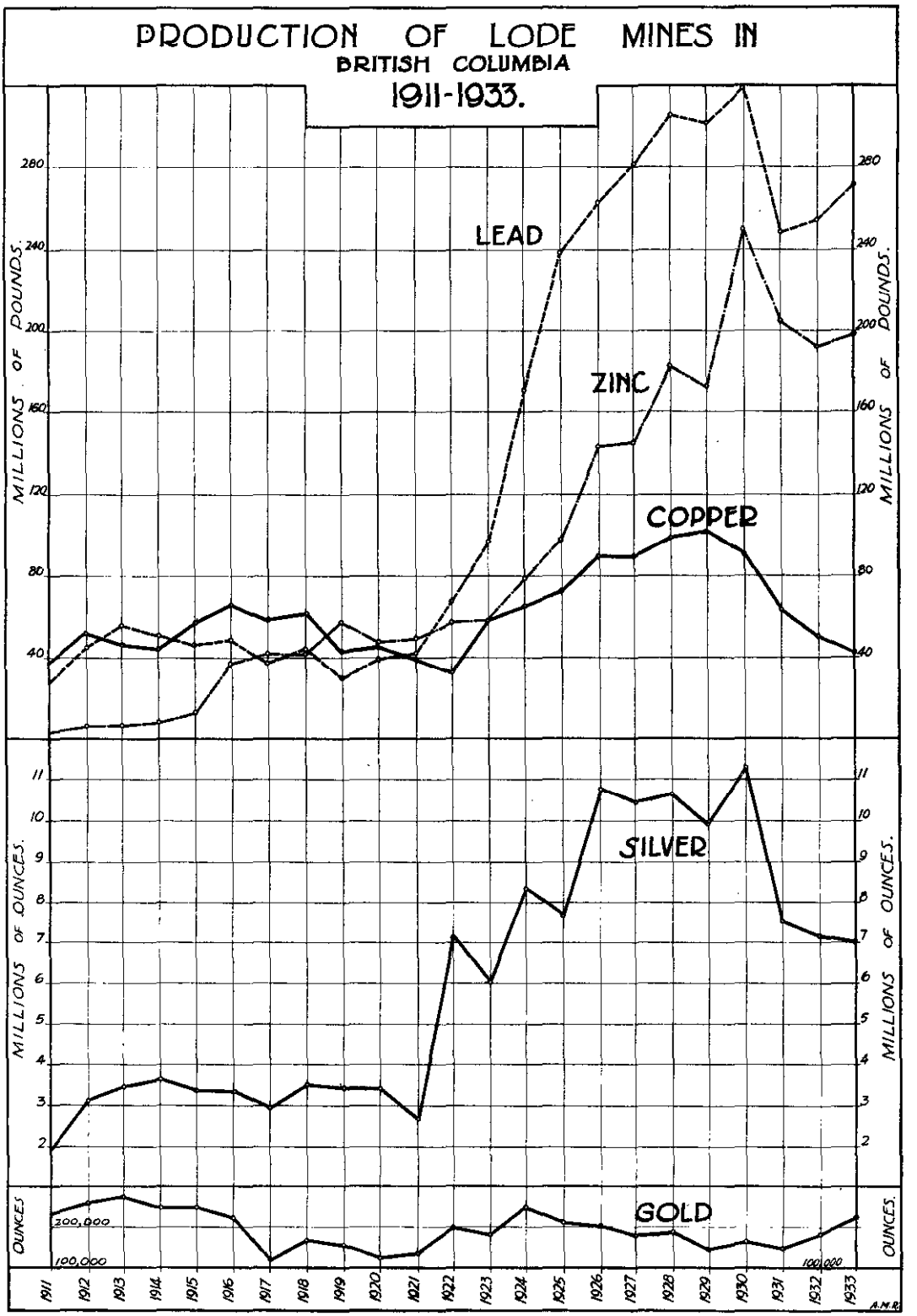

PRODUCTION OF LODE MINES IN
BRITISH COLUMBIA
1911-1933.
LEAD
ZINC
COPPER
SILVER
GOLD
MILLIONS OF POUNDS.
MILLIONS OF OUNCES.
OUNCES
200,000
100,000
100,000
280
240
200
160
120
80
40
11
10
9
8
7
6
5
4
3
2
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
A.M.R.

TABLE XIV.—MEN EMPLOYED IN THE MINERAL INDUSTRY OF BRITISH COLUMBIA, 1933.

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	257	473	261	734	89	305	.....	.....	.....	20	4	12	1,421
No. 2	434	95	111	206	9	.....	8	2	10	26	2	4	691
No. 3	118	62	168	230	2	.....	84	34	118	52	22	6	548
No. 4	75	102	56	158	1	.....	298	143	441	31	6	9	721
No. 5	175	639	427	1,066	270	2,131	522	176	698	70	2	74	4,486
No. 6	75	415	312	727	160	.....	1,329	498	1,827	177	233	303	3,502
Totals	1,134	1,786	1,335	3,121	531	2,436	2,241	853	3,094	376	269	408	11,369

TABLE XV.—TONNAGE, NUMBER OF MINES, AND NET VALUE OF LODE MINERALS, 1933.

District.	Tonnage.	No. of Shipping Mines, 1933.	No. of Mines shipping over 100 Tons.	Net Value of Lode Minerals produced.
No. 1	1,729,410	10	7	$2,799,093
No. 2	19,795	2	1	230,472
No. 3	1,099	4	2	17,528
No. 4	9,952	22	8	331,781
No. 5	1,493,531	66	26	6,677,527
No. 6	776,991	5	3	3,919,967
Totals	4,030,778	109	47	$13,976,368

TABLE XVI.—METALLIFEROUS MINES SHIPPING IN 1933.

NORTH-WESTERN DISTRICT (No. 1).

Mine or Group.	Mining Division.	Locality.	Owner or Agent and Address.	Character of Ore.
Engineer	Atlin	Windy arm	R. H. Brooks, Atlin	Gold.
Bonanza	Nass River	Anyox	Granby Cons. M.S. & P. Co., Ltd., Vancouver	Copper, silver, gold.
Hidden Creek	Nass River	Anyox	Ditto	Copper, silver, gold.
Granby Point	Nass River	Anyox	Ditto	Gold, silver.
Dunwell	Portland Canal	Glacier creek	Dunwell Mines, Ltd., Victoria	Silver, gold, lead, zinc.
Premier	Portland Canal	Cascade river	Premier Gold Mining Co., Ltd., Premier	Gold, silver, lead.
Spider	Portland Canal	Divide lake	K. H. Gray, Agent, Stewart	Gold, silver.
Gold Harbour	Queen Charlotte	Moresby island	Gold Harbour Mines, Ltd., Vancouver	Gold, silver.
Hunter Group	Skeena	Khutze inlet	J. M. Meldrum, Vancouver	Gold, silver, copper.
Surf Point	Skeena	Porcher island	N. A. Timmins Corporation, Montreal	Gold, silver.

NORTH-EASTERN DISTRICT (No. 2).

Cariboo Gold	Cariboo	Barkerville	Cariboo Gold Quartz Mining Co., Ltd., Vancouver	Gold, silver.
Glacier Gulch	Omineca	Smithers	S. F. Campbell and associates, Smithers	Gold, silver.

CENTRAL DISTRICT (No. 3).

Mine or Group.	Mining Division.	Locality.	Owner or Agent and Address.	Character of Ore.
Vidette	Ashcroft	Savona	Vidette Gold Mines, Ltd., Vancouver.	Gold, silver, copper.
Windpass	Kamloops	Chu Chua	Windpass Gold Mining Co., Vancouver	Gold, copper.
Nicola	Nicola	Stump lake	Nicola Mines and Metals, Ltd., Vancouver	Gold, silver, lead, zinc.
Pre-Cambrian	Vernon	Ewings Landing	Pre-Cambrian Gold Mines, Seattle, Wash.	Gold, silver.

SOUTHERN DISTRICT (No. 4).

Lightning Peak	Grand Forks	Lightning peak	Jordan, Calder, and Jordan, Edgewood	Silver, lead, zinc.
Molly Gibson	Grand Forks	Burnt basin	Oscar Anderson, Rossland	Gold, silver.
Union	Grand Forks	Granby river	Jas. F. McCarthy, Grand Forks	Gold, silver, zinc, lead.
Beaver	Greenwood	Beaverdell	Beaver Silver Mines, Ltd., Vancouver	Silver, gold, zinc, lead.
Bell	Greenwood	Beaverdell	Bell Mine, Ltd., Penticton	Silver, gold, zinc, lead.
Butcher Boy	Greenwood	Carmi	Canadian American Mines, Ltd., Vancouver	Gold, silver, zinc.
Carmi	Greenwood	Carmi	Ditto	Gold, silver, zinc, lead.
Dentonia	Greenwood	Greenwood	Dentonia Mines, Ltd., Calgary, Alta.	Gold, silver, lead.
Dynamo	Greenwood	Greenwood	Jerome McDonell, Greenwood	Gold, silver, lead.
Gold Drop	Greenwood	Jewel lake	W. E. McArthur, Jr., Greenwood	Gold, silver.
Highland Lass	Greenwood	Beaverdell	Highland Lass, Ltd., Kelowna	Gold, silver, zinc, lead.
Jack Paul	Greenwood	Rock Creek	Jack Paul Mining Co., Spokane, Wash.	Gold, silver, zinc, lead.
Mogul	Greenwood	Horseshoe mtn	Mogul Mining Co., Westbridge	Gold, silver.
North Star	Greenwood	Jewel lake	W. E. McArthur, Jr., Greenwood	Gold, silver, lead.
Sally	Greenwood	Beaverdell	Sally Mines, Ltd., Penticton	Gold, silver, lead, zinc.
Tiger	Greenwood	Beaverdell	J. L. Nordman, Beaverdell	Gold, silver, lead, zinc.
Wellington	Greenwood	Beaverdell	Beaverdell-Wellington Syndicate, Greenwood	Gold, silver, zinc, lead.
Grandoro	Osoyoos	Oro Fino mtn	Grandoro Mining and Milling Co., Ltd., Vancouver	Gold, silver.
Horn Silver	Osoyoos	Similkameen	J. W. Clark, Princeton	Gold, silver, lead.
Morning Star	Osoyoos	Fairview	Morning Star (Fairview) Gold Mines, Ltd., Oliver	Gold, silver.
Twin Lake	Osoyoos	Oro Fino mtn	Twin Lakes Gold Mining Co., Penticton	Gold, silver.
Victoria (Oliver)	Osoyoos	Fairview	A. Carmichael, Oliver	Gold, silver.

EASTERN DISTRICT (No. 5).

Midway	Fort Steele	Moyie	B.C. Cariboo Gold Fields, Ltd., Vancouver	Gold, silver.
Sullivan	Fort Steele	Kimberley	Cons. M. & S. Co. of Canada, Ltd., Trail	Silver, lead, zinc.
Monarch	Golden	Field	Base Metals Corporation, Field	Silver, lead, zinc.
Pool Mountain	Lardeau	Camborne	Pool Mountain Gold Mines, Ltd., Vancouver	Gold, silver, lead.
Arlington	Nelson	Erie	G. Birtsch, Nelson	Gold, silver, lead, zinc.
Boulder City	Nelson	Salmo	L. R. Clubine, Salmo	Gold, silver.
Bunker Hill	Nelson	Nelway	Crossley, Brodie, and Burns, Nelson	Gold, silver.
California	Nelson	Toad mtn.	W. J. Turner, Nelson	Gold, silver, lead, zinc.
Columbia	Nelson	Sheep creek	J. Sapples, Salmo	Gold, silver.
Granite	Nelson	Taghum	Livingstone Mining Co., Taghum	Gold, silver.
Humming Bird	Nelson	Roaring creek	Nelson Gold Mining Syndicate, Nelson	Gold, silver, lead, zinc.
Keystone	Nelson	Erie	Keystone Mine, Erie	Gold, silver, zinc, lead.

EASTERN DISTRICT (No. 5)—*Continued.*

Mine or Group.	Mining Division.	Locality.	Owner or Agent and Address.	Character of Ore.
Kootenay Belle	Nelson	Sheep creek	Kootenay Belle Gold Mines, Ltd., Vancouver	Gold, silver.
Perrier	Nelson	Cottonwood creek	Perrier Gold Mines, Ltd., Nelson	Gold, silver, zinc, lead.
Reno	Nelson	Sheep creek	Reno Gold Mines, Ltd., Vancouver	Gold, silver, lead, zinc.
Royal Canadian	Nelson	Nelson	E. Bergstrom, Nelson	Gold, silver.
Sanca	Nelson	Ginols Landing	Canada Smelters, Ltd., Sanca	Gold, silver.
Second Chance	Nelson	Erie	Chas. Mazeroll, Erie	Gold, silver.
Second Relief	Nelson	Erie	Relief Arlington Mines, Ltd., Vancouver	Gold, silver.
Vancouver	Nelson	Sheep creek	F. Unfried, Nelson	Gold, silver.
Venus-Juno	Nelson	Morning mtn	J. C. Allison, Nelson	Gold, silver.
Wilcox	Nelson	Ymir	Wilcox Mining Syndicate, Rossland	Gold, silver, lead, zinc.
Yankee Girl	Nelson	Ymir	E. P. Crawford and F. R. Weekes, Ymir	Gold, silver, zinc, lead.
Tamarac	Nelson	Ymir	E. W. Widdowson, Nelson	Gold, silver.
Queen	Nelson	Salmo	C. E. Witter, Salmo	Gold.
Chapleau	Slocan City	Chapleau creek	J. Greenwood, Slocan City	Gold, silver.
Gold Viking	Slocan City	Slocan City	R. G. Henderson, Slocan City	Silver, gold.
Little Daisy	Slocan City	Enterprise creek	C. Cleary, Silverton	Gold, silver.
Bosun	Slocan	New Denver	C. J. Campbell, New Denver	Silver, gold, lead, zinc.
Grey Copper	Slocan		S. J. Towgood, Silverton	Silver, lead, zinc.
Mammoth	Slocan	Kaso	Western Exploration Co., Silverton	Silver, zinc, lead.
Molly Hughes	Slocan	New Denver	Molly Hughes Mines, Ltd., Spokane, Wash.	Silver, gold, lead, zinc.
Rio	Slocan	Jackson basin	W. R. Roberts *et al.*, Silverton and S. Marzoli, Retallack	Silver, gold, lead, zinc.
Ruth	Slocan	Sandon	Ruth-Hope Mining Co., Vancouver	Silver, gold, lead.
Silversmith	Slocan	Sandon	A. K. and O. J. Olsen, Sandon	Gold, silver, zinc, lead.
Standard	Slocan	Sandon	Western Exploration Co., Silverton	Silver, gold, lead, zinc.
Victor	Slocan		E. Doney, Sandon	Silver, gold, lead, zinc.
Rossland properties	Trail Creek	Rossland	Leasers from Cons. M. & S. Co. of Can., Ltd.	Gold, silver, copper.
Velvet	Trail Creek	Rossland	Velvet Gold Mining Co., Seattle, Wash.	Gold, silver, copper.
Cliff	Trail Creek	4-Mile creek	S. J. Hackney, Rossland	Gold, silver.
Daryl	Trail Creek		E. DeKinder, Nelson	Gold, silver.
Evening Star	Trail Creek	Rossland	C. E. Fraser, Mgr., Rossland	Gold, silver.
Georgia	Trail Creek	Rossland	C. E. Fraser, Mgr., Rossland	Gold, silver.
Gold Drip	Trail Creek	O.K. mtn	M. Penny, Rossland	Gold, silver.
I.XL	Trail Creek	Rossland	I.X.L. Leasing Co., Rossland	Gold, silver.
Midnight	Trail Creek	Rossland	Midnight Syndicate, Rossland	Gold, silver.
O.K.	Trail Creek	O.K. mtn	O.K. Leasing Co., Rossland	Gold, silver.
Spring Creek	Trail Creek		T. H. Sargeant, Trail	Gold, silver.

WESTERN DISTRICT (No 6).

Big Boy	Clayoquot	Herbert arm	A. C. Wright, Trustee, Vancouver	Gold, silver.
Bralorne	Lillooet	Cadwallader ck	Bralorne Mines, Ltd., Vancouver	Gold, silver.
Pioneer	Lillooet	Cadwallader ck	Pioneer Gold Mines of B.C., Ltd., Vancouver	Gold, silver.
Enid-Julie	Nanaimo	Phillips arm	R. Crowe-Swords, Vancouver	Gold, silver.
Britannia	Vancouver	Britannia beach	Britannia Mining & Smelting Co., Ltd., Britannia Beach	Copper, silver, gold.

DEPARTMENT OF MINES.

VICTORIA, B.C.

HON. G. S. PEARSON - - - - - - - *Minister of Mines.*
ROBERT DUNN - - - - - - - - - *Deputy Minister.*
(Position vacant) - - - - - - *Provincial Mineralogist.*
D. E. WHITTAKER - - - - - *Provincial Assayer and Analyst.*
JAMES DICKSON - - - - - - - *Chief Inspector of Mines.*

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, No. 6 District, Vancouver.

District Inspectors.

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

Descriptions of the functions of the Department of Mines have been printed in previous Annual Reports and are not repeated in this Report. During 1933 the personnel of the staff remained as shown in the 1932 Annual Report, with the exception that Senior Inspector Robert Strachan was moved from Fernie to Nelson. At the present time Mr. Strachan has been granted leave of absence owing to ill-health. Due to the fact that the 1933 Annual Report of the Department of Mines does not appear until May or June of 1934, and for the information of the public generally, the staff of the Department of Mines as at April 27th, 1934, is given above.

Since the beginning of 1934 several changes have taken place in the personnel of the Department. John D. Galloway, Provincial Mineralogist for many years, resigned from that position on February 28th, 1934, to engage in practice as a consulting mining engineer. Following Mr. Galloway's resignation, A. M. Richmond was placed temporarily in charge of the Bureau of Mines with instructions to compile and prepare the Annual Report for 1933. Shortly after Mr. Galloway's resignation and effective March 31st, 1934, G. A. Clothier, Resident Mining Engineer for the No. 6 Mineral Survey District for many years, also resigned his position to engage in practice as a consulting mining engineer. His position was filled by the appointment of A. M. Richmond, Assistant Resident Mining Engineer for the Province for several years, to be Resident Mining Engineer for the No. 6 Mineral Survey District, with headquarters at Vancouver.

More recently, the Clinton, Ashcroft, and Yale Mining Divisions, which were formerly a part of the Central District (No. 3), were transferred to the Western District (No. 6), administered by A. M. Richmond, Resident Mining Engineer, with headquarters at Vancouver. These Mining Divisions were formerly administered by P. B. Freeland, the Resident Mining Engineer at Penticton.

Any information not included in this Annual Report which is available in any branch of the Department will be furnished to those writing for it to the Department of Mines, Victoria, B.C.

ASSAY OFFICE.

REPORT BY D. E. WHITTAKER, PROVINCIAL ASSAYER.

During the year 1933 there were made by the staff in the Government Assay Office 4,732 assays or quantitative determinations and 186 analyses; of these the majority were for the Bureau of Mines or for other departments, for which no fees were received.

The fees collected by the office were as follows:—

Fees for analyses	$117.50
Fees for assaying	187.97
Fees for assayers' examinations	60.00
Total cash receipts	$365.47

Determinations and examinations made for other Government departments for which no fees were collected:—	
Attorney-General's Department	$352.00
Agricultural Department	1,510.00
Board of Health	620.00
Treasury Department	12.00
Other departments	55.00
	$2,549.00
Value of work done outside of Mines Department work	$2,914.47

The value of gold melted during the year 1933 was $211 in 8 lots, as compared with $806.50 in 15 lots in 1932.

FREE DETERMINATIONS.

In addition to the above quantitative work, about 2,525 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 January 31st, June 24th, and December 16th, 1933. Three candidates applied for examination on December 16th and passed the examination on that date. Two candidates applied for exemption on January 31st and June 24th, 1933, and were granted exemption. The Board recommended that certificates be issued to five candidates.

GOLD COMMISSIONERS AND MINING RECORDERS.

The following list shows the Gold Commissioners and Mining Recorders of the Province, revised to April, 1934:—

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Deputy Recorder.
Atlin	Atlin	W. W. Wright	W. W. Wright	
Sub-office	Telegraph Creek			J. V. Boys.
Sub-office	Haines (U.S.)		(Com. for taking Affidavits)	B. A. Barnett.
Sub-office	Squaw Cr. 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	J. V. Boys	J. V. Boys	
Sub-office	Boundary via Telegraph Creek			A. R. Hunter.
Liard	Telegraph Creek	J. V. Boys	J. V. Boys	
Sub-office	Porter Landing			W. G. Crisp.
Sub-office	McDame Creek			G. Edgar.
Sub-office	Fort St. John			F. W. Beatton.
Sub-office	Fort Nelson			J. S. Clark.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Deputy Recorder.
Skeena	Prince Rupert	N. A. Watt	N. A. Watt	
Sub-office	Kitimat			Chas. E. Moore.
Sub-office	Copper River			L. G. Skinner.
Sub-office	Terrace			O. T. Sundal.
Sub-office	Stewart (Portland Canal)			H. W. Dodd.
Sub-office	Rosswood			Mrs. Alberta Smith.
Sub-office	Kimsquit			Percy Gadsden.
Nass River	Anyox	N. A. Watt	E. Ross Oatman	
Sub-office	Alice Arm			Mrs. L. Cummings.
Sub-office	Stewart			H. W. Dodd.
Portland Canal	Stewart	N. A. Watt (at Prince Rupert)	H. W. Dodd	
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			
Omineca	Smithers	H. B. Campbell	H. B. Campbell	
Sub-office	Fort Grahame			L. T. Kempple.
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) via Fort Grahame			James Ware.
Sub-office	Cedarvale			John Thompson.
Sub-office	Terrace			O. T. Sundal.
Sub-office	Fort Fraser			J. D. Moore.
Sub-office	Vanderhoof			Geo. Ogsdon.
Sub-office	Pacific			T. H. McCubbin.
Sub-office	Hazelton			Wm. Grant.
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.
Sub-office	Copper River			L. G. Skinner.
Peace River	Fort St. John	H. B. Campbell (at Smithers)	F. W. Beatton	
Sub-office	Prince George			G. Milburn.
Sub-office	Finlay Forks			A. MacKinnon.
Sub-office	Hudson Hope			F. F. Monteith.
Sub-office	Pouce Coupe			M. S. Morrell.
Cariboo	Barkerville	J. P. Scarlett	J. P. Scarlett	Miss L. D. Boyd.
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. McKinlay.
Clinton	Clinton	R. J. A. Dorrell	R. J. A. Dorrell	
Sub-office	Williams Lake			L. C. Maclure.
Sub-office	Haylmore, Bridge River P.O.			W. Haylmore.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Deputy Recorder.
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.)	W. C. Adam	Geo. D. Mead.
Sub-office	Lytton			O. L. Hall.
Nicola	Merritt	E. Fisher (at Kam.)	A. G. Freeze	
Yale	Hope	E. Fisher (at Kam.)	H. Beech	J. W. Chadwick.
Sub-office	Lytton			O. L. Hall.
Similkameen	Princeton	L. A. Dodd	L. A. Dodd	
Sub-office	Hedley			R. E. Baxter.
Vernon	Vernon	R. M. McGusty	R. M. McGusty	F. H. C. Wilson.
Sub-office	Kelowna			C. W. Dickson.
Greenwood	Greenwood	Chas. Nichols	Chas. Nichols	
Sub-office	Kettle Valley			G. B. Gang.
Sub-office	Beaverdell			T. W. Clarke.
Sub-office	Oliver			E. B. Rossiter.
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	A. W. Anderson	A. W. Anderson	H. C. Moore.
Windermere	Windermere	A. W. Anderson (at Golden)	A. M. Chisholm	
Fort Steele	Cranbrook	A. A. Robertson	J. E. Kennedy	
Sub-office	Fernie			H. A. Bryant.
Ainsworth	Kaslo	Ronald Hewat	W. M. H. Dunn	
Sub-office	Trout Lake			H. Macpherson.
Sub-office	Poplar Creek			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			A. M. Holman.
Sub-office	Vananda			Leonard Raper.
Sub-office	Shoal Bay, Thurlow P.O.			Arthur Pritchard.
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	Chilliwack			Chas. J. Whittaker.
Vancouver	Vancouver	A. S. Tyrer	R. A. Burgoyne	
Lillooet	Lillooet	L. J. Price	L. J. Price	T. B. Williams.
Sub-office	Haylmore, Bridge River P.O.			W. Haylmore.

GOLD COMMISSIONERS' AND MINING RECORDERS' OFFICE STATISTICS, 1933.

District and Division.	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 Leases.	Bills of Sale, etc.	Free Miners' Certificates.	General.	Mining Divisions.	Districts.
North-western District (No. 1)																**$19,928.75**
Atlin	555	5	1	62	95	17		2	18	17	145	153	$2,053.50	$7,455.65	$9,509.15	
Stikine	92			9	16				7		5	1	408.00	137.75	545.75	
Liard	31			1	4					8	31	7	140.00	2,814.25	2,954.25	
Nass River	62	1		21	119	12							392.00	384.50	776.50	
Portland Canal	131	2		263	385	22	2						826.00	2,173.85	2,999.85	
Skeena	171	1		66	42	14	1	31	12		1		837.00	1,143.50	1,980.50	
Queen Charlotte	64			97	22	11			4	11	1	22	281.50	780.00	1,061.50	
Bella Coola	16			4	9								68.75	32.50	101.25	
North-eastern District (No. 2)																**90,610.97**
Cariboo	1,784	6	4	6,863	1,816	998		4	121	288	161	124	7,565.50	50,940.83	58,506.33	
Quesnel	738	2	5	2,690	47	135			20	130	111	148	3,164.50	16,930.40	20,094.90	
Omineca	494	6	8	435	651	201	12	7	120	77	69	37	2,869.00	9,085.74	11,954.74	
Peace River										1	1			55.00	55.00	
Central District (No. 3)																**25,922.50**
Nicola	84			107	48	27					1	2	*304.50*	*639.50*	*944.00*	
Vernon	276	1		246	53	19		9	23	11	11	3	1,156.75	1,928.50	3,085.25	
Yale	280	4	2	868	271	205		2	70	17	51	51	1,479.25	5,910.25	7,389.50	
Ashcroft	210		1	627	145	72			51	17	15	12	1,091.50	3,004.40	4,095.90	
Kamloops	577	1	4	452	165	75		4	121	17	16	22	2,533.00	3,501.85	6,034.85	
Clinton	182		3	355	135	56			121	12	33	65	812.75	3,560.25	4,373.00	
Southern District (No. 4)																**20,329.80**
Grand Forks	90			51	63	6		41	26				412.00	1,378.25	1,790.25	
Greenwood	262	2	5	363	164	37	2	72	40	29	36	71	1,214.50	5,719.20	6,933.70	
Osoyoos	263	5	2	390	88	65		49	3				1,520.75	2,653.45	4,174.20	
Similkameen	325	3	5	300	174	27	1	4	33	63	68	95	1,720.25	5,711.40	7,431.65	
Eastern District (No. 5)																**33,697.30**
Fort Steele	468	6	3	420	118	50		7	60	37	96	95	2,525.25	8,222.15	10,747.40	
Windermere	62			93	56	14			22		6		311.25	1,249.50	1,560.75	
Golden	84	4		93	30	9		4	17	2	1	2	496.25	666.20	1,162.45	
Ainsworth	108	2	2	84	160	22		28	17				872.00	1,813.15	2,685.15	
Slocan	44	1	1	22	79								309.50	249.50	559.00	
Slocan City	34			69	46	3						2	151.50	314.75	466.25	
Nelson	484	9	2	704	383	112	6	135	21		6	18	2,794.25	6,849.75	9,644.00	
Arrow Lake	25			10	14								118.50	82.75	201.25	
Trail Creek	113	4		22	21	3		7					930.50	312.75	1,243.25	
Revelstoke	137	2		101	95	64		63	4	8	14		865.75	3,584.80	4,450.55	
Lardeau	45	1		99	153	9						1	306.25	671.00	977.25	
Western District (No. 6)																**68,063.15**
Nanaimo	95			306	140	27	1	27	1				372.75	1,966.25	2,339.00	
Alberni	115			98	16	16	3	13	11	2			379.75	754.35	1,134.10	
Clayoquot	115			397	48	31						1	429.00	1,366.55	1,795.55	
Quatsino	39			56	96	9	15						173.00	546.05	719.05	
Victoria	512	30	3	57	24	4			27	15	9	18	4,318.00	1,526.65	5,844.65	
Lillooet	1,195	16	2	4,303	1,193	782	6	2	9	47	86	17	5,724.25	23,230.50	28,954.75	
New Westminster	343	2	2	373	38	48	2	22	26	4			1,535.50	1,594.10	3,129.60	
Vancouver	3,169	163	18	86	91	11		2					23,664.75	481.70	24,146.45	
Totals	13,674	279	73	21,663	7,313	3,213	51	535	1,005	813	974	967	$77,129.00	$181,423.47	$258,552.47	**$258,552.47**

REPORTS OF RESIDENT MINING ENGINEERS.

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

Report by Joseph T. Mandy, Resident Mining Engineer (Headquarters, Prince Rupert).

GENERAL SUMMARY.

The mining industry in this district during 1933 has been featured by increased interest and activity in gold-mining. This is largely the result of national and international monetary requirements and the policy adopted in 1930 by the Department of Mines to thoroughly study the gold aspects of the mining industry. Through the energetic activity of the Department in this respect the gold potentialities of this district are now more definitely recognized and are receiving increased attention from prospectors, operators, and capitalists. New gold discoveries have been made; several new development projects have been started on properties with gold possibilities; new gold production has been made from several properties and is planned from several others; new prospecting areas have been penetrated with good results and attention has been directed to favourable areas as yet unprospected.

The large mining companies of the district, the Granby Consolidated Mining, Smelting, and Power Company, Limited, at Anyox, and the Premier Gold Mining Company, Limited, at Stewart, have continued in active production. Creditable cost reductions and technical achievements have characterized these operations, the companies adjusting their procedure to the changing economic situation. Both companies have maintained employment at an economic maximum and have directly supported communities of 3,000 people. The *Premier* pay-roll amounts to $35,000 per month and the Granby pay-roll to $125,000 per month, making the annual pay-roll for the two companies about $2,000,000.

During 1933 six new lode-gold operations have been started in the district. New small-scale gold production has materialized at five properties and is planned from four others. In addition, exploratory development and prospecting work has been carried out on many lode-gold and placer-gold properties throughout the district.

Producing placer-gold operations in the district have expanded and sound financial interests are being attracted to this field. Many individuals have also earned a livelihood at individual placer operations on gold-bearing gravels. Dormant placer-gold possibilities are being efficiently tested and new promising areas are being opened up.

This activity in gold-mining has very materially aided in stabilizing the industrial, financial, domestic, and social affairs of the district at a time when the silver and base-metal industries were depressed, and has greatly mitigated the relative effects of the general industrial depression. Although activity in silver and base metals has been subdued, some very sound and constructive work has been carried out by prospectors on this type of deposit, and the chances for properties of this type to attract development capital when base metals reach a reasonable and stable price has been materially increased. As this district possesses very important resources in silver and base metals, this constructive work is laying a sound foundation for future mining expansion. Commendable individual enterprise in this respect has also been shown in the undertaking of leasing operations on properties possessing promise of high-grade shipping-ore. During the latter part of 1933 signs of reviving interest in silver and base metals have been definitely indicated by an increasing number of inquiries from sound financial interests for likely properties of this type. In this category extensive exploration and development of the *United Empire* property at Stewart has already been undertaken and other similar operations are in the offing. The future for silver and base metals is slowly becoming brighter.

During 1933 about 2,000 individuals have earned a direct livelihood from approximately 160 separate mining operations in the district. This is exclusive of general prospecting activities, and it is estimated that the total direct mining pay-roll for the district during the year has amounted to about $3,000,000. These operations have directly supported twenty-one separate communities aggregating about 5,000 people.

The mining industry of this district is in a sound condition and well organized for steady progress. The future can be faced with well-founded optimism.

Production.

New small-scale lode production has started at the *Early Bird* (Gold Harbour Mines, Limited), Queen Charlotte islands; the *Surf Point* mine on Porcher island; the *Ben Ali* and *Dunwell* at Stewart; the *Hunter* and *Heather*, Khutze inlet; and the *Engineer* at Atlin. These are as yet small operations and, with the exception of the *Surf Point*, still in the prospecting condition; with further exploration, however, they may show possibilities for expansion. New small-scale production in the near future is planned from the *Skidegate-Sunrise* on Graham island; the *Rupert* group (Haida Gold Mines, Limited), Moresby island; the *Princess Royal* (Princess Royal Gold Mines, Limited) on Princess Royal islands; and the *United Empire* at Stewart. Gold and silver production from the Premier Gold Mining Company, Limited, shows a decided decrease. With new producers definitely materializing, future producers in the offing, and with the prospect of a revival of interest in silver and base metals, the outlook for sustained production from this district is bright.

The following list gives production from lode mines in No. 1 District during 1933:—

Name.	Ore.	Gold.	Silver.	Copper.	Lead.
Atlin Mining Division—	Tons.	Oz.	Oz.	Lb.	Lb.
Engineer	30	103	64	.....	.....
Nass River Mining Division—					
Bonanza	128,124	506	49,184	5,703,358	.....
Granby Point	5,987	1,549	39,548	.....	.....
Hidden Creek	1,406,076	2,327	169,122	28,713,101	.....
Portland Canal Mining Division—					
Dunwell (leasers)	1,740	617	26,158	4,523	54,626
Premier	185,421	49,469	1,002,487	25,226	676,809
Spider	3	3	961	.....	.....
Queen Charlotte Mining Division—					
Gold Harbour	400	53	25	.....	.....
Skeena Mining Division—					
Hunter Group	3	30	12	53	.....
Surf Point	1,626	1,268	345	.....	.....
Totals	1,729,410	55,925	1,287,906	34,446,261	731,435

The placer-gold output from No. 1 District for 1933 was 11,893 oz., valued at $202,181, as compared with $144,347 in 1932.

Development and Exploration.

Lode-mining.

Development and exploratory operations have been continued at the *Premier* mine and by the Granby Consolidated Mining, Smelting, and Power Company. In the Atlin Mining Division extensive underground exploration of the *Whitewater* group, Taku river, was carried out by the Alaska Juneau Gold Mining Company with promising indicative results. In this area this company also did further intensive surface exploration on the *Silver Bird* and *Silver Queen* groups, but so far with negative results.

Development has increased in the Portland Canal Mining Division. On the *Georgia River*, diamond-drilling and underground work has been done by the Helena Gold Mines, Limited, a reorganization of the Georgia River Gold Mines, Limited. On the *Dunwell*, lessees have been continuously at work and have started work on the *Spider* with profitable results. Following the reorganization of the *Big Missouri* company, exploratory operations were resumed on the property. Seasonal exploratory operations have also been sustained on the *Unicorn*, adjoining the *Big Missouri*. On the *Salmon Gold*, the Salmon Gold Mines, Limited, did surface prospecting which resulted in additional gold discoveries of importance, and it is understood financing has been completed which will permit the further exploration and development of this property. Underground exploration of the *Pioneer* group in the Tide Lake area was also carried out. Extensive surface and underground exploration and development was initiated on the *United*

Empire and will be continued throughout the winter. Active exploratory operations were also carried out on the *Kenneth* group by the Argentine Syndicate. In the Unuk River section further surface exploration of the promising gold discoveries made in 1932 by a local syndicate has shown encouraging gold values over appreciable widths and more intensive exploration is planned for the 1934 season. Constructive exploration on several other properties in the Portland Canal Division was undertaken by individuals.

In the Nass River Division development and exploration operations have been few in number, but towards the close of the season evidence of a revival of interest promises increased activity in this area in 1934. Constructive exploration by individuals was accomplished on several properties in this Division, especially on the *Tyee*, *Highland*, and *Summit* groups.

In the Skeena Division the *Surf Point* mine has been kept in continuous operation by the N. A. Timmins Corporation, and with the construction of a mill of 30-ton daily capacity the property has been brought into profitable production. Operations have also been initiated on the *Surf Inlet*, *Pugsley*, and *Wells* groups on Princess Royal island by the Princess Royal Gold Mines, Limited. Further exploration of the *Hunter* and *Heather* groups was done by individuals and a small tonnage of high-grade gold ore was shipped.

In the Queen Charlotte Division development and exploration activity has shown an encouraging increase. On the west coast of Moresby island Haida Gold Mines, Limited, has carried out intensive surface and underground exploration of the *Rupert* group, and this work is to be continued throughout the winter months. At Gold Harbour, on Mitchell inlet, the Gold Harbour Mines, Limited, commenced exploratory operations on the *Early Bird* and installed a small mill for the purpose of bulk-sampling the mined material. Operations closed for lack of funds on December 13th.

Placer-mining.

Development and exploration activities have shown a constructive increase and improved working methods embodying a more thorough testing of the ground are being introduced. Several new enterprises backed by sound capital and under efficient technical direction were started and the field for favourable exploration is gradually and definitely broadening. Besides the higher-grade gravels, attention is being directed to possible opportunities for large yardages of lower-grade gravels that may be amenable to large-scale operations with modern power equipment. This latter phase of placer-mining has heretofore been almost entirely overlooked in this district.

The number of individual producing placer-gold operations in the district has gradually increased. The number of men engaged in this form of mining, making expenses, wages, or better in the Skeena, Queen Charlotte, Atlin, Stikine, and Liard Divisions, has assisted in relieving the financial burden on the country. Approximately 132 individual placer operations, in which about 341 men and some women were engaged, have been active during the 1933 season on forty-three different gold-bearing creeks in widely scattered localities in the district.

In the Atlin area placer-mining has been very active and with the introduction of two well-financed drilling outfits under qualified technical direction exploration in this camp is on a much sounder basis than it ever has been before. Dormant possibilities are being thoroughly prospected and some encouraging results achieved. Geological clarity relative to old-channel structures and locations is gradually emerging and evidence of further possibilities is developing. Besides new locations and extensions of operating workings, there are still appreciable yardages of low-grade rim-rock and bed-rock gravels—material running from about 30 to 80 cents to the yard—with patches of high-grade gravels remaining in old drift-workings that some day may be mined. In the Tatshenshini River section of the Atlin Division operations on Squaw creek have extended to the upper section of the creek, and the discovery, in September, 1933, of a new gold-bearing creek named " Gold Run " near the confluence of the Parton and Tatshenshini rivers was reported.

The Stikine Division in 1933 had the first appreciable placer-gold production in several years. This resulted from the introduction of a gasoline-tractor drag-line scraper on Barrington river (North fork of the Chutine river) to take the place of the small dredge which was found inadequate to handle the boulder conditions of the area. During 1933 about 100 oz. of gold was recovered in testing operations and it is planned to extend the work next season.

In the Liard Division placer operations have been small in the Dease Lake area, but work by individuals is progressing on two new creeks and interest is being aroused in other creeks

contiguous to Dease lake. McDame creek has also received some further attention. On Gold Pan creek, tributary to the Little Eagle river, some sound and methodical work was accomplished. In the Turnagain River area four new creeks are being explored by a few prospectors.

Prospecting.

Prospecting has been quite active throughout the district, especially for lode and placer gold, and new areas are being penetrated. Due largely to educational efforts of the Department of Mines, the efficiency of prospectors has been improved and their ranks have been increased by many of the younger generation.

The stimulus of the gold interest has resulted in sound and detailed work being carried out on many claims with gold possibilities, and on several claims encouraging discoveries have been made. This work has also indicated commercial gold possibilities where they have heretofore not been expected to be of particular importance. Geological conditions relative to mineral occurrences of the district have been clarified, and in connection with placer gold the favourable field for search has been extended and wasteful effort in unfavourable areas generally eliminated.

There is a tremendous unexplored territory in this district and the Resident Engineer has considered it of outstanding importance to incorporate into his season's field-studies the general exploration of as much new territory as possible. In this way it is hoped to bring to light promising areas and to direct the attention of prospectors and exploratory interests to the most likely sections in them. It is encouraging to note that the work along this line has already produced favourable results. During the 1933 season the reconnaissance of the Tatshenshini River area was continued and the country between Dease lake and the Turnagain river in the Liard Division was explored and partially mapped. Details of these map-areas are incorporated in the body of this report.

In the Annual Reports for 1929, 1930, 1931, and 1932 much information relative to prospecting will be found. In these publications, especially in the 1932 Report, specific areas are recommended for prospecting. Bulletin No. 1, 1932, contains much information relative to lode-gold prospecting, and in Bulletins No. 1, 1931, and No. 1, 1933, information relative to placer-gold prospecting is specifically detailed. Prospectors and others interested in the mineral occurrences of this district are urged to carefully study these publications of the Department of Mines.

Roads and Trails.

Assistance has been rendered by the Department of Mines and the Department of Public Works in the construction and reconditioning of mining roads and trails where such work has seemed definitely warranted. Work of this description has been carried out in the Skeena, Nass, Portland Canal, Stikine, Liard, and Atlin Mining Divisions and has materially aided and encouraged active operators and prospectors.

Aviation.

The use of aeroplanes for exploration, transportation of men, equipment, and supplies into the more remote northern areas showed a marked increase during 1933 and has proved beyond question the suitability and efficiency of this method of transportation. Canadian Airways, Limited, established a base at Atlin with a W. 34 Junkers freighting-aeroplane. This plane successfully carried out several extended trips in the Atlin, Yukon, Unuk River, and Tatshenshini River areas. Exploration in the Tatshenshini River area was also served by a cabin-plane operated by the Spencer interests of Vancouver. A small Eastman, open-cockpit, 3-passenger aeroplane based at Atlin and piloted by J. Eastman made extended and frequent flights in connection with prospecting and exploration. W. Strong, with a freighting cabin-plane based at Juneau and Tulsequah, also carried out extended flights. During the year an Eastman plane, based at Anyox and piloted by J. McConnachie, a very capable pilot, made several flights in the coastal area.

Providing aeroplane transportation is made available for the more general use of the prospector and individual with restricted funds, through the lowering of the heretofore generally prohibitive fees charged by the large companies, it will prove a potent aid in the exploration and development of the more remote sections of this district. Otherwise, the use of this remarkably efficient mode of modern transportation will be but a luxury or an instrument of dire necessity.

Geological Survey of Canada.

No field-work was carried out in this district during 1933 by the Geological Survey of Canada. It is again strongly recommended that geological and topographical mapping of the Unuk River section be commenced and that further detailed geological work be carried out in connection with the ore-deposits of the Salmon River-Cascade Creek area.

Addresses and Prospectors' Classes.

During 1933 addresses covering various phases of the mining industry were given at several places in No. 1 District. During the winter months a series of lectures and classes for prospectors were conducted at Prince Rupert. These were well attended and received with enthusiasm.

Acknowledgment.

The Resident Engineer desires to express his thanks for their co-operation to the prospectors, operators, and all whose with whom he has come in contact during the conduct of his work.

In the following report details of mining activities and mineral possibilities in the various Divisions of the district are set out.

BELLA COOLA MINING DIVISION.

This Division has been described in previous Annual Reports, and in Bulletin No. 1, 1932, its geological characteristics are described and likely areas for prospecting mentioned. During 1933 the Division was comparatively inactive and was not visited. Operations were, however, continued at Beale's limestone-quarry on Cunningham island.

QUEEN CHARLOTTE MINING DIVISION.

This Division is thoroughly covered in previous reports, and in Bulletin No. 1, 1932, its geological aspects and prospecting opportunities are described. Likely prospecting areas are also referred to in this report.

Lode Gold.

Skidegate-Sunrise. This property, situated on Graham island, is described in former Annual Reports, the recent work being detailed in the 1932 volume. During 1933 operations were continued by Kitsault Mines, Limited, under the supervision of W. G. McMorris, and were suspended early in May on account of lack of funds. The work, drifting and crosscutting on the 100-foot level, exposed continuation of the structure with good vein-widths, but so far no commercial ore-shoots. The objective has been to pick up on the 100-foot level the ore-shoots indicated from surface down to the 50-foot level. At the close of 1933 it is understood plans were being formulated for further exploration of the veins on, and below, the 100-foot level by diamond-drilling. The installation of a small mill to treat the ore-tonnage estimated between the 50-foot level and surface is also contemplated.

Gold Harbour Mining Co., Ltd. This company was incorporated during 1933 with a capitalization of 1,000,000 common shares of $1 par value. Fiscal agent for the company is British Colonial Securities, Limited, 322 Standard Bank Building, Vancouver, B.C.

Exploratory operations were started on the *Early Bird* group, situated at Thetis cove (Gold harbour), Mitchell inlet, west coast of Moresby island. The *Early Bird* property is described in detail in the 1932 Annual Report. A plant consisting of a 50-horse-power Junkers-Diesel engine, compressor, and a 40-ton daily capacity amalgamating-mill was installed. The property has not been examined since operations were started in the summer of 1933, but it is understood that initial milling consisted of treating the old dump referred to in the 1932 Annual Report and two gold bricks aggregating about 140 oz. were produced. Some underground and surface exploration was also carried out, a crew of about twelve men being employed. It is reported that, on account of lack of funds, operations were suspended on December 13th. It is also reported that shortly previous to the suspension of operations a new vein with fair width and values was discovered.

It must be clearly understood, as was stressed in the 1932 Annual Report, that the property is entirely a prospect as yet, with no definite ore-tonnage of known value being either blocked out or indicated. The objective, therefore, of a mill-installation is for the purpose of bulk-sampling the mineralized zone to ascertain the possibilities of commercial values being found

either in sections of it or in individual stringers and small veins. For this purpose the operation requires assaying equipment on the ground, detailed sampling, assaying, mill-tonnage checking, underground surveying, and tabulation of mill-lot locations under the close supervision of a qualified mining engineer.

Haida Gold Mines, Ltd.

This company was incorporated during 1933, first as a private company and later as a public company with a capitalization of 2,000,000 shares of no par value. The head office is at 510 Hastings Street, Vancouver. Exploratory operations were started on the *Rupert* group (see *Kootenay* group, 1932 Annual Report) in the summer and continued throughout 1933. The property is described in detail in the 1932 Annual Report. The work done included surface stripping and trenching, underground drifting and crosscutting, with detailed sampling. The original claims and showings have also been surveyed and several additional claims were staked. Operations have been carried on in a creditably sound, efficient manner and surface exploration has resulted in the discovery of several new veins.

Drifting in No. 1 tunnel on "C" vein totals about 280 feet. This work is reported by the management to have shown the characteristic vein-structure to persist with main vein-widths of 16 to 48 inches, several branch stringers entering the foot-wall. Visible gold in fine distribution is reported to have been encountered at intervals between the portal and the face, and detailed sampling carried out by the management shows encouraging values varying from 0.02 to 1.42 oz. gold per ton, with an average assay value for the 280-foot tunnel-length of 0.214 oz. gold per ton across a width of 29 inches. As values in this occurrence are confined, as far as is known, to more or less finely distributed native gold, it is suggested that the true value of mined ore can only be accurately determined by bulk-sampling. Ore values could be tested in a milling unit, the estimate being based on mill-recovery and tailing values, but such an installation would require the development of a sufficient indicated tonnage of ore to pay for plant amortization and operating charges. For initial guidance in this respect it is recommended that bulk representative samples of several tons of ore be shipped at intervals to a smelter for treatment and value determination. Such ore shipments would, of course, be determined by detailed sampling as at present carried out.

The property was examined late in 1933 by C. C. Starr, an independent engineer, and a crosscut tunnel (No. 3 tunnel) at elevation 218 feet, 228 feet below No. 1 tunnel-horizon, was started. It is estimated that this crosscut will intersect the projection of "C" vein at 385 feet, and also, at closer intervals, the newly discovered "AA" vein and the "A" and "B" veins. The work is being carried out efficiently and economically by hand-mining methods. Adequate camp accommodation has been constructed at altitude 160 feet and about 500 feet from the portal of No. 3 tunnel. B. G. Hawkins, Vancouver, is managing director and A. T. Ingraham is superintendent. A crew of about eight men is employed.

Placer Gold.

The occurrence of fine gold in old and new sea-beach black-sand concentrates is described in Bulletin No. 1, 1933, and also in the 1932 Annual Report.

On Blue Jacket creek, Masset inlet, Graham island, from five to seven men have been earning small wages, or expenses, by sluicing concentration streaks in sands and gravel of a raised beach deposit overlying a basal formation of grey glacial clay. On the east coast of Graham island, between Rose spit and Cape Ball, several men have earned expenses by sluicing the black-sand beach concentrates. On Shuttle island, east coast of Moresby island, an operation for pumping the wet gravel to bed-rock of a small beach was started in December. Gold-recovery is made in sluice-boxes. The gold content of this beach is derived from the erosion of small gold-bearing veins which outcrop along the adjacent shore of the small bay.

Non-metallics.

Graham island contains appreciable areas of clays and clay shales, some of which appear to be good grade, of good plasticity, and probably suitable for brick and tile manufacture. The very fine clay in bedded distribution in the bluffs of the Cape Ball area are mentioned in reports descriptive of the east-coast beach.

The occurrence of agate pebbles of many varieties, from carnelian to an opaque and banded matrix variety of buff, brown, and black shades, is noted along the entire stretch of the beach

from Cape Fife to Cape Ball. These agates occur in greatest abundance in the neighbourhood of semi-consolidated conglomerate-beds in the bluffs. An examination of the beds, particularly those constituting the apex of Cape Ball, indicates that the agate pebbles originate from the erosion of the conglomerate-beds in which they are seen to occur in place. It would seem that these stones might find some commercial market in the British Columbia tourist trade or possibly in the Chinese semi-precious-stone trade.

Sections of Cretaceous sandstones occupying areas of the north-easterly quadrant of Moresby island, between Cumshewa inlet and Skidegate inlet, are considered to possess interesting possibilities for building and structural purposes. On the south side of Maude island there is an appreciable area of this material. On the north side, and about 5 miles from the head of Cumshewa inlet, beds of pure and even-grained sandstone up to several feet in thickness were observed. They should be excellently suited for the manufacture of grindstones, whetstones, oilstones, etc. The sandstone-beds outcrop just above high-tide mark and dip inland at a flat angle.

SKEENA MINING DIVISION.

Geological characteristics and the potential occurrence of ore-deposits in this Division are described in detail in the Annual Reports for 1929 and 1930. In Bulletin No. 1, 1932, economic geological conditions and likely areas for prospecting are discussed. In Bulletin No. 1, 1933, the placer possibilities are outlined.

Coast Section.

Hunter and Heather. These two groups, comprising twelve claims, owned by the late C. W. Meldrum and associates, of Vancouver, are situated on the North fork of the Khutze river, about 13 miles from the head of Khutze inlet. The property is described in detail in Bulletin No. 1, 1932. During 1933 further work was accomplished by the owners with a crew of three men. About 3 tons of ore mined from the surface outcrops was back-packed out and shipped. Plans are being formulated for the more intensive development of this property and increased small-scale shipments.

Princess Royal Gold Mines, Ltd. This company was incorporated in May, 1933, with a capitalization of 7,000,000 shares of no par value. The registered office of the company is 809 Rogers Building, Vancouver, and J. B. Woodworth is president and managing director.

The property consists of the old *Surf Inlet* and *Pugsley* mines, formerly operated by the Belmont Surf Inlet Mines, Limited (*see* Annual Reports for the years 1917 to 1925 and also that for 1930), and the adjoining *Wells* group (*see* Annual Report for 1920). It is understood that initial work carried out during the year included repairs to the wharf and buildings and that mining has commenced with a small crew. Some ore has been extracted for shipment.

Surf Point. This property, situated on Porcher island, is described in former Annual Reports. A three-quarter interest in the property is owned by the N. A. Timmins Corporation, Montreal, and a one-quarter interest by J. B. Woodworth, of Vancouver. The present operations are being carried out by the N. A. Timmins Corporation, with R. E. Legg superintendent at the mine and Alphonse Paré, Montreal, consulting engineer.

During 1933 construction of a 25-ton flotation-mill was completed and milling commenced in July. By the end of September 106 dry tons of concentrates assaying 6.6 oz. gold per ton was shipped. Mill-heads for this period assayed 0.78 oz. gold per ton. Another lot of approximately 76 tons of about the same grade concentrates was shipped early in October. Shortage of water for mill and plant purposes during the December cold snap necessitated the cessation of operations for a short period. At the close of 1933 additional Diesel-engine power was installed and this will facilitate required development of ore reserves for capacity milling. During 1933 the adjoining *Jeannie* claim was added to the holdings of the Timmins Corporation in this area. A crew of twenty-two men is employed.

Edye Pass This group of five claims is owned by F. T. Patterson, of Prince Rupert, and adjoins the *Surf Point* on the north. Several good lenses of gold-bearing pyrite in a system of quartz veins in quartz diorite, similar to those exposed on the *Surf Point*, have been uncovered by extensive stripping, sometimes in deep muskeg. The show-

ings are described in previous Annual Reports and reference to the property is also included in Bulletin No. 1, 1932. Early in 1933 Frank Patterson, with the assistance of one man, did about 150 feet of open-cutting on a small, continuous high-grade vein on the *Jeannie*, and they extracted about 80 tons of ore that should assay about $60 in gold per ton. The structure of this vein is better defined and the sulphide mineralization more continuous than is general with the veins in this area, and at the bottom of the cut it is about 150 feet long and 10 inches average width, with good definition and high-grade mineralization. About 600 feet north-west of this vein, and about 100 feet lower elevation on the *Nabob* claim, another vein has been stripped for 150 feet. This vein strikes N. 10° E. (mag.), dips vertically, and is from 18 to 20 inches wide and contains leached sections indicative of good sulphide mineralization. At the extremes of stripping the vein is covered by heavy overburden. Short-hole diamond-drilling of a defined depression lining up with this vein and extending into the *Eagle* group is recommended. During the summer of 1933 the *Jeannie* claim was sold to the N. A. Timmins Corporation.

Eagle. This claim, owned by T. Dawson, of Porcher island, adjoins the *Surf Point* on the west. The showings are described in the 1932 Annual Report. During 1933 a crosscut tunnel was driven for 60 feet into the west side of the gulch and intersected three small, barren quartz stringers. Extensive stripping on the top of the west-side ridge, bordering the gulch at this point, was also accomplished and exposed some small quartz stringers containing a little pyrite. The tunnel below the cabin on the east side of the gulch was extended to 60 feet. Some open-cutting on small converging gouge-filled seams on the east side of the gulch, about 500 feet below the cabin, was carried out. Trenching through the muskeg up the easterly hill-slope for drainage purposes was also done. This area, towards the *Surf Point* line, and the centre of the draw or depression which lines up with the vein described on the adjoining *Jeannie* claim, should be thoroughly prospected.

Mascot. This claim is situated on Porcher island in the vicinity of the *Surf Point* mine and north of the *Marguerite* claim of the latter group. It is owned by J. H. Jones, of Porcher island, and the showings are located about half a mile from the shore of Edye passage. A quartz vein in quartz diorite has been exposed for 65 feet by two shallow cuts and about 30 feet of stripping at 150 feet elevation. The vein strikes N. 75° E. (mag.) across a small winding creek and dips 80° north. In the cut on the west side of the creek there is exposed 44 inches of banded and sheared quartz with stringers of pyrite across 12 inches on the foot-wall. In the creek-bed and under the water some streaks of pyrite in the central part of the vein can be seen. A selected sample of pyrite from this cut assayed: Gold, 0.8 oz. per ton; silver, 1.2 oz. per ton. About 15 feet west of this cut 24 inches of quartz is exposed in the right bank of the creek. Stripping on the east side of the creek exposes from 8 to 24 inches of quartz, and it is understood that further stripping in this direction, towards the Little Useless Creek canyon, has added to the continuity of the vein since the property was examined. The vein should be prospected for in the canyon, because a drift on it from the canyon-bottom would offer an efficient means of exploration for ore-shoots with about 50 feet of back. On the west side of Little Useless canyon some quartz stringers, a well-defined shear with some disseminated pyrite, and a wide, heavily oxidized shear-structure on the foot-wall side of a pegmatite dyke, all warrant prospecting by open-cutting and sampling.

Promise. This claim is situated on Porcher island to the west of the *Marguerite* and on the westerly slope of the mountain to Edye passage. The property was originally owned by A. J. Holden, of Porcher island, but, it is understood, has now lapsed. The lower area, contiguous to the shore-line, is close to the roof-contact of the intruded quartz diorite of the batholith which is exposed in the higher elevations. Along the shore area erosion has only partly eliminated the triassic roof-rocks and the formation consists of a patchy distribution of quartz diorite, triassic sediments and lavas, and absorption hybrid rocks of these formations.

The showing is located on the easterly side of the mouth of Little Useless creek at elevation 100 feet and about 300 feet from the shore. Here an open-cut in hybrid quartz diorite exposes an irregular shear-structure about 12 inches wide filled with crushed quartz and containing blebs and streaks of pyrite. The vein strikes east-west and dips 60° south, and the excavation, which is a crosscut, should be continued in an easterly direction into the hill. From another showing at high-tide mark on a fractional claim west of the *Promise*, 6 tons of selected ore

shipped to the smelter returned 3 oz. gold and 2 oz. silver. The area is favourable for the occurrence of gold-bearing quartz-pyrite veins and should be thoroughly prospected.

Bell Mountain. This group is owned by Frank Patterson and Lionel Heath, of Porcher island. It is situated on Porcher island on the east side of a draw leading to a hanging-valley about 3 miles south-easterly of the *Surf Point* mine and about 2½ miles from the shore of Edye passage. On the *Santa Claus* claim, at elevation 1,025 feet on the 37° sloping mountain-side, a well-defined shear-structure, 10 to 18 inches wide, striking east-west and dipping 80° north, can be traced up a small draw to elevation 1,125 feet. At both ends of the tracing continuity is obscured by overburden, but the depression in which the vein lies continues up the slope in alignment with the strike of the vein. The formation is an altered quartz-diorite intrusive close to its roof-horizon with triassic lavas. Quartz replacement varying from bands and stringers to a solid filling across its whole width composes the shear-structure, and mineralization consists of blebs and bands of pyrite up to 2 inches in width in lenticular distribution. The hanging-wall is well defined by 2 inches of gouge and crushed rock. The best mineralization, generally confined to the hanging-wall of the shear, extends up the draw for about 50 feet from the tunnel portal. A 15-foot open-cut continuing with a tunnel 10 feet long has been excavated on this showing at elevation 1,025 feet. In this working the vein is 6 to 8 inches wide, varies in dip, and is mineralized with patches and streaks of pyrite and gossan. A sample of selected pyrite ore from the surface exposures assayed: Gold, 1 oz. per ton; silver, 0.2 oz. per ton. This showing warrants exploration to determine distribution of values and mineralization and the possible location of high-grade ore-shoots. This work should initially be accomplished by open-cuts at short intervals along the strike of the vein-shear.

On the *Bell Mountain* claim, and about 600 feet south-easterly of the *Santa Claus* showing, 20 feet of surface-trenching and a tunnel 15 feet long, driven S. 75° E. (mag.), exposes a shear-structure, 2 to 3 feet wide, striking apparently S. 45° E. (mag.). This structure is highly oxidized and carries stringers and bands of quartz. A sample of the oxidized vein material assayed: Gold, 1.02 oz. per ton: silver, 0.2 oz. per ton. A crosscut tunnel should be driven at a lower elevation to intersect the projection of this structure below surface alteration. Some further trenching exposes a roof-breccia indicating a favourable roof-horizon on a flat-lying embayment-contact in the quartz diorite.

This property is in a geologically and structurally favourable area for the location of gold-bearing pyrite quartz veins possibly amenable to small-tonnage, high-grade production. The claims have been very superficially prospected as yet and, with detailed prospecting, additional veins may be discovered.

Wren. This claim is owned by W. H. Patmore, of Prince Rupert, and is situated on Porcher island, about 1 mile south-westerly of the *Bell Mountain* group. The formation in this area consists of altered triassic sedimentaries and lavas, and hybrid types of these with granitic rock, occurring as a thin roof-covering over the underlying batholith. In places granitic dykes intrude this formation, which gradually thins out up the mountain-slope to the exposure of the granitic rock towards the crest of the ridge at 1,400 feet elevation. A well-constructed cabin is located at about 900 feet elevation.

The main showing consists of a quartz vein and sheared structure 8 to 40 inches wide striking north-east and dipping from vertical to 60° north. This occurs in the altered schist and has been traced for about 100 feet from altitude 1,200 feet to altitude 1,225 feet. The vein-filling consists of milky quartz in blebs and bands up to 24 inches wide with oxidized sheared schist. Open-cutting and stripping shows some pyrite mineralization. A sample of oxidized and crushed material from the upper cut assayed: Gold, 0.5 oz. per ton; silver, 0.7 oz. per ton. About 12 feet north-west of this vein is a parallel quartz vein 12 inches wide which is well defined on the hanging-wall with oxidized gossan and gouge. No work has been done on this vein. About 100 feet south of these showings, at 1,340 feet elevation, a parallel quartz vein up to 12 inches in width outcrops about 15 feet north of a small granitic exposure. This has been stripped for 30 feet in heavy overburden, and an open-cut shows a width of 12 inches with oxidized gouge on the hanging-wall and sparse mineralization of pyrite and chalcopyrite. A sample of selected sulphides assayed: Gold, 2.3 oz. per ton; silver, 0.6 oz. per ton. The geology and structure in this locality is favourable, and as good gold values are found in the veins they should be further explored for the possible occurrence of lenses and shoots of sulphides

that may constitute small tonnages of high-grade ore. The locality should also be prospected further for the occurrence of additional veins.

Several hundred feet southerly from these showings, and on the top of the ridge at 1,350 feet elevation, a quartz vein 6 to 7 feet wide, mineralized with sparse blebs of pyrite and chalcopyrite, is exposed in altered schist here probably in thin covering over the underlying granite. This vein strikes east-west and can be traced by natural exposures for about 300 feet. A selected sample of sulphides from this vein assayed: Gold, *nil;* silver, *nil.*

Bald Mountain.

This is an old group of claims situated on Porcher island, about 2½ miles from the head of Jap inlet, off Edye passage. A good trail leads from Jap inlet to the property. There is a cabin at elevation 400 feet and the showings and workings are around 700 feet elevation and north-easterly from cabin. The property was formerly operated by the International Copper Company and is described in the Annual Report for 1916.

The formation consists of highly metamorphosed and thinly laminated schists and gneissic rocks (probably resultant from triassic sediments) intruded in places by pegmatite dykes. The schists strike generally east-west and dip 70° north. In places the schists are quartzitic and garnetiferous, featured by a high epidote content and pronounced flow-structure. Evidence indicates these roof-rocks were deeply buried below the zone of fracture and within the zone of rock-flowage before the period of uplift, and then subjected to dynamic and contact metamorphism during the period of uplift and batholithic injection.

The showings consist of small lenticular and dispersed segregations of a sparse mineralization, generally high-temperature minerals such as pyrrhotite, magnetite, and chalcopyrite. What was formerly interpreted as a wide zonal shear-structure containing these small dispersed mineral segregations can be interpreted to be an areal flowage-structure on the border of the zone of cleavage unfavourable for sustained mineral concentration. Appreciable stripping, open-cutting, sinking, and some tunnelling, based on structural misinterpretation, has been carried out, as well as extensive open-cutting on a wide unmineralized pegmatite dyke.

R.K.

This group of three claims, owned by G. F. Kemp and associates, of Jap inlet, Porcher island, is situated near the south shore of a lagoon about 2 miles west of Jap inlet. The showings are located about 300 feet from the shore in low-lying ground, heavily covered with muskeg and about 50 feet above sea-level. The formation of this area consists of mica-schists with small granitic absorption zones, representing the roof-horizon of the older triassic rocks thinly overlying the buried granitic batholith. Before erosion and at the time of batholith injection the locality was probably deeply buried by a thick covering of roof-rocks and the horizon now exposed is indicated as being within the zone of rock-flowage.

A trench, about 50 feet long through 4 feet of overburden, has exposed a lens of glassy (high temperature) quartz about 10 feet long and 3 feet wide, striking 10° W. (mag.) and dipping 70° east, conformable to the attitude of the schist. A selected sample of the sparse pyrite mineralization in the quartz assayed: Gold, *nil;* silver, *nil.*

Marion.

This claim, staked by L. W. Patmore, of Prince Rupert, is situated on the north side of the North arm of Kitkatlah inlet, Porcher island, and about 1 mile from the shore. The geology of the area consists of triassic sediments and lavas occupying a low-lying section fringing the shore and inland up to 700 feet elevation, from which the quartz diorite of the underlying batholith is exposed in the steeply rising mountain-slope. Lamprophyre, aplite, and pegmatite dykes intrude both the granitic and overlying rocks.

The showing consists of a quartz-filled shear-structure, a few inches to several feet in width, and varying in strike from west to north-west with a dip 70° to the south in a country-rock of quartz diorite. This is exposed in a small deeply cut creek-depression which rises steeply between elevations 900 and 1,200 feet. The showing consists of quartz stringers and veins up to 2 feet width in crushed and sheared diorite. In a few places the shear probably strikes out of the creek-bed and is covered by the heavy overburden on the right bank. This is also probably the case at the upper limit of the exposure at 1,200 feet elevation, where the angle of slope increases by about 10°. Mineralization is comparatively sparse and consists of blebs and small bunches of pyrite. Two samples of the pyrite from the lowest and highest exposures both assayed: Gold, *nil;* silver, *nil.*

Non-metallics.

Several deposits of fair-grade sericitic mica, varying in colour from white to greyish-white, have been discovered in the Tuck Inlet area contiguous to Prince Rupert and also in the Baker Inlet section about 35 miles south of Prince Rupert. A small amount of work has been done on these deposits and samples submitted to Provincial consumers have aroused some interest. The deposits are at present handicapped by a restricted market, but, should this expand, the location of the deposits contiguous to deep-sea transportation would assist their exploitation.

Extensive deposits of limestone and marble occur contiguous to seaboard at many places along the coastal area, as at Kumealon inlet, Banks island, James island, and King island.

KITSUMGALLUM LAKE SECTION.

During 1933 assessment-work and some prospecting has been carried out on several claims in the Maroon and Goat Mountain area. In the 1928, 1930, and 1931 Annual Reports there are detailed descriptions of the most important properties and recent developments, and in Bulletin No. 1, 1932, the geology is described and the properties classified. Prospecting during 1933 extended over the divide into the Lorne Creek area and promising discoveries of veins carrying gold values are reported by J. Thomasson, of Prince Rupert, and A. Johnson, of Dorreen.

Placer-mining.

Placer aspects of this section are described in Bulletin No. 1, 1933. During 1933 from twenty to thirty individuals have been active on Douglas creek and prospecting has extended to the head of the creek, where a nugget weighing 6.27 oz., the biggest so far discovered on this creek, was found by T. Ekman and O. Foslund. Continued high water impeded the operations of individuals on this creek and only small recoveries have been made. At the low-water period, and just when equipment was nicely installed for shovelling, a sudden and extensive flood practically cleaned out the creek and caused grave loss and discouragement to these prospectors, who have been very creditably bucking the tide of adversity with hard work for several years.

LAKELSE SECTION.

This area is described in detail in the 1930 Annual Report. Those interested in the lode-gold possibilities and geology of the area are invited to study the introductory sections of Bulletin No. 1, 1932, pages 14 to 21.

During 1933 further assessment-work on the Thornhill Mountain claims and some prospecting in the Williams Creek area was carried out. The *A and B* on Thornhill mountain was optioned to an individual operator and the tunnel continued and side-swiped on a flat vein in search of a possible high-grade gold-pocket. This objective was not achieved and the option was relinquished. In this section attention of exploratory operators is especially directed to gold possibilities in the *St. Paul* group.

NASS RIVER DIVISION.

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

During the first part of 1933 a strike at Anyox necessitated the suspension of operations for a short period. With very creditable energy and organization, operations were quickly resumed and have continued on a normal capacity basis, the mill treating about 5,000 tons of ore daily. At the close of 1933 employees in offices, mine, mill, smelter, and coke plant numbered about 1,075 and the pay-roll was about $125,000 per month.

Production has been steadily maintained and with the improved copper price stock blister-copper shipments have been facilitated. At *Hidden Creek* a feature of the mining has been the breaking of large ore-tonnage from old stope-sills and bottoms by large-blast mining methods.

During the year 1,268,000 tons of ore is estimated to have been broken by this method in thirty-two large-blast operations. In one large blast 500,000 tons of ore was broken with the use of 1 lb. of explosive for each 5.6 tons of ore. The big-blast operations during 1933 required the drilling of 14,996 holes 14 to 20 feet in length, and the driving of 2,060 feet of powder drifts. This procedure results in an appreciable reduction in mining costs and thereby extends the possible ore reserves in the mine.

In the old workings of the *Granby Point* mine detailed sampling of the quartz vein in argillite revealed gold values varying from 0.25 oz. to more than 1 oz. per ton in some of the

pillars and remaining portions of the vein. This work made available about 10,000 tons of good-grade gold-bearing siliceous flux and it was being mined at the rate of about 1,000 tons per month during the latter part of 1933. This vein, from 2 to several feet wide, lies at a flat attitude more or less conformable to the argillites and is mineralized with zinc-blende, galena, pyrite, and some chalcopyrite. Samples taken to determine possible surface enrichment assayed as follows:—

Description of Sample.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
(1.) Unoxidized quartz mineralized with zinc-blende, pyrite, and some galena	0.2	14.0	*Nil*	0.6	1.0
(2.) Oxidized quartz, otherwise similar to sample No. 1	0.6	35.5	*Nil*	Trace	1.0
(3.) Unoxidized banded quartz vein with ⅛-inch bands and dark halos of graphitic and micaceous material along small straight and curved compression-fractures, showing sparse sulphide mineralization	0.76	11.0	*Nil*	*Nil*	*Nil*

These samples and assays, taken in conjunction with the structural attitude of the vein, indicate gold and silver enrichment in the outcrop-zone and along parallel compression joints or fractures to a shallow depth below. The enrichment occurred subsequent to folding and around the eroded apex of an anticline. These notes may be of interest in connection with the appraisal of other similar occurrences.

At the *Bonanza* mine, production has been maintained and exploration has been carried out on the north side of the second level with indications of ore and structure continuity. On the south side, development has carried continuity of the ore-zone in a south-westerly direction with encouraging results. A new raise has been driven from the main tunnel-level to facilitate mining in this extension of the workings.

During 1933 *Hidden Creek* mine operated 341 days and produced 1,404,519 tons of ore; the *Bonanza* mine in 335 working-days produced 128,124 tons of ore; and *Granby Point* mine, with 125 working-days, produced 5,987 tons.

Alice Arm Section.

Although the Alice Arm section has been dormant from an operating standpoint, some very useful work has been done by prospectors on several claims, particularly on the *Tyee*, *Highland*, and *Summit* groups. The gold possibilities of the west side of the upper Kitsault valley have become more definitely apparent, especially on the *Homestake* group, where sampling is reported to show good gold values across appreciable widths. Plans are being made for further development in the spring. With a stable and reasonable price for silver, the many promising properties in the Alice Arm area are certain to attract attention.

During the period of recent inactivity in this area the Dolly Varden Railway has been unfortunately neglected in the matter of required maintenance and repair. This railway is the main artery of transportation into and along the Kitsault River valley and from it trails radiate to many promising prospects. From its upper terminus a good road leads to the upper Kitsault valley and lateral trails serve several promising prospects. The railway artery is the only present means of transportation for the Kitsault River valley and its upkeep and availability is vital to activities in this area. It is consequently urged that this railway be kept in an efficient condition of repair and the right-of-way cleared of ingrowing brush and other periodical obstructions.

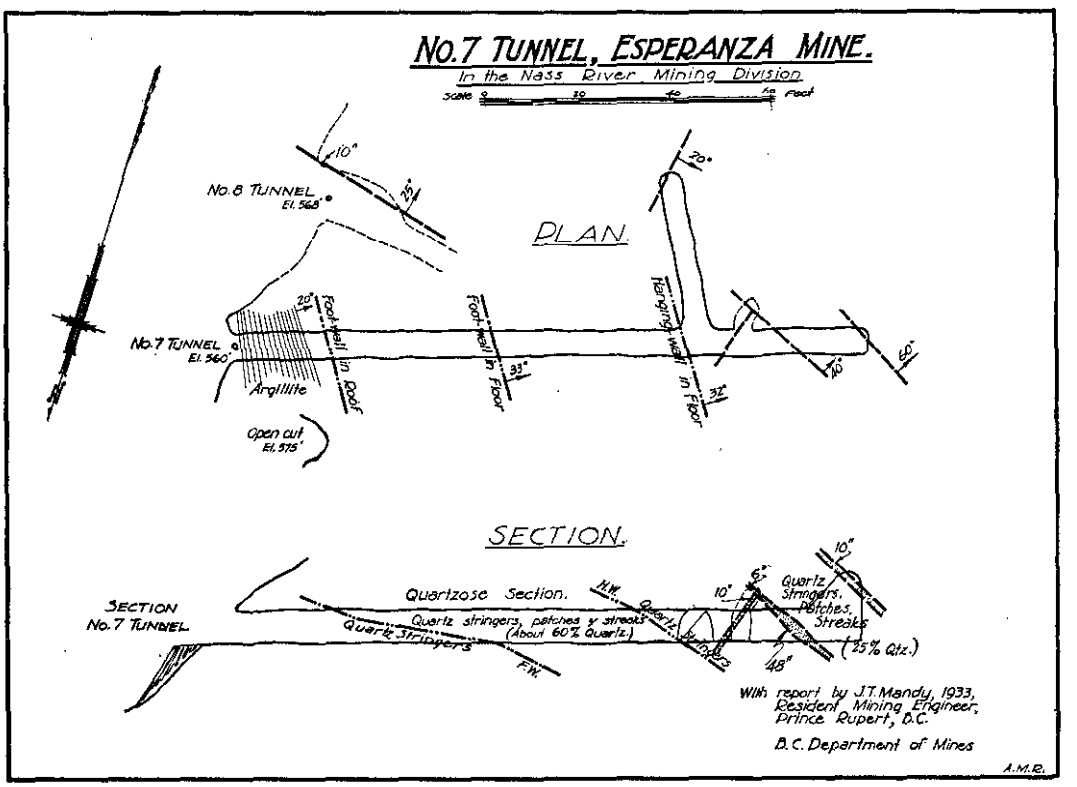
Kitsault Valley Section.

For information about the many promising properties in this section those interested are referred to former Annual Reports.

Brown Bear. This old group of claims, owned by G. Casey, of Prince Rupert, and partner, is situated about 2½ miles from Alice Arm, on the southerly slope of McGrath mountain, and half a mile from the Illiance River road. The property is

described in the 1916 Annual Report under the heading of *Casey* group. Some recent work was done on a showing that was thought by the owners to possibly contain uranium mineralization and the property was examined mainly to obtain clarity on this point.

At elevation 375 feet, open-cutting exposes a zone 14 feet in width composed of stringers of quartz and calcite in altered argillite and tuff. The zone strikes N. 30° E. (mag.) and is mineralized with a few specks of pyrite. No signs of uranium mineralization are to be observed. At 500 feet elevation and about 1,000 feet east of the first showing an old open-cut and incline shaft exposes a quartz-barite vein, 4 feet wide, striking east-west and dipping 10° south. Mineralization consists of galena, mispickel, pyrite, and some zinc-blende. A selected sample from this assayed: Gold, trace; silver, 0.6 oz. per ton. About 500 feet east of this, at 545 feet elevation, an open-cut and shallow shaft exposes several feet of similar vein-matter with some pyrite, galena, and zinc-blende. On account of the comparatively flat topography of this area the ground is heavily covered with overburden, and although the locality is favourable for the occurrence of silver-zinc-lead ore-bodies, detailed prospecting is difficult.



Esperanza. This property is described in detail in former Annual Reports. Because of interest in the showings in No. 7 tunnel it was examined to establish some clarity in this respect. No. 7 tunnel is a crosscut about 140 feet long on an approximate bearing of S. 73° W. (mag.). At 99 feet from the portal a 35-foot drift, bearing S. 8° E. (mag.), has been excavated and at 111 feet from the portal a small stope has been mined for about 4 feet in the roof of the tunnel. Slightly north-westerly of No. 7 tunnel portal and 15 feet higher in elevation a small open-cut exposes a quartz vein about 3 feet wide.

No. 7 tunnel portal lies 8 feet lower and 40 feet N. 23° E. (mag.) of No. 8 tunnel portal. It crosscuts the argillite formation, which is slightly folded and strikes south-easterly, with a south-westerly dip of from 20° to 30°. At 21 feet in from the portal, and adjacent to a slip dipping 80° east, the tunnel enters the foot-wall of a quartz vein entering the roof, apparently conformable with the formation. At 36 feet in from this point the foot-wall of the vein dips

into the floor at an angle of 30° and the tunnel crosscuts what appears to be the body of a vein for about 42 feet, at which point what seems to be the hanging-wall dips into the floor on the south side of the tunnel at an angle of 32°. Should this body of quartzose material exposed in this stretch of the tunnel represent one vein, it would have a true width of 22 feet. The material exposed is not solid quartz, but consists of masses, patches, stringers, and replacement areas of quartz in the argillite, the quartz representing about 60 per cent. of the whole. Stringers of quartz lead from the main mass into both the hanging- and foot-wall country and consequently the lens or vein may have a greater width than that indicated in the tunnel section. Mineralization is sparse and consists of small streaks and patches of pyrite, mispickel, some zinc-blende and galena. These seem to be developed mainly along the walls and cross-fractures. Practical information regarding the values in this exposure requires closely spaced channel-sampling, bulk-sampling, or a combination of both methods.

In the short east drift a quartz vein is intersected 9 feet from the face. It strikes N. 40° W. (mag.) and dips 20° south, cutting across the face, which shows a width of 43 inches of stringers and blebs of quartz. Mineralization is sparse and irregular and consists of small patches and streaks of pyrite, mispickel, some galena and zinc-blende. In the small stope, 15 feet west of the east drift, two quartz veins, 6 and 10 inches wide respectively, are exposed. The larger vein is intersected and faulted by the smaller vein.

The continuation of the main crosscut for 27 feet from this stope to the face intersects the smaller stope-vein, which widens to about 4.5 feet and splits into two branches, with the foot-wall branch dipping into the floor of the east side 12 feet from the face. The hanging-wall branch, about 10 inches wide, continues along the roof with good definition and with stringers and blebs of quartz branching into the foot-wall. Streaks and blebs of quartz, 1 to 12 inches wide, constitute about 25 per cent. of the main crosscut face for a height of 8 feet to the foot-wall in the roof.

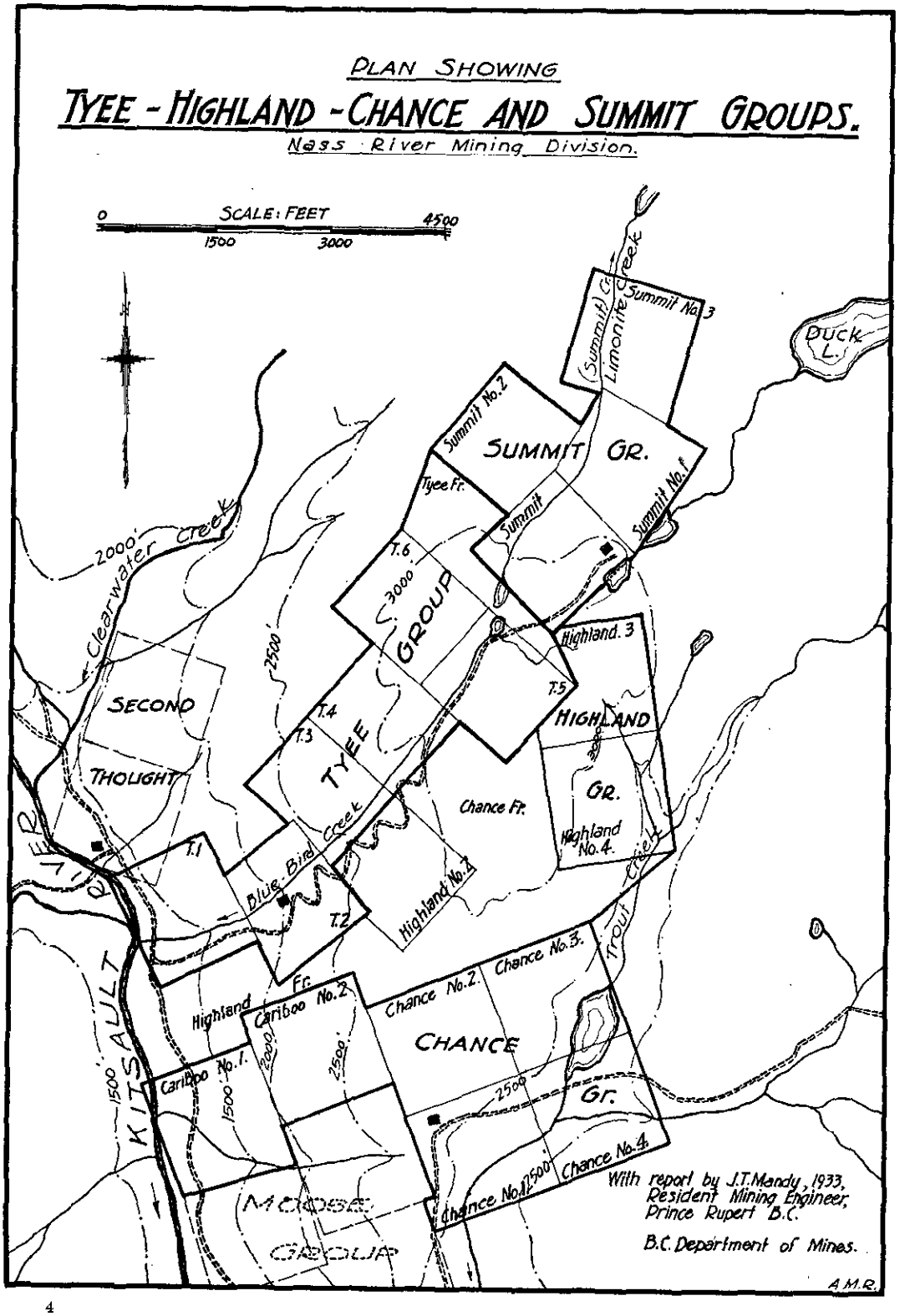
Tyee and Highland.

These groups, owned by Archie McPhail, of Alice Arm, are situated on the east side of the Kitsault River valley, about 4 miles from the terminus of the Dolly Varden Railway at Camp 8. A branch trail from the main Kitsault Valley trunk trail extends through the property. The *Tyee* group comprises six claims and a fraction, extending along Blue Jacket creek from the Kitsault river at 1,300 feet altitude to the summit of the ridge at 3,300 feet altitude. The *Highland* group comprises three claims and two fractions located easterly of the *Tyee*. The cabin is on the *Tyee No. 2* at elevation 1,925 feet, about half a mile from the valley-bottom.

For a general description of the showings and geology of these groups, readers are referred to the 1930 Annual Report. The so-called "*Bluebird*" vein strikes through the *Tyee* group from elevation 2,300 feet, with a fairly continuous outcrop to the summit. Beyond this point and on the *Summit* group, intermittent outcrops are locally correlated with the "*Bluebird*" vein, but further exploration is required to definitely establish this continuity. On the *Tyee* the "*Bluebird*" vein strikes generally north-easterly and dips from 40° to 70° west. The attitude of the vein is apparently conformable with the formation of argillite and interbedded tuffs. It is a brecciated vein varying in width from about 6 to 15 feet, cemented with quartz and some calcite, but mineralized very sparsely on surface in places with a little galena and pyrite. In some exposed sections both the hanging and foot walls of argillite and tuff are sheared and oxidized for appreciable widths, carrying stringers of quartz and calcite with sparse mineralization of pyrite, galena, and zinc-blende. In the east, or foot-wall country, bands of light and dark tuff strike towards the "*Bluebird*" vein. In four places where these have been opened up, the dark-tuff bands show some quartzose replacement with stringers and reticulated veinlets of galena across appreciable widths.

In No. 1 cut in the tuff area at elevation 2,225 feet, on the north side of a branch creek to Bluebird creek and about 600 feet easterly of the cabin, 10 feet of fair mineralization is exposed. It is mainly pyrite and galena with some grey copper, with a cross-structure of joint-planes ½ to 1 inch wide, containing stringers of steel galena. The south or hanging-wall side shows 12 feet of scattered mineralization, principally pyrite and galena. A 1-foot-wide quartzose-band on the foot-wall side carries some grey copper and what appears to be flakes of argentite.

At elevation 1,775 feet on the south bank of Bluebird creek a 6-foot tunnel has been excavated in quartzose, brecciated and sheared argillite, with some pyrite mineralization. At


PLAN SHOWING
TYEE - HIGHLAND - CHANCE AND SUMMIT GROUPS.
Nass River Mining Division.
0 SCALE: FEET 4500
1500 3000
Summit Cr.
Limonite Creek
Summit No. 3
Duck L.
Summit No. 2
SUMMIT GR.
Tyee Fr.
Summit
Summit No. 1
2000'
Clearwater Creek
T.6
3000
GROUP
2500'
Highland. 3
T.5
SECOND
THOUGHT
T.4
T.3
TYEE
HIGHLAND
GR.
Chance Fr.
Highland No. 4.
Blue Bird Creek
T.1
T.2
Highland No. 1
Trout Creek
Highland Fr.
Cariboo No. 2
Chance No. 2
Chance No. 3.
CHANCE
Cariboo No. 1.
1500'
2500'
Gr.
KITSAULT
Chance No. 1
2500'
Chance No. 4
With report by J.T. Mandy, 1933,
Resident Mining Engineer,
Prince Rupert B.C.
B.C. Department of Mines.
A.M.R.

elevation 2,480 feet, on the south side of the creek, a tunnel 12 feet long crosscuts alternating bands of light and dark tuffs, with some galena mineralization in the dark tuff. This showing is adjacent to the foot-wall of the "*Bluebird*" vein, which parallels the creek. In the gully of Bluebird creek, at 2,625 feet elevation, No. 6 cut has been excavated for 17 feet across the hanging-wall side of the "*Bluebird*" vein. This cut exposes interbedded dark tuffs and argillite, some quartzose replacement, quartz and calcite stringers, and scattered, somewhat sparse mineralization of pyrite and galena. The exposure is appreciably oxidized and the open-cut has not completely cross sectioned the probable width of hanging-wall mineralization. The foot-wall section, comprising about 15 feet of brecciated and vuggy quartzose material of the "*Bluebird*" vein proper, has not been explored. In the foot-wall country and 10 feet southerly of the "*Bluebird*" vein foot-wall, No. 5 cut exposes stringers of steel galena across a width of 15 feet in a band of grey tuff. To determine continuity of mineralization this band of tuff should be stripped and test-pitted in a south-easterly direction.

No. 7 cut, at 2,700 feet elevation, has been excavated for 10 feet in grey-tuff foot-wall of the "*Bluebird*" vein and exposes stringers of galena across a width of about 5 feet, striking N. 30° W. (mag.) towards the "*Bluebird.*" At elevation 2,740 feet, and adjacent to the foot-wall of the "*Bluebird*" vein, an 18-foot tunnel has been driven across bands of light and dark tuffs, exposing galena and pyrite mineralization at the portal across a width of 4 feet in a band of grey tuff striking N. 15° W. (mag.) and dipping 50° W.

On the *Highland No. 3*, at elevation 3,500 feet, a series of small cuts, extending over a distance of 300 feet and across a formation of grey tuffs striking N. 30° E. (mag.), exposes stringers and veinlets of quartz up to 12 inches in width, with an irregularly distributed mineralization of fine-grained galena, striking N. 25° W. (mag.). A. McPhail deserves credit for having carried out some very informative prospecting on these groups.

Summit. This group of four claims, owned by A. Davidson, of Alice Arm, is situated on the north slope of the ridge to Clearwater creek at from 3,100 to 3,200 feet elevation. It adjoins the *Tyee* group on the north-east and is reached by travelling over the divide from Bluebird creek and along the valley of Summit creek to the cabin. The easterly showings are described in the 1930 Annual Report. During 1932 and 1933 some useful prospecting has been done in the north-westerly area of the claims along the projection of the "*Bluebird*" vein. A number of small pits and strippings expose a scattered mineralization of galena, with probably some mispickel and zinc-blende, in streaks, veinlets, and disseminations. The correlation of these various showings is not clear, but they appear to occur in parallel bands of grey tuff, as exposed on the adjoining *Tyee* ground. At the westerly end of the work a tunnel 12 feet long has been driven across 6 feet of brecciated quartz which may be the continuation of the "*Bluebird*" vein. To definitely determine this correlation further exploration by trenching is required.

Homestake. This group of claims is situated at the head of the Kitsault valley, on the west side above the glacier. It is about 8 miles by fair trail from the terminus of the Dolly Varden Railway. The property is owned by A. Davidson, Gus Pearson, and partners, and several years ago was under option to the Consolidated Homestake Mining and Development Company, Limited, and that company did some stripping, open-cutting, and tunnelling. Past exploration-work is described in the 1918 and 1921 Annual Reports.

The mineral occurrence consists of a main silicified zone, up to 30 feet wide and striking N. 7° W. (mag.), with a northerly dip. It is mineralized in places with veinlets and disseminations of pyrite, galena, zinc-blende, and chalcopyrite. Several cross-veins striking about N. 70° E. occur on the lower side of the main zone. Open-cuts on one of the cross-veins exposes encouraging mineralization in places. In the crosscut tunnel to the main zone some good quartz replacement widths carrying scattered, but sparse, mineralization have been penetrated. It would seem that the various showings are worth thorough sampling and the quartz-zones in the tunnel should be carefully channel-sampled to determine their possible gold content.

At the end of 1933 some sampling at one of the zones exposed by open-cutting is reported to have shown values of from 0.48 to 1.12 oz. gold per ton, across widths of 12 and 26 feet. A granitic cupola structure favourable for the occurrence of gold-bearing ores is found in this locality on the west side of the upper Kitsault River valley, and gold values characterize showings on neighbouring properties. The area warrants intensive exploration.

PORTLAND CANAL MINING DIVISION.

The geological features of this Division have been covered in previous Annual Reports, especially those for 1929 and 1930, and in Bulletin No. 1, 1932. During 1933 mining activities have shown a steady increase and opportunities for small-scale operations on high-grade silver or silver-gold ore-bodies were taken advantage of. The feature of 1933 has been the successful results achieved by lessees on high-grade silver-gold showings on the *Dunwell* and *Spider* properties, and on a good-grade gold-showing on the *Ben Ali* claim of the *Dunwell*. The success of these undertakings has done much to attract attention to the economic possibilities of many promising properties in the Stewart area when operated in a miner-like manner.

Detailed prospecting has been done on many of the old properties with good results. In this respect the *Dunwell*, *Ben Ali*, *Spider*, *Kenneth* (Argentine Syndicate), *United Empire*, *Ben Bolt*, *L.L. & H.*, *Lucky Date*, *Unicorn*, *Salmon Gold*, *Troy*, and several properties in the Marmot River area may be mentioned. This type of work is particularly useful and the detailed prospecting of old properties in the known mineralized areas of the Bear and Salmon rivers has a good chance of being rewarded with additional discoveries of importance that would materially enhance the value of the properties and the commercial possibilities of the Stewart area. The concentration of such work in the known mineralized sections which are already served by road and trail facilities, and which have as yet been only superficially prospected, would bring surer, quicker, and more substantial development activities to the Stewart area than the dispersal of such work in sections of the Portland Canal of unknown possibilities and remote from transportation. There are sufficient attractive possibilities in the immediate vicinity of Stewart, as yet only very sparingly explored, to occupy the attention of prospectors for many years. Through the results achieved in the last three years the Stewart area has been placed on a sound foundation for steady future progress.

Georgia River Section.

Helena Gold Mines, Ltd.

(*See* previous Annual Reports under Georgia River Gold Mines, Limited.) A detailed description of recent workings is given in Bulletin No. 1, 1932, and in the 1932 Annual Report. Helena Gold Mines, Limited, was incorporated in 1933, with a capital structure of 2,000,000 shares of $1 par value, to acquire title and assets of the Georgia River Gold Mines, Limited. The office of the company is at 902 Credit Foncier Building, Vancouver.

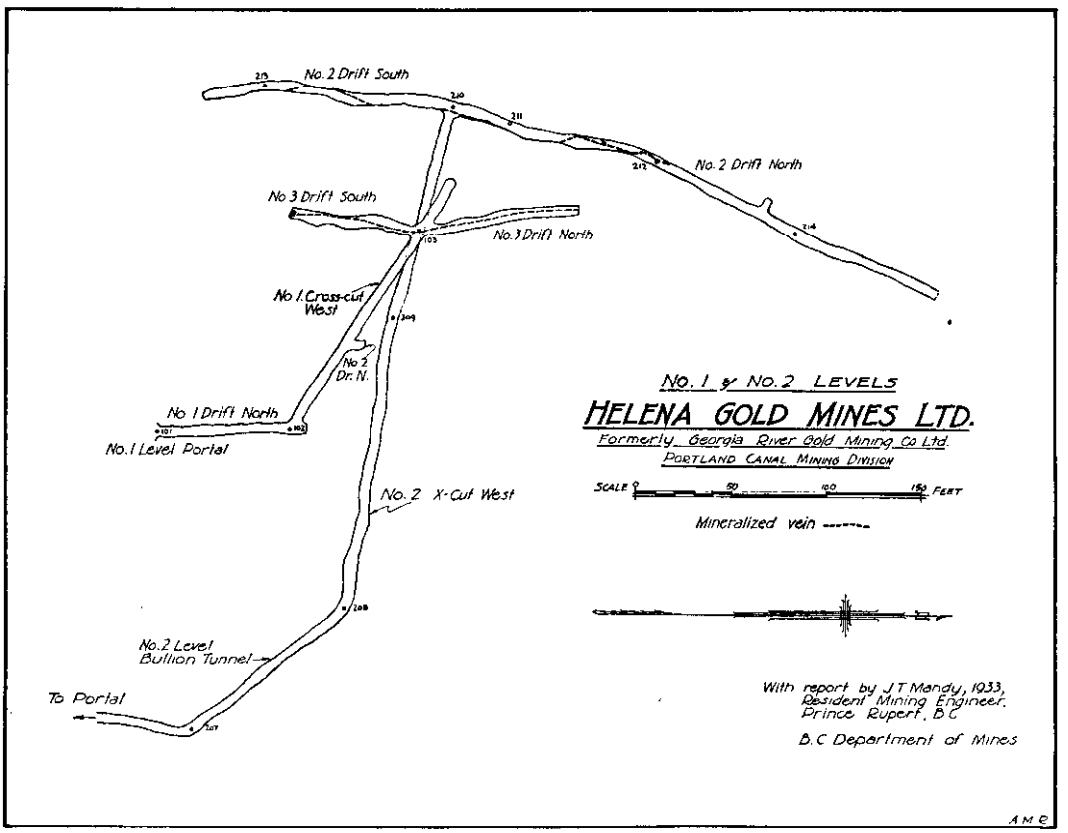
Seasonal exploration-work with a crew of eleven men was started by the company at the end of June and suspended in October. The work consisted of nine diamond-drill holes aggregating about 3,050 feet, in which it is understood no values of importance were encountered. Underground work was concentrated in drifting on the south-west vein intersected in the cross-cut on *Bullion* tunnel-level at elevation 3,350 feet. The south drift on this level, about 135 feet long, shows for the first 90 feet a quartz vein, 1 to 14 inches wide, with fair but erratically distributed mineralization in a few places. Beyond this the vein pinches and the south-drift face shows a fracture only 3 inches wide. The north-drift showing is better, but still erratic in structure and mineralization, and for a length of about 125 feet the vein varies from 3 to 30 inches wide. In some places along this vein-length in the north drift good mineralization from which good gold values are reported can be seen. From this point to the face (at the time of examination, September 29th, 1933), about 150 feet farther, the vein consists of small lenses of barren quartz with calcite stringers, gradually diminishing to about 2 inches of barren quartz in the face. The north drift was being continued to penetrate the andesitic formation and explore for the mineralization showing on surface in the creek to the north.

Previous work on this vein in the No. 1 tunnel-level at 3,600 feet elevation showed vein-widths of 4 to 30 inches over a length of 65 feet in the south drift, and vein-widths of 5 to 8 inches over a length of 50 feet in the north drift, with good gold values reported. To correlate this small shoot with that in the *Bullion* tunnel requires raising and sub-level exploration. As this vein is narrow it does not promise large tonnage possibilities, and it should be pointed out that any possible stoping operations over practical mining widths would be accompanied by appreciable dilution of values, an important factor in valuing the mineral-showing.

The statement in a pamphlet issued concerning Helena Gold Mines, Limited, that "visible gold is frequently observed" is by no means substantiated by fact. Free or visible gold has

not been observed by the Resident Engineer; it is not a characteristic of the ore where such does occur; and it can be stated that if it has been observed by others it is of extremely rare occurrence. The small shoots of good-grade ore that have been uncovered show a characteristic mineralization of mainly galena, zinc-blende, pyrrhotite, and pyrite with gold values.

Since the last work, reported in Bulletin No. 1, 1932, No. 3 tunnel has been extended north of the raise to the *Bullion* tunnel-level, along the shear-structure, with a crosscut (No. 4 crosscut west) for about 40 feet to the west. In the southerly section of No. 3 tunnel, No. 1 crosscut east and No. 2 crosscut west and No. 2 drift north have also been driven. The work during 1933 was very efficiently carried out under the superintendency of J. C. McCutcheon.



Pedro Georgia River Syndicate.

(*See also* 1928 Annual Report.) This property includes sixteen claims, and although several showings are reported to occur on it the showing specially examined was the vein-structure located on the *Pedro* claim. This has been opened up by two tunnels, on which work was being continued. These tunnels explore a quartz vein which outcrops along the bed of a steep creek-gulch. The vein strikes S. 30° E. (mag.) and dips 50° west in a formation of andesitic volcanics intruded in places by granitic dykes. The upper tunnel, on a S. 37° E. (mag.) bearing and 90 feet long, is 1,000 feet above the Georgia River valley-bottom. The vein, intersected 6 feet from the portal, shows a width of 5.5 feet of quartz with sparse pyritic mineralization, rapidly diminishing to a generally barren and sheared fissure about 10 inches wide. The face of the drift is in feldspar porphyry, the vein showing a width of 14 inches of sheared material containing some blebs of quartz and calcite and a sparse impregnation of pyrite. At 12 feet from the portal a crosscut to the north intersects a quartz stringer 6 to 10 inches wide containing some pyrrhotite. This has been drifted on for 14 feet, showing an erratic vein-continuity with blebs of quartz and some cross-shearing. At this point there is a crosscut for 24 feet to the north-east along a small cross-fracture.

The lower tunnel, 50 feet lower in elevation, which starts as a crosscut, has been driven about 150 feet along a general south-easterly bearing. A granitic dyke cuts through near the portal. At 70 feet from the portal a small shear, containing blebs of quartz, comes in on the north side and has been drifted on to the north for about 20 feet. The face of the main tunnel is in andesitic rock and shows a sheared fissure 14 inches wide with blebs of quartz and iron oxide. At the face there is a crosscut into the foot-wall for 10 feet.

The exposed mineralization in general consists of small erratically distributed bunches and blebs of pyrite, chalcopyrite, and pyrrhotite, with some galena and zinc-blende. A selected sample taken from a small dump of about 1½ tons of this material at the upper tunnel portal assayed: Gold, 1.4 oz. per ton; silver, 13 oz. per ton.

The geology of the area is favourable for the occurrence of gold-bearing ore-deposits and the claims should be intensively prospected for additional showings. In the event of further exploratory work being undertaken in the tunnels described, it should be done along the main shear showing (in the tunnel-faces) for the purpose of picking up the possible occurrence of fair-sized lenses of ore. It is suggested that this vein first be prospected along its outcrop for the occurrence of lenses or ore-shoots, which should then be further explored by open-cutting and tunnelling.

Bulldog Creek and Marmot River Sections.

Prospecting and exploratory work was carried out on several properties in these areas and new discoveries of gold-bearing ores were reported. Properties worked included the *Marmot Engineer*, *Bi-Metallic*, and *Monday* groups. The Marmot River South Fork area and that of the headwaters of Bulldog creek are occupied by a granitic cupola structure which should be prospected in detail for gold-bearing ores, both in the roof-rocks and in the granitic rocks adjacent to the contact. Other than maintenance and some repair-work on the aerial tramway, no mining operations were carried out at the *Porter-Idaho* and *Prosperity*. The *Silverado* was also inactive. Properties in these sections are described in former Annual Reports.

Bear River Section.

Exploration and assessment-work in this section was carried out on several properties, including the *Kenneth* (Argentine Syndicate), *Ben Bolt*, *L.L. & H.*, *Lucky Date*, and others. These and other properties in this area as well as those in the American Creek area are described in former Annual Reports. Interest during 1933 was mainly centred in the *United Empire* and *Dunwell* operations.

United Empire Gold and Silver Mining Co., Ltd.

(*See* former Annual Reports; also Bayview Mining Company, Limited.) After acquiring the *Lucille*, *Third Fraction*, and *Beth* claims from the Bayview Mining Company, the United Empire Company commenced extensive exploration at the beginning of August, 1933. With the assistance of the Department of Mines a new and more practical trail to the property was completed. Surface-stripping and open-cutting on several veins exposed good widths of galena and zinc-blende mineralization carrying high silver values, while open-cutting on the siliceous zone mentioned in the 1930 Annual Report exposed promising mineralization across appreciable widths.

A power-house and a commodious bunk-house were erected close to the main tunnel. The property is also equipped with an efficient assay plant in charge of Neill Monro. Operations are being carried out under the supervision of W. Dann.

Extensive surface-stripping and open-cutting was done on the Thomson and Brindle veins, about 1,400 sacks of high-grade ore being produced from this work. At elevation 2,940 feet and south-easterly from the Dann tunnel a vein occurring in tuff was stripped and open-cut on the north side of a creek. This vein strikes N. 55° W. (mag.) and dips 85° south, and at this locality shows 24 inches of heavily oxidized outcrop with some zinc-blende and galena. The vein can be traced to altitude 2,900 feet, where it crosses the creek. At this altitude and 25 feet westerly of the lower section of this vein the "Thomson" cut exposes a fracture replacement-zone, with quartz and calcite stringers, about 8 feet wide, striking N. 35° W. (mag.) and dipping 70° south. The zone is fairly well mineralized with massive galena and zinc-blende in bunches, stringers, and lenses from 2 to 3 inches wide. These two veins should intersect above the "Brindle" tunnel and the section is promising for the occurrence of good widths of mill-grade ore. About 450 sacks of selected ore estimated to assay about 200 oz. of silver per ton

had been produced up to the time of examination (September 28th, 1933). The "Thomson" vein has been traced for about 100 feet southerly to above the "Twin Tunnels" (Trites and Heideman). These two old tunnels at 2,776 feet elevation, both crosscutting for the "Thomson" vein about 150 feet ahead, are about 30 feet apart and bearing at a slight angle to each other. The "Trites" tunnel winds at an acute angle to the estimated strike of the vein for about 100 feet. The present company has turned the tunnel south with a bearing of S. 77° W. (mag.), and at the time of examination the face showed disseminations of pyrite and some vein-structure indicating the possible proximity to the objective. It is reported that the vein was intersected on October 1st, 1933, showing a width of 9 feet and carrying good values.

An open-cut was being excavated on the "Brindle" outcrop at 2,600 feet elevation, where the vein is about 6 feet wide, strikes N. 65° W. (mag.), and dips about 80° south. On the hanging-wall side there is a 30-inch width of massive galena and zinc-blende with stringers into the body of the vein. The foot-wall is heavily oxidized and sheared. When examined in September last, three men were sacking ore from this cut and 280 sacks of selected ore had been produced. This showing on this vein is adjacent to the granite-contact and the vein gradually fades out about 30 feet south of the cut as it enters the hybrid contact-rocks which merge into the granite intrusive some 60 feet south.

The old "Brindle" tunnel at 2,550 feet elevation, aimed to crosscut the above vein, has its portal in hybrid rocks just north of the actual granite-contact. The inside section of the tunnel, which was driven in a S. 80° W. (mag.) direction, was unfortunately turned southerly into the main mass of the granitic intrusive, with the face heading S. 25° W. (mag.). Any further exploratory work contemplated in this tunnel could best be accomplished by continuing the main tunnel along its original S. 80° W. (mag.) bearing until it is well within the contacting andesitic rocks, when, if it has not already intersected the "Brindle" vein, a survey should indicate the direction for crosscutting to pick up the vein.

The "Dann" tunnel has been advanced 12 feet beyond the cross-vein (*see* 1929 and 1930 Annual Reports), with the tunnel-face bearing N. 60° W. (mag.). A sample across the tunnel-face (as at September 28th, 1933) assayed: Gold, trace; silver, 1 oz. per ton; lead, *nil;* zinc, 1 per cent. The cross-vein shows about 30 inches with some mineralization of galena, zinc-blende, and ruby silver.

The higher area around the workings described is open to snowslides and not a safe location for permanent operations. To establish a permanent main working-site a crosscut tunnel was started in October at 2,720 feet elevation, about 50 feet lower and 1,600 feet from the "Trites" tunnel, and about 600 feet from the new bunk-house. This low-level tunnel will also explore the intervening ground for additional vein occurrences.

Towards the close of 1933 snow retarded the placing of power machinery, but creditable progress was accomplished by hand-work. Equipment at Stewart awaiting placement included a 261-cubic-foot compressor, blower, motor, Gardner Denver drill, and sharpener equipment. The power-line from the *Dunwell* plant to the property was completed at the end of 1933. It is understood that, when weather conditions permit, an aerial tramway down the mountain will be installed. With normal weather conditions prevailing, power should be turned on at the mine early in 1934. Credit is due W. Dann for his energetic conduct of the work.

Dunwell Mines, Ltd.

(*See* former Annual Reports.) Successful leasing operations have been continued on this property by individuals, with the result that additional ore possibilities have become evident. This work resulted in the shipment of over 500 tons of high-grade silver-gold ore from the old *Dunwell*. From the *Ben Ali* 102 tons of ore assaying 1.4 oz. gold per ton and 23 oz. silver per ton was shipped and an appreciable tonnage is on hand awaiting shipment.

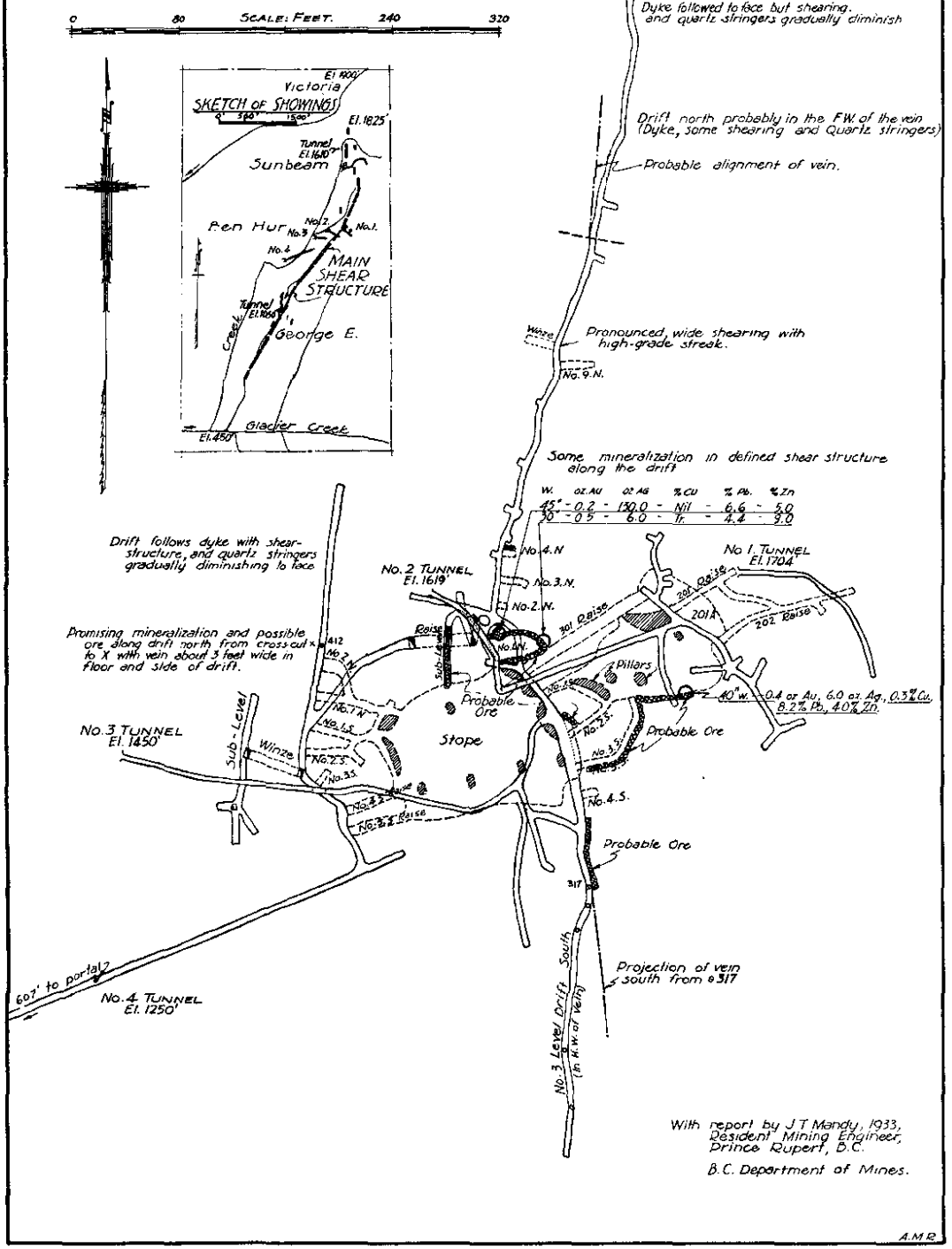
With reference to the interest being taken in the possibilities for resumption of mining operation by the company on this property, those interested should refer to the Annual Report for 1932, page 58. Examinations made during 1932 and 1933 indicate that probable structural and geological conditions governing the ore-bodies were not recognized in former operations. Coupled with this, the operation was ill-advisedly burdened with premature construction of a mill of a capacity much in excess of the developed ore reserves.

There is, in the writer's opinion, an excellent chance for bringing this property back into profitable production, initially on a small scale, with a comparatively small expenditure and in a short time, providing the operation is conducted economically and in a technically sound and

PLAN SHOWING

MAIN WORKINGS DUNWELL MINE

In the Portland Canal Mining Division



With report by J.T. Mandy, 1933, Resident Mining Engineer, Prince Rupert, B.C.

B.C. Department of Mines.

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efficient manner. It is also indicated that such initial small-scale operation, say of 25 tons daily capacity, could probably be expanded. It is urged that in this expected resuscitation of the *Dunwell* a competent and experienced mining engineer be employed to direct the operations.

Generally speaking, examinations of the *Dunwell* have indicated a probable ore-horizon along the dip in the known veins of from 300 to 400 feet deep, raking from north to south at possibly 50° through practically the entire *Dunwell* property. It is indicated that this ore-horizon may be structurally related to and conformable with the southerly plunge of the *Ben Ali* granitic stock, which outcrops about 1,800 feet to the westward of the main *Dunwell* workings. With this governing structural condition, mineralization and ore-carrying structures could be expected to occupy a zonal horizon in the Bitter Creek formation roofing the granitic stock at some distance above and conforming to the plunging contact of the stock. In this horizon ore-shoots are distributed lenticularly. A remarkable feature of the ore is the high gold content in places. This will assay from 0.25 to 2 oz. gold per ton and in places selected samples have assayed 11 oz. gold per ton. In the vein system lying to the north of No. 3 tunnel-workings, and going upward along the rake to the north boundary of the property on the *Sunbeam* claim, there is an excellent chance for the development of further ore. Southerly from No. 3 tunnel and downward along the rake there is an extensive undeveloped territory with some very interesting showings, in which there is a strong probability that bodies of commercial ore could be developed. At several places in both No. 4 and No. 3 levels, and in the old stopes between and above these levels, there are places where mining operations could be started in ore. In the southerly area in the canyon, as yet totally undeveloped, shoots or lenses of commercial ore are also indicated.

On the *Ben Ali*, about 4,000 feet north-westerly of the No. 3 level workings, there is a gold-bearing pyrite vein in granitic rock which could be developed to deliver a small tonnage of ore assaying 0.5 to 1 oz. gold per ton. This vein has the possibility of being developed into a self-contained mine of about 10 tons per day output, but it might be more economical to deliver the ore to a mill at the main workings of the *Dunwell* by means of a cheaply constructed aerial tramway. In the *Ben Ali* area there is also a good possibility, with exploration, for the discovery of other similar veins in this granitic area.

Surface exposures on the *Dunwell* have not been sufficiently correlated to definitely identify the vein-structures exposed. Generally, the condition indicated is one main north-south shear-structure extending throughout the length of the property, with smaller more or less parallel lateral veins converging towards and junctioning with it at acute angles along strike and dip. The vein-structures are frequently accompanied by light-coloured pre-mineral lamprophyre dykes. These were probably injected along already-formed shear-structures, subjected to subsequent stresses, and appear to have had a controlling influence on later mineralizing solutions. Mineralization of the ore-shoots and lenses consists mainly of a quartz-calcite gangue with zinc-blende, galena, pyrite, and tetrahedrite. Argentite, ruby silver, native silver, and probably some electrum constitute very high-grade ore in places. Commercial-grade ore in shoots or lenses seems to favour intersection areas of the lateral veins with the main north-south structure, but occurs in both structures. There is no definite evidence to indicate that commercial ore is confined solely to these areas of vein-intersection and their vicinity, and further development may show a wider ore-distribution. Underground mining through No. 4, No. 3, and No. 2 adits has been confined principally to one ore-shoot occurring apparently around one such vein-intersection area, but in the extensive underground workings and in surface exposures commercial mineralization is indicated at places appreciable distances north and south of this formerly mined area. In the northern area of the group on the *Sunbeam* claim there appears to be a main north-south structure with lateral veins converging towards it in its southerly extension.

On the extreme north end of the *Sunbeam* claim and adjacent to the *Victoria* group south line at 575 feet elevation, above No. 4 tunnel, an open-cut and incline shaft about 8 feet deep exposes a defined vein 6 feet wide which strikes No. 20°–30° W. (mag.) and dips 50° west. This is the so-called "*Sunbeam*" vein. It is well mineralized in places with galena and zinc-blende and contains an 8-inch stringer of mineral that should make high-grade ore, the whole probably making good mill-feed. This showing is about 200 feet west of and parallel to the so-called "*Dunwell*" vein, but the two structures seem to converge and probably junction in this area. It is also interesting to note that this point is about 375 feet higher and 1,600 feet north of the north end of the No. 3 tunnel north drift, which is the nearest underground working.

From this point the "*Sunbeam*" vein is traced south for about 450 feet by a series of pits and cuts along a defined depression, through which it cuts at an acute angle. From the southern 150 feet of this draw lessees have shipped about 100 tons of high-grade ore from shallow cuts and pits and about 200 tons of high-grade mill-feed still remains on the dumps. The northerly 300 feet may contain a continuation of this ore-shoot of similar high-grade ore. At about 150 feet lower elevation and west of these exposures the "*Sunbeam*" tunnel, bearing N. 65° E. (mag.) and about 500 feet long, at 300 feet intersects a sheared and brecciated vein 4 feet in width which strikes N. 40° W. (mag.). This is probably the "*Sunbeam*" structure, but a small amount of drifting shows quartz stringers with only sparse mineralization.

About 600 feet south of the lessees' workings in the draw, and at 100 feet lower elevation, a vein is exposed in two short tunnels at the mouth of a creek-canyon which here strikes east-west. The vein is about 4 feet wide, is considerably crushed, and distorted and probably faulted by an east-west fault in alignment with the canyon. Southerly of the east-west creek a small exposure of good-grade ore can be seen in the creek-bed. The southerly extension of this vein probably aligns itself here with the bed of the creek.

North-easterly of the east-west creek, between elevations 520 and 540 feet above No. 4 tunnel and from 50 to 100 feet east of the creek, several open-cuts expose a vein from 3 to 5 feet wide, well mineralized in places with zinc-blende, galena, and pyrite. This vein strikes N. 30° W. (mag.) and dips 45° west, and may possibly be the southerly extension of the "*Sunbeam*" or main structure. These showings are 900 feet north of the face of No. 3 tunnel north drift and from 300 to 340 feet higher in elevation.

Although correlation is not yet definite, it would seem that the main underground workings on the *Ben Hur* claim, off No. 2, No. 3, and No. 4 tunnels, are on the "*Sunbeam*" vein-structure with possibly closely related lateral branches. No. 4 main crosscut tunnel intersects the main vein-structure at 960 feet in. From the portal to about 480 feet in, several small quartz veins from 2 to 30 inches wide are intersected and should receive some exploration. At 480 feet from the portal a silicified shear-zone 20 feet wide, with some pyrrhotite and mispickel mineralization, is well worth exploration. At the end of the crosscut tunnel the main vein has been drifted on for 380 feet north. For the first 220 feet of this length the vein is 3 to 5 feet wide and fairly well mineralized with galena, zinc-blende, and pyrite, and sections of it would probably make good milling-ore. At 40 feet from the drift a crosscut-intersection stope and chute entry has been installed. Commencing about 50 feet above the drift-level, the vein has been stoped out for a height of 150 feet to No. 3 level and a length of 120 feet, an area of approximately 18,000 square feet. Allowing an average stope-width of 5 feet, this represents a stoped block of about 90,000 cubic feet. Appreciable ore probably still remains in the drift-back to the stope. Below the drift-level between station 412 and the main crosscut (a length of about 220 feet) there is an excellent chance of developing ore along what appears to be the southerly rake of this ore-shoot. North of station 412 the drift continues 160 feet to the face, with the shearing gradually diminishing along the dyke which accompanies the vein.

No. 3 crosscut tunnel, at 200 feet higher elevation from No. 4 crosscut, intersects the main vein-structure at about 450 feet from the portal. Near the point of intersection, between No. 1 and No. 2 south raises, an area 160 feet high and averaging 90 feet long has been stoped out along the upward extension of the ore-shoot below No. 4 and No. 3 levels. A tonnage of ore could probably still be extracted between No. 3 level and the stope-bottom between No. 1 and No. 3 south raises, along a length of 80 feet and an average height along the vein of 40 feet. Along the south side of No. 3 raise south the vein is about 3 feet wide and well mineralized in places, indicating probable extension of mill-grade ore in this direction. The lateral limits of this stope were not entirely accessible for safe examination, but the southerly limit above No. 3 south raise was examined. This showed appreciable galena and zinc-blende mineralization in places across widths from 24 to 40 inches, indicating the extension of the ore-shoots south of this south stope-limit. At 50 feet up the south limit of this stope from No. 3 raise south a sample across 40 inches assayed: Gold, 0.4 oz. per ton; silver, 6 oz. per ton; copper, 0.3 per cent.; lead, 8.2 per cent.; zinc, 4 per cent.

South along No. 3 level drift for 120 feet from No. 3 raise south the vein is 2.5 to 4 feet wide and well mineralized in places, more especially for the last 40 feet north of station 317. At station 317 the drift south goes off the vein and continues for 250 feet in the hanging-wall country.

Off No. 1 raise north a stope 40 feet high and 20 feet long has been excavated. Along the south limit of this stope 8 to 12 inches of good-grade ore is exposed on the hanging-wall and foot-wall of the dyke which accompanies the vein. In places the ore penetrates the dyke, making a mineralized vein-width of about 30 inches. A sample across 30 inches of average ore along the south limit of this stope assayed: Gold, 0.5 oz. per ton; silver, 6 oz. per ton; copper, trace; lead, 4.4 per cent.; zinc, 9 per cent. About 15 feet north of this stope, lessees, at the time of examination (October 1st, 1933), were stoping in the back of the drift. The vein here showed a width of 45 inches of high-grade ore with spectacular native silver in places for a length of about 20 feet. A sample across 45 inches of the vein exposed in the south end of this stope assayed: Gold, 0.2 oz. per ton; silver, 130 oz. per ton; copper, *nil;* lead, 6.6 per cent.; zinc, 5 per cent.

From No. 1 raise north the north drift continues on the well-defined vein-structure for about 400 feet, showing vein-widths along this stretch of from 2 to over 5 feet with fair mineralization in places. At 400 feet from No. 1 raise it is possible the drift goes off the main vein into the foot-wall country and for the last 240 feet to the face it follows a dyke accompanied by some shearing and quartz mineralization similar to that generally found with the vein. In No. 4 north raise a narrow width of high-grade ore shows at the bottom of the raise. Between No. 1 north raise and a point 400 feet north there is a good possibility for the location of ore in conformity to the indicated north-south rake of the ore-shoots or lenses. It is indicated that north of No. 4 north raise the north drift is structurally below the north-south rake of the ore-horizon.

In the southern section of the property, on the *George E.* claim, about 200 feet lower than No. 4 tunnel, there are two old tunnels on the east and west side of a deep canyon. The canyon probably coincides with the main north-south structure of the property and marked shearing with quartzose vein-matter of appreciable width can be seen along its base, especially towards its south end on the *George E.* claim. The old tunnels on the east and west sides of the canyon are probably on veins converging laterally to the main shear-structure. The tunnel on the east side of the canyon was not examined. The tunnel on the west side is about 500 feet long and had been started on a vein 4 to 5 feet wide which follows a dyke and strikes N. 15° W. (mag.), with a dip of 55° west. The tunnel is very crooked and appears to veer to the east off the vein at 170 feet from the portal, following a slip. The vein is fairly well mineralized from the portal to the winze, a distance of about 150 feet. At the winze, said to be 57 feet deep, the vein is 3 to 4 feet wide and well mineralized. A crosscut to the west at 50 feet north of the winze intersects a dyke with accompanying shearing and vein material on its foot-wall. This vein should be further explored by north and south drifts. The main tunnel continues along the slip on a winding course and shows shearing, calcite, and a little pyrite in the face. At 100 feet from the face a small vein is intersected. A crosscut to the west from near the main tunnel-face intersects this vein, which is drifted on north and south for about 100 feet. The vein is 18 inches to 6 feet wide and well mineralized in places. About 35 feet from the start of this drift the vein is 4 to 6 feet wide and well mineralized. A sample across 5 feet of this section assayed: Gold, 0.5 oz. per ton; silver, 17 oz. per ton; copper, trace; lead, 28 per cent.; zinc, 5 per cent.

On the *Ben Ali* claim a well-defined, sheared quartz vein in a granitic rock is exposed in open-cuts and tunnelling along a horizontal length of 350 feet through a vertical distance of 250 feet. The vein strikes N. 70° W. (mag.), dips 80° south, and varies from 20 to 48 inches in width. Mineralization consists mainly of pyrite with some zinc-blende and a little chalcopyrite. A sample across 20 inches of well-mineralized ore showing in the upper cut at 850 feet elevation assayed: Gold, 0.5 oz. per ton; silver, 0.1 oz. per ton; copper, 0.8 per cent.; lead, *nil;* zinc, 9 per cent. At 790 feet elevation a drift 51 feet long exposes the vein 4 to 6 feet wide and well mineralized. A sample across 4 feet in the face assayed: Gold, 0.64 oz. per ton; silver, 4.6 oz. per ton; copper, 0.2 per cent.; lead, *nil;* zinc, 6 per cent. At 730 feet elevation a drift 30 feet long shows the vein 4 feet wide carrying similar ore. At 715 feet elevation a tunnel has been faced up on the vein and shows a width of 5 feet, with 4 feet carrying similar mineralization to the three upper workings. At 630 feet elevation a drift 375 feet long has been driven on the vein. At the portal of this adit the vein is about 4 feet wide and shows a bunchy distribution of ore for a length of 80 feet. Along a further stretch of 100 feet length mineralization is sparse, although the quartz is well developed. At this point the vein pinches, but starts to widen again at about 40 feet from the face, which shows a width of 18 inches of

defined structure but no mineralization. At 50 feet lower elevation and northerly of the vein-projection from this tunnel an old open-cut close to the trail exposes quartz well mineralized with pyrite. This exposure does not line up with the vein exposed in the upper workings.

Salmon River Section.

Premier Gold Mining Co., Ltd. Operations at this property have been adjusted to an all-milling programme. At the time of examination (October 3rd, 1933) five drills were in operation and mining was being carried out on the No. 3 level in the foot- and hanging-wall country of the ore-zone, with the best ore coming from the foot-wall side. Exploration, which included 6,045 feet of diamond-drilling, has been continued adjacent to the producing areas, but no new ore of importance has been located. Further exploration from the No. 6 level has so far proved disappointing. During the first six months of the year 9,647 tons of crude ore was shipped to Tacoma and Anyox. The total tonnage produced in 1933 amounted to 185,421 dry tons. Total output for 1933 amounted to 49,469 oz. gold and 1,002,487 oz. silver. An average of 200 men were employed in 1933, with a pay-roll that approximated $375,000. The property was operated for 365 days of the year.

Big Missouri. (*See* former Annual Reports.) A reorganization of this company was effected and exploratory operations were resumed with a crew of twenty-five men employed. Drifting off No. 306 and No. 343 tunnels is being continued and further diamond-drilling is planned.

Unicorn Mines, Ltd. (*See* former Annual Reports.) Seasonal exploratory operations both on the surface and underground were continued on this property, with two men employed. Surface-stripping and open-cutting have clarified structural conditions and indicated what appears to be a new parallel zone with promising values about 180 feet above No. 2 tunnel. This was originally thought to be the continuation of the *Unity* zone, which was opened up in the lower tunnel.

In No. 3 tunnel the 201 crosscut west, about 270 feet north of the portal, was extended to 35 feet since the previous examination. Siliceous replacement, typifying the *Unity* zone, was encountered at 25 feet and continued to the face, showing appreciable pyrite mineralization, with some galena and zinc-blende. The management reports this intersection assayed: Gold, 0.18 oz. per ton; silver, 4 oz. per ton; lead, 1 per cent.; zinc, 4 per cent. This crosscut is reported to have been extended a further 6 feet since the examination (September 24th, 1933), with the zone still showing strongly in the face.

Approximately 135 feet north of the portal the 301 west crosscut at 35 feet intersected an east-west vein about 3 feet wide mineralized with pyrite, some galena and zinc-blende. At 45 feet in this crosscut a stringer about 3 inches wide mineralized with seams of galena and reported to carry high values in gold and silver was cut. At 72 feet the zone was encountered and had been penetrated for 16 feet at the time of examination. The face of the crosscut shows appreciable quartz replacement and pyrite mineralization with some zinc-blende and galena. The management reports the occurrence of fine native gold in places across this intersection and an average assay of about 0.12 oz. gold per ton. Since the examination the management reports having extended the crosscut a further 8 feet and slightly into the hanging-wall of the zone, showing it to have a total width of 22 feet and an improvement in mineralization on the hanging-wall side. The average assay of moiled samples across 8 feet of the hanging-wall side taken by the management are reported to assay: Gold, 0.16 oz. per ton; silver, 1 to 2 oz. per ton. A chip-sample is reported to assay: Gold, 0.24 oz. per ton; silver, 1.6 oz. per ton. Bunches of solid sulphides occurring in the zone at this intersection, and stated as not included in the average samples quoted, are reported to assay: Gold, 0.88 oz. per ton.

Approximately 180 feet above No. 2 tunnel and to the west of it (*see* map in 1930 Annual Report) a 45-foot open-cut along the slope of the ridge exposes a quartz replacement-zone about 20 feet wide mineralized with pyrite and some zinc-blende and galena. A series of samples across this zone are reported to average 0.2 oz. gold per ton and about 3 oz. silver per ton. A section 2 feet wide on the east side of this zone, and another about 3 feet wide and 10 feet north of this, are reported to assay respectively 2 oz. and 0.4 oz. gold per ton. It is recommended that No. 2 tunnel be extended to intersect this zone. From an approximate alignment of the "*Unity*" zone exposures on surface and in No. 3 tunnel it would appear that this newly opened zone above No. 2 tunnel is quite probably a separate zone altogether, more or less parallelling

the "*Unity*" on the west. If this can be substantiated by further tracing in a southerly direction towards No. 3 tunnel, constructive depth exploration and development could be carried out on it by extending a No. 3 tunnel west crosscut to its intersection. The projection of these zones to the south would carry them into the *Big Missouri* ground, where further work may permit a constructive correlation with structures occurring on that property at a much lower elevation.

No further work has been done on the east-west cross-structures exposed above No. 4 tunnel and south-westerly of No. 2 tunnel (*see* 1932 Annual Report). The intersection of these cross-structures with the *Unity* and No. 2 zones offers a likely objective for future exploration. The work on this property is being efficiently carried out under the supervision of John Hovland with the assistance of one miner.

Spider. (*See* 1920 Annual Report.) This property is now owned by Theo. Collart, of Prince Rupert. It is located adjacent to the west side of Long lake and is reached by a 3½-mile trail from the *Big Missouri* road. The property has been idle for some years, but in the fall of 1933 leasing operations were undertaken by O. McFadden and partner, of Stewart, on a rich surface outcrop. By November 3½ tons of ore had been shipped, the ore containing 1.01 oz. gold per ton and 294 oz. silver per ton. Winter work is being continued underground.

Salmon Gold Mining Co., Ltd. (See *Salmon Gold* group, former Annual Reports.) This company was formed to carry on further development of the *Salmon Gold* group, located on the west side of Summit lake, Salmon River valley. During 1933 surface prospecting resulted in additional discoveries of importance. The recession of the ice for a further 200 feet above the main zone also disclosed a continuation of the massive pyrrhotite in this direction to elevation 3,900 feet. Several smaller veins from which encouraging gold assays are reported have also been uncovered on the bluff about 200 feet above this point.

At altitude 3,475 feet, and north of the main zone, a new zone, about 30 feet wide, striking N. 60° E. (mag.) and composed of calcite and quartz stringers with intervening replacement, mineralized with pyrite, pyrrhotite, and some chalcopyrite and occasionally specks of galena, has been uncovered. A selected chip-sample across about 20 feet of this zone assayed 0.7 oz. gold per ton and 0.7 oz. silver per ton.

At 3,600 feet elevation a similar parallel sheared zone between defined walls about 9 feet apart, but showing stringers and replacement for an additional 12 feet into the hanging-wall, has been discovered. A patch of spectacular free-gold ore was found on the foot-wall side of this zone, but the general mineralization consists of arsenopyrite, pyrrhotite, and pyrite. Although no free gold could be identified in place at this location, the mineralization and vein character is identical to the specimens seen. A chip-sample on the foot-wall side assayed: Gold, trace; silver, trace.

To determine the possibility for surface enrichment due to oxidation, samples of selected oxidized and unoxidized pyrrhotite were taken from an open-cut on No. 1 vein at 3,800 feet elevation. The oxidized ore assayed 1.46 oz. gold per ton and 1.3 oz. silver per ton. The unoxidized ore assayed 0.7 oz. gold per ton and 0.1 oz. silver per ton. Although there is a difference of 50 per cent. in values in these two samples, the result cannot be taken as conclusive of enrichment, because the samples were from different sections of ore.

Extensive exploration by diamond-drilling and underground work is required to prove the commercial possibilities of the numerous promising showings on the property. It is understood that finances are in hand for the initiation of this work early in 1934.

Active prospecting and exploration was also carried out on the *Troy* group, at the head of Summit lake; the *Pioneer*, at Tide lake; and on several other properties in the upper Salmon River Valley area.

Unuk River Section.

During 1933 more interest was displayed in the possibilities of this promising area, the development of which has been handicapped by inaccessability. The enterprise of the McKay Syndicate, of Premier, has demonstrated that McKay lake at 3,600 feet altitude, between Sulphur and Sulphurets creeks, is quite suitable for aeroplane landings and take-offs. This has partially solved the problem of transportation and several flights to McKay lake were successfully com-

pleted by a Canadian Airways aeroplane in connection with the further development of the McKay Syndicate's *Unuk* group. To open the country to the average prospector and the detailed prospecting that the section warrants, it is essential that adequate trail facilities up the Unuk River valley be provided. Much activity in this section would undoubtedly materialize with a comparatively small expenditure on a foot-trail that could, as development warranted, be expanded for horse and tractor traffic and could initially be used in conjunction with river navigation.

Geologically, the favourable location of the area along the great mineral-bearing eastern contact-zone of the Coast range, and the fact that mineral-bearing potentialities of possible commercial importance have already been demonstrated, makes the eastern contact area of the Unuk River section one of the most favourable areas of the coastal territory for the development of ore-bodies of commercial importance.

During 1933 a reconnaissance of the area from Burroughs bay, at the mouth of the Unuk river, through Alaskan territory to the British Columbia boundary was undertaken by the Alaskan Forest Service for the purpose of investigating possible transportation routes through Alaskan territory, a distance of 24 miles. The estimated cost of a trail suitable for caterpillar-tractor traffic along this 24 miles is $51,000. As the river is fairly easy to navigate by small river-boats from Burroughs bay to the boundary (below the canyons), the Alaska Forest Service plans, for the time being, to facilitate navigation by cleaning out the river below the canyon. Navigation in the canyon section in British Columbia is dangerous and at times impractical. A trail around this canyon section, a distance of about 4 miles, is necessary and it should be continued at least the additional 14 miles to the mouth of Sulphurets creek. Branch trails up the South fork and Sulphurets creek and necessary cable crossings should also be constructed.

Unuk. This group of claims is located between the headwaters of Sulphur and Sulphurets creeks. (*See* map, 1932 Annual Report.) It is owned by T. S. MacKay, A. H. Melville, W. A. Prout, and partners, of Premier. Very creditable exploration-work which resulted in further encouraging results was accomplished in 1933. The discovery being prospected is described as a large siliceous replacement-zone generally heavily pyritized and carrying zinc-blende, galena, and some chalcopyrite mineralization. Encouraging gold values have been found in places.

Provisions and equipment, including an assay outfit, were flown in by aeroplane, and during 1933 a cabin was constructed, six open-cuts were excavated, and stripping and general prospecting undertaken. No. 1 cut is reported to expose a mineralized and silicified width of 48 feet assaying 0.16 oz. gold per ton, of which two sections, 9 feet and 4 feet wide, assay respectively 0.45 and 0.62 oz. gold per ton. Cut No. 2, abut 90 feet to the north of No. 1, is reported as showing a shattered condition with about 10 feet of quartz on the east side. The values in the cut average 0.02 oz. gold per ton and a picked specimen assayed 0.08 oz. gold per ton. In cut No. 3, about 50 feet south of No. 1 cut, an average assay of 0.2 oz. gold per ton across 12 feet is reported. In cut No. 6, about 20 feet south of No. 1 cut, the average assay across 12 feet is reported to be 0.14 oz. gold per ton. Two specimen samples of the heavier sulphide ore from this cut are reported to assay 0.84 and 0.32 oz. gold per ton.

About 500 feet south of No. 1 cut, No. 4 cut was excavated on a series of quartz stringers in quartz porphyry. These were traced about 15 feet and the following values are reported: Across 6 inches, 2.56 oz. gold per ton; across 6 inches, 8.08 oz. gold per ton; across 12 inches, 1.96 oz. gold per ton; across 7 inches, 2.40 oz. gold per ton. High gold values from samples taken during superficial prospecting of several other sections of the property are also reported, but time was not available for the further exploration of these showings.

The reported results so far uncovered are quite encouraging and indicate that further intensive exploration of this group is certainly warranted. Considerable work will be required to definitely determine the structural attitude of the main zone and possible ore-shoots in it, and this exploration, including diamond-drilling, is planned for the 1934 season.

STIKINE MINING DIVISION.

Activity in this area has been mainly confined to placer-mining. Placer possibilities of the bars and low benches along the Stikine river below Telegraph Creek received attention from a few individuals. At the old town of Glenora, J. Ralton and J. Gann washed gravel from the

exposed low-water bar. Only very sparse fine colours were being recovered. These men had back-packed into this country from Hazelton and deserve much credit for their enterprise. As their chances for worth-while recovery were slim at their Glenora location, they were advised to test out the lava-buried gravels on the east side of the Stikine river near the Tahltan and Tuya confluences.

At 6-Mile creek, below Telegraph Creek, Art Leverett was preparing to sluice along the low bench on the west side of the Stikine river. A thin strip of ground bordering the river was ground-sluiced by old-timers, but this work apparently only mined the top gravels. Although not much water is available for sluicing, the ground is worth investigation for small individual recovery.

Barrington River.

(*See* former Annual Reports.) S. D. Barrington, of the Barrington Transportation Company, Wrangell, Alaska, installed drag-line shovel equipment to replace the dredge that proved inefficient to handle the boulder condition encountered at this operation. The equipment consists of a Northwestern Engineering Company tractor-mounted 1-yard drag-line shovel operated by a 60-horse-power gasoline-engine, two 2-yard Ford dump-trucks, and a sawmill actuated through the drive-wheel of an old truck. The crew consisted of one man operating the shovel, one man in the pit, one man hauling, three men at the sluice, and one cook. Operations were personally directed by S. D. Barrington. At the time of examination (September 1st to 4th, 1933) gravel was being excavated from a pit about 18 feet deep and 100 feet long and hauled about 1,000 feet to the sluice. Boulders, some of them 6 to 8 feet in diameter, comprise about 50 per cent. of the material in this pit. The pay-gravel is covered by 4 to 6 feet of wash overburden, varies in thickness and character, and is irregular in attitude. In places the pay-ground is clayey and contains streaks of yellow gumbo. As would be expected with these characteristics, gold values are spotty. Several approximate rocker tests on material from this pit were made by the Resident Engineer and they showed a gold content from 21.2 cents to $2.76 per cubic yard, with an average of 60.2 cents per cubic yard for the pit (gold 820 fine and $20.67 per fine ounce).

South of this excavation about 230 feet a pit 80 feet long, 30 feet wide, and 16 feet deep was dug. Water seeped into this pit, however, and it was abandoned for the time being, and at the time of examination about 4 feet of water lay in the bottom. Some panning from the east side of the south end of this pit showed a gold content of from 22 cents to $2.12 per cubic yard of gravel (gold 820 fine and $20.67 per fine ounce). Pay-ground generally is found at about 8 feet from surface and dips gently west towards the river. On the west side of the pit this "pay" would mostly lie under the water at present accumulated in the bottom. To make this pit accessible the drain to the south would have to be extended into it and deepened.

From extensive testing-work carried out during 1933 about 100 oz. gold was recovered. It is reported that from the last day's run of ninety-nine cars (about 180 yards) 11 oz. of gold was recovered. It is planned to continue and expand this operation during the 1934 season. The drag-line shovel method is well adapted to this character of ground and might advantageously be used in conjunction with a high line. As the "pay" is apparently spotty, digging operations should be guided by careful and detailed advance testing and sampling.

Tahltan River.

On the Indian reserve around the confluence of the Tahltan with the Stikine John Carlick (Indian) was shovelling-in from a low creek-bench above the bridge. One cut at the lower end of this bench and about 100 feet above the bridge showed 8 feet of stratified and imbricated gravel. The upper section of this gravel is loose and easily picked and it is superimposed on 18 inches of clayey gravel which should contain the best values. Coarse colours were panned by the Resident Engineer from this basal streak and one test-pan calculated out to 0.25 oz. gold per cubic yard. Up to the time of examination (August 29th, 1933) John Carlick reported a recovery of over 9 oz. gold. The last clean-ups, representing five and three days, returned 1 oz. 9.5 grains and 13 dwt. 23 grains of gold respectively. Pete Hingon and Charles Twobit (Indian) are also shovelling from the low bench on the right bank of the Stikine river below the bridge.

Work on this ground is being very spasmodically carried out by the Indians, and it is unfortunate that one or two white miners, who attempted to locate and who would doubtless work the ground more systematically and energetically, have been prohibited by the Department of Indian Affairs from locating on this ground.

LIARD MINING DIVISION.

In this Division mining activity has been practically confined to placer-gold operations. In connection with lode gold some further exploration was carried out by Homer Ficklin on the *Keystone* group in the Thibert Creek area. Although this Division contains an extensive unexplored area favourable for the occurrence of placer-gold deposits, its lode-gold possibilities should not be neglected. Those interested in favourable localities for lode-gold prospecting are referred to Bulletin No. 1, 1932, and also to the 1932 Annual Report.

The production of placer gold for 1933 amounted to 200 oz., compared with 357 oz. gold in 1932. Although activity in the older sections is somewhat subdued, interest is being shown in unexplored territory and an increase in activity with a hopeful prospect for increasing production can be expected. During 1933 the Resident Engineer made an exploratory reconnaissance into the practically unknown territory east of Dease lake, including the Little Eagle, Gold Pan, and Turnagain (Little Muddy) River areas.

Placer-gold Mining.

Dease Lake Section.

The Telegraph Creek–Dease Lake road, which serves this section from the head of navigation on the Stikine river, is badly in need of reconstruction and repair. As this is an important transportation artery it is urged that this work be undertaken. Work by individuals was started on two new creeks in this section during 1933.

Steamboat Creek.—This creek is about 1 mile south of Porter, on the north end of Dease lake. Claude Irvine is driving a tunnel on the south side of the creek near the mouth, and was about 20 feet into the bench on August 28th, 1933. The objective is to hit the rim to the northwest, where promising values were encountered in 1923 in a shaft that encountered water before penetrating to bed-rock. It is estimated that about 200 feet of tunnel will be required.

Three-mile Creek.—This creek is 3 miles south of Porter, on the west side of Dease lake. Edward Asp is prospecting on bed-rock and recovered about 1 oz. of fairly coarse gold from panning tests. It is intended to drain and clean bed-rock. This creek occupies a narrow V-shaped valley enclosed by a steep rim. The grade of the creek is steep, with heavy wash, big boulders, and slide-rock. In places, however, good "sniping" for an individual may be found.

Little Deloire Creek.—George Finn here made a drain to pick up bed-rock and did some stripping with a boomer. Good prospects are reported to have been found and some work was carried out several years ago in this area by Mitchell Bros., with promising indications reported.

Berry Creek.—On this creek, which is a tributary of Thibert creek, Hans Erickson and Fred Niller have started a tunnel on the left bank. In an old drift reported to have been excavated several years ago by George Finn some exceptionally high pans were reported. This drift is reported to have been abandoned on account of the big boulders encountered.

Mosquito Creek.—(*See* former Annual Reports.) The Mosquito Creek Hydraulic Association continued operations during 1933 under the direction of J. R. Gibson and J. H. Searfoss, of Seattle. Operations were mainly concentrated on stripping overburden preparatory to piping into pay-ground.

Three J's Placer Mines, Inc.

This company, with advertised offices at 406 Arctic Building, Seattle, Wash., and 416 Washington Building, Tacoma, has a reputed capitalization shown on the letter heads of the company of $100,000, with incorporation under the laws of the State of Washington. The personnel of the company is cited as follows: Joseph J. Jackson, president and manager; Rees T. Evans, vice-president; Lewis Williams, secretary-treasurer. During 1933 a prospectus containing extravagant statements concerning ground reputedly held by this company was issued in Seattle. In this prospectus the statement of average values of "$2.25 per cubic yard" and "there are approximately 3,800,000 cubic yards in this lease, and even figured on the basis of 50 cents per yard would yield approximately $1,900,000" are entirely misleading and cannot be substantiated by the exploration so far carried out on the ground referred to.

The ground occupied by this company comprises one creek lease and two bench leases at the mouth of Thibert creek, near its confluence with Dease lake. At the time of examination (August 28th, 1933) prospecting was being carried out by Joseph J. Jackson with a crew of three men. On *J.J. No. 1* bench lease on the left bank there are appreciable remains of old-

timers' shallow shovelling workings; also an old tunnel (Adsom tunnel); one old shaft 38 feet deep; and one shaft, the old Epsom shaft, about 23 feet deep. In the old shafts and tunnel it is reported that bed-rock was not encountered, and the old shovelling operations were apparently carried out on shallow interglacial gravel concentrations in localities where the necessary water was most easily procurable for these operations on the high bench.

On the *J.J. No. 1*, on the bench about 15 feet above and 400 feet from the north bank of the creek, J. J. Jackson had excavated a test-pit from which about 20 cubic yards of gravel was sluiced and from which 1.325 oz. gold is reported to have been recovered. From the bottom of the old shaft (38 feet), which is 22 feet above and about 82 feet N. 20° W. (mag.) of the old Adamson tunnel, J. J. Jackson reports to have drilled to 42 feet, when the drill stuck. It is planned to continue this hole. It is reported that the top layer of 11 feet in this shaft is estimated to contain pay values. J. J. Jackson also reports the drilling of two holes on this bench to 29 feet and 28 feet, and one from the bottom of the old Edsom shaft to 31.5 feet, and he claims pay values in these holes with the encountering of bed-rock in one hole showing "pay" 7 feet from surface and 8.5 feet from bed-rock, with loose barren wash between the two streaks.

Shovelling from gravel on a flat outcrop of bed-rock on the right side of Thibert creek and about 8 feet above the creek-bed was being done at the time of examination. Here the high gravel bench rises abruptly for about 200 feet above the creek-bed. When examined the cut on the bed-rock outcrop at the base of this high gravel bench was about 40 feet long, 8 feet deep, and 10 feet high, equivalent to about 100 cubic yards of excavated gravel, and it was reported to have yielded 1.8 oz. gold. Gold estimated at about 2 oz. was also seen in the sluice-boxes, which, added to that reported as already recovered, would make a total of 3.8 oz. gold recovered from the 100 yards taken from this cut. The best "pay" was reported to be contained in a layer of clayey ground about 18 inches thick, on bed-rock. An old-timers' tunnel, known as the old "White" tunnel, on the westerly extension of this flat bed-rock and about 600 feet west of the cut, is reported to have yielded about $25,000. This flat bed-rock outcropping at the Jackson cut, about 8 feet above the present bed of Thibert creek, may quite possibly represent the site of an ancient bed of the creek and would be well worth exploration by means of a drift-tunnel to determine the possible occurrence and location of an old buried pay-channel.

The high, abrupt gravel bank above the Jackson cut is apparently composed of glacial debris, with a few stratified streaks in it representing interglacial wash, in which some more or less minor concentrations of gold may occur in erratic distribution. Between these erratic interglacial concentrations of the bench would be appreciable widths of practically barren glacial debris, from which fine colours might be panned. Whether this bench above the cut would constitute a profitable working proposition is highly speculative and would depend upon the amount of possible pay-ground in more or less barren ground. To determine this would entail considerable exploration. The bringing-in of water to operate on the high-bench area on a scale suggested by the large amount of ground to be moved would probably entail considerable cost and should receive very careful study.

Three small cuts into the high gravel bluff at intervals of 50 feet above the Jackson bed-rock cut and four similar cuts to the south are reported to have shown encouraging prospects. The erratic nature of this high bench flanking the right side of Thibert creek does not appear encouraging for profitable operation. The ground covered by creek lease No. 2 was drilled in 1929 by Vancouver interests and is described on page 116 of the 1929 Annual Report.

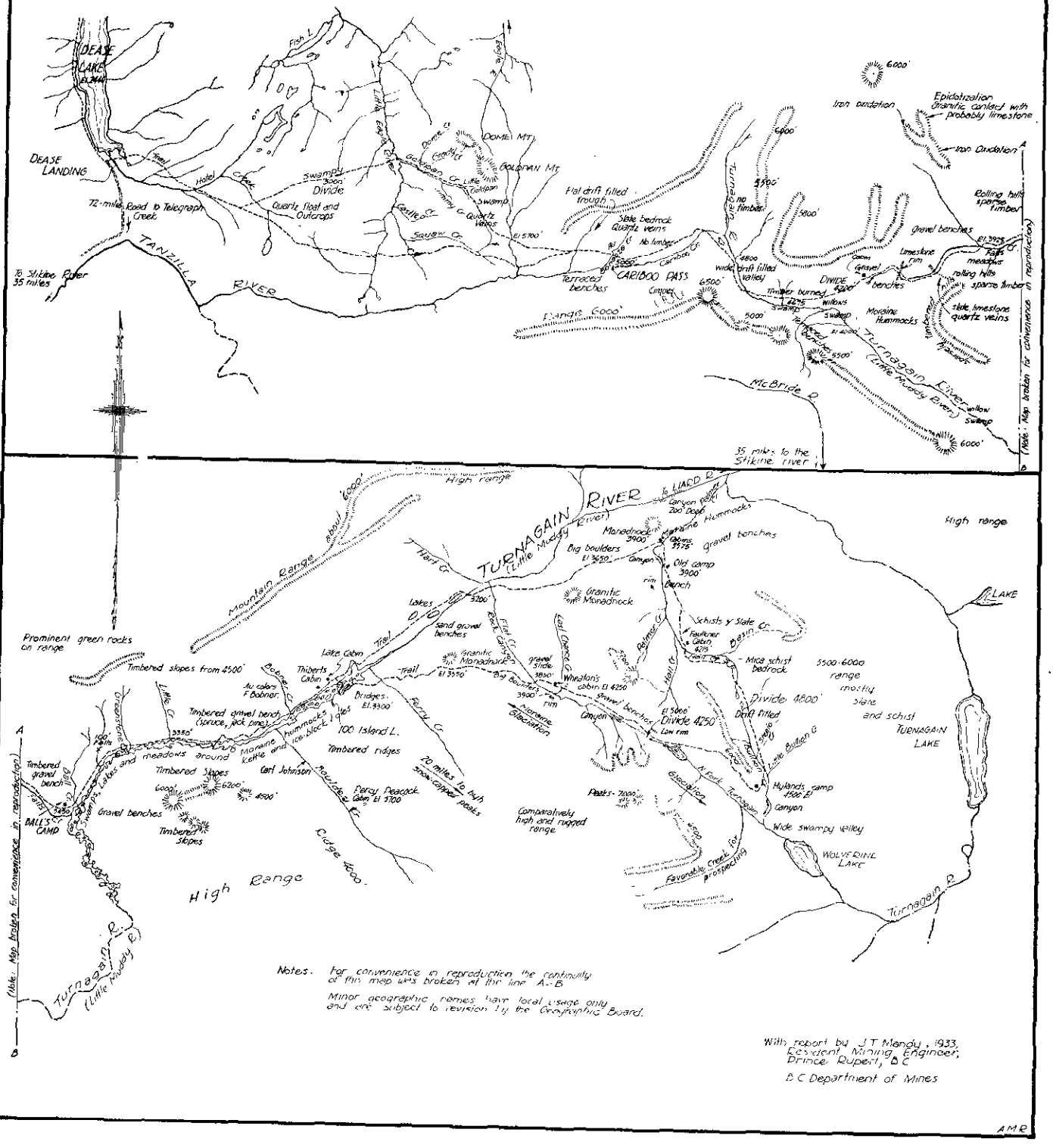
During the 1933 season energetic prospecting was done by J. J. Jackson, and, besides shaft-sinking and considerable open-cutting, a reservoir, dam, flume, sluice-boxes, ditches, and a log warehouse were constructed. In addition, lumber was whip-sawed and some trail-work done.

McDame Creek.—A detailed description of this creek is contained in the 1931 Annual Report. During 1932 exploratory work was continued on several leases. This included work on the *Viking* lease by Frank Crawford, of McDame, and on the *Centreville Hydraulic*, *Princess Edith*, and *Buccaneer* by G. A. Brown and associates, of Victoria. The results reported from this work are not conclusive, but would seem to be sufficiently encouraging to warrant further exploration. Some further exploratory work was carried out during 1933 by G. A. Brown and associates on leases near Centreville. Some exploratory shaft-sinking and tunnelling is also reported to have been done on the Pendleton ground by Pendleton and Casey for Seattle interests. Below the Pendleton ground Max Enderby was shovelling-in. Dan Kane and Frank Crawford also continued prospecting and Joe Sexsmith and L. Holensee carried out "sniping" operations with some gold-recovery.

MAP OF DEASE LAKE - TURNAGAIN (LITTLE MUDDY) RIVER AREA.

SKETCH MAP FROM COMPASS TRAVERSE

SCALE 0 2½ 5 7½ 10 12½ 15 MILES



Notes. For convenience in reproduction the continuity of this map was broken at the line A - B

Minor geographic names have local usage only and are subject to revision by the Geographic Board.

With report by J.T. Mandy, 1933. Resident Mining Engineer, Prince Rupert, B.C.

B.C. Department of Mines

AMR

LITTLE EAGLE, GOLDPAN, AND TURNAGAIN (LITTLE MUDDY) RIVER AREAS.

This area lies to the east of Dease lake and is reached by trail from Dease Landing at the head of Dease lake. Horses for operations in this area may be hired from several people at Telegraph Creek, including R. Hylands, Bill Elder, and George Ball.

There are no accurate maps covering the area east of Goldpan creek, the existing maps which cover this area being dangerously inaccurate and unreliable. The Resident Engineer carried out a compass traverse of his entire journey and the map accompanying this report is the plotting of this traverse; it makes a map with some degree of accuracy.

Provisions and supplies can be secured from the Hudson's Bay stores at either Telegraph Creek or Dease Landing (*see* page 56, 1931 Annual Report). Moose and caribou are generally plentiful throughout the area and in some sections willow-ptarmigan and grouse. In the Turnagain River area, grayling, arctic and rainbow trout, pike, suckers, and arctic whitefish occur in quantity. Grizzly and brown bear, mountain goat and sheep are also frequently seen. The area is generally a game paradise and mosquitoes and black-flies are plentiful.

The climate is typical of the Interior Plateau dry belt, with a moisture precipitation of about 30 inches per annum. Snow precipitation is light and does not exceed an average of 3 to 4 feet. Winter temperatures are low, with probably an extreme average of about 20° F. below zero, but the ground is not permanently frozen. Only a few small glaciers occur in the area. During the summer months the temperature is high during the day, with generally cool nights.

The low-level slopes are openly wooded with spruce up to 18 inches in diameter, and pine, poplar, larch, and birch, in patchy distribution. In the valley-bottoms and swampy areas are alder and willow.

Superficial Geology.

The area occupies part of the great interior elevated upland plateau of about 3,500 to 4,500 feet general altitude above sea-level. Rising above this to altitudes of from 6,000 to 7,500 feet above sea-level are the bare crests and ridges of the Cassiar mountain range.

With the exception of a small section around the headwaters of the Tanzilla river draining to the Pacific ocean, the area traversed by the Resident Engineer lies on the arctic slope and is drained by two main rivers, the Little Eagle river draining into the Dease river and the Turnagain river draining into the Liard river. The broad valleys of the main drainage-troughs are drift-filled, in places planated, and possess a low average gradient. In places, especially along the central section of the Turnagain river between Falls creek and the confluence of the Turnagain with its South branch, a distance of about 33 miles, high morainal hummocks with a maze of picturesque and placid lakes and sloughs within their confines constitute a remarkable and fascinating feature of the broad river-trough. High gravel benches also form a feature of this area. On the divide to the Tanzilla river, in the central section of Falls creek and around the headwaters of Flat creek, terraced benches are found.

The lateral creeks draining to the main river-troughs are drift-filled in varying degree, but are generally marked by prominent terrace-benches around their mouths. This characteristic is also noticeable near the head of Falls and Flat creeks. Generally the area has been subjected to widespread glacial action during the glacial period, when the main ice-mass occupied what is now the main valley of the Turnagain river. In places there is evidence of lateral ice-tongues having extended along side-valleys, now occupied by lateral creeks. This is evident along Flat creek and across the divide of that creek to the South branch of the Turnagain river. In other cases, however, lateral creeks appear to occupy sites at an angle to the main ice-movement and consequently they have received some protection from intense glaciation. In some cases, however, tributary creeks have their sources in pronounced cirques, possess very steep gradients, and show evidence of having been subjected to active lateral glacial action, and are consequently unfavourable for placer-gold deposits.

Although some intrusive granitic outcrops were observed, such are comparatively scarce, and any main batholithic mass extending from either the Coast batholith to westward, or the Cassiar batholith to eastward, is probably deeply buried by a thick roofing of slate, limestone, schist, and older volcanic rocks. At the head of Falls creek a small granitic contact area was noted, and between Palmer and Flat creeks two granitic monadnocks feature the generally subdued topography of the Turnagain valley.

Outcrops of quartz veins were noted in several places, but pronounced structural breaks are not much in evidence and lode-deposits would generally tend to those of low-temperature type.

Possibilities for placer-gold deposits are present in inter- and post-glacial concentrations of the drift-filled valleys, especially in those sections showing evidence of planation by subsequent water-flow. The best possibilities for placer-gold concentrations, however, exist in the valleys lateral to the main ice-movement. These possibilities are indicated on the accompanying map and are evident from the citation of topographical features. On the map likely creeks for prospecting are indicated. In general the area has been subjected to extensive glacial action during the Glacial period and the occurrence of old Tertiary or pre-Glacial gold-bearing channels is not likely, except in patches or sections of creeks topographically protected from intensive glaciation. In such sections the old channels would most probably occur more or less deeply buried beneath glacial drift. Inter- and post-glacial placer-gold deposits resulting from reconcentration of glacial gravels may occur in several sections of the area.

Accessibility.

The trail into the area is marked on the map and the route is characterized by extensive swamp areas. These swamp areas are numerous on the divide to the Little Eagle river, between the headwaters of Goldpan creek and the divide to the Tanzilla river, and between Burnt Timber camp and the headwaters of Falls creek. In these sections extreme caution is required to prevent horses from being inextricably mired. Between Burnt Timber camp and the headwaters of Falls creek the trail follows along the valley-bottom of the Turnagain river and was probably originally located along game-trails. It would seem that in this section a better trail could be located higher up the ridge and along the timber-fringe. Generally, the trail followed into this area is haphazardly located and the route could be considerably improved in many places.

Prospecting.

With the exception of placer on Goldpan creek, which was located in 1924, the area has only received the attention of a few prospectors during the last three years, and only very cursory prospecting for placer gold has been carried out on a few creeks. On the majority of creeks looked at by the occasional prospector the work done consisted of merely scratching superficial gravels and bed-rock was not reached. In some instances also, prospecting has been carried out by apparently "greenhorns" on glacial moraine accumulations of gravel where there is no chance for placer-gold concentrations. Successful and efficient prospecting in this area must be dependent on a knowledge of glacial effects and the ability to discriminate between favourable and unfavourable topography. Whereas some sections are clearly unfavourable, others, especially areas in troughs at right angles to the direction of movement of ancient glaciers, are favourable. Particular attention should be paid to V-shaped lateral creek-troughs in preference to the typical U-shaped glaciated valleys. Several unprospected creeks of the first type were noted in the area. On the accompanying map, features of topography that may assist prospectors are noted.

In prospecting this area the section lying between Dease lake and the Little Eagle river should not be neglected. The upper reaches and tributaries of Hotel creek, draining into Dease lake, are worth prospecting, as also are the lateral creeks draining into the Little Eagle river on its west side, especially the creek directly opposite Goldpan creek. Attention is also directed to a small creek (Bonanza creek) forming what appears to be the headwaters of the Tanzilla river at Caribou pass. Rough prospecting by the Resident Engineer, in the short time available, disclosed coarse colours in shallow and light gravel. The creek contains three to four sluice-heads of water and could be conveniently prospected by the use of a rocker. There is, however, no timber in the vicinity of this creek and for sluicing lumber would have to be brought in. Towards the headwaters of the North fork of the South branch of the Turnagain river and on its south side a favourable creek for prospecting is noted on the map.

As is the case with the entire Cassiar, this area requires experienced and persistent prospectors, men who are not afraid to work. The country is no place for "greenhorns," nor for those who wait for somebody else to show up something. For the right type of prospector this area offers a favourable field, which as yet is practically unprospected and of great extent.

Goldpan Creek.

This creek is about 18 miles east of Dease Landing. The trail is very muddy and swampy in places, especially on the divide to the Little Eagle river, and requires to be puncheoned and in some sections relocated. Goldpan creek is about 4 miles long and flows into the Little Eagle

river at altitude 4,000 feet near its headwaters. The Little Eagle river at this point occupies a flat trough about 400 feet wide of low gradient between steep and, in places, precipitous rims. This section of the Little Eagle would be worth testing for inter- and post-glacial gold concentrations. The ground may be amenable to dredging.

The lower section of Goldpan creek up to its confluence with Grady creek at altitude 4,270 feet, a distance of about 1 mile, occupies a partially V-shaped trough varying from about 60 feet wide at its lower end to about 200 feet wide in the section between Dome and Grady creeks (Cambron ground). Low creek-benches form the banks of the creek between the trough-rims. Here the creek has a gradient of about 5 per cent. At the confluence with Grady creek, Goldpan creek makes a sharp bend between canyon-walls about 30 feet wide and 220 feet long, beyond which for a distance of about half a mile the trough is a basin-like area of lower gradient and about 500 feet wide (Moody lease). For the next half a mile (Vickery ground) the creek-trough narrows to a width of from 40 to 150 feet and an altitude variation of 4,425 to 4,650 feet. For slightly over half a mile above this to the junction of Goldpan and Little Goldpan creeks at altitude 4,825 feet the creek is again confined to a width of from 40 to 60 feet between steep rock-rims. Little Goldpan creek branches north for about three-quarters of a mile, with a narrow bouldery bed and about 10 per cent. grade to its source on the southerly slopes of Goldpan mountain. Goldpan creek continues easterly for about three-quarters of a mile in a flat, drift-filled trough to its source on the easterly slopes of Goldpan mountain.

Below Grady and Dome creeks, the main tributaries, Goldpan creek contains about 400 miners' inches of water at normal flow at its mouth, about 350 inches between Dome and Grady creeks, and above Grady creek probably not more than about 200 inches. Hydraulicking operations consequently only appear feasible for the stretch of the creek below Grady creek, and for the most efficient practice a ditch about 3,000 feet long to Dome creek would be required. This would give a head of about 150 feet at the Cambron workings near the outlet of Dome creek.

The high-bench areas flanking Goldpan creek and its tributaries are covered with thick deposits of glacial drift consisting of boulder-clay, sands, and gravels. In places these may overlie old bed-rock creek-channels or sections of them which may have been sufficiently protected from glaciation to enable them to still retain gold that may originally have been deposited in them. Such buried channels appear to occur at the outlet and in the lower section of Dome creek, and also to the east of the canyon area of Goldpan creek near its confluence with Grady creek. Stream-erosion in the area appears to be comparatively recent and it is consequently improbable that such old channels would be pre-Glacial or Tertiary in age. Rather would they have originated during the later recessional periods of the ice during the Pleistocene, and the gold occurring in them would consequently be mainly derived from stream-erosion and concentration of glacial drift. Where this process has occurred in lateral creeks, such as Dome and Grady, richer concentrations of gold could be expected in the main trough of Goldpan creek around its confluence with these side-creeks. The topography of the area and the character of the gravel-deposits occupying the trough of Goldpan creek indicate that the gravel of Goldpan creek and the placer gold has mainly originated from the stream-erosion and concentration of glacial drift. In places, especially in the central sections of the creek, remnants of a possible pre- or inter-glacial channel still occupied by the present bed of the creek are indicated in weathered bed-rock and a thin layer of partially cemented gravel under the glacial gravels of the present bed. Such exposures can be seen in Cambron's and Vickery's workings. Bed-rock of the creek area consists of slightly folded slate, schist, carbonate rock (magnesian), and sandstone, with small quartz veins and seams, striking N. 10° E. (mag.), or at an angle of about 50° across the creek-trough.

Gold was discovered on the creek in 1924 and no work of any extent was carried out until the season of 1925. The gold is comparatively coarse and flat and nuggets up to about 2 oz. in weight have been found. Mining has been carried out by hand methods only. Ground-sluicing, which is well adapted to the creek condition, is the present method being employed. Although a few large boulders 3 to 4 feet in diameter occur, the average boulders are about 12 to 18 inches in diameter. Depth to bed-rock in the lower section of the creek is 3 to 5 feet, in the central basin section on Moody's ground as much as 35 feet, while in the upper section the ground is shallow. Most of the work has been done on the section between the mouth of Goldpan and a point 700 feet below Dome creek, a distance of about 3,000 feet. The lower or narrow part of this section towards the outlet for a length of about 1,400 feet has been practically worked out,

although a few small narrow lateral strips of unworked ground still remain. The ground for about 1,000 feet above this has been worked in the central part of the creek-bed, with appreciable likely lateral ground still remaining unworked. In the central section of the creek, about 2 miles from the mouth, a stretch 350 feet long and 30 feet wide on bed-rock has been worked. With the exception of a few test-pits and small cuts, the rest of the creek is practically unworked and very inadequately prospected. According to the most authentic information available, about $35,000 in gold has been extracted from Goldpan creek since its discovery in 1924. Based on figures of recoveries from the lower section of the creek towards the outlet and embracing the creek-bed for a width of about 30 feet, this section of the creek returned about 0.7 oz. gold per running foot of channel. Values in the upper unworked sections of the creek can, however, only be determined by testing or working, and it is possible that pay values may extend laterally from the present channel in the wider sections of the trough.

Ben Cambron Lease.—Mr. and Mrs. Ben Cambron are mining by ground-sluicing on a creek lease located on a lower section of the creek, extending to just below the confluence with Grady creek and between about elevations 4,100 and 4,270 feet. The trough of Goldpan creek in this section strikes N. 60° E. (mag.) and the formation of rusty slate-schist and arkose strikes N. 10° E. (mag.) and dips 80° west. The tent camp is situated on the right bank of the creek at elevation 4,100 feet. The work of the present operators since the start in 1927 has been methodically done, starting from the lower end of the lease and working up-stream. A feature of the operation is the efficient apron-gated two-way boomer dam about 200 feet ahead of the present cut. The dam is located 600 feet below the present confluence of Dome creek, which enters Goldpan trough on the north side over a high rock-rim.

With the exception of some worked ground on the left side of the creek at the lower end of the workings, the bulk of the cutting to bed-rock has been carried up-stream on the right or north side of the creek-bed proper and adjacent to the low bench on this side. Confining the trough lateral to the low creek-benches on both sides are the high drift-covered benches of the range-slopes. At the time of examination bed-rock was being cleaned opposite what appears to be an old-channel entry of Dome creek. This is marked by a draw extending from Goldpan trough to the present channel of Dome creek on the high bench. The site of the old Dome Creek mouth-channel is further indicated by rim-rock slope and lateral spring seepage from the Dome Creek drainage area through the indicated old channel into Goldpan creek.

Depth to bed-rock in the creek-bed along the Cambron workings for a distance of about 500 feet is from about 4 to 5 feet. At the time of examination (August 19th, 1933) good recovery of coarse gold was being made, and it is noteworthy that shortly previous to the examination twenty-two nuggets weighing in all 9 oz. 14 dwt. had been picked up on bed-rock. Total recovery up to the time of examination amounted to slightly over 60 oz. of gold. Between the creek and the cut a strip about 250 feet long and averaging about 15 feet wide of the creek-bed proper below the dam remains to be sluiced. On both sides of the creek low bank-benches are also likely sections for pay values below the present dam. The area on the left side, about 250 feet long by 30 feet wide, could be ground-sluiced from the present dam. The upper section of the area on the right side could, however, be best worked by bringing in the water of Dome creek. Above the present dam about 1,500 feet of likely virgin creek-ground still remains to be worked. Along this stretch there are convenient sites for dams for ground-sluicing.

At the lower end of the lease W. Moody was shovelling-in from unworked patches of creek ground and he was recovering some values.

W. Moody Lease.—Above the Cambron ground W. Moody superficially prospected the creek lease lying between the Cambron and Vickery leases and commencing just below the confluence of Grady and Goldpan creeks. The most of the ground covers the central basin area, about 1,000 feet long and from 200 to 500 feet wide. Several cuts and one pit about 30 feet deep have been excavated in this section, but bed-rock has not been reached. An old channel of Goldpan creek is indicated on its left or south bank, south of the canyon and the confluence with Grady creek. This ground could be conveniently explored by tunnelling from the west side of the slope. On entry into the basin area this tunnel would afford drainage for the further prospecting of the deep ground above.

A. M. Vickery Lease.—This creek lease adjoins the Moody ground on the east or up-stream side and is being ground-sluiced from a dam constructed at 4,475 feet elevation. The creek-bed is about 50 feet wide at the lower end of the lease, 150 feet wide in the central section, and from

40 to 80 feet wide at the upper end. The work consists of a bed-rock drain at the lower end of the lease excavated for about 400 feet before encountering bed-rock. From the excavation on bed-rock up to the dam, 325 feet long, 30 feet wide, and 12 to 14 feet deep, about 670 oz. gold is estimated to have been extracted. This working is on the left or south side of the creek-trough. The lateral ground, about 40 feet wide on the right side of the creek, has not been worked. A thin strip of ground remaining on the left bank at the upper end of the workings was worked by lessees, who did not penetrate to bed-rock and piled boulders on what should be likely ground on bed-rock. At the time of examination several colours from about 1 to 10 grains in weight were observed on bed-rock at the dam, and Vickery reports a nugget weighing about 1¼ oz. being picked up on the rim at this point. In the central section of the cut the bed-rock dips slightly, and the drain should be deepened about 3 feet below this point to enable it to be efficiently cleaned. The following is a section of the cut at its head: 14 inches of soil, 4 feet glacial debris, 10 feet of wash consisting of stratified layers of fine gravel and sand, 2 to 3 feet of weathered bed-rock and creek-wash on hard bed-rock of slate, shale, rusty carbonate rock, and fine quartz-seams.

It is recommended that work be systematically carried out from the lower end of the bed-rock drain with crosscutting ground-sluicing. This work should be carried up across the whole creek-channel from rim to rim.

Up to the time of examination (August 20th, 1933) about 25 oz. gold is reported to have been recovered by sluicing, panning, and picking-up in intermittent operation. The gold is generally heavy, but not usually coarse, with pieces up to about 10 grains in weight.

The section of the creek above the Vickery ground is described in the introductory remarks concerning Goldpan creek, and at the time of examination this section of the creek was vacant. Although some prospecting has been done on it, certain patches of the upper sections appear worthy of more intensive prospecting by individuals for shovelling-in ground.

Dome Creek.

Dome creek rises on the slopes of Dome mountain and flows south into Goldpan creek on its north side and about 4,000 feet from its mouth. It is about 3½ miles long. Its present entry into the Goldpan trough is down the steep slope of a bench about 200 feet high which confines Goldpan creek on its north side at this point. It is evident that this is a youthful channel entry to Goldpan creek and the old channel, which is referred to in the discussion of Ben Cambron's ground, is indicated about 900 feet down-stream.

From the top of the bench at the mouth, elevation 4,400 feet, the creek follows a flat, deeply drift-filled meadow-land trough about 200 feet wide for a distance of about 1 mile. The stream varies in grade from about 2 per cent. at its lower end to about 6 per cent. at the upper end. The lower section of this stretch embracing the old-channel area is covered by a lease owned by W. Grady and Ben Cambron, which it is intended to ground-sluice when the Cambron operation on Goldpan creek has progressed beyond the point of the old outlet of Dome creek. Some prospecting by means of small cuts and "sniping" on the rim has been done in this section.

The ground up-stream from this lease is vacant, and in this stretch the creek flows for about half a mile from elevation 4,800 feet, through a series of small rock canyons and meadows with a grade of between 5 and 6 per cent., the gravel of the creek-bed varying from 3 to 10 feet deep to bed-rock. Some small patches of the shallowest ground of this section have been worked by small cuts and pits or merely "sniped." From this work some coarse gold is reported to have been recovered, with one nugget weighing about 2½ oz. At this central section of the creek a deep steep-sided draw about 40 feet wide cuts into the creek-trough on its right or west side, striking N. 60° W. (mag.) and forming a pronounced break in the topography, which can be seen continuing on to the north-west for about 3 miles across 6-Mile creek and possibly beyond what is known as 6-Mile mountain sloping to the Little Eagle river. This draw cuts across the folded formation of slate and shale and in its bottom boulders and float of quartz were observed, especially in the vicinity of its junction with Dome creek. This draw would be worth prospecting for lode-deposits. About 1,000 feet up-stream a parallel, though shallower draw strikes off from the east side of the creek and may possibly be the same break offset by a fault along Dome Creek trough.

The upper 2-mile length of Dome creek to its source at 6,000 feet elevation in its lower section flows in a narrow rock canyon and in its upper area section flows through a narrow

meadow-trough, with the grade steepening to between 8 and 15 per cent. Rim boulders characterize the creek-bed in this area and numerous quartz veins were observed crossing the creek in a formation of slate and schist which strikes north-west and dips 60° west. This upper section of the creek area should be prospected for lode-deposits.

Boulder Creek.

Boulder creek flows into the south side of the Turnagain river, about 2 miles west of 100-Islands lake. It is reached by trail from Goldpan creek to Lake Cabin, a distance of 38 miles. At Lake Cabin a dugout canoe and rough rowboat are available for navigation to the west end of the lake, whence a trail leads up the mountain-slope to the central section of the creek. Boulder creek is about 4 miles long and in its lower section occupies a comparatively narrow trough generally confined by steep rim-rock with a canyon about half a mile long in the central section. Above the canyon the trough widens and is confined by more gently sloping limits. The creek has a generally steep gradient, is featured by big boulders, and contains about 800 miners' inches of water at normal flow.

Carl Johnson Lease.—This creek lease is located down-stream from the canyon and includes the lower end of the canyon. At 3,475 feet altitude Carl Johnson is ground-sluicing in the attempt to reach bed-rock. So far, however, bed-rock, which is indicated at a depth of from 5 to 6 feet, has not been reached, and some shovelling-in has been done from above bed-rock on the right rim of the creek. At the time of examination work was being carried on very intermittently, and Johnson reports that from three days' shovelling about ½ oz. gold was recovered. For 1932 Johnson reports a recovery of 24 oz. gold from about two months' work. The gold is flat and fairly coarse and probably resultant from creek reconcentration of glacial drift. Considering the intermittent nature of the work and the fact that bed-rock has not been reached, the results achieved are quite encouraging. The ground, however, is heavy gravel-wash and contains many large boulders, some of them as large as 6 feet in diameter.

Percy Peacock Lease.—At 3,700 feet elevation, about half a mile above Johnson's lease and about 3 miles from the mouth of Boulder creek, Percy Peacock owns a creek lease and is constructing a dam preparatory to ground-sluicing. The ground included in this lease lies above the canyon and occupies a wider and flatter section of the creek-trough than that occupied by the Johnson lease below the canyon. Furthermore, the boulder condition here does not appear to be so serious. Unfortunately, no tests to determine values or depth to bed-rock have been carried out. However, from the attitude of contiguous rim, the ground is not indicated as being excessively deep. The dam is 10 feet high, with a by-pass and apron-gate 12 feet wide. A comfortable log cabin has been constructed about a quarter of a mile below the dam.

Flat Creek.

This creek is reached by trail from Lake Cabin, a distance of about 8 miles. The Turnagain river is crossed by two bridges about a quarter of a mile below Lake Cabin. These log bridges, 5 feet wide and 165 and 85 feet long respectively, of four piers and five spans in the first instance, and two piers and three spans in the smaller bridge, were constructed by the Department of Public Works for an expenditure of less than $500 granted by the Department of Mines and represent a very commendable and efficient piece of construction.

Flat creek appears to have been excessively glaciated, with a subsidiary valley glacier moving down its trough from the divide to the valley of the Turnagain river, during the glacial period. The section is consequently not favourable for the retention of pre-glacial placer-gold deposits. On the other hand, inter- or post-glacial deposits resulting from the reconcentration of glacial debris may occur. Deep and comparatively recent glaciation in the creek-trough itself, probably the result of a late and intermittent ice advance, indicates, however, an unfavourable condition for even the latter types of placer deposit. The creek, which is about 7 miles long, is characterized by deep drift-benches along its banks, with an extensive rock canyon in its lower section and one canyon of small extent in the upper section. A low morainal and deep drift-filled divide separates its headwaters from those of the South branch of the Turnagain river. The creek rises in three cirques in the peaked range of about 7,000 feet elevation. In its central section above the lower canyon Flat creek contains about 700 miners' inches of water. Four holes drilled by Jack Wheaton across the creek-bed of this section encountered bed-rock at about 21 feet.

Last Chance Creek.

This creek flows into Flat creek over the high drift-covered bench of its north side about 4 miles from the mouth. The elevation at the junction of Flat and Last Chance creeks is 3,950 feet, while at the top of the bench on Last Chance creek it is 4,200 feet.

Jack Wheaton owns a creek lease covering the outlet area of Last Chance creek. Near the edge of the bench drop-off to Flat creek the water of Last Chance creek is used through an automatic boomer to ground-sluice through the high bench. A pole sluice has been constructed at the base of the bench-cut and all material is sluiced through the boxes. The bench material shows partial stratification of clay, clayey sand, sand, and gravel, dipping down-stream, with some boulders up to about 2 feet in diameter. Fine gold, with some pieces up to about ⅓ grain in weight, can be panned, but the bulk of the gold in the bench is very fine and associated with much black sand.

The objective of the operation is to sample the bench material and also to cut through the bench to the underlying rim of Flat creek for the purpose of prospecting this for a possible old channel. A comfortable cabin and good cache are located close to the workings.

Bullion Creek.

Bullion creek flows into the headwaters of the South branch of the Turnagain river and is reached by trail from Wheaton's camp on Flat creek, a distance of about 8 miles. The creek is about 4 miles long, with an altitude variation of between about 4,100 feet at its outlet to 4,800 feet at its source on the divide to the South fork of Hall creek. The lower section of the creek just above the outlet flows through a deep rock canyon about three-quarters of a mile in length. Above the canyon the trough gradually widens to a comparatively flat drift-filled valley.

Seven creek leases have been staked by R. Hylands and W. Blick, of Telegraph Creek. A substantial log cabin and cache have been constructed at 4,500 feet altitude and about 500 feet from the workings. Gold was discovered on this creek in 1932 on the *Beaver* lease just above the canyon. On the *Fox* lease, covering the canyon below the *Beaver*, encouraging prospects are also reported to have been found. The canyon creek-ground is bouldery and only small areas of low bank-benches exist adjacent to the precipitous rock walls, and they are probably encumbered with slide-rock.

Preliminary prospecting consists of a cut about 300 feet long on the left side of the creek, from which encouraging prospects of coarse gold are reported. In a cut on the right side of the creek the first set-up of seven boxes starting at the canyon are reported to have returned 2 oz. 3 dwt. 10 gr. in gold. The second set-up of eleven boxes above this is reported to have returned about 13 oz. gold. This represents a cut-length of 216 feet and a width of 16 feet, which, with 5 feet to bed-rock, works out to 640 cubic yards, with a recovery of about 0.0234 oz. gold per cubic yard. The yield from the last set-up of eleven boxes, however, calculates out to 0.0332 oz. gold per cubic yard. The creek contains about 600 miners' inches of water at normal flow. Bed-rock consists of schist, slate, and a rusty carbonate rock with quartz stringers. In places it is soft and decomposed and covered with a layer of brownish-yellow clay. At the time of examination a layer of this material covered bed-rock at the head of the cut and coarse colours were panned from it. This condition indicates that bed-rock would have to be thoroughly cleaned into the layer of decomposition and the clay disintegrated by drying and weathering before sluicing it. The creek-wash is comparatively heavy, with boulders averaging about 2 feet in diameter, with a few up to 5 feet in diameter. In the canyon the creek gradient is approximately 15 per cent.; at the mouth it is flatter; at the workings it is about 4 per cent.; at midway about 3 per cent.; and at the head the gradient is practically level.

At the time of examination a substantial dam for a two-way automatic boomer for ground-sluicing was being constructed about 600 feet above the canyon at altitude 4,450 feet. This dam, 70 feet long and 8 feet high, was constructed of logs, with earth and rock fill. It is recommended that this dam be raised to facilitate the sluicing of the entire width of the creek-trough, remembering the fact that bed-rock slopes slightly from the left to the right side of the creek.

Above the *Beaver* lease the valley flattens and the depth to bed-rock probably increases under the drift-filling. At the entry of the creek into the canyon, and above an appreciable bend in the canyon, the possibility for an old channel is indicated under the right bench. This should be prospected for by drifting from the canyon side.

Of interest is an appreciable width of quartz stringers and replacement with some pyrite mineralization at the canyon-head. This warrants prospecting for lode values.

Hall Creek.

Hall creek is reached by trail from Hyland's cabin on Bullion creek and over the divide to Faulkner's cabin at the confluence of Hall creek and Hall Creek South fork, a distance of about 7 miles. Details of this trail are shown on the accompanying map. The South fork of Hall creek occupies a V-shaped trough bounded by steeply sloping and generally exposed or lightly covered rim-rock of slate and schist, which is in contrast to other creeks of this section, where high gravel benches cover the slopes. Both Hall creek and the upper section of Palmer creek also occupy V-shaped troughs, with a topography indicating comparatively subdued glaciation. The lower section of Palmer creek, however, on its entry into the valley of the Turnagain river, is covered by deep glacial debris and morainal deposits. The upper sections of Palmer creek, Hall creek, and Hall Creek South fork warrant detailed prospecting. From observation and information collected, only a small amount of superficial prospecting has been carried out in this section. The upper section of Hall Creek South fork should be prospected especially for shallow ground suitable to shovelling-in and "sniping."

At the junction of Hall creek and Hall Creek South fork a syndicate of Telegraph Creek people are operating a small hydraulicking plant. Six creek leases are owned by this syndicate and at the time of examination (August 24th, 1933) the work was being done by E. W. Faulkner, unassisted. The equipment consisted of one 5-inch nozzle at elevation 4,200 feet, with the pipe-line intake at 4,275 feet and a flow of about 200 miners' inches of water. The monitor set-up is practically in the 70-foot-wide canyon-mouth of the South fork at its junction with Hall creek and on the uppermost lease. The grade of both creeks at this locality is flat and the pit is wet from Hall Creek water backing up into the South fork. With this condition bed-rock cannot be adequately cleaned and sluiced. There is also no room for tailings-disposal. Down-stream along Hall creek the creek-grade is also flat and restricted for tailings-disposal and the conditions are not suited to efficient hydraulicking. The gravel is comparatively light and large boulders are absent. At the operation bed-rock depth is from 3 to 4 feet. For 1,200 feet above the set-up the creek-trough consists of a low bank-bench area about 90 feet wide fronting the upper canyon. In this stretch the grade increases somewhat and the conditions handicapping the present set-ups may be partially eased as the cuts progress up-stream. Values in this ground have not been ascertained, however, and it is suggested that a bed-rock drain and shovelling-in operation would not only sample the ground, but would possibly be productive of better recovery than that being obtained by hydraulicking.

Palmer Creek Lower Section.

In the lower section of Palmer creek at its entry into the Turnagain River valley, in the vicinity of the two cabins, Percy Peacock has been doing some ground-sluicing of typical glacial and morainal debris. About 1½ miles westerly of this, and in the valley of the Turnagain river, J. Hicks has also been prospecting in similar ground. This area is composed of deep glacial drift, with a hummocky morainal topography, and is unfavourable for placer-gold concentrations.

ATLIN MINING DIVISION.

Interest in lode-gold mining in this Division has increased and the prospects for the revival and expansion of active operations with possible production is bright. Activity in placer operations has also increased and interest has expanded into virgin areas.

Possibilities for prospecting in this Division are outlined in former Annual Reports, and also in Bulletin No. 1, 1931; Bulletin No. 1, 1932; Bulletin No. 1, 1933; and in the Annual Report for 1932, all of which are issued by the British Columbia Department of Mines and can be procured by writing the Department at Victoria. Prospecting in this Division for both lode and placer gold has markedly increased, a most encouraging development for the future expansion of mining in this Division.

Taku River Section.

Whitewater. This group is described in the 1929, 1930, 1931, and 1932 Annual Reports; Bulletin No. 1, 1930; and Bulletin No. 1, 1932. In 1933 the property, which had reverted to the original owners when the N. A. Timmins Corporation, of Montreal, relinquished their option, was optioned by the Alaska-Juneau Company and develop-

ment operations were commenced in May. After the completion of initial camp and trail construction a prospect-tunnel was started 1,000 feet south of Whitewater creek at an elevation of 240 feet above the Tulsequah river. A 220-cubic-foot capacity portable gasoline-compressor was installed near the portal. Mounted jack-hammer drills were used in driving the tunnel, which is 7 by 5 feet in section, and the work was carried on in two shifts with a total crew of twelve men. At the close of 1933, in October, 683 feet of underground work had been completed. This consisted of 450 feet of crosscutting in the main tunnel and 233 feet of drifting on the three most promising of the six zones encountered. The management reports that the ore-bodies encountered in this work are narrow and discontinuous and strike in various directions. A peculiarity of the deposits is that both the wall-rock and the ore are fine-grained and so similar in appearance that they are difficult to differentiate visually. It is also reported that the values, which are in gold only, are not high, but are fairly uniform. It is planned to continue exploration during the summer of 1934 with the objective of outlining ore-shoots that may yield a profit on mining.

The Alaska-Juneau Gold Mining Company also carried out further exploration of the *Silver Horde* group, owned by Wilms, Smith, and Bacon, and on the *Silver Queen* group, owned by J. D. McDougal and associates. The management reports that so far nothing of importance has been uncovered on these groups.

Atlin Lake Section.

Engineer.

During 1933 some selective mining was undertaken in the known rich areas of the small veins on this property by Reginald Brooks, and a small tonnage of high-grade gold ore was extracted and shipped. This property is described in former Annual Reports and is referred to in Bulletin No. 1, 1932, on page 24, under "Belt (D), Sub-Belt (1)." It is stressed that the possibilities of mill-grade ore potentialities from this property, from the large replaced shear-zone known to occur on the ground, remains to be proved and has not yet been adequately explored.

During 1933 an examination of this property was made by the Resident Engineer for the purpose of studying the structural and genetic relation to the veins of the granitic intrusion lying easterly to south-easterly of the *Engineer* vein system. It would seem that the *Engineer* veins owe their origin to this granitic intrusion, which comes up at a comparatively flat angle on the south and south-east, assuming a shallow wavy roof southerly and easterly of the *Engineer* vein system, and then plunges west and north-west beneath the siliceous shales and argillite of the Lower Jurassic Laberge series in which the veins occur. Cutting through the vein system and striking north-westerly a shear-zone occupies a topographical depression extending from the most southerly granitic outcrop, at elevation 3,175 feet, to the lake-shore at the camp. The smaller veins on which former development was mainly concentrated strike at an angle of about 45°, or less, to this shear and are probably faulted by it.

Where the shear-zone has been crosscut in two places on the No. 5 level it shows a width of from 20 to 40 feet of crushed and brecciated slates, containing veins and stringers of quartz, in places showing intensive silicification, and generally is well mineralized with pyrite in veinlets and fine disseminations. At the time of examination (in 1930 and 1933) the sixth, seventh, and eighth levels were flooded and consequently were not accessible. It is reported, however, that the shear-zone was intersected by a crosscut from the eighth level and that it showed similar width and mineralization to that disclosed on the fifth level. It is also reported that where intersected and partially explored on both the fifth and eighth levels, low-grade but indicative gold values were found in sections of the shear-zone.

Very high-grade gold ore occurs in the small veins where they have been opened up, and it characteristically is found in small "pockets," "bunches," or "lenses," in erratic distribution and frequency. Whereas no appreciable tonnage can be expected from these small pockets as shown by present development in the upper horizons, from the eighth level to the surface, yet their exceptional richness should make small-scale, economically conducted, selective mining a profitable enterprise, provided it is not burdened by excessive overhead and company structure. Further depth exploration and development of these smaller veins parallelling the plunging granitic contact is warranted.

The bulk of the mining so far done on the small veins has been on the fifth level and between that level and the surface, mainly on the "E" and "Double Decker" veins. It is understood

that only a very limited amount of stoping has been done between the eighth and the fifth levels. On account of the loss of early records in the wreck of the C.P.S. "Sophia," estimates of production from the mining of the small veins varies between wide limits. Official Government records show, however, that between 1913 and 1932 about 17,418 oz. gold was produced, about 65 per cent. of it being produced between 1925 and 1927. Further production of this type is possible from further development of the small veins laterally and in depth both below the present lowest working-horizon. Intensive and closely spaced exploration in the area already opened up between the eighth level and surface may also disclose further pockets of high-grade ore. There are several veins on the property which have received little or no exploration at depth, and in which there is a good chance of opening up the characteristic high-grade pockets of ore. These include especially a series of small veins lying east of the shear-zone and amongst which are the "Shaft," "Governor," "Andy," "Boulder," "Blue," "Foy," and "Collins" veins. A larger and continuous vein called the "Mickey," located towards the north-easterly portion of the property and extending north-easterly from "Hub B," has had practically no underground exploration done on it. It is considered, therefore, that additional possibilities of small-scale high-grade production from the numerous small veins on the *Engineer* group have not been exhausted or fully explored. With further work additional pockets and lenses of ore in the known veins and also in "blind" veins, or veins not known to outcrop, may be discovered. It is, however, stressed that the character of these smaller veins indicates high-cost mining from restricted but high-grade pockety ore-tonnage. It is possible that in the aggregate ore of appreciable value could be extracted from the small veins.

There is no evident criterion regarding the definite depth to which the present ore-bearing characteristics of the smaller veins may persist. However, it should be considered that the vein characteristics indicate an origin from solutions of medium-low temperature. The veins were consequently formed and mineralized comparatively close to the original surface (say at a depth of about 5,000 to 8,000 feet). The depth-continuity is consequently dependent on the depth to which subsequent erosion has extended. For this type of vein it must also be stressed that the vein-structure itself will continue for an appreciably greater depth than the commercial mineralization in it.

In considering the further exploration and development of this property, the possibility for the development of a larger but lower-grade tonnage than that to be obtained from mining the smaller veins is suggested in the possible development of low-grade ore in the shear-zone. The structure and general mode of occurrence of the *Engineer* vein system suggests the shear-zone was possibly an introductory channel for mineralizing solutions, with slightly higher-temperature and more dispersed mineralizing aspects than the smaller marginal or lateral veins. Gold values in the shear-zone would consequently be expected in dispersed pyritic mineralization in contrast to the "pockety" native gold-silver alloy mineralization of the small fissures. It is understood that the small amount of exploration-work done on this shear on the fifth and eighth levels has shown sections of indicative and, in places, commercial-grade ore over appreciable width. The main chance for the development of a low-grade tonnage operation in the *Engineer* mine is indicated in the further exploration of the shear-zone for this possibility, especially in proximity to the granitic intrusive to southward, and at its junction or intersection areas with the smaller veins.

This exploration should take the form of drifting along the foot-wall of the shear-zone, with crosscuts through its entire width at regular intervals and detailed methodical sampling as the work proceeds. During the course of this work selective production from the smaller veins could be carried on, and should ore of mining value and width be disclosed in the shear-zone its grade could be materially "sweetened" by ore from the smaller veins.

Cleaner Consolidated Mines, Ltd.

This property was also examined in 1933 to correlate it with the conditions described for the *Engineer*. The property consists of three Crown-granted claims—namely, the *Lakeview* (Lot 241), *Taku Chief* (Lot 240), and *Myosotis* (Lot 239)—all located on the east shore of West Taku arm adjoining the *Engineer* group on the east.

A north-south series of veins similar to that occurring on the *Engineer*, and varying in width from a few inches to about 5 feet in places, have been uncovered on the property. These veins are probably genetically related to a granitic intrusive outcropping southerly and easterly of the *Myosotis* and plunging north-westerly under the Laberge series of slates and shales, on

which formation the group is staked. Proceeding northerly from the *Myosotis* through the *Taku Chief* to the *Lakeview* ground, there should be a greater thickness of clastic rocks overlying the granitic intrusive, with an increasing distance from the granitic contact as one proceeds north. This fact may be of importance, in that mineralization in this area probably emanated from the granitic injection, and is of a comparatively low-temperature type. It should be pointed out that this is a structural difference between the *Gleaner* and the *Engineer* group, which latter property lies closer to the granitic lateral and roof contact.

Known mineralization on the *Engineer* group consists of native gold and silver-gold alloy minerals, possibly some telluride, occurring in small pockets and lenses erratically distributed in the veins. There are no apparent reasons to believe that the mineralization on the *Gleaner* should be of a different type to that occurring in the small veins on the *Engineer*—namely, small erratically distributed pockets and lenses of high-grade gold ore that would be amenable to an economically conducted, small-tonnage, selective-mining operation.

On the *Gleaner* group a considerable amount of open-cutting and trenching has been carried out on a number of small veins. It is understood that this work disclosed native gold pockets on four veins. Two crosscut tunnels have also been driven, the longest of which is approximately 750 feet in length, with three drifts from 6 to 12 feet in length on its north wall and one drift about 25 feet in length on its south wall. The main crosscut tunnel, 7 by 10 feet, is driven N. 72° E. (mag.) for about 750 feet, with a back of about 100 feet at the face. The formation disclosed in this tunnel is slate, with a 20-foot-wide pyritized granitic dyke cutting through near the face. This tunnel crosscuts several banded veins, with quartz stringers 1 to 2 inches in width, over widths of from 1 to 4½ feet. The veins generally strike northerly and dip westerly. The gangue consists mainly of quartz with some calcite and occasionally some mariposite, and is similar in character to that occurring on the *Engineer*. In places the veins are brecciated, with inclusions of wall-rock sometimes partly replaced. Comb-structure is evident and vugs or druses filled with calcite and mariposite also occur. Practically no sulphides are evident in the veins intersected by this tunnel. It is understood that they do not show any gold value of consequence, but this can only be determined by a very close and detailed hand-sampling, or preferably by bulk-sampling.

The tunnel located towards the southerly end of the *Myosotis* claim was locked and could not be examined. The property is equipped with a 36–42-horse-power Petter semi-Diesel engine, belt-connected to a 9 by 8 Canadian Ingersoll-Rand horizontal compressor; a blacksmith-shop; and camp in fair condition. Camp and main workings are at about 2,700 feet altitude.

It is considered that this property warrants further development and exploration for the disclosure of high-grade pockets and lenses similar to those which occur on the *Engineer* group. It is suggested that in the conduct of this work exploration be intensified on the veins in a southerly direction towards the granitic contact. It is also suggested that this work could be more efficiently carried out by combining the *Gleaner* group with a main operation on the *Engineer*.

During 1933 A. M. Richmond, Assistant Resident Engineer, Victoria, examined various properties in the Atlin and Big Horn Creek areas of this Mining Division for the purpose of determining possibilities that might warrant further development and exploration. His reports are appended herewith.

ATLIN DISTRICT LODE-GOLD PROPERTIES.

REPORT BY A. M. RICHMOND, ASSISTANT RESIDENT MINING ENGINEER (HEADQUARTERS, VICTORIA).

INTRODUCTION.

In the summer of 1933 the writer was detailed to make a survey of the lode-gold prospects and possibilities in the Atlin area, and accordingly one month was spent in examining properties adjacent to the town of Atlin, in the Bighorn section of Tagish lake, and along the southern end of Taku arm, near the *Engineer* mine. Preliminary to studying the lode-gold possibilities the more important placer operations along Ruby, Boulder, Spruce, Pine, and McKee creeks and the O'Donnel river were visited, and it is sufficient to state that a very favourable impression was gained of the future placer possibilities of the already thirty-five-year-old placer camp.

Much has been written about the many interesting and promising possibilities that have been uncovered in the placer mines along the many creeks in the Atlin district. For detail information of this phase of mining, the reader is referred to the comprehensive reports of the Resident Engineer for the district.

Lode-mining and particularly lode-gold mining in the Atlin district has not taken a very prominent place in the past. This is due to several reasons, but principally to transportation costs and the apparently short open season in which prospecting and development on the surface can be undertaken. Furthermore, practically all the residents of Atlin and the vicinity are placer-miners or depend on the placer-mining industry for their livelihood. And due to the comparatively short summer season which exists in this country they must devote their energies intensively to the problem of recovering as much gold as possible from the placer-creeks. Consequently, they do not have time in the favourable prospecting season to go out looking for lode-deposits.

When placer gold was first discovered in the Atlin area in 1898, many quartz vein-outcroppings were found and partially prospected. On some of the claims much of the development-money was spent unwisely, while at others the work proved disappointing. At a few of the properties showings of fair promise were developed, and in the case of the *Engineer* mine, on Tagish lake, a producing mine was operated for several years with an appreciable gold production. Small mills were also constructed at the *Imperial* property near Atlin and on the *Bighorn* group in the Bighorn Creek area, but they were used principally for testing purposes and were closed after a short run.

One of the chief difficulties in the way of mining development in this area is the cost of supplies, and this in turn is due in large part to the cost of transportation, which in this locality may or may not be unreasonably high. From Vancouver to Atlin the freight rates vary from about 2 to 6 cents per pound, depending on the commodity, on all articles brought in. This cost is naturally included in the cost of supplies at Atlin. Such prices as $9 per hundredweight for potatoes, 25 cents a loaf for bread, 40 to 60 cents per pound for meat, 80 cents per dozen for eggs, 80 cents per pound for butter, $9 per case (8 gallons) of gasoline, $50 per thousand for undressed lumber, and $75 per thousand for plain dressed lumber are the usual thing rather than the exception. Everything else costs in proportion and this adds considerably to the cost of mining.

The climate is not really a handicap, and it is possible to conduct underground mining operations the year round without any serious handicap, provided the necessary preparations are made prior to the winter season. A very distorted idea of the climatic hardships has been gained from the reports sent out at the time of the Klondyke rush of 1897 and 1898. It is true that it is cold in winter; a temperature of 50° below zero for short periods of time not being unusual, but probably in winter the average temperature is not greater than 15° to 25° below zero. The snowfall is light and does not generally accumulate to a depth greater than 2 feet at any time. In summer the weather is particularly delightful and, for reasons unknown, the locality is quite free from biting-insects which usually prevail throughout the North. In June and July daylight prevails almost throughout the twenty-four hours of the day. The open season extends from early in May until about the middle of October, and occasionally until as late as December.

As a result of the time spent in examining the area, and from a study of the available geological literature, it is considered that several areas are promising for the prospector. Prospecting in the Atlin area is recommended in the section south of Surprise lake, and more particularly in the triangular area bounded by Dixie, McLay, and Farnsworth peaks. Prospecting in the old sedimentary formations to the west of Dixie mountain and along the headwaters of Spruce creek and O'Donnel river is also recommended as holding forth promising possibilities for the quartz prospector. In the Bighorn area prospecting in the green amphibole schists close to the contact of the granitic rocks is also recommended.

As a result of the examination, activity in the Bighorn Creek area has been stimulated and development-work has been proceeding throughout the winter months at the *Spokane* group under the sponsorship of Norgold Mines, Limited.

The following reports describe in detail all the lode-gold properties with the exception of the *Engineer*, *Gleaner*, and adjacent properties. These are described in detail by the Resident Engineer for the district.

Atlin Lake Area.

Of the many lode locations close to the town of Atlin, and including such properties as the *Anaconda, Beavis, Imperial, Lakeview, Pictou,* and *Yellow Jacket* groups, the most developed and the best known is the *Imperial* group on Munroe mountain.

Imperial. This ground, owned by J. Stokes, of Atlin, and W. Moore, of Nanaimo, is situated about 4½ miles north-east of Atlin. A road leads from Atlin to the foot of the mountain, just below the tunnels on the property. The development-work has been confined to opening up one well-defined quartz vein in the hornblende-porphyrite country-rock. The vein strikes N. 50° to 65° W. and dips at 50° to 60° to the south-west. In width it varies from 5 inches to over 6 feet, averaging approximately 2½ or 3 feet. The vein-filling is composed mainly of quartz and crushed country-rock, through which are disseminated particles of galena, chalcopyrite, pyrite, copper carbonates, and, occasionally, free gold.

Two crosscut tunnels, 25 and 112 feet long, have tapped the vein at elevations of 3,350 and 3,260 feet respectively, roughly 1,100 feet above the level of Atlin lake. On the upper level 169 feet of drifts have been driven on the vein. On the lower level 135 feet of drifting on the vein has been done. The writer took fourteen samples, ten channel samples and four representative samples of small dumps of ore at the tunnel portals, with the following results:—

Description.	Gold.	Silver.
	Oz. per Ton.	Oz. per Ton.
(1.) Sample of small dump at portal of lower tunnel	2.00	2.50
(2.) Sample of large dump at portal of lower tunnel	Trace	Trace
(3.) Specimen samples selected from the lower dumps, much oxidized	1.30	1.00
(4.) Channel sample across 8 and 24 inches at west face of upper tunnel drift	Trace	Trace
(5.) Channel sample composite across 22-, 6-, 16-, and 36-inch vein-widths at points 20, 30, 40, and 50 feet from west face of upper tunnel drift	0.80	1.00
(6.) Channel sample composite across 37-, 21-, and 32-inch quartz vein-widths at points 60, 70, and 80 feet from west face of upper tunnel drift	Trace	Trace
(7.) Channel sample composite across 12- and 8-inch vein-widths at 110 and 120 feet from west face of upper tunnel drift	0.24	0.06
(8.) Channel sample composite across 18- and 22-inch vein-widths at 6 and 16 feet from west face of lower tunnel drift	Trace	Trace
(9.) Channel sample across 54 inches of quartz vein-filling oxidized at main crosscut and drift intersection	Trace	Trace
(10.) Channel sample across 44-inch vein-quartz in lower tunnel drift at point 30 feet to east of main crosscut intersection	*Nil*	*Nil*
(11.) Channel sample across 55-inch vein-quartz in lower tunnel drift at point 60 feet to east of main crosscut intersection	*Nil*	*Nil*
(12.) Channel sample across 33-inch quartz-vein at open-cut at upper vein several hundred feet north of main tunnel-workings	*Nil*	*Nil*
(13.) Channel sample across 41 inches in same open-cut as sample 12, but 14 feet to the west	*Nil*	*Nil*
(14.) Channel sample across 33-inch vein-width of quartz in open-cut above the upper tunnel stope break-through	Trace	Trace

The samples indicate a 20-inch width of ore in the upper tunnel over a length of 35 feet at the western end of the drifting which averages 0.8 oz. gold per ton and 1 oz. silver per ton. Unfortunately the work on the lower level of the property has been done on the eastern end of the vein and away from the possible downward continuation of the small ore-shoot remaining in the upper level. Work to the western end of the lower level should pick up the ore with less than 125 feet of drifting along the vein.

The small ore-shoot indicated on the upper level has been stoped through to the surface on one end. It is reported by the present owners that a recovery of $10 per ton in gold was made from the 200 tons thus removed. There formerly was a small stamp-mill on the property, but this is now dismantled. The property is advantageously situated locally with respect to transportation, timber, water, and supplies, and its possibilities, while apparently small at the present stage of development, are by no means limited.

Lakeview. On this property, situated about 1,000 feet above and to the north of the outlet end of Surprise lake, are to be found several white quartz veins, sparsely mineralized with galena and pyrite. On the largest of the veins, uncovered by numerous trenches and two shallow shafts, a 250-foot adit-tunnel has been driven in a northerly direction. This tunnel exposes the vein, 1 to 4 feet in width, in close proximity to the paralleling dyke, but mineralization is very sparse. A sample across 10 inches of slightly oxidized quartz from an open-cut just above the tunnel portal assayed: Gold, trace; silver, 0.2 oz. per ton. A selected sample of the best mineralized quartz on a 2-ton dump of ore at the tunnel portal assayed: Gold, 1.4 oz. per ton; silver, 30 oz. per ton. The veins are very persistent and have been traced by surface trenches along a length of several hundred feet, but the values found in past work are indicated as being small. The area is, however, favourable for prospecting, the absence of heavy timber and overburden making surface exploration relatively inexpensive. The many rich placer-streams of the immediate vicinity certainly justify a more intensive search for lode-deposits than has been made in the past in this particular area.

Pictou. This claim, owned by A. L. Cameron, of Atlin, is situated about 2 miles south-east of the town of Atlin and is easily accessible via road and trail through sparsely timbered creek-bench land. This claim is believed to be located on what was formerly known as the *Hudsons Bay* ground.

The workings consist of a 50-foot tunnel at 2,300 feet elevation (Atlin lake is 2,200 feet above sea-level) and a shallow shaft approximately 100 feet north of the tunnel portal. In the tunnel quartz stringers are intersected within a few feet of the portal and a narrow quartz vein cuts diagonally across the face. The fissures are only a few inches in width in the tunnel and sparsely mineralized. In the open-cut, however, the quartz vein is from 18 to 24 inches wide, strikes north-east and dips steeply to the south-east, and the two channel samples taken across 22- and 24-inch vein-widths assayed respectively: Gold, 0.10 oz. per ton; silver, 0.40 oz. per ton; copper, *nil;* and: Gold, 0.60 oz. per ton; silver, 5 oz. per ton. The first sample was taken across an oxidized section of the vein-outcrop; the second sample, in which the larger gold values were obtained, was from an oxidized exposure of the vein in the cut and included such country-rock as occurred between the vein-walls in addition to the quartz vein-filling.

The samples are encouraging and some further surface work in a north-east and south-westerly direction is justified.

Anaconda. This property, owner not known, is situated on the shore of the lake about half a mile by trail south of the town of Atlin. The showings consist of narrow quartz stringers and lenses in a magnesite-carbonate country-rock of the W. E. Cockfield's Gold series. Development-work done many years ago includes a 90-foot crosscut adit-tunnel driven from a point 15 feet above the level of the lake. At 10 feet in from the portal of the tunnel (driven in a south-easterly direction) a narrow quartz vein 6 to 9 inches in width, striking north and south and dipping 72° to the west, was cut. A channel sample composite from four points on this exposure across widths of 6, 9, 8, and 6 inches assayed: Gold, trace. What is apparently the same vein as encountered in the crosscut outcrops on the surface at 50 feet higher elevation. Here the vein is irregular in width and cannot be traced for any distance. The showings are not attractive.

Beavis. The *Beavis* property, comprising five claims, is situated close to the shore of Atlin lake and approximately 1 mile by road from Atlin. It is owned by H. Malquin, of Paris, France; C. E. Wynne, of Alkali Lake; and the estates of Captain Hawthorne and E. A. Robinson, of Victoria. From the evidence on the ground several thousand dollars was expended in the development of the claims. When visited in 1933 the workings could not be examined, but a study of the rocks on the shaft-dumps indicates that underground work was in black chert and granite porphyry. Selected specimens on the dump showed small amounts of pyrite mineralization in a quartz gangue.

Yellow Jacket. This group, comprising six claims obtained on lease from the Government and sixteen claims held on location, is situated adjacent to Discovery and covers the bed-rock exposures along Pine creek. The only working of importance on this group is said to be a shaft now filled with placer tailings and consequently inaccessible. The ground is controlled by interests represented by W. L. Scheeler. It is planned to investigate the possibilities of the old workings on the strength of reports and data that excellent gold values were obtained from quartz-filled fissures which are reported to be of minable widths in

the underground workings off the shaft. The bed-rock formation in the area is mainly a magnesite-carbonate rock.

Bighorn Creek Area.

The *Bighorn*, *Spokane*, and *Red Rupert* properties were examined in this area. The most promising of the three properties is the *Spokane*, which is at present under development by a Vancouver company; the *Bighorn* group, a short distance up-stream, would make an attractive lease, and the *Red Rupert* justifies further surface prospecting.

Spokane. The *Spokane* group of fourteen claims was acquired early in 1934 by Norgold Mines, Limited, and at the present time a crew of men is engaged in prospecting and development work on the Incline tunnel section of the property, which is situated on the west side of Bighorn creek, 9 miles by road from Lawsan's camp on Taku arm of Tagish lake. The present owners, represented by J. E. R. Wood and W. L. Scheeler, of Atlin, acquired ten of the claims by location, purchasing the central four claims of the group from Lawsan, Schwanekamp, and Schulz, of Atlin.

The original locations were made on a remarkably persistent, uniform fissure-vein found cutting the schisted and gneissic amphibolite and granitoid rocks of the area. The vein strikes N. 80° W., almost at right angles to the valley of Bighorn creek, and dips to the north at 70° to 85°. It has been traced along a horizontal length of 3,000 feet and through a vertical distance of over 1,500 feet. The vein-filling, which averages 2½ to 3 feet in thickness, is composed of quartz and minor amounts of crushed wall-rock. It is mineralized with small particles of pyrite, small amounts of galena, and numerous samples show it to be auriferous.

Development-work on the vein includes several shallow open pits and three short adit-drift tunnels, named in ascending order the Peter's, Blacksmith, and Incline tunnels. They are located at 3,470, 3,620, and 4,200 feet above sea-level, the upper tunnel being 1,500 feet vertically above the valley-floor of Bighorn creek. The best showing is at the upper (or Incline) tunnel, where the vein averages 30 inches wide in the 12-foot tunnel-length. Two channel samples across 30 inches at the face and 5 feet back assayed 0.04 oz. gold, 0.06 oz. silver, and 1.32 oz. gold, 0.3 silver per ton respectively. This gives an average of 0.68 oz. gold and 0.18 oz. silver per ton. Another group of samples channelled across the vein at six places in the Incline tunnel over an average width of 30 inches, by a reliable engineer, assayed 0.275 oz. gold per ton. Farther up the hill from the Incline tunnel are found the ruins of an old arrastra, and a sample of the roasted quartz lying on a small dump beside the vein assayed 0.64 oz. gold per ton.

The occurrence of gold, the persistence of the vein both horizontally and vertically, the uniformity of the mineralization, and the favourable location for economical development (with the exception of high freight tariffs) make the showings attractive and worthy of technically directed development. This work should be first confined to the trenching and thorough sampling of the vein on the surface above and below the Incline tunnel. Drifting on the vein at the Incline tunnel is also recommended.

Bighorn. This property, comprising four claims and a mill-site and owned by Fred Lawsan, is situated on the west side of Bighorn creek, approximately 10½ miles by road from the owner's camp on the shore of Taku arm. The camp buildings on the valley-floor at 2,730 feet elevation are 560 feet above the lake; the principal showings and underground workings are directly behind and 900 feet vertically above the camp on the lower edge of a steep bluff. The camp and workings were formerly connected by a small aerial tramway, now in disrepair, in addition to the present precipitous trail.

The country-rocks are schisted members, mostly dark-green-coloured gneisses and mica-schists of D. D. Cairnes's Mount Stevens formation, and they are cut by younger quartz-porphyry and rhyolite dykes. The formation in a general way strikes about N. 15° E. and dips to the north-east at angles up to 15°.

The veins on the property for the most part are lens-shaped and almost always intercalated in the foliation planes of the enclosing country-rock. The workings, comprising several open-cuts and two tunnels, 46 and 35 feet long and called the North tunnel and the Little tunnel respectively, have developed several short lens-shaped sections of vein along a 200-foot length of the property. In the North tunnel, driven in a north-westerly direction, the vein has a horizontal attitude and varies from 2 to 24 inches in width. Near the tunnel-face the vein tends to dip flatly into the hill, and it appears as though this dip might be accentuated a short distance ahead of the tunnel-face. In the paralleling Little tunnel, 48 feet south of the North tunnel and at the

same elevation, the vein is from 4 to 18 inches in width. In the face of the bluff at the portals of the two tunnels the vein is exposed by open-cuts to the west for a distance of 130 feet.

Sparse mineralization of the lens-shaped vein sections of quartz has taken place, the principal minerals found being pyrite, galena, and chalcopyrite, with occasionally free gold. Several specimens showing free gold in small particles were obtained by the writer in the course of his examination.

Eight composite channel and dump samples were taken at the tunnel-workings, with the following results:—

Description.	Gold.	Silver.
	Oz. per Ton.	Oz. per Ton.
(1.) Channel sample composite across 24 and 16 inches of quartz on the east and west walls of North tunnel, 12 feet out from the tunnel-face	Trace	Trace
(2.) Channel sample composite across 6 inches, 6 inches, 6 inches, and 6 inches on east and west walls of the North tunnel at points 20 and 30 feet out from the tunnel-face	*Nil*	*Nil*
(3.) Representative grab-sample of 12-ton dump at portal of the North tunnel	1.16	0.40
(4.) Representative grab-sample of 15-ton dump of sorted rejects between the North and Little tunnels	0.15	0.04
(5.) Channel sample composite across 8 inches at face and 8 inches and 4 inches of vein-filling on the east and west walls of Little tunnel, 10 feet out from face	*Nil*	*Nil*
(6.) Channel sample composite across 9, 6, 10, and 13 inches on the east and west walls of the Little tunnel at points 20 and 30 feet out from the tunnel-face	0.40	0.20
(7.) Channel sample composite across 14-, 8-, 9-, and 14-inch vein-widths at 5-foot intervals west of the Little tunnel portal	1.30	0.40
(8.) Representative grab-sample of 15 tons of ore on dump 100 feet west of tunnels	0.30	0.10

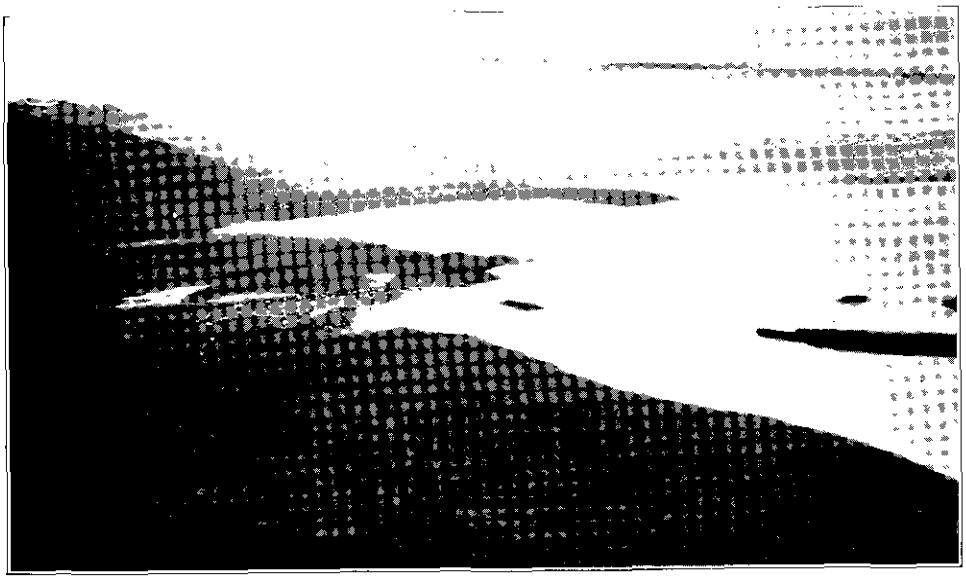
The above sampling results indicate a small tonnage of ore at and to the west of the Little tunnel which averages 9¼ inches wide with a grade of 0.84 oz. gold per ton. Further prospecting by surface-trenching near the top of the rock-slide to the east of the present workings would seem to be justified in an endeavour to find the faulted section of the series of lenses thus far exposed. The property would respond best to an energetic lessee.

The owner has obtained specimen assays of up to 8 oz. gold per ton, and from the operation of a small crusher and a 1-stamp crushing-mill used in conjunction with plates and blankets, a recovery of over $2,000 is reported to have been made from small tonnages of selected ore mined at the tunnel-workings several years ago.

Red Rupert. This group of two claims, situated 1½ miles by trail south of the *Bighorn*, on a tributary of Bighorn creek, is owned by B. J. Schwanekamp and Charles Hill, of Atlin. The claims are situated above timber-line at an elevation varying from 3,640 feet at the camp to 5,000 feet in the vicinity of a large porphyry dyke. The workings consist of three small open-cuts along a narrow quartz vein in rocks of the Mount Stevens series. An old tunnel, caved at the portal and stated to be 30 feet long, is situated 20 feet below the open-cuts.

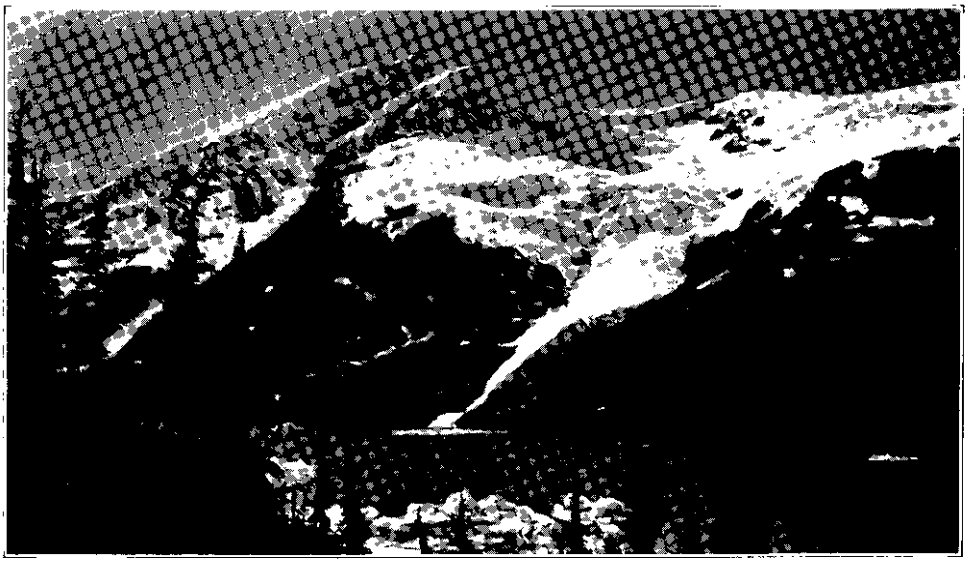
Three channel samples were taken across the vein-exposure, here striking east and west, with a dip of 45° to the south, with the following results: Sample No. 1, a composite sample of two channel samples across the 14-inch vein-width at the centre cut, assayed: Gold, 0.30 oz. per ton; silver, 0.1 oz. per ton. Sample No. 2, a composite of two channel samples across the 12-inch vein-exposure in the upper open-cut, assayed: Gold, 1 oz. per ton; silver, 0.4 oz. per ton. The third sample across a 24-inch vein-width in the lower open-cut and about 20 feet from sample No. 2 assayed: Gold, 0.8 oz. per ton; silver, 0.2 oz. per ton.

The vein is not extensively exposed, but the three samples taken are indicative at least, and some further surface-trenching and ultimately the cleaning-out of the old tunnel are warranted under the prevailing market price for gold. Exceptionally high-grade gold assays are reported as having been found in the vicinity of the present workings, but as to the authenticity of this there is no definite evidence.



Atlin Town and Lake from the Air.

Turnagain River, Head of, Liard M.D.



Summit Lake, Portland Canal M.D.

Unuk Group, Portland Canal M.D.

Taku Arm Area.

In this area the *Engineer*, *Gleaner*, *Rupert*, *White Moose*, and *Happy Sullivan* properties were visited and reports are appended herewith on the three last mentioned, the *Engineer* and *Gleaner* reports appearing under the report of the Resident Engineer for this district.

Happy Sullivan. This property, owned by Clarence Sands, of Atlin, is situated on the east side of Taku arm, about 1½ miles north of the *Engineer* mine. The three claims at 3,650 feet elevation are accessible via a brushy wagon-road from the *Engineer* wharf to Sheep creek, and thence by 1½ miles of steep trail to the camp-site at 3,400 feet elevation on the north side of the creek.

The showing, situated a few hundred feet above the camp-site between 3,700 and 3,780 feet elevation, consists of a wide pyritized shear-zone in sedimentary rocks, principally sandstones of D. D. Cairnes's Laberge series. The gold occurs in small stringers of quartz. The workings on the property consist of several long rock-cuts across the apparent trend of the shear and two short tunnels, one at 3,650 feet elevation, caved at the portal, and one 30 feet long at 3,750 feet elevation, situated a short distance north-westerly from the lower tunnel portal. The upper tunnel has been driven N. 10° E. along a narrow quartz-filled fissure in the shear-zone. The fissure varies in width from 6 to 8 inches, with a short section in the floor of the drift at the portal averaging 12 inches wide. Two small dumps of quartz at the portal of this tunnel, containing about 5 tons each, were carefully sampled, with the following results: (1.) Sample of west dump assayed: Gold, 9.44 oz. per ton; silver, 6.6 oz. per ton. (2.) Sample of east dump assayed: Gold, 8.44 oz. per ton; silver, 5.5 oz. per ton.

The surface-trenching was obviously done with the idea of testing the shear-zone for low-grade tonnage possibilities, and probably with disappointing results, but the narrow high-grade vein possibilities have not been thoroughly tested, and trenching downhill along the outcrop of the tunnel quartz vein in conjunction with careful sampling is justified. The high gold assays given above were obtained from material in which no free gold was visible and which contained no appreciable pyrite mineralization. The lower tunnel, being caved at the portal, could not be examined; it is a crosscut driven in the direction of the vein.

Rupert. The *Rupert* group of ten claims, situated high up on the east and north slopes of Whiteface mountain, opposite the *Engineer* mine on Taku arm, is believed to be owned by the A. Rupert and J. Johnson interests. The property has not been explored for many years and consequently the workings are generally in a bad state of repair and difficult to examine. Years ago a beach camp was constructed on the west shore of Taku arm about 1½ miles south-west of the *White Moose* workings. A steep trail 1½ miles long connects the beach camp with the south tunnel camp at 3,650 feet elevation, and another 1½-mile trail connects the south tunnel and north tunnel workings, the latter at 4,700 feet elevation.

The country-rocks are greenish schistose amphibolites of W. E. Cockfield's Yukon group. At the south tunnel these rocks are found in contact with granitic intrusives of the Coast Range batholith. D. D. Cairnes, in Memoir 37 of the Geological Survey of Canada, mentions that at least five veins had been discovered at the date of his examination and that float from a sixth vein was in evidence, but due to the lack of a guide familiar with the old workings the writer was only able to locate the No. 1 and No. 2 veins on the south section of the property and the old tunnels on the north end of the mountain.

The No. 1 vein, on which 315 feet of drifting and crosscutting has been done at 3,650 feet elevation, strikes N. 40° W. and dips 75° to the north-east. At the adit portal the vein is 48 inches wide, and the white quartz vein-filling is sparsely mineralized with pyrite, galena, and sphalerite. The vein is followed for 150 feet in the tunnel to the face of the shortest branch of the forked drifts, which start 85 feet in from the portal. In this 150-foot distance the vein pinches and swells, is badly broken and contorted, and at the face is but 14 inches wide. The longest branch drift is in granite throughout its length. Two channel samples were taken, one across 48 inches of representative vein-filling at the tunnel portal and the other across 14 inches of oxidized quartz at the face of the short branch drift. The 48-inch sample assayed: Gold, trace; silver, 1.6 oz. per ton; lead, *nil;* zinc, trace. The 14-inch sample assayed: Gold, trace; silver, 1.6 oz. per ton; lead, 0.6 per cent.; zinc, trace.

The No. 2 vein is about 300 feet up the mountain-side from the No. 1 vein. It is from 6 to 8 feet wide, strikes N. 33° W., dips vertically, and can be traced along the outcrop for several

hundred feet. It is similar in appearance to the No. 1 vein, but even more sparsely mineralized. It was not sampled.

After considerable searching, the evidence of the north tunnel-workings in the form of two dumps of ore and waste, outcropping from a snow-slide, was found about 1½ miles north of the above-mentioned workings. A representative sample of a pile of sorted ore at the lower tunnel was taken, and it assayed as follows: Gold, trace; silver, 3 oz. per ton; lead, 0.9 per cent.; zinc, 1.5 per cent.

The showings examined are not attractive, but the area is a favourable one for prospecting and better showings might be found.

White Moose.

The *White Moose* group of eight mineral claims is situated along the shore of Taku arm, opposite the *Engineer* mine. It is owned by the estates of the late O. Partridge and Lord Egerton. The country-rock in the vicinity of the workings is the green schistose amphibolite of the Mount Stevens formation of D. D. Cairnes, or the pre-Cambrian Yukon group of W. E. Cockfield's classification. These rocks are badly broken and contorted, very much altered and metamorphosed. The showing of principal interest is located at the north end of the property close to the lake-shore and consists of a quartz vein 18 to 48 inches in width, which cuts diagonally across the schistosity of the enclosing country-rocks. The vein strikes N. 30° E. and dips at 65° to the west. The vein at the lake-shore is 2 feet wide and sparsely mineralized with tetrahedrite, chalcopyrite, galena, and pyrite. A shallow shaft and adit-tunnel, now caved and inaccessible, were driven on the vein many years ago, and from an examination of the small dumps at the collar and portal it would appear that the mineralization throughout the excavational work was of similar character to that showing on the surface. A sample of the small dump (approximately 5 tons) was taken, and the assay showed it to contain: Gold, 0.15 oz. per ton; silver, 4 oz. per ton: copper, 1 per cent.; lead, trace; and zinc, 1.5 per cent.

Approximately 1,500 feet in a south-westerly direction from the shaft-workings, and possibly on an extension of the same vein system, there is another camp where two adit-tunnels have been driven as drifts on the vein. The vein at this locality strikes N. 35° W. and dips at 80° to the west. Both tunnels were found to be caved at the portals and could not therefore be examined in detail, but the dumps indicate that a considerable proportion of the underground work was in quartz. A sample of the upper dumps was taken, and found to assay: Gold, trace; silver, 3.6 oz. per ton; copper, 1.5 per cent.; lead, 5 per cent.; zinc, 5 per cent.

Placer-mining—Report by J. T. Mandy, Resident Mining Engineer.

Atlin Lake Section.

The placer-gold production from Atlin Mining Division during 1933 was 11,299 oz. gold, valued at $192,083, as compared with 8,040 oz. gold, valued at $136,680, for 1932. Placer operations by companies and individuals were especially active during 1933, and increased interest was shown not only in the present worked creeks in the older areas, but in virgin territory. Engineers representing large capital have been active in this field and numerous inquiries from operators in distant fields augur a sound future expansion. With the introduction of two drilling outfits and new capital under qualified technical direction, exploration is on a much sounder basis than it has been heretofore. In this area dormant possibilities are being thoroughly probed and some encouraging results achieved. Geological clarity relative to old-channel structures and locations is gradually emerging, and evidence of further possibilities is being found. Besides new locations and extensions of operating workings, there are still appreciable yardages of low-grade rim-rock and bed-rock gravels (material running from about 30 to 80 cents per yard, with patches of higher-grade ground) remaining in old drift-workings that may some day be mined. In some cases gravel running 2 oz. gold per set, or about 1 dwt. per square foot of bed-rock, is left unmined as unpayable, due to the haphazard workings and numerous undeground inclines, lack of surveying and mapping of the workings. What is especially required in this section is a survey of drift-workings, a thorough sampling of old workings, and methodical planning of underground operations. It is, unfortunately, not generally recognized that structure and distribution of values play as important a rôle in placer-deposits as they do in lode-deposits. The recognition of these principles and the study of the various types of deposits will greatly help in the future expansion of the placer-mining industry. Further expansion of placer-mining in the Atlin section will probably tend towards the extension of

drift-mining to include lower-grade gravels, the use of power scrapers and shovels, and possibly modern dredging equipment. The introduction of some system of mining and treating the low-grade gravels which have heretofore been ignored will not only greatly increase gold production, but will bring within the scope of mining much potential ground that has been left unmined.

O'Donnel River.

Nathan Murphy (assisted by Mrs. Murphy) and Melvin Beckman have continued drifting on their bench lease. At the time of examination (August 4th, 1933) a wide heading bearing S. 74° W. (mag.) on flat, soft bed-rock was being excavated and good gold values were being recovered. An appreciable area of pay-ground is available for excavation in these workings.

Marco Pini, working on a "lay" on a portion of Nathan Murphy's ground in the low area about 200 feet from the river, is sinking a shaft to reach bed-rock of the creek-trough. At the time of examination the shaft was reported to be 22 feet in depth, 21 feet of which is in old tailings, and it is now estimated that a further 14 feet of sinking will be required to reach bed-rock. The collar of this shaft is 25 feet lower than the portal of Murphy's tunnel and about 25 feet above the river. The sinking equipment consists of an 8-foot water-wheel with a 12-inch drum on the shaft friction-hoist. It would appear that this wheel is too small and the drum too big for the present weight of the bucket and it should be either changed or geared. The water-wheel also operates a Cornish pump.

Louis Picolo is shovelling-in on the Prpich ground above Murphy's and recovering some gold.

About 400 feet north-westerly from Murphy's tunnel, Oscar Fosberg, Andy Finnet, and Harold Lynd are driving a tunnel on a "lay" from Nathan Murphy. The tunnel is about 339 feet long, heading east, and in the face about 4½ feet of bed-rock is being carried with an encouraging recovery of gold.

About half a mile north of Louis Picolo's workings, Charlie Lee drove a tunnel 100 feet into the bench in 1932. The first 40 feet of this tunnel follows bed-rock, which then dips south-west. In 1933 Tom Freeval drifted for 45 feet north from this tunnel along the rim. Some nice colours can be panned from the face of this drift, and on bed-rock, at about 20 feet in on the left side, pans of about 5, 3, and 4 grains of gold to the pan were recovered by the Resident Engineer. Further work should be carried out in this tunnel.

Wilson Creek.

Nilta Mining Co. This company is a private incorporation with a capital of $25,000. H. G. Jamieson is general manager and president and the offices are at 704 Dominion Bank Building, Vancouver. The company owns three creek leases and two benches, on which test-pitting and exploration is being carried out. On the *Patricia* bench lease three or four tets-pits have been put down about 5 feet, but it is understood that no commercial values were encountered. On the *Lena* creek lease four test-pits were sunk through wash-gravel and returned colours. On the *Eliza C.* creek lease eight test-pits, from 6 to 11 feet deep, were sunk through surface loam and wash. Bed-rock, which is known to consist of hard-pan, was not encountered and these holes are reported to have returned colours. On the *Katherine E.* creek lease several pits were dug to hard-pan and values of from about 5 to 9 cents to the square foot were encountered. In these holes depth to hard-pan varies from 3 feet to over 8 feet. The ground in this area consists of a thin covering of top soil, 3 to 4 feet of light gravel-wash containing a few boulders up to 18 inches in diameter superimposed on yellow hard-pan. The company plans to install a mechanical shovel and trenching attachment with a capacity of 400 yards a day.

Alec Cline. This working is the uppermost on Wilson creek and includes a fringe of some ground that was formerly worked with good returns. The ground consists of light wash to a depth of about 4 feet on clay hard-pan. The creek-trough in this area is flat and about 400 feet wide between glacial-debris benches. Alec Cline is ground-sluicing and shovelling and making a fair recovery.

McKee Creek.

Very creditable hydraulicking has been carried out on this creek by George Adams with the object of stripping overburden preparatory to sluicing into "pay" of the old channel on the north side. The conditions on this creek are described in former Annual Reports. During the

season operations were started on May 16th, 1933, and it is estimated that when stripping is completed (at the end of 1933) sufficient pay-gravel will be available to enable piping to be carried out in it for two or three seasons. Operations were being carried on in two pits with a crew of ten men and the use of 6-inch nozzles on the monitors. At the time of examination (July 24th, 1933) an area around the lower pit of 600 feet long, 100 feet wide, and 100 feet deep had been stripped.

A traverse of the upper area of this creek above the pressure-box was carried out by the Resident Engineer. In this section the attitude and exposures of rim-rock indicate a continuation of the possible old channel for about 1½ miles under the bench of the right bank. Along this distance high rim is exposed on both sides of McKee creek, indicating little likelihood of a channel breaking through to the south side. Beyond the last up-stream exposure, at 3,700 feet altitude, the ground is deeply buried and no rim is exposed, but the topography and slopes of the range to the north indicate that the stream may have been crowded to the south and, consequently, in this upper area an old channel may possibly cross the creek or coincide with its present trough.

Spruce Creek.

Activity and interest on this creek markedly increased during 1933 and the creek was responsible for the bulk of the Atlin gold production. The creek is fully described in former Annual Reports. In the lower central area some further prospecting was done in an attempt to trace the swing-over of the old channel under the right bench towards Pine creek.

In this section Louis Lockey has excavated a tunnel 200 feet long in glacial boulder-clay of the right bank. No bed-rock was encountered in this work, but some glacial wash shows near the face in the clay. The objective of this work is to crosscut the possible extension to the right bank of the channel and bed-rock showing in the Faulkner workings on the left bank. A short distance above Louis Lockey's tunnel, Olaf Hultgren owns two bench claims on the right bank and has started a drift into the bench. The drift, which starts in glacial debris, extends for about 80 feet along a bearing of N. 17° W. (mag.). At 40 feet in from the portal a pit 4 feet deep shows bed-rock dipping towards Spruce creek. In this opening 4 feet of glacial clay and 3 feet of glacial wash is superimposed on bed-rock. It is roofed over by glacial boulder-clay. The face shows 3 feet of wash, roofed and based by bouldery clay, and it is quite possible that bed-rock is not more than about 3 feet below the tunnel-floor. Gold colours can be panned from the exposure of bed-rock in the tunnel.

D. K. Faulkner has continued drifting and crosscutting, handling about eight cars of muck a day and recovering from 35 to 75 cents in gold per car. C. McKinnon drifted into the hill through old workings above Faulkner, on weathered serpentine bed-rock. The present tunnel is being driven to connect with a former tunnel about 25 feet away, in the face of which flat, hard bed-rock was encountered carrying values of about 50 to 60 cents to the car.

Above McKinnon's workings, Maurice Bride is shovelling tailings in the creek-bed on the *Pinto* creek claim and recovering about $8 per day. During the winter the tunnel on the *Lynx* creek claim will be continued.

On the *Gladstone* lease Carl Lykergard is drifting on a "lay" from Jack Tintinger. The drift is headed east into the hill contiguous to the old McClusky workings. A tunnel had also been driven 220 feet parallel with the creek. It is reported that gravel in this section on bed-rock returned from 60 cents to $1 to the car of ½ cubic yard. Above bed-rock the gravel is reported to return about 40 cents to the car. An appreciable area of this grade of ground still remains to be worked. About eight cars are being trammed per day.

Joe Clay continued shovelling-in on the *Hardscrabble* creek lease with a crew of from three to five men and recovered good values. The equipment for this work consists of a very efficient water-wheel hoist and Chinese pump. In this work ½-yard skips are used and up to 158 skips of gravel per day have been mined by three men, with an average of between sixty to seventy-five skips per day. Of the material excavated, about two-thirds to three-quarters is sluiced; the rest, consisting of boulders, being dumped.

On the *Olalla* creek lease, optioned from I. Matthews, and on the *Tax* lease, No. 160, optioned from J. E. Smith and W. B. Conroy, interests associated with A. R. Kaufman, of Kitchener, Ontario, have been exploring with a Cordova drill with the objective of proving sufficient ground to warrant the installation of a power-shovel. The drill equipment consists of a 6-inch bit and casing, manufactured by the Harmon Machinery Company, Limited, Cordova, Alaska. Power

is supplied by a No. 30, 5 by 6, steam-engine (6 to 11 horse-power), using wood fuel. A crew of five men is employed. It is reported that from 10 to 16 feet of hole is drilled per eight-hour shift. The *Tax* lease is about 1,600 feet long and is down-stream from the *Olalla* lease, which is about 1,250 feet long. In former workings the *Tax* lease had been worked on either side of Spruce creek by hand-shovelling to bed-rock. The lower 200 feet and the upper 800 feet to the Matthews property-line appears to have been worked across the entire width of the creek-trough. The central section is composed of a strip about 150 feet wide and 600 feet long that has not been worked. The *Olalla* lease, adjoining the *Tax* lease on its up-stream end, appears to be unworked ground. In this locality the old channel of Spruce creek follows along under the left bank of the present Spruce Creek trough and possibly fringes or coincides with the present trough to some extent. At about 300 feet above the *Olalla* lease the old channel appears to cross the present creek-trough from the left to the right bank, with its bed-rock at about 30 feet below the present creek-bed. The channel then continues up-stream, more or less under the right bank through the Bratt-Morse-McKechney, Buchanan and Beaton ground, at the up-stream limits of which it appears to again cross the present Spruce Creek trough and cuts over towards the mouth of Dominion creek at the junction of the latter with Spruce creek. From this attitude of the old channel it is probable that the *Olalla* and *Tax* lease ground would owe an appreciable portion of its value to the gold washed down-stream out of the old channel which crosses the present creek above the Matthews ground. Experience on Spruce creek has proved that such ground can contain high values. The creek-trough along the location of the *Tax* and *Olalla* leases averages about 150 feet wide, with depth to bed-rock averaging about 20 feet. To operate this ground it would be necessary to either flume out or divert the creek-water and come up from the lower end of the *Tax* lease with a bed-rock drainage-cut. This cut would have to penetrate the entire length of the *Tax* lease, with 600 lineal feet of virgin ground to carry its cost up to the down-stream boundary of the *Olalla* lease. The method of operation that suggests itself for this type of ground is power-shovelling. At the time of examination (July 23rd, 1933) several test-holes had been drilled to bed-rock and encouraging values are reported to have been encountered in some of them.

On the right bank, at the lower end of the *Tax* lease, a drift-tunnel was being excavated by O. Holmgren. This had penetrated about 48 feet, with rim-rock showing at the face dipping about 5° into the hill. The face of the drift shows wash-gravel with a streak of sandy clay about 1 inch wide. The gravel is reported to pan about 75 cents to the cubic yard.

Stephen Elieff and partners are working on a lease of 600 feet acquired from I. Matthews. This work is mainly on the *Ajax* lease, adjoining the *Poker* lease, on which extensive previous work has been done. At the time of examination the drift was heading S. 30° E. (mag.) into the hill and a small fault in bed-rock was showing in the face, with bed-rock coming up to within half the height of the face. Further drifting, however, should bring bed-rock along the floor of the drift. Some very rich ground had been passed through up to this point and values as high as 7.5 oz. of gold to the set had been encountered up to the point of the bed-rock dipping below the floor of the tunnel on the low side of the fault. A 5° incline for 30 feet in a S. 60° W. (mag.) direction encountered bed-rock again, with values of around 2 oz. of gold per set. On account of the difficulty of tramming and the expense of timbering, which is estimated at this spot to amount to $59 per set in three shifts, this ground could not be made to pay. It is reported that about 218 oz. of gold was recovered during 1933 from this operation. To more efficiently operate this ground it is recommended that a complete survey be made. This survey might indicate the possibility of greater efficiency in mining from a new incline entry.

On the *Radio* fraction James Nedved has connected up with a drive to the old shaft, as reported in the 1932 Annual Report, and he is now sinking to bed-rock. At the time of examination (August 2nd, 1933) the shaft was 28 feet in depth below its intersection with the drift. It is estimated that an additional 8 feet of sinking is required to reach bed-rock. When this has been accomplished it is planned to drift up-stream on the fraction situated on the east corner of the *Joker* lease bordering the creek.

Axel Nelson and partners continued their drifting on a "lay" from L. Schulz. The drainage-tunnel was completed. The general layout of the ground was referred to in the Annual Report for 1932. At the time of examination (August 2nd, 1933) a drive was being excavated across the creek-trough and at a depth of about 30 feet below the creek-bed. The objective of this drive is to afford drainage of the creek ground lying to the north-west and also

of the *Calder* lease, situated on the north bank. Rich ground was being encountered in the workings of this operation and during the season 691 oz. of gold is reported to have been recovered. In the clean-up, previous to the examination (August 2nd, 1933), 16 oz. gold is reported to have been recovered from the washing of 270 cars, or about 135 cubic yards of gravel.

In the *Cassidy* group of creek claims lying up-stream from this operation, and also in the *Calder* lease, situated on the north bank of Spruce creek, work was carried out by Frank Breeze. This was directed to reaching bed-rock on the *Calder* lease, but water difficulties intervened. The draining of this ground, however, by the bed-rock tunnel being driven in the down-stream workings of Axel Nelson will facilitate this operation. With reference to the *Calder* lease, it would appear that a small strip of the Spruce Creek old channel falls within and skirts the southerly boundary of this lease contiguous to the creek. Some low-grade values may extend for an appreciable distance towards the north rim, but good-grade values could probably only be expected along the thin strip skirting the southerly boundary. This alignment of the channel, however, indicates that good chances for an appreciable width of the pay-channel lie in the *Cassidy* group of creek claims. To operate this ground, however, drainage is required, and if possible the creek should be flumed out. With the continuation of the Axel Nelson bed-rock drain beyond the *Calder* lease and up-stream into the *Cassidy* group, the drainage of this ground will be facilitated. With this drainage completed, a shaft for the operation of the entire holdings could be conveniently located at the south-westerly end of the *Calder* lease. From the values being obtained in contiguous workings it is considered that a profitable operation could be established on this ground, embracing, especially, the *Cassidy* group of creek claims.

Otto Miller is drifting on the *Peterboro* lease from a 10° incline, 54 feet deep, past old workings, to get into unexplored ground to the south. When examined the drift had advanced 319 feet and had just about entered unworked ground lateral to the old workings. Two pans of bed-rock material at the face of this drift, which was heading S. 7° E. (mag.), returned about 0.12 oz. gold per pan. This is extremely encouraging for the encountering of rich values lateral to the old workings, and it is indicative of the opportunities that still exist on Spruce creek in this type of ground.

I. Matthews is drifting from a 135-foot incline into the bench on the left bank. Two drifts are being driven, one up-stream and one down-stream. The down-stream drift is about 160 feet in from the face of the incline and heads S. 50° W. (mag.). The up-stream drift has been advanced about 500 feet into the hill in a N. 50° E. (mag.) direction. In these workings a 400-foot-wide channel on flat bed-rock is indicated. In both drifts flat bed-rock exists on the southerly edge of the "pay," at which point it appears to plunge south-easterly, indicating the possible existence of a deeper channel lying easterly of the presently worked Spruce Creek channel. This supposition is also supported by similar conditions of south-easterly-plunging bed-rock observed at the limits of old workings on this side of the creek on the *Gladstone* lease and also in the Faulkner workings. It is quite possible that this indicated old channel may lie between Spruce and Little Spruce creeks and possibly follow an old buried trough of Little Spruce creek. In this connection deep drilling in the Little Spruce Creek area would be very informative. In the Matthews workings four men are employed underground, two men at each face, and one man is employed on the hoist, with one man bucking timber. Eleven cars of dirt per man were being produced per day, and it is estimated by I. Matthews that 75 cents per car or about $8 per day per man is required to pay. At the time of examination the ground being mined was reported to run about $1.25 per car of about ½-cubic-yard capacity. A total of 515 oz. gold is reported to have been recovered during 1933.

Bratt, Morse & Company had advanced their face, at the time of examination (August 1st, 1933), about 400 feet east of the shaft and were heading S. 80° E. (mag.), practically across the creek. This heading shows a local turn of the old channel conforming to about the point of rim exposed on the left bank of the creek on surface and referred to in the 1932 Annual Report. In the drifting some ground showing uneven bed-rock, with patches of bed-rock dipping below the drift-floor and carrying very high values, was encountered in the area of this channel bend. The face at the time of examination was in good "pay." It was estimated then that about 500 feet of unworked ground lay ahead of the working-face. A total of about 1,250 oz. gold is reported to have been recovered in these workings during 1933.

Buchanan and Cummings continued operations on the *Clydesdale* bench lease. As recommended in the 1932 Annual Report, drifting was continued along the southerly boundary of the

lease and showed gradually improving values approximating 60 cents to $1 per car, with lowering bed-rock. In places ground carrying about 4 oz. gold per set was encountered on flat, though hummocky bed-rock, with the channel apparently striking S. 80° E. (mag.) and conforming to the bed-rock direction in the Bratt, Morse & Company's workings adjoining down-stream. A few sets east of this point the values decrease slightly. The drift is heading N. 80° E. (mag.), and due to rising, still hummocky, bed-rock, the workings were turned slightly to the south. On turning again to the original heading direction of S. 80° E. (mag.), values of 4 oz. gold per set were encountered and were reported, at the time of examination (August 1st), to be continuing in the face. In an earlier drift back from the face high rim-rock was encountered on the south, indicating that the present direction of drifting should be about in the centre between the rims of either the main or a subsidiary channel. In accordance with the interpretation of the channel direction in this locality, as outlined in former Annual Reports, values, though patchy in character, should improve as drifting is continued along the bearing of the present working-face. In the workings about 3 feet of bed-rock is carried in the face. It is hard, smooth greenstone, indicating a swift water and slightly canyony condition in the old channel in this area. It is estimated that about 200 feet of ground lies ahead of these workings on this lease.

On the *Beaton* lease drifting was continued and 3,722 oz. gold was recovered during 1933. At the time of examination (August 1st) a south drive was heading S. 60° E. (mag.), and with a further advance of five sets in this direction it was planned to crosscut over and to connect with the old Beaton shaft on the *Sunlight* creek lease. As the workings have advanced beyond the efficient scope of the present shaft, this new shaft connection will greatly facilitate tramming and should lower costs and permit an increased output. The connection will also give better air-circulation. The old shaft is reported to be 110 feet deep and it is estimated that it will have to be sunk a further 82 feet to make the underground connection. A north drive also heads S. 25° E. (mag.) at about 2 feet higher elevation than the south drive, and at the time of examination the face was about 1,600 feet east of the present working-shaft on the *Goodwill* bench lease. The main drift heads east for about twenty-three sets east of the north drive. According to rim-rock outcrops and its correlation with the attitude of bed-rock underground, the old channel in this locality strikes N. 80° E. (mag.). At the time of examination a crew of fourteen men was employed, with eleven men underground. An output of about 5½ cars per day to the man was being made. Recoveries varied from about 60 to 100 oz. gold per week and costs averaged about $875 per week.

An examination of the *Can* creek lease and the *Fern* bench lease, owned by F. H. Brackett, situated in the area between the Beaton leases and Dominion creek, indicated a possibility for rim values along a small strip of the easterly edge of the *Can* lease and the north-easterly corner of the *Fern* lease. This ground could be prospected by sinking a shaft at the northerly boundary of the *Can* creek lease.

At the mouth of Dominion creek, George Noland, in association with Juneau, Alaska, interests, continued the sinking of the shaft. This shaft, 4½ by 9 feet between timbers, at the time of examination (July 30th) was down about 45 feet in glacial clay. It is estimated that a further 200 feet of sinking will be required to reach bed-rock. The cost of sinking is reported as $7 per foot. Water conditions were not as bad as was first expected and only about 5 gallons of water per minute was making in the shaft. The equipment at this working consists of a sawmill; Pelton wheel, operated with 500 feet of 12-inch to 6-inch pipe-line at 110 feet head; and a "New Way" 3½-horse-power gasoline-hoist. It is intended to install additional water-driven equipment for hoisting. The alignment of the old channel through the Beaton workings to the west indicates that it should cut across about the southerly section of the *Canyon* lease, which lies between the *New Year* lease on Dominion creek, owned by Joe Yonaites, and the Beaton *Sunlight* creek lease.

In the upper Spruce Creek area several individuals have been shovelling and sluicing and several leases which have been taken up by outside interests have been superficially explored. There are possibilities for the expansion of operations in this section.

Pine Creek.

(*See* Annual Reports for 1930, 1932, and Bulletin No. 1, 1931.) Keystone-drilling in the lower section of Pine creek in the Stephendyke area was undertaken by Vancouver interests, with reported encouraging results.

On the right and left limits of the old workings in Pine Creek valley at Discovery, drifting was done by two individuals who are reported to have recovered wages. These workings indicate the possibilities of encountering "pay" in certain sections on flat bed-rock and rim along the limits of the old hydraulicking operations.

Hydraulicking was continued by Fred Hjelm & Company above Discovery. A recovery of about 900 oz. of gold was made in the 1933 season. At the time of examination (August 5th) the workings included two pits on the old channel striking N. 40° E. (mag.) on the left bank of Pine creek and contiguous to the present creek-bed. This ground is comparatively low and drainage and tailings-disposal offer some difficulty. Bed-rock consists of weathered serpentine dipping slightly to the west, and it is overlain by a thin layer of hard-pan, on top of which is 6 feet of yellow gravel, and then 5 feet of glacial debris and 3 feet of surface soil. Pit-drainage is carried out by an hydraulic elevator with a lift of about 10 feet. Two monitors are used, one for cutting in the pit and the other for tailings-disposal and stacking. In the course of this operation some very rich ground has been passed through and it is interesting to note that the clean-up for the month of July amounted to 321 oz. of gold.

Ole Lovegren continued his drifting operation with the object of picking up the old "Gold Run" channel on the south side of the road. This property is situated on the left bank of Pine creek, about 400 feet down-stream from the Pine Creek bridge. The ground is penetrated by a short incline shaft to bed-rock, which lies at about 20 feet below the surface. Extensive old workings are penetrated by a winding tunnel. The old workings represent, approximately, the easterly limit of what was known as the old "Gold Run" channel, from which phenomenal gold values were recovered in the old workings. The "pay," apparently, was lost at about this point. The present operator has been recovering small gold values in his exploratory work and the present face of his workings is heading about N. 80° E. (mag.) in somewhat bouldery ground on a flat and decomposed bed-rock.

For several thousand feet easterly from Lovegren's workings about a dozen shafts have been sunk to bed-rock in former years in an attempt to pick up the old "Gold Run" channel. These shafts vary from 12 to 30 feet in depth and in some of them good values were reported to have been recovered, while in others only indicative values were found.

About 1,500 feet north-easterly of Lovegren's workings, E. H. Woodean is operating, single-handed, the *Violet* lease and the *Sporty* claim. The ground is operated through a shaft 30 feet deep to bed-rock, with drifting heading generally in an easterly direction. At the time of examination the ground being drifted in was returning about 0.06 oz. gold per cubic yard. Ten to fourteen cars per day were being produced and the average recovery was reported to be from 3 to 4 oz. of gold in six days. The channel that Woodean is working on is approximately 20 feet wide and winding. Although this may be a subsidiary channel, it does not appear to be the main Pine Creek channel, which possibly crosses over above the Lovegren workings to the right bank of Pine creek, trending towards the mouth of Birch creek. The ground in this vicinity is interesting and well worth investigation. On account of the situation of bed-rock below the present Pine Creek bed and depth from surface to bed-rock in the upper Pine Creek section, its operation would offer technical difficulty to any other method than perhaps dredging.

Birch Creek.

(*See* Annual Report for 1930; Bulletin No. 1, 1931; and Bulletin No. 1, 1933.) Joe Yonaites is shovelling-in from bed-rock on the right bank of Birch creek in worked ground which is covered with old tailings. On the left bank the drain for a drift-tunnel has been completed and it is planned to drift during the winter.

About a quarter of a mile above Joe Yonaites' workings, G. Bouquist was "sniping" on the old Pierce lease and excavating a drain on a patch of unworked ground in this area. Up to the time of examination, shovelling on bed-rock had returned about 4 oz. of gold and it is claimed from $2 to $3 per day was being recovered. Billy McDonald is ground-sluicing on a small piece of unworked ground referred to in former reports, and should receive some encouragement in gold values when he starts to shovel-in.

Above McDonald's operation George Gash is excavating a drainage-cut in the deep ground referred to in former Annual Reports.

Boulder Creek.

(*See* Annual Reports for 1930, 1932, and Bulletin No. 1, 1931.) The Consolidated Mining and Smelting Company continued hydraulicking operations on this creek in the attempt to get into "pay," and some very creditable work has been carried out under the supervision of McLeod White and J. K. Cram. Considerable stripping was undertaken and this gives more room for tailings-disposal by stacking. The high-line method of handling boulders has also greatly increased the efficiency of the operation. Water conditions were improved through increasing the head by 60 feet. A 200-foot head of water is now available at the top of the cut, equivalent to a head of 260 feet at the bottom of the cut. Piping is done with a 5-inch nozzle. About 30,000 cubic yards of gravel was being moved per month. Up to the time of examination (July 29th) an advance of 600 feet had been made in stripping, and the ground being worked in, on account of its containing more sand and gravel and less clay, was being more easily cut. On the north side of the cut, rim-rock had been picked up for a length of about 25 feet, dipping south, and on the south side rim-rock had been picked up in a drift. It is interesting to note that, whereas the north rim is covered with gravel, on the south side glacial clay is superimposed upon it. It is estimated by the management that bed-rock would be picked up in the cut at approximately the location of the monitor set-up. This estimated contacting with bed-rock is considerably above the point originally anticipated and, consequently, the ground below this point will probably have to be drifted. No gold-recovery was made from this operation during 1933.

Ruby Creek.

(*See* Annual Reports for 1930 and 1932; Bulletin No. 1, 1931; and Bulletin No. 1, 1933.) Hydraulicking operations were continued on the Matson and Schulz "lay" towards the mouth of this creek and about 240 oz. of gold was recovered during 1933.

Emil Turnquist continued his drifting operations above the Matson-Schulz ground and recovered about 298 oz. of gold during 1933.

McKay, Morrison, and Johnson also continued their drifting operation above the Emil Turnquist ground and recovered 207 oz. gold during 1933. At the time of examination the rock-rims showed the channel to be striking N. 20° to 30° W. (mag.), with the working-face heading N. 20° W. (mag.). A clean-up from 170 cars (about ½ cubic yard per car) returned 9 oz. in gold. Most of this material came from the ground closer to the west rim, which showed poorer values than the average. The alignment of rim-rock showed the working-face to be trending towards the west rim, and it seemed advisable to turn the face approximately 10° to the east to get into the centre line of the channel, which should be from 40 to 60 feet wide at this point. The west rim at this locality shows glacial clay with some pebbles coming down to contact with the rim and gradually cutting out the river-gravel wash. This condition indicates the possibility for glacial action from a small cross-moving glacier in the upper area of the creek. Down the creek no glacial mud occurs between the lava and the river-gravel and, at a point about 1,500 feet up-stream, a shaft through the lava showing no glacial mud between the lava and the river-wash. These conditions and surface topography indicate the possibility for a cross-moving glacier during the glacial period having moved down from the draw to Volcanic creek east of Krumbeigel's shaft and down Little Boulder creek to Boulder creek.

Arno Krumbeigel continued the sinking of his shaft to penetrate the lava in the attempt to reach bed-rock and the old channel. At the time of examination (July 29th) the shaft had reached a depth of 85 feet in lava. Equipment consists of a Petter semi-Diesel 12–14-horse-power engine belt-connected to a geared pump-arm and also to a friction-hoist. Drilling is carried out by hand with a crew of three men and an average of ten holes, 2 feet deep, are drilled per day. As lava depth generally increases towards the proximity of its source of origin, and as this source is on the divide between Ruby creek and the Fourth of July valley, it is impossible to form any reliable estimate of the depth of lava to be penetrated before the underlying gravel and bed-rock is reached.

Otter Creek.

(*See* 1930, 1931, and 1932 Annual Reports; also Bulletin No. 1, 1931, and Bulletin No. 1, 1933.) The Compagnie Francaise des Mines d'Or du Canada was vigorously continuing hydraulicking under the management of J. E. Moran with a crew of nineteen men at the time of examination (July 27th). During drifting operations after the close of the hydraulicking season

a cave-in in the drift-workings resulted in the death of Mr. Moran. It is fitting to pay a tribute to this efficient operator, whose loss to the mining industry of the Province and to the Atlin area in particular will be sorely felt. At the time of examination two monitors were in operation and piping was being done in a lower pit near the lake with the object of coming in on bed-rock with a drain for drifting which will be done in the rich ground exposed in the winze, as described in the 1932 Annual Report. Piping was also being carried out in the upper pit. Boulders were being shifted with a caterpillar tractor and chains, and up to the time of examination about 10,000 boulders had been moved at an estimated cost of about 10 cents per boulder, as compared with a cost of about 25 cents per boulder disposed of with the use of dynamite. The two pits are piped intermittently, and approximately eight hours out of the twenty-four is consumed in moving boulders, so that piping is only carried out about two-thirds of the time. During the season 307 oz. of gold was recovered.

Cracker Creek.

(*See* Annual Report for 1932.) Drifting operations were continued on this creek by Olsen and Broten on a "lay" from Paul Eggert, of Atlin. It is interesting to note that the face, heading S. 45° E. (mag.) in high rim and referred to in the 1932 Annual Report as appearing to be too far east and to the left of the projection of the probable old channel, was continued and broke through this rim. The rim dips about 10° east and a recovery of coarse gold was made at the break-through. Great credit is due these operators for having continued this crosscut in the face of what appeared to be unfavourable conditions. At the point where gold was encountered on this south rim values were reported to be about $3 to the car (about 10 cubic feet). In the sluicing of this material about 3 oz. of coarse gold was recovered, with the biggest nugget weighing approximately 10 dwt. It is planned to drift along this rim with the objective of encountering bed-rock, which is estimated to be at about a depth of 10 feet below the present-worked tunnel-floor. These men are splendid workers and about seventeen cars per day are being excavated. With the long distance of winding tunnel to be trammed in these workings this is an extremely creditable result.

TATSHENSHINI RIVER SECTION.

This area is described in detail in Bulletin No. 1, 1933, and also in the Annual Report for 1932. Prospecting activity has gradually increased in this area and is spreading over a wider territory. On Squaw creek operations during 1933 were extended to include the upper section of this creek, but appreciable vacant ground still remains. At the time of examination by the Resident Engineer (in July) the individual operators were preparing for the season's work, but on some creeks, where sluicing had just started, good recoveries were being made. It is understood that at the close of 1933 about 600 oz. gold had been recovered and individual recoveries had been quite satisfactory, with more large nuggets being taken from Squaw creek than during any previous year. Approximately fifteen nuggets were reported, weighing from 4 to 9 oz. each. At the time of examination approximately forty individuals were active on the creek. Most of these people were unfamiliar with placer-mining and prospecting and had come in, more or less inadequately equipped, over the trail via Haines and Pleasant Camp. In September, and at a place which only allowed a small amount of superficial work to be carried out before winter set in, a new gold-bearing creek named "Blizzard" or "Gold Run" was discovered and promising indications uncovered.

Entry into this section by the Resident Engineer was made via Whitehorse, Champagne, the Dezadeash river and lake, Klukshu and Dalton Post. In connection with this route it is suggested that those contemplating the trip communicate with George Chambers, Champagne Landing, Yukon, who will supply the necessary transportation facilities of truck, river-boat, and pack-horses at reasonable rates. George Chambers conducts a trading-post at Champagne Landing and transports supplies to Dalton Post and the Squaw Creek area. Champagne Landing is 65 miles from Whitehorse via a very poor automobile-road. Champagne to the boat-landing on the Dezadeash river is 3 miles by truck-road. From this point to the head of Dezadeash lake, a distance of 55 miles, transportation is by means of a small river-boat with attached outboard motor. Approximately 42 miles of this distance is via the Dezadeash river, the remaining 13 miles being by way of Dezadeash lake. From Dezadeash lake there is a good pack-horse trail through open country to Klukshu Indian village, a distance of about 7 miles, and from there

it is a distance of about 18 miles to Dalton Post by trail. At Dalton Post the Tatshenshini river has to be forded and this requires local knowledge and caution. There is a well-marked trail between the Tatshenshini river and Squaw creek, a distance of approximately 15 miles via the upper trail to Muncaster's cabin, or 12 miles via the lower trail to the mouth of Squaw creek. The time generally required to make this trip is as follows: Whitehorse to Champagne, 6 hours; Champagne to the head of Dezadeash lake, 9 hours; Dezadeash lake to Dalton Post, 7 hours; Dalton Post to Squaw creek, 5 hours. Freight charges quoted by George Chambers are as follows: Whitehorse to Squaw creek, 13 cents per pound; Whitehorse to Champagne, 2 cents per pound; Champagne to Dezadeash lake, 2½ cents per pound; Dezadeash lake to Dalton Post, 4½ cents per pound; Dalton Post to Squaw Creek, 4 cents per pound.

The route via Whitehorse and Champagne makes accessible much country in Yukon Territory and the lower Tatshenshini River area. For the upper Tatshenshini River section, in the neighbourhood of the Kelsall and Parton rivers, however, the route via Haines and Pleasant Camp is much shorter and more practical. For this latter route those interested are referred to former reports.

Prospectors going into this area are advised that big game is extremely scarce and, with the exception of a few mountain sheep and goats in the higher altitudes of the mountain areas, edible game in the lower altitudes is restricted to a few grouse and in some localities numerous willow-ptarmigan and gophers. In the lower area of the Tatshenshini river, from about Dalton Post down-stream, king salmon can be caught by drag-net or traps during the running season. Salmon, grayling, whitefish, and arctic trout can also be caught in the Klukshu and Dezadeash Lake areas, where there are also a few moose. In the upper Tatshenshini section, around the Kelsall and Parton rivers, mountain-trout are sometimes seen in the clear spring-water creeks. Game scarcity in the upper Tatshenshini River area and in the Squaw Creek section, consequently, requires the prospectors to rely upon food transported in by themselves or pack-trains. In this respect the pack-trains of F. Muncaster, George Chambers, the Kane Bros., and Johnny Fraser make periodic trips.

Squaw Creek.

B.C. Prospectors, Ltd.

Although the exploration carried out by this company was restricted to the mouth of Squaw creek in Yukon Territory, it was examined by the Resident Engineer en route into Squaw creek in connection with possible correlation of conditions with those of the upper Squaw Creek section in British Columbia. A portable drill was transported to the mouth of Squaw creek and drilling operations commenced under the supervision of O. D. Frith and H. McN. Fraser with a crew of five men. The drill, with a 24-inch stroke, was equipped with a 4-inch bit, ¾-inch Manila rope, 5-foot casing-lengths, and was operated by an 8-horse-power Cushman gasoline-engine. It is reported that 12 to 20 feet of drilling was accomplished per eight-hour shift. Holes were cased throughout and sampling was carried out by pumping and panning every foot of ground drilled, approximately three pump-loads being required for each foot of hole.

Before drilling at the mouth of Squaw creek was started this outfit drilled some holes in the neighbourhood of Dalton Post, on the right bank of the Tatshenshini river, with discouraging results reported. It might be of interest to mention that from observations made by the Resident Engineer on the trip from Dalton Post to Squaw creek, it would seem that ancient glaciation and subsequent erosion between Dalton Post and the mouth of Squaw creek are indicative that this section is not favourable for the occurrence of placer-gold deposits.

At the mouth of Squaw creek several holes were drilled on the right side of the mouth of the creek in a fan outwash and bench area bordering the Tatshenshini river. At the time of examination holes were being drilled paralleling the creek. It would seem that a far more constructive plan of drilling would be to cross-section the outwash at right angles to the present creek-bed, with a possibility of picking up old channels. An examination of this area indicated that the creek has moved over from the west side of the fan to its present position on the east side. This has been mainly brought about by slides and sloughs from the confining ridge on the west side. A constructive plan to follow would be to commence drilling on the west side at a selected point which would offer a fair chance of picking up the rim exposed on the ridge, and drill subsequent holes across the fan to the east. From various geological conditions involved the best gold values should be contained in the oldest channels on the west side. It is reported

that the drilling on the east side of the fan was not productive of encouraging results and the drill was withdrawn after these holes were completed.

Victoria Ventures, Ltd.

This company, with its subsidiary, the Yukon Ventures, Limited, explored ground along the lower section of Squaw creek from the British Columbia boundary towards the confluence with the Tatshenshini river. This ground is entirely in Yukon Territory, but it was inspected to correlate it with that portion of the creek in British Columbia territory. At the time of examination (July 9th) Fred M. Brown and George Pearson were working under the supervision of John S. Shaller, and it is understood, at that time, that J. A. Willis and Walter Scott were on their way in from Whitehorse. J. J. Mann, who had come in with the outfit, had left the camp and was prospecting in the lower area of the Tatshenshini valley. The work being carried out consisted of a long drainage-cut in an attempt to reach bed-rock on the left bank of Squaw creek below the canyon-mouth. This cut, about 220 feet in length, was in very bouldery ground and at its face was about 12 feet deep, with rising ground ahead and no good prospect of reaching bed-rock at this point. At the time of examination no values were being recovered in this cut, but it is understood that some gold was recovered from subsequent sluicing. It is also understood that a very creditable amount of prospecting was subsequently carried out in test-holes to bed-rock, trenching and crosscutting at points farther up the creek, and that some encouragement was encountered. The operators were advised by the Resident Engineer to try cutting in at some other locality, with a better chance of reaching bed-rock. The work being done was being efficiently and energetically carried out under the supervision of John Shaller, who is an experienced placer-miner. In this area the creek-trough is about 300 feet wide and gradually narrows to a width of about 200 feet, where it is confined by precipitous and high rock-bluffs with low gravel flood-benches bordering the creek. Above this the creek is contained in a narrow and very deep canyon with perpendicular walls of limestone, dolomite, and altered schistose rocks. Above this canyon to the Yukon boundary the creek-trough flattens as it enters the outwash area on the British Columbia side of the boundary-line. In traversing this area numerous large boulders of quartz and quartzose material from the bluff-walls were observed, and it would seem quite constructive if some prospecting for lode-deposits were done in this locality. It would also seem that some of the low bench and flood areas contiguous to the creek-bed, and also the creek-bed itself, would be worth while prospecting for bed-rock deposits of placer gold.

On the British Columbia side of the boundary claims *Nos. 1, 2, 3, 4, 5,* and *6* below *Discovery* had been staked, and *Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 15, 16, 19, 20, 21, 22, 28,* and *30* above *Discovery* had been staked or were occupied. At the time of examination J. Robinson was ground-sluicing on *No. 1* and *No. 2* below *Discovery* in ground from 4 to 5 feet deep on bed-rock.

On *Discovery* Paddy Duncan with five men and Alex. Davis and partner were shovelling-in on bed-rock. Recoveries at the time of examination were varying from about $7 to $15 per day for two men to about $40 in the Paddy Duncan operation. The total recovery on this ground for the season is reported to amount to about 350 oz. gold.

On *No. 1* above *Discovery* shovelling and sluicing was carried out during the season with a reported recovery of about 60 oz. gold.

On *No. 2* above *Discovery* Mr. and Mrs. Jimmy Kudwat were shovelling-in on the left bank of the creek in ground 4 feet deep to bed-rock. At the time of examination an estimated recovery of $40 was made on July 10th with $10.30 on July 11th. The total recovery from this claim during 1933 is reported to be about 60 oz. gold.

On *No. 3* above *Discovery* the Kane Bros. were getting squared around for sluicing. At the conclusion of the season a recovery of about 50 oz. gold is reported to have been made.

On *No. 4* above *Discovery* Mr. and Mrs. D. A. Stanton, working on a "lay" from Johnny Fraser, were cutting in towards the slide on the right bank on a quartzose shale bed-rock with some pyrite and much iron oxidation. Approximately 30 oz. gold is reported to have been recovered from this claim during 1933.

On *No. 5* above *Discovery* Mr. and Mrs. Muncaster were shovelling-in contiguous to the slide in ground about 3 feet deep to a soft, black, shaly bed-rock, here containing quartz stringers. At the time of examination (July 11th) about 5 dwt. gold was recovered in two hours' shovelling on bed-rock. This claim was only worked intermittently during 1933 and the recovery of gold is reported to be about 1½ oz. On *No. 8* above *Discovery*, owned by Mr. and Mrs. Muncaster, a recovery of about 10 oz. gold is reported for 1933.

On *No. 9* above *Discovery* A. Gedney was cutting in to bed-rock on the right side of the creek in a locality in which it appears that an old bed probably cut diagonally across the present creek-trough from rim to rim and then again swung over to the right bank farther up the stream. A recovery of about 20 oz. gold is reported for 1933.

On *No. 12* above *Discovery* J. Granstrom was shovelling-in above bed-rock on the left bank of the creek in a cut that had advanced approximately 40 feet up-stream. Some gold was recovered.

On *No. 13* above *Discovery* prospecting was being done by Hans Johnston.

On *Nos. 15* and *16* above *Discovery* Oscar and Edward Jurgelit were prospecting.

On *Nos. 19, 20,* and *21* above *Discovery* preliminary prospecting was being done by George C. Mattern, E. B. McRevy, and S. H. Fuller.

On *No. 28* above *Discovery* Ed. F. McAllister was cutting in towards the right bank through 4 feet of overburden to what appeared to be an outcrop of soft rim-rock. At the time of examination about ¾ oz. coarse gold had been recovered from 1½ days' shovelling. The creek-bed in this locality is about 100 feet wide, with confining side-benches of glacial debris and sloughed slopes. Contiguous rim-rock outcrops suggest that an old bed of the creek may probably be found under the sloughed slope of the right bank.

On *No. 30* above *Discovery* L. V. Russell was cutting in through wash overburden on the right bank in the attempt to reach bed-rock.

The claims in the upper section of Squaw creek, as described in the 1932 Annual Report, are in deeper ground than those in the lower area, but as yet have only been very superficially prospected and would seem to be worthy of more intensive exploration. For further information concerning the area of this creek and opportunities therein, those interested are referred to Bulletin No. 1, 1933, and to the Annual Report for 1932.

Gold Run (Blizzard) Creek.

Acting upon information given in the Annual Reports and on advice given in the field by the Resident Engineer, H. H. Darud carried out some very creditable prospecting in the neighbourhood of the junction of the Tatshenshini and Parton rivers, and in September discovered promising prospects on a creek named "Gold Run" by the discoverer. This creek is indicated in the Annual Report for 1932 as the Duncan Cabin creek, about 1 mile up-stream from the mouth of the Parton river. In a communication to the Resident Engineer, H. H. Darud, the discoverer, gives the following information regarding this creek: He arrived at the creek on September 5th and made the discovery on September 11th. After staking he did some prospecting and then, on account of approaching cold weather, went out on September 13th. In the small amount of prospecting done the discoverer reports that he uncovered fine gold on surface and down to about 4 feet depth. Below this, for about 1½ feet, coarse gold was found, but time was not available for penetrating to bed-rock, which, from the appearance of the ground, is estimated to be about 7 or 8 feet below surface. Ground conditions are reported to be quite bouldery and similar in this respect to that described for Squaw creek. In the prospecting-work one pit 4 feet deep was excavated near the mouth of the creek at timber-line, but on account of lack of drainage could not be sunk any deeper. In this pit fine gold is reported to have been recovered all the way down from the surface.

The formation of the creek is described as being composed of old volcanics with a granitic intrusion outcropping along the right bank. Numerous quartz boulders in the creek-bed are also reported. It is estimated that the creek, from its mouth to its source, is about 8 miles long. Subsequent to the discovery, fifteen creek claims and two creek leases are reported to have been staked. H. H. Darud plans to fly into this area in the season of 1934 and commence active exploration with a small crew.

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

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

INTRODUCTION.

The general geologic and mining features of this district have been discussed at length in previous Annual Reports, those for 1927 to 1930 containing extended bibliographic references. The following publications of this Department relate to gold only: Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia"; Bulletin No. 3, 1932, "Lode-gold Developments in British Columbia during 1932"; and Bulletin No. 2, 1932, "McConnell Creek Placer Area." Reference is also invited to: "Gold Occurrences of Canada, Summary Account," 1933, published by the Geological Survey of Canada; and "Gold in Canada," 1933, published by Mines Branch, Department of Mines, Ottawa.

GENERAL SUMMARY.

Activities in metal-mining during 1933 were confined almost entirely to gold properties, and in this connection the dominant feature was the interest evinced in the lode-gold potentialities of the Cariboo district, embracing the Cariboo and Quesnel Mining Divisions. This interest, which was first manifested at the close of 1932, mainly in the form of extensive blanket-staking of mineral claims after snowfall, was followed in 1933 by active development at many different points by several of the large mining companies and by many newly incorporated companies. The frequent use of the word "Cariboo" in the names of the latter clearly indicates the interest this area has for the public. This interest, resulting undoubtedly from the success of the Cariboo Gold Quartz Mining Company, Limited, was further stimulated during 1933 by the continued success of the company and by the constantly increasing price of gold.

The sequence of events, which may without exaggeration be termed "The Second Cariboo Gold-rush," illustrates very pointedly the far-reaching beneficial effect of the growth of the mining industry. Locally, that effect was very marked: the old towns of Barkerville, Quesnel, and Stanley were transformed and rapidly expanded both in size and population; a new town named Wells, after Fred Wells, appeared on the map; and employment was found for hundreds.

The output of the Cariboo Gold Quartz Mining Company, Limited, for 1933 totalled $228.908, a distinctly satisfactory result in view of the fact that this property, which commenced milling operations on January 2nd, 1933, was experiencing its first year of productive life.

New operations were greatly retarded by an unusually late spring and by early snows in the fall. In spite of this, however, the sum total both of underground development and surface work carried out during 1933 was very considerable, apart altogether from the extensive development carried out by Cariboo Gold Quartz Mining Company, Limited.

As to the result of development to date, gratifying results have been obtained at several different points, but in certain regions it has been rendered evident that faulting problems will involve expense in deciphering. Development to date has been almost entirely directed to the north-west ends of the pre-Mississippian vein-belts. The south-eastern portions of both these belts contain showings of decided promise. Moreover, the very extensive belt of quartz veins following the path of the Central batholith, the potentialities of which are practically unknown, offers a field for investigation which cannot be quickly covered. There is, however, every present indication that the lode-gold possibilities of the Cariboo district will be thoroughly probed with a high measure of geologic and executive skill.

In the Omineca Mining Division, although only small-scale development took place, nevertheless encouraging results were gained and expansion seems likely both on Dome mountain and on Hudson Bay mountain. A car of ore was shipped by the owners of the *Glacier Gulch* group, situated on the latter mountain; Columario Consolidated Gold Mines, Limited, resumed operations at its property near Usk late in 1933 with a force of fifteen men; and the discovery of quartz veins of promise is reported in the McLeod River area.

Noteworthy efforts on the part of two separate groups of individuals were: (1) Shipment of approximately 30 tons of ore by the owners of the *Glacier Gulch* group, near Smithers; and (2) the installation of a wood producer-gas power plant and small pilot-mill on the *Gold Brick* group (formerly *Horseshoe* group) on Bob creek, near Houston, by H. C. Stratford and associates.

In placer-mining, material expansion took place and important developments resulted at several properties, notably at that of Consolidated Gold Alluvials of B.C., Limited, in the Cariboo Mining Division. Much large-scale activity was manifested not only in the Cariboo district, but also in the Manson section of the Omineca Mining Division, where the Consolidated Mining and Smelting Company of Canada, Limited, installed a Sauerman high-line plant with a 2-cubic-yard bucket. Access to this section is now greatly facilitated by the construction of a road from Fort St. James to a point 15 miles north of the Nation river. Activity was marked in the McLeod River area, where new discoveries are reported. Activity of individuals was manifested on Lorne, Dog, and Bob creeks. Generally speaking, there is every indication that the placer-mining industry is in a healthy condition, and it is desired to emphasize the fact that properties offering promise to capital under intelligent direction, yet await development.

In coal-mining, the market for "Bulkley Valley Coal" from F. M. Dockrill's colliery near Telkwa continues to increase, the production being 25 per cent. greater than in 1932. Lake Kathlyn Anthracite Coal Company carried out a considerable amount of exploratory development at its property on Hudson Bay mountain.

Of real service during 1933 was the assistance rendered by the Geological Survey of Canada. Dr. W. E. Cockfield and Dr. George Hanson and party worked in the Barkerville area, while Dr. F. A. Kerr and party worked in the Manson section.

PRODUCTION.

Name.	Ore.	Gold.	Silver.
Cariboo Mining Division—	Tons.	Oz.	Oz.
Cariboo Gold Quartz Mining Co., Ltd.	19,769	7,660	823
Omineca Mining Division—			
Glacier Gulch	26	82	15

PROSPECTING.

Reference is particularly invited to the subject-matter under this heading in the 1932 Annual Report. This information applies with equal force at the present time. The prospector's attention is directed to the following localities:—

(1.) Spanish mountain, near Likely, warrants close search for gold-bearing quartz veins; likewise the area immediately contiguous lying to the north-west or south-east.

(2.) In the McLeod River area indications suggest that the south-eastern extremity of a north-westerly-trending belt of country containing quartz veins is to be found about 4 miles north of the McLeod river; consequently prospecting from the latter point north-west would seem advisable. In this region any creeks flowing north-east or south-west should be most promising for placer, because such direction is across the belt of country mentioned.

(3.) It would appear that in Hixon Creek valley there has been preserved quite a large remnant of terrain which underwent deep secular decay in Tertiary times. It is not known to what extent similar remnants have been preserved in neighbouring valleys, except that there is evidence of such on Terry creek. The remnants are likely to be extensively kaolinized and closely resemble clay false bed-rock; they may be overlain by placer deposits or entirely hidden by vegetation, and low-lying benches in this region merit close investigation.

GOLD ON RIVER-BARS.

The total gold recovered from bars on the Fraser and Quesnel rivers during 1933 was undoubtedly considerable. While no doubt it is true that the inexperienced in many cases, owing to exaggerated stories in circulation, have been led to entertain an erroneous idea as to the profit to be made from washing the gravels of the Cariboo district, it is probably equally true that there has been failure to appreciate the fact that experience is essential, and that the well-directed efforts of the hard-working and experienced placer prospectors on the many river-bars have enabled many to gain at least a "grubstake" from this source.

Good recoveries of fine gold from river-bars can be made with apparatus involving very small capital outlay, provided that the correct principles are embodied therein. Conversely, the

installation of expensive plant may prove a failure if principles are disregarded. While different capable workers employ somewhat different methods, attention to the following points is of great importance:—

(1.) While there is no difficulty in recovering fine bar gold by means of blanket table or sluice, it is quite essential that all coarse material should be removed by screening before passing material over the table or through the sluice. The material should all pass a $\frac{3}{16}$-inch mesh screen at least. Some workers prefer carpet to blanket. Corduroy is used extensively at milling plants in various parts of the world. It is rarely or never used by bar-workers, possibly because the right quality is not obtainable locally.

(2.) An *even flow* of water and material over the blanket-sluice is important.

(3.) The slope of a blanket-table should be from 1¾ to 3 inches per foot, depending upon the rate of flow.

(4.) Some workers use wire screen over blankets to reduce the scouring tendency.

(5.) It is quite essential that blankets be rinsed off in a clean-up tub or pan at least every one and a half hours.

(6.) *If gold is found rusty and hard to amalgamate, attrition will usually prove as effective* as warming or using chemicals.

An ordinary "long-tom" mounted on rockers is popular with some miners. If the sand or gravel has to be transported by hand for any appreciable distance a convenient scheme is to mount the feed-box on a wheelbarrow-frame. Feed-box is hinged at discharge end to frame, and at the other end is a leg so that it can be inclined at any desired angle. It is mounted at such a height that it discharges directly on to the fixed grizzly, and is loaded in the horizontal position.

Roads and Trails.

Assistance was rendered under the "Mines Development Act" in connection with many roads and trails throughout the district during 1933. The road from Fort St. James northwards towards the Manson section is now passable for trucks and light cars to a point 15 miles north of the Nation river. It ends at the pack-train camp at Moosmoos meadows. The distance from this point by pack-trail over Bald mountain to Slate creek is about 30 miles. The distance from Fort St. James to the Nation river is 68 miles.

Addresses.

During the winter addresses to prospectors were given by the Resident Engineer at important centres throughout the district.

Acknowledgment.

The Resident Engineer desires to express his thanks for the many courtesies received from operators and prospectors.

OMINECA MINING DIVISION.

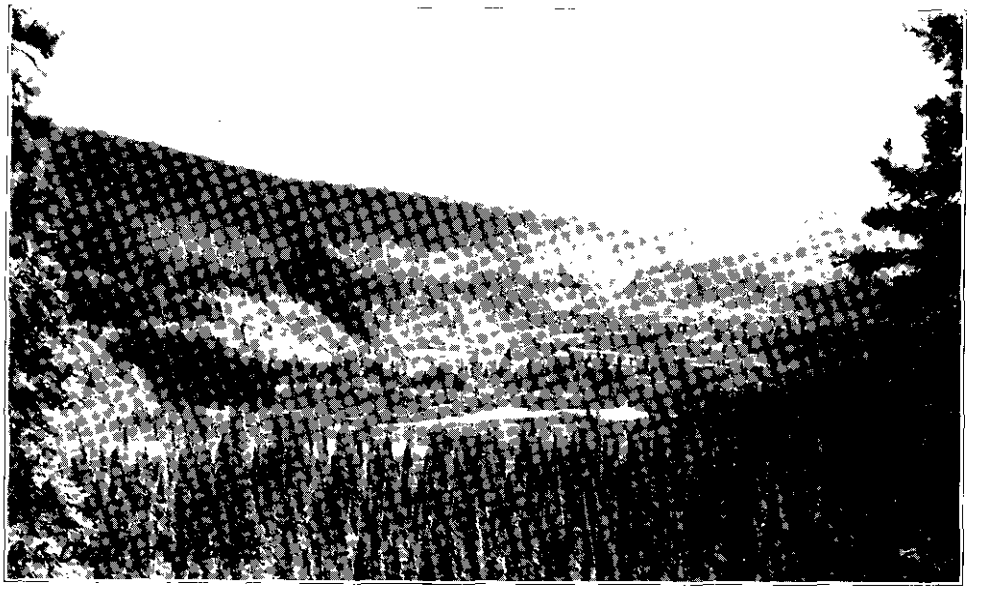
Skeena Section.

Columario Consolidated Gold Mines, Ltd.—Late in 1933 operations were resumed at the property of this company, near Usk, with a crew of fifteen men. Work proposed for the winter months includes raising between upper and lower tunnels on veins 4 and 5; crosscutting between veins 4, 5, and 6 and the driving of the main haulage-tunnel. The work was speeded up shortly after the close of 1933.

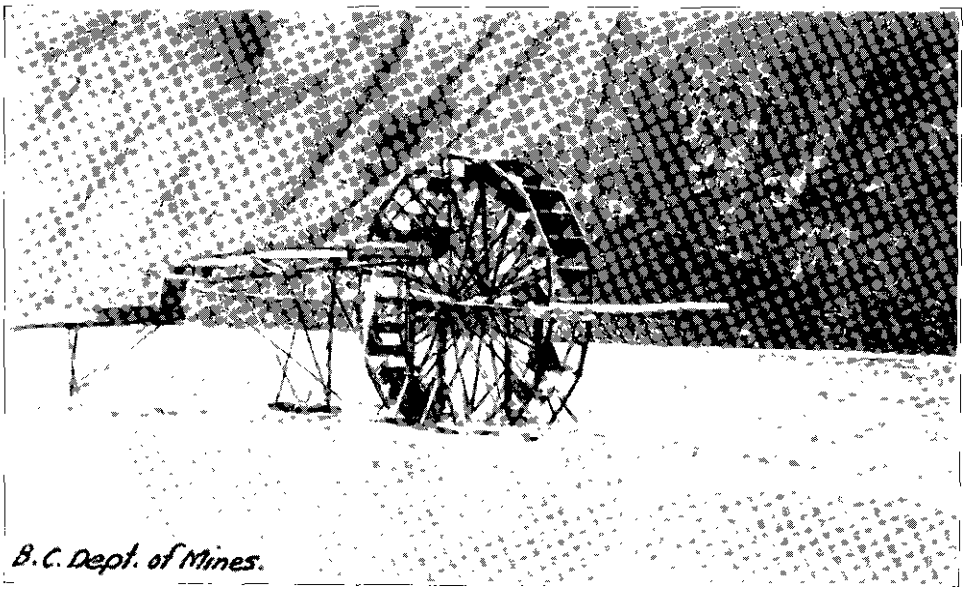
Lorne Creek.—A number of men carried on prospecting both for lode gold and placer on this creek and in the adjoining areas.

Hazelton Section.

North of Hazelton, in the more immediate vicinity of Kispiox, sedimentary rocks of the Hazelton series are intruded at different points by stocks of granodiorite, and there is evidence of mineralization of the higher-temperature class carrying gold values. While no exposure of commercial proportions has yet been discovered, there appears to be no reason why such should not be discovered, and in the hope of making such discoveries a certain amount of prospecting is being carried on by local ranchers and natives.

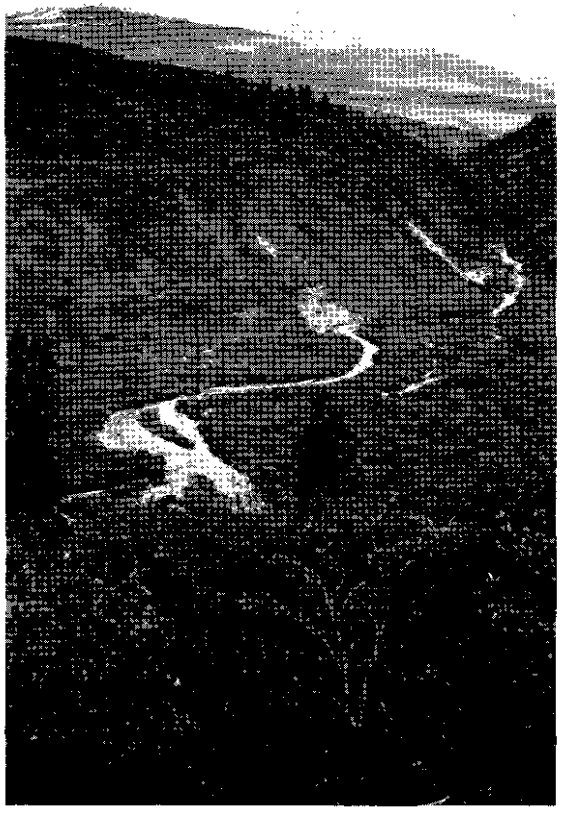


McConnell Creek, Omineca M.D.



Carlson's Water-wheel, Quesnel River.

Cambron Placer, Liard M.D.



Goldpan Creek, Liard M.D.

Fortune Hill. This claim, owned by L. Hagen, of Hazelton, is situated on the right bank of the Skeena river, about 4 miles above the mouth of the Kispiox river. In the near vicinity of a tongue of quartz feldspar, intrusive into the sedimentary rocks, there is exposed in the sediments by open-cut about 200 feet above the river a replacement-zone the maximum width of which is 12 feet. Mineralization consists essentially of arsenopyrite, sphalerite, and pyrite, with a little chalcopyrite. It appears to be mainly confined to the foot-wall. The strike of the zone is N. 35° W. (mag.) and it dips 30° south-west into the steeply sloping hillside. A sample of selected portions assayed: Gold, 0.22 oz. per ton; silver, 8.5 oz. per ton.

Silver Bell. This claim, owned by W. G. Jeffry, is situated on Lot 344, close to the Hazelton–Kispiox road, just west of the Skeena river, and three-quarters of a mile below the mouth of the Kispiox river. At different points on this property a number of well-mineralized fractures in the sedimentaries have been uncovered. These vary in width from a few inches up to 18 inches. Mineralization consists mainly of arsenopyrite, pyrite, and some galena. A sample of the more heavily mineralized portion of the largest fracture above mentioned assayed: Gold, 0.15 oz. per ton; silver, 3.3 oz. per ton.

Smithers Section.

Activities in this area were confined mainly to Hudson Bay Mountain properties. Pertinent information relative to the main geologic features will be found in Bulletin No. 1, 1932.

Jessie Gold Mines, Ltd. A small amount of development was carried out at this company's property. The main tunnel was advanced about 30 feet, which with some crosscutting brought the total footage of development to 38 feet. It seems likely that the vein followed by this tunnel is No. 2 vein. No. 1 vein was passed through 12 feet from the present face, striking N. 35° E. (mag.) and dipping south-east. At or near the point of intersection, No. 2 vein seems likely to be found in the north wall of the main tunnel, but further investigation is necessary to determine this.

The following sample was taken of selected portions of the ore-streak, 2 feet in width, at a point about 15 feet east of No. 1 vein, in the main tunnel: Gold, 0.20 oz. per ton; silver, 3 oz. per ton; lead, 2 per cent.; zinc, 8.9 per cent. Descriptions of this property will be found in the 1928 Annual Report and in Bulletins Nos. 1 and 3, 1932.

Glacier Gulch. During 1933 S. F. Campbell, Grover Loveless, and Wesley Banta, of Smithers, the owners, installed a small aerial tramway and shipped a car of ore, assaying 3.0985 oz. gold per ton, from their property. A description of this interesting property will be found in Bulletin No. 1, 1932, wherein it is commended to attention. It is noteworthy that, in process of mining this ore, free gold, not hitherto observed, was found to be of frequent occurrence. Hitherto the association of gold has been noted with tetradymite only. Mining this car-load has effected but little change in the appearance of the property and prospects of getting another car of similar grade ore seem equally good. The owners are now engaged in doing so. A sample taken across a width of 4.5 feet at the point of mining last October assayed: Gold, 2.60 oz. per ton.

With the aid of the Government, the Lake Kathlyn branch road has been extended to the lower terminal of the aerial tram, giving ready means of transportation. It seems quite likely that development at this property may disclose possibilities of a larger tonnage of lower-grade ore than that recently shipped. Facilities for economic mining are very favourable and the topography is such that depth can be very readily gained by an adit-tunnel.

Coronado. This property was re-examined in 1933 at the request of beneficiaries of the estate of the late J. R. McDonald. A full report by John D. Galloway appears in the 1914 Annual Report. This report was reprinted in the Geological Survey Summary Report, Part A, 1925, and it is unnecessary to repeat it herein.

Since the above report was published the only development of importance accomplished was the advancement of the lowest or No. 1 tunnel on the main vein 85 feet to a point 240 feet from the portal, and the driving ahead of the No. 2 tunnel, also on the main vein, another 55 feet to a point 90 feet from the portal. No further ore was disclosed as a result of this development.

The development-work would seem to indicate that the mineralization, although distinctly "bunchy," is of a higher-temperature class, and therefore contains more gold, than is usually met with on this mountain at the elevation of this property (3,000 to 3,500 feet). As pointed

out in Bulletin No. 1, 1932, there is marked evidence of the zonal distribution of minerals on this mountain, and the elevation at which gold-bearing mineralization becomes marked is usually about 4,200 feet, the original lower-temperature zone above this elevation having been largely removed by surface erosion. In the case of the *Coronado* property it seems that there has been sufficient erosion below the critical horizon to expose the higher-temperature zone, and it is a justifiable assumption that mineralization will become more auriferous as workings on this property advance into the mountain. Some surface work would seem to be justified. It should be directed to tracing any connection between the mineralization exposed in the adit on No. 2 vein and that exposed on the steep bluffs on the west bank of Sloan creek. At this latter point conditions for gaining depth are excellent when tunnelling is warranted.

Silver Lake. An option on this and adjoining groups is held by W. R. Wilson & Sons, and during 1933 a crosscut tunnel was commenced at 6,200 feet elevation and advanced a distance of 32 feet. By preliminary surface work on the elevated plateau above the tunnel it was shown that the showings exposed were of considerable promise. The presence of gold values suggests that the plateau is an uneroded remnant of the lower-temperature zone once existent, which has been largely removed by erosion, and, further, that gold values may be expected to increase materially as depth is gained. A description of this property is given in the 1928 and 1931 Annual Reports, and mention of it will be found in Bulletin No. 1, 1932. It is understood that an expansion of activities at this property is contemplated in 1934.

Telkwa Section.

Free Gold. This property, situated on Dome mountain and owned by Alex. Chisholm, of Smithers, was developed on a small scale in 1932 by Babine Gold Mines, Limited. Work comprised driving a crosscut tunnel to intercept the downward continuation of a number of quartz veins which are mineralized with pyrite, sphalerite, and subordinate amounts of galena, with associated gold values up to several ounces per ton. Vein-widths vary from a few inches up to a maximum of 5 feet. It was not possible for the Resident Engineer to visit the property during 1933, but R. W. Wilson, the manager, states that the results were encouraging, and that it is proposed to install machinery and enlarge the scope of operations during 1934. The property is described in Bulletin No. 3, 1932.

Houston Section.

Gold Brick. This property (formerly the *Horseshoe* group) is situated on Bob creek, 9 miles from Houston, from which place there is a motor-road to the property. It is owned by G. W. Smith and associates, of Houston, who in 1932 discovered that free gold is present to some extent in the oxidized rock-outcrops on the left bank of the creek, about 1 mile above the mouth of Bob creek. The property is described at length in the 1928 Annual Report, and also in the Geological Survey Summary Report, Part A, 1929, page 93A. Early in 1933 an option was secured on the property by A. J. MacPherson, with whom is associated H. C. Stratford, a mechanical engineer of inventive ability. A wood producer-gas power plant of 175-horse-power capacity and small pilot-mill were installed, the lumber required for the buildings and other purposes being sawn by the power plant mentioned. This type of power plant is rare in British Columbia and is of much interest. It was largely constructed on the ground from improvised material by H. C. Stratford, whose mechanical genius is reflected in the many novel features of the milling equipment and plant. However, before the mill was put into operation, work was suspended entirely in October. It is unknown whether there is any prospect of resumption, but the inventive ability reflected in this plant and the hard work involved are deserving of a happier issue than that which has apparently eventuated.

The commercial gold possibilities of this property, more generally known as the "Bob Creek Porphyry Dyke," have engaged the attention of various examining engineers at different times for a number of years past. It is quite evident that if gold values are sufficient to permit the mining of this highly altered belt of volcanic rocks in whole, or even in part, extremely low mining and milling costs might be secured. An intelligent opinion as to average values can only be formed after thorough sampling. Of seven samples taken by the Resident Engineer from the canyon-walls on the south side of the creek, four showed upon assay a trace of gold only, and the remaining three assayed respectively 0.04 oz., 0.20 oz., and 0.10 oz. gold per ton. Such

samples and assays in themselves are quite insufficient to form an opinion of average values, but they do indicate the advisability of systematic and thorough sampling. It seems well worth noting that, inasmuch as intrusive rocks are known to exist to the south of this property, there is a possibility that gold values might increase in this direction. Having regard to all surrounding features, this property merits close investigation.

Bob Creek Placer.—R. R. MacDonald, who has carried out much testing on this creek for the past few years, succeeded in getting down to rim-rock by opening up a bed-rock drain on the left bank of the creek a short distance below the canyon, and washed a considerable yardage of rim-rock gravels by hand-mining methods. The general character of the gold is fine, but no difficulty is experienced in its recovery in a sluice-flume. The gradient of the creek from the head of the canyon to the mouth averages about 4¾ per cent. The owner intends to install a small hydraulic plant, as values are stated to be encouraging. A detailed survey might indicate that a certain amount of hydraulicking is feasible.

Topley Section.

Golden Eagle. This property contains high silver values, the mineralization consisting essentially of tetrahedrite, galena, and sphalerite, with appreciable gold values. A full description of it is to be found in the 1930 and 1931 Annual Reports. The owners, C. Matheson and D. Heenan, of Topley, continued prospecting of the surface during 1933 and obtained evidence of the probable continuation of the larger vein north-westwards.

Box Group.—This property, owned by Mrs. Frank Taylor, of Smithers, adjoins the *Golden Eagle* on the south. A description of it is given in the 1927 Annual Report. Assessment-work was performed during 1933 on behalf of the owner.

Jack Rabbit. A description of this property is given in the 1928 Annual Report. It is owned by Matthew Sam, of Topley, who carried out further prospecting during 1933, stripping the hillside in the vicinity of the original tunnel, near the portal of which the seam of chalcopyrite showed good gold values.

Burns Lake Section.

Radio Gold Mines, Ltd. The property of this company is situated about 2 miles in a northerly direction from the Taltapin Mining Company's property, and it is reached by following the road from Burns Lake to the latter property (a distance of 26 miles from Burns Lake). This road is just passable for light cars in dry weather. The area lies directly in the path of the Central batholith, which at this point shows marked magmatic differentiation. Many phases of batholithic rock intrude the older rocks of the region, here called the Hazelton volcanics. From this description it is evident that the region may be described as being generally favourable for mineral occurrence. Further accounts of the region will be found in the 1927 and 1928 Annual Reports. There is also a map in the 1924 Annual Report.

Within a strip of country several hundred feet wide a number of quartz veins occur. Some of these veins are several feet in width, and one outcrop is 65 feet in width, although this may be greater than the true width of the vein. The strike of these veins varies from N. 45° E. (mag.) to N. 85° E. (mag.) and, where exposed, the dip appears to be to the south-east. Mineralization is sparse and consists of pyrite, chalcopyrite, and molybdenite, and is of the higher-temperature class. Samples taken from shallow pits sunk on two of these veins showed traces only of gold, but it is considered that this vein system well merits prospecting and preliminary development.

Under the direction of Arthur Woods, a portable air-compressor operated by gasoline-engine was installed during 1933, and at the time of inspection (July 27th) a few men were employed in sinking a shaft on a vein in hornblendite, the latter being mineralized with pyrite and pyrrhotite. The shaft was then down to a depth of 20 feet.

Hiyou. This claim, owned by A. Ostrem, of Burns Lake, is situated near Star lake, a small lake about 5 miles north-east of Burns lake, near Bald mountain. The rock in the vicinity is mainly batholithic rock which is pyritized in places. Samples of the more heavily mineralized portions failed, however, to disclose the presence of gold or silver when assayed.

Endako.

In view of the fact that there is evidence of a revival of interest in molybdenite properties, attention in this connection is directed to the *Stella* group, owned by A. Langley and associates, and situated south-west of Endako. A description of this property is to be found in the 1927, 1928, and 1929 Annual Reports.

Northern Portion of Omineca Mining Division.

The Consolidated Mining and Smelting Company of Canada, Limited, carried on preliminary development at the *Polaris* group (gold quartz), near Aiken lake, at the headwaters of the Mesilinka river. In the vicinity of Aiken lake Frank Martin, of Hazelton, was engaged in prospecting during 1933, and he reports promising indications of mineral.

The region north-west and south-east of Aiken lake is one of potential promise lying in the path of the Cassiar-Omineca batholith. It was not possible for the Resident Engineer to visit this area during 1933, but, from what is known, prospects for lode-gold occurrence would seem to be favourable, likewise for post-Glacial placer concentrations. Placer was discovered many years ago on Jimmay creek. The area is best reached from Takla Landing, whence a good trail leads to Old Hogem, at which point the Omineca river must be crossed and the Duck Creek trail followed to and across the Osilinka river. From Old Hogem onward the trail is reported in poor condition.

On McConnell creek Paul A. von Aueberg carried out a considerable amount of testing with a small crew of men. He states that encouraging results were obtained, and that it is hoped a power-shovel will be installed on the creek in 1934.

In April R. H. Watson and B. Phillips, representing the Edmonton Gold Syndicate, flew in by aeroplane to Two Brothers lake, source of Thudegade creek, a tributary of Finlay river, situated in the north-western extremity of this Mining Division, for the purpose of examining placer-showings on Maclaren creek, a creek flowing into Two Brothers lake. The result of their investigation is not known.

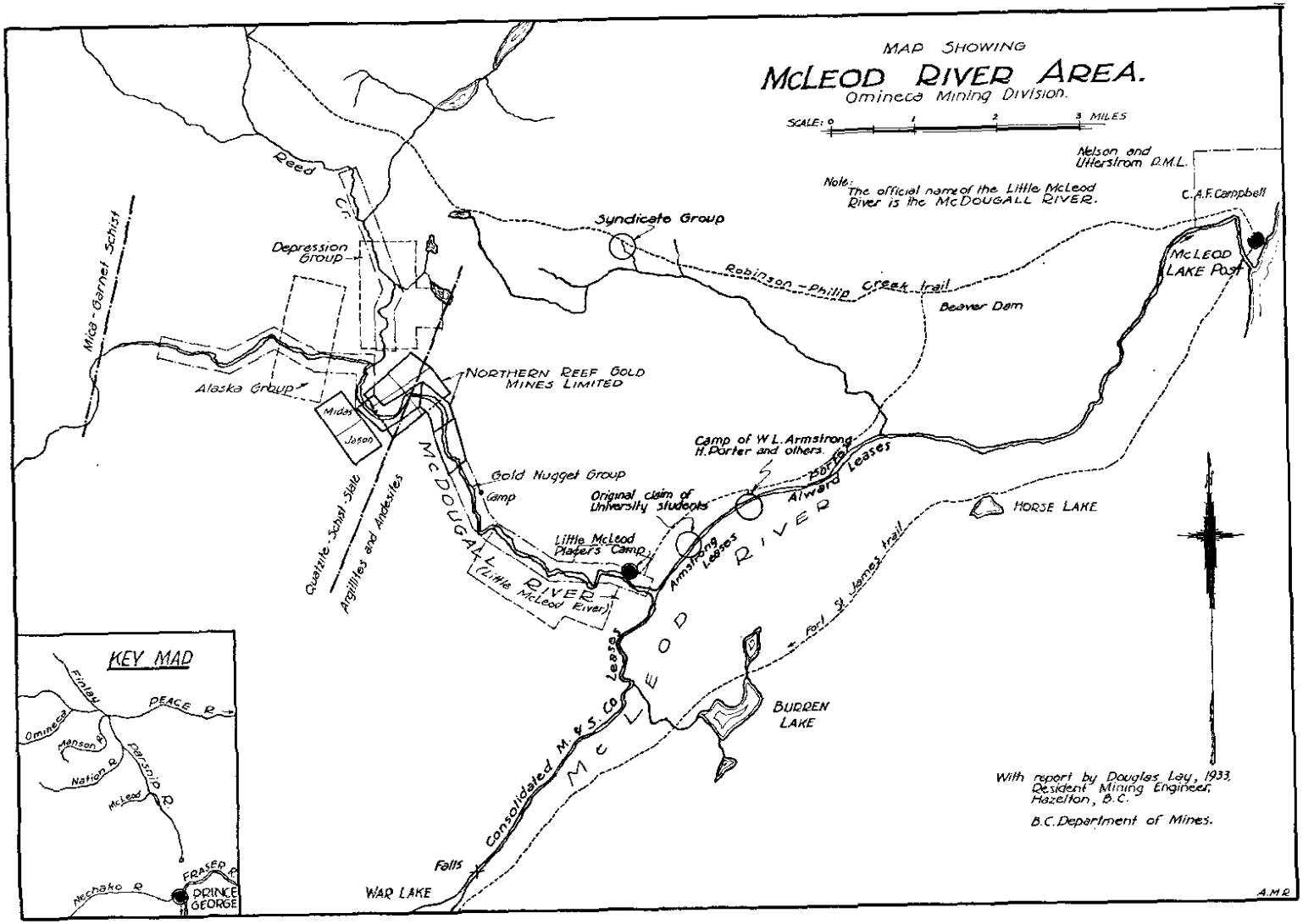
McLeod River Area.

A brief general description of this area, and of the routes thereto, will be found in the Annual Report for 1932. A map of the area, on a scale of 1 inch to the mile, has been published by the Department of Lands and copies may be obtained from the Surveyor-General, Victoria. It should be noted that the official name of the "Little McLeod" river is now the "McDougall" river.

The Resident Engineer visited the area during the latter part of July, 1933, and four days were spent therein. Subsequent to this visit further discoveries of placer and lode gold were reported as being made on, and in the vicinity of, the McDougall river. These discoveries were not inspected and no first-hand account of them can therefore be given. It is, however, interesting to note that such discoveries of placer occur on a portion of the river where the direction of flow is such as to cut across the path of the underlying batholith. Down-stream where the river flows parallel to the batholith the placer values are smaller, but they again improve when the McLeod river is reached and the direction of flow is north-easterly.

Evidence obtained to date indicates the existence of a number of quartz veins in a strip of country some miles in width (from the *Syndicate* group to the McDougall river). These quite possibly occur in the form of a belt trending north-westerly from a point about 5 miles north of the McLeod river, and follow the path of the Cassiar-Omineca batholith. It seems likely that this belt is cut close to its south-eastern extremity by the north-easterly-flowing portion of the McDougall river, because the direction of the McLeod River valley about 5 miles south of this is such as to expose these veins to great advantage, whereas in the McLeod River valley only a few mineralized quartz stringers have so far been discovered. Prospecting for gold-bearing quartz veins north-west of the scene of the new discoveries on the McDougall river is clearly advisable.

In connection with placer possibilities the following conclusions have been arrived at from field-study: Apparently the McLeod river originally continued its flow in a north-easterly course in the vicinity of McLeod Lake Post, and the present sharp bend to the south-east was developed in quite recent times. This is substantiated by the fact that the site of the original trading-post is now situated in the present river-bed.


MAP SHOWING
McLEOD RIVER AREA.
Omineca Mining Division.
SCALE: 0 1 2 3 MILES
Note: The official name of the Little McLeod River is the McDOUGALL RIVER.
Nelson and Utterstrom D.M.L.
C.A.F. Campbell
McLEOD LAKE Post
Reed Cr.
Mica-Garnet Schist
Depression Group
Syndicate Group
Robinson-Philip Creek trail
Beaver Dam
Alaska Group
Midas
Jason
NORTHERN REEF GOLD MINES LIMITED
Quartzite-Schist-Slate
Argillites and Andesites
McDOUGALL (Little McLeod River)
Gold Nugget Group
Camp
Camp of W.L. Armstrong H. Porter and others.
Original claim of University students
Alward Leases
HORSE LAKE
Little McLeod Placers Camp
Armstrong Leases
McLEOD RIVER
Fort St. James trail
Consolidated M. & S. Co. Leases
BURDEN LAKE
Falls
WAR LAKE
KEY MAP
Finlay
PEACE R.
Omineca
Manson R.
Parsnip R.
Nation R.
McLeod R.
FRASER R.
Nechako R.
PRINCE GEORGE
With report by Douglas Lay, 1933, Resident Mining Engineer, Hazelton, B.C.
B.C. Department of Mines.
A.M.R.

The geological conditions favour placer deposits of truly local origin, although some of them are obviously the result of post-Glacial concentration. Metals of the Platinum group which are found in the gravels probably originated in the pyroxenite rocks which outcrop locally.

Commercial possibilities are indicated, although to date there is no evidence suggesting that placer deposits of the bonanza type are likely to be found. Had the course of the McLeod river been a few miles north of where it is, there is every reason to suppose the placer deposits would have been more extensive, and possibly richer.

A feature of the placer gold on the McLeod river is its occurrence on rock benches. Such rock benches indicate former channels occupied by the waters as they cut down through the rock, and with evidence of concentration on one rock bench the inference is that such concentrations may occur on higher rock benches, the existence of which may be obscured by post-Glacial terracing of gravels. Consequently, whereas in the absence of any evidence of rock benches a superficial concentration only could be justifiably anticipated on gravel benches, in this region some care should be taken to ascertain if rock benches underlie gravel-covered benches.

The mantle of glacial drift does not appear to be thick in the area, and if boulder-clay is not present, as seems to be the case in the McLeod River valley, even in post-Glacial concentrations, the best gold concentrations may be found immediately overlying rock benches. Good values have been reported on the flats at a considerable distance south of the McLeod river. Investigation seems merited to determine if such are underlain at shallow depth by rock. There is no evidence of glacial erosion in the region, and the absence of large boulders in the gravels of the McLeod river will greatly facilitate operations.

A belt of garnetiferous rocks trends north-west in the vicinity of Carp lake, and as it is cut by the drainage system, garnets are very prevalent in the gravels. By-product possibilities of platinum seem worth bearing in mind.

Syndicate. This group of mineral claims, owned by W. L. Armstrong, J. A. F. Campbell, and associates, of Prince George, is situated on a branch of an unnamed creek which flows south-easterly into the McLeod river. The Philip Robinson Creek–McLeod Lake Post trail passes through the north end of the property, which is about 12 miles from McLeod Lake Post.

Exposures are by natural agencies only, and it is consequently rather difficult to form an exact idea of vein-strikes, as exposures along the strikes are confined to a few feet only and the veins are to a considerable extent covered by detritus. In the immediate vicinity of the trail the small creek has cut a deep rock gorge in the argillite country-rock, and a dozen or more veins are exposed in the bed of the creek in a distance of a few hundred feet. In main, the veins are small, although one appears to be about 6 feet in width. The larger veins do not show any appreciable mineralization. A sample of one vein showing sulphides failed upon assay to disclose appreciable gold values. These veins appear to cut the bedding-planes of the enclosing argillites, which strike north-west and dip north-east at varying angles, and are intruded in the vicinity of the veins by a well-pyritized andesite dyke. A sample of the latter showed a trace of gold upon assay. Samples of some pyritized porphyritic intrusive tongues exposed close to the trail 7½ miles west of McLeod Lake Post also assayed a trace of gold.

About 1,800 feet to the south-west of the veins and on the left bank of the main unnamed creek are some exposures of quartz which seem to be in place. They trend with the strike of the country-rock and are of considerable size. While no evidence of distinct promise was obtained, justification seems to exist for further prospecting and surface work on this property.

Placer Leases of W. L. Armstrong, H. Porter, and Associates.—These leases, eight in number, extend down-stream on the right bank of the McLeod river from a point about opposite the mouth of the McDougall river. They cover the ground on which C. Nelson's claim was situated and of which a description is given in the 1932 Annual Report. During 1933 an option was acquired on these leases by B.C. Cariboo Gold Fields, Limited, and a large amount of testing was carried out under the direction of V. Dolmage. In the vicinity of the original location of C. Nelson's claim a low-lying deeply oxidized rock bench is overlain by a few feet of gold-bearing gravels. It has been ascertained that the rock bench gradually rises to a few feet above the river, where its contour is obscured by two extensive gravel-covered benches, about half a mile in length and hundreds of feet in width, which extend up-stream. The topography suggests the probable existence of a buried channel of the river instream and it is worth testing this area to determine if commercial possibilities exist. The comparative absence of large boulders, the

deeply decayed bed-rock, and the large yardage of gravels available are desirable features for drag-line placer-mining operations. There is post-Glacial concentration of a superficial nature at the tops of the gravel benches, but further testing of the rock-bench possibilities up-stream and down-stream from C. Nelson's original point of discovery should be done, in addition to testing for the bed-rock of the buried channel-segment previously mentioned. Subsequent to inspection in 1933 H. Porter sank a shaft from the surface of the large bench some 40 feet above the river and reached rock at or near the level of the river. No noteworthy values were found on the rock, but it is not known whether this shaft is bottomed on rim-rock or on bed-rock. The deeply rotted bench on C. Nelson's original claim is indicative of pre-Glacial age of the bench, but not necessarily, of course, of the gravels thereon, which are largely post-Glacial. Immediately overlying the rock benches are boulders of pyroxenite, which are of local origin, inasmuch as pyroxenite outcrops in the near vicinity. Similar pyroxenite boulders were found to overlie a low-lying rock bench on R. W. Alward's lease down-stream, and such pyroxenite boulders may conceivably be pre-Glacial.

While there is no surrounding evidence suggesting that bonanza placer concentrations are likely to be found either on rock bench or old-channel bed-rock, nevertheless it is deemed that this ground merits further investigation along the lines suggested to determine if large-scale commercial possibilities exist.

Leases of R. W. Alward and Associates.—These leases immediately adjoin down-stream those above described. Time only permitted of a brief examination of the R. W. Alward lease, but it was evident that possibilities could only be fully determined by systematic prospecting of the many benches found on this ground. It is the low-lying rock benches that have afforded the best concentrations of placer on this river to date, and there may be several such on this ground.

On the lower portion of the R. W. Alward lease one low-lying rock bench about 175 feet wide, and somewhat greater in length, flanks the right bank of the river. On the upper end of this bench a pan of gravel was taken immediately above bed-rock and the total gold and platinum determined in the pannings. On a basis of 150 pans per cubic yard, and a valuation of $20.67 per oz. for gold and $40 per oz. for platinum, the values indicated were: Gold, 44.7 cents per cubic yard; platinum, 19.5 cents per cubic yard; or a total value of 64.2 cents per cubic yard. The gravels immediately overlying the rock bench consist of boulders of pyroxenite and garnetiferous rocks.

Lease of C. A. F. Campbell.—This lease is situated on the left bank of the river where it bends sharply south-east and covers what was the original north-east course of the river at this point. It is not known that any definite showings of placer have been found on this ground, but it is understood that placer-ground has been found at different points in the gravels underlying the extensive meadows which exist on the left bank of the Pack river in this region and through which the McLeod river originally flowed.

Cariboo Northern Development Co., Ltd.

This company, managed by F. B. Chettleburgh, was formed to acquire the recent discoveries of placer and lode gold made on the McDougall river. The company's holdings comprise sixteen placer-mining leases and twenty-seven mineral claims, and include the *Ruby*, *Pearl*, *Myrtle*, and adjoining mineral claims staked originally by A. Bellos, of Prince George, by whom they were optioned to H. C. Reed, of Victoria, who assigned his interests to this company.

A crew of twenty men was employed by F. B. Chettleburgh in the latter part of 1933 testing the property of this company and that of the associated Gold Nugget Placers, Limited, which owns three placer leases on the McDougall river adjoining the leases of the Cariboo Northern Development Company on the south.

F. B. Chettleburgh kindly supplies the following account of results obtained: "The Cariboo Northern and Gold Nugget testings in yardage ranging from 2 yards to 13 yards gave as follows: Low benches ran as high as $3.15; intermediate benches as high as 79 cents; high benches as high as 11 cents. The water situation was good, lakes giving from 125 to 260 feet of head. The country is more bench-like and less cut up than the lower reaches. About $12,000 spent testing last season on the McDougall river and twenty men employed. Insufficient work has been done on the lode to positively give any definite statement regarding the merit of the same, but it looks most decidedly encouraging. I took fourteen samples from the surface, more or less at random, and got from 40 cents to $3.60 per ton in gold. These samples were taken from

bodies or zones and not from quartz leads. The rock varies; slate, argillites, quartzite, and schistose rocks, being made up of 50 per cent. quartz in the form of irregular veinlets and carrying arsenopyrite. This body of mineralized rock often forms the bed-rock of the gravels; thus hydraulicking will serve the double purpose of washing the gravel and at the same time lay bare the formation. The concentrates all carry platinum values."

Little McLeod River Placers, Ltd.—This syndicate holds five placer leases on the McDougall river. The leases extend up-stream from the mouth of the river and cover the ground held in 1932 by H. Porter and associates. It is described in the 1932 Annual Report. During the earlier part of 1933 F. B. Chettleburgh was engaged in systematic testing of this ground with a small crew of men.

Manson Section.

Important developments in this section during 1933 included the installation of a Sauerman drag-line plant, with a 2-cubic-yard bucket, on Slate creek by Consolidated Mining and Smelting Company of Canada, Limited, and the installation of a Sauerman drag-line plant with a 1-cubic-yard bucket at the east end of Little Wolverine pass by Omineca Placers, Limited. The Germansen Placers, Limited, continued hydraulicking on Germansen river. Vital creek offers promise of developing into an important "deep-lead" placer mine, and results obtained by J. J. Warren and associates in connection with the buried channel-segment on Tom creek were important.

The Manson section lies immediately adjacent to the eastern flank of the Cassiar-Omineca batholith and stocks of it intrude the schistose sedimentary and volcanic rocks of Carboniferous age, which are of widespread distribution throughout the area. While the section is primarily noted for its placer deposits, it is evident that lode-mineral possibilities merit close scrutiny. In this connection it may be pointed out that while many well-mineralized quartz veins, some of large size up to 60 feet in width, are of frequent occurrence, particularly in the eastern part of the area, such have not disclosed noteworthy gold values, although good silver values per unit of base metal are indicated. Another type of quartz vein is to be found only in what seem to be quartz-feldspar sills, which occur in a north-westerly-striking belt of country which is cut by the Germansen river, Slate creek, and Manson river. Such veins appear to be gash-veins and they are mineralized with chalcopyrite, tetrahedrite, invariably some gold values, and quite high silver values per unit of base metal. Sometimes the gold values are as much as 1 oz. gold per ton and the veins are exemplified on the properties of *P.E.M.* and *Mother Lode* groups, described in Bulletin No. 1, 1932, and on the *Fairview* mineral claim described herein.

The Manson section is divided by mining activities into two areas—one at the west end comprising the drainage areas of Silver and Quartz creeks, the other at the east end comprising the drainage areas of the Germansen and upper Manson rivers. These two areas are about 50 miles apart by trail and between them no important discoveries of placer have been made. Although a pack-trail is continuous between these sections, the Stuart-Trembleur-Takla Lakes water system is the natural transportation route to the western part, while the eastern part is best reached by the newly constructed road from Fort St. James. Light cars can be taken over this road in dry weather to a point 15 miles north of the Nation river, or within 30 miles of Slate creek by pack-trail. These two areas will be subsequently referred to herein as "*Western Area*" and "*Eastern Area.*"

In connection with placer occurrence in both areas the same generalization governing throughout the Cariboo district can be applied—namely, the most important placer deposits are found on creeks which flow in a northward direction (either north, north-west, or north-east). Slate creek is the sole exception in the Manson section, just as Keithley creek is the most important exception in the Cariboo district. In the opinion of the writer this is due mainly to the more rapid movement and greater scouring action of alpine glaciers in the valleys of southward-flowing creeks, and that exceptions may be traced to protective local topographic features which tended to arrest such movement of glaciers.

Western Area.

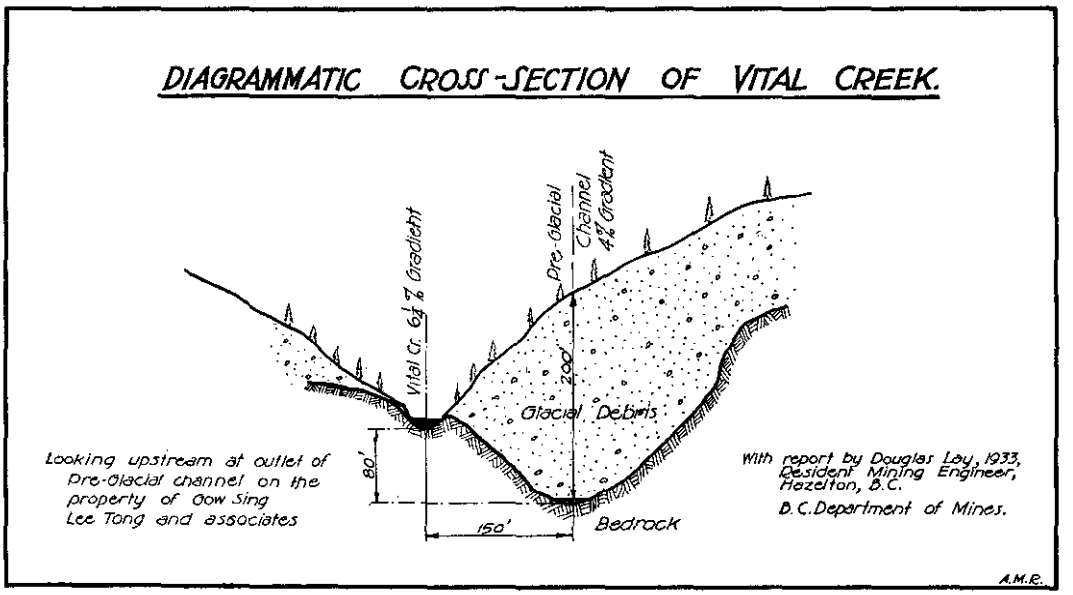
Important activities are to be found on Vital, Tom, Kelly, and Quartz creeks. To study the bed-rock geology in the region the Resident Engineer this year went on foot over the Vital mountains from the head of Kelly creek to Vital creek; thence up the North fork of Vital creek to Quartz creek; thence back to Kelly creek. It was seen that the older Carboniferous

intercalated schistose sediments and volcanics are intruded by frequent stocks of acid batholithic rock. In the intruded rocks, generally speaking, are a multiplicity of quartz veinlets. Numerous quartz veins occur on Tom and Quartz creeks and it is quite evident that, in view of bed-rock geology and placer discoveries, close prospecting for lode-mineral possibilities is justified. The occurrence of arquerite on Vital creek lends additional interest to lode-mineral possibilities. Close to the main trail, about 4 miles west of Tom creek, occurs a prominent outcrop of rock, which weathers to a rust colour on the surface, but shows a green colour on fresh fracture-faces. This has been determined by the Bureau of Mines as ankerite, the green colour being due to nickel.

A feature of the local geology is the master-valley, the Driftwood River-Takla-Trembleur-Stuart Lakes valley which was once occupied by one of the main drainage-tongues of the glacier, which moved south-east. Placer occurrence is comparatively easy to decipher. It is evident that Vital and Tom creeks escaped any serious effects from glaciation, and the buried ancient channel-segments on both these creeks offer considerable commercial promise, especially Vital creek, which appears to possess the qualifications of a "deep-lead" mining enterprise of importance.

Vital Creek.

Vital creek flows north-east into Silver creek from its source in Vital mountains. A prominent feature is the great length of its pre-Glacial channel, which lies buried in the left bank of the creek. It is clear that post-Glacial rejuvenation in this region has been immediately to the south of the pre-Glacial channel in the rock adjacent to the right rim of the latter, so that



the waters of the creek are cased off in a rocky bed about 80 feet above and 150 feet distant from their pre-Glacial course. The outlet of this buried channel is exposed on the claims of Gow Sing, Lee Tong, and associates, where a tunnel follows the bed-rock of the channel for a distance of 935 feet (measurement on August 12th, 1933). It is believed that the values in the centre of the channel average in the neighbourhood of 6 oz. gold per set (10-foot cap, sets spaced 3½-foot centres). The full width of pay-ground is not known. The bed-rock gradient is about 4 per cent.

Approximately 1½ miles above the outlet of the ancient channel the workings of R. M. Shepherd and associates indicate the existence of the channel, although bed-rock has not yet been reached and values thereon are not yet known. Field-study in this region indicates the possibility of this buried channel continuing up-stream on the north side of the North fork of Vital creek. The bed-rock gradient of the ancient channel is 4 per cent., while the gradient of Vital creek is about 6¼ per cent.

The values and surrounding features combine to make this old channel, considered in its entirety, an attractive "deep-lead" mining enterprise of importance. It is free from many difficulties usually inherent to that form of mining, in that the waters of the modern creek are effectually cased off in their bed-rock channel to one side; the very tight boulder-clay present in the upper portion of the glacial drift overlying the old channel should materially assist in sealing off surface waters; and the tunnel driven by Gow Sing and associates indicates that the gravels stand up well, and for this class of mining, drifting is very easy; and the many large glacial boulders are found at just such a height above bed-rock that a tunnel can be advanced underneath them. The question of hydraulicking the ground has been raised, but while Vital creek is a large stream, and a good piping-head could doubtless be secured, nevertheless there are many reasons why it would be inadvisable to entertain such a project without most careful investigation beforehand. First and foremost, hydraulicking is a seasonal operation, whereas deep-lead drift-mining is a continuous operation. Again, the very tight boulder-clay present in the glacial overburden, and the enormous dilution that would result owing to the great depth of glacial debris (the values in which cannot be expected to be material) from surface to bed-rock, are factors adverse to consideration of this form of mining. Deep-lead mining in this case offers so many advantages that its adoption seems advisable. No mining difficulties seem likely to occur, but it should be borne in mind that a measure of directive technique is essential to this class of mining. Strictly speaking, Keystone-drilling should be undertaken prior to mining at any point far up-stream, to delimit bed-rock contours and to determine bed-rock values. In view of the difficulty and consequent expense of getting such equipment on the ground, some attempt to reach bed-rock by tunnelling and by sinking seems justified. It is quite essential that an accurate survey of the tunnel at the outlet end of channel and of the area up-stream contiguous to the creek should first be made.

It is understood that R. M. Shepherd and associates, who hold leases 1½ miles above the channel-outlet, have acquired an option on the claims of Gow Sing and associates. Intervening ground is held by Alex. C. Clark and E. Johnson.

Claims of Gow Sing and Associates.—The possibilities of this ground are explained by a study of the foregoing text. A tunnel from the surface follows the centre line of the channel for a distance of 935 feet (as at August 12th, 1933). The tunnel is well constructed and ventilated by means of a water-blast, air being conveyed to face in wooden pipe, lumber for which is whipsawed on the ground. For safety the tunnel cannot be much further extended without providing another means of exit to the surface. Viewing this creek as one project, simultaneous sinking of several shafts, after due investigation, would be called for.

Leases of R. M. Shepherd and Associates.—These leases are situated some distance up-stream from the above-mentioned property, the camp being close to the forks of Vital creek. At the date of inspection (August 11th, 1933) a tunnel was being driven just above the creek-level, a short distance down-stream from the camp and about 1½ miles up-stream from the buried channel-outlet, on the property of Gow Sing. This tunnel had penetrated what seemed to be the right rim of the buried channel and it was being continued in extremely tight boulder-clay which required blasting. The length of this tunnel was 140 feet and the bearing varied from S. 57° W. to S. 67° W. (magnetic bearings). The approximate average bearing in the Gow Sing tunnel is S. 42° W. (mag.), the average direction of the channel in that region. Previously a shaft had been sunk at a point 250 feet up-stream to a depth of 40 feet and a drift run from the bottom of the shaft, but this working was discontinued owing to water. As already mentioned, R. M. Shepherd has acquired an option on the claims of Gow Sing and associates, and it is understood that some work was to be carried on this winter.

Lease of E. Johnson.—Up-stream from the claims of Gow Sing and associates there is evidence of a possible tributary run of gold coming in from the north, which this lease covers. The possibilities will probably not be fully disclosed until deep-lead operations are advanced.

Tom Creek.

In previous reports the probable existence of a buried channel-segment on the east side of the canyon was indicated. During 1933 J. J. Warren, W. Gibbon, and E. T. Gibbon purchased W. McCormick's leases, staked additional ground, and reached the bed-rock of the old channel at a depth of 73 feet from the surface by sinking on the indicated course of the channel. This shaft is about 250 feet down-stream from the head of the canyon, at which point the creek

diverges from its former channel. W. McCormick had previously run a short tunnel in the right bank of the creek at this latter point and reached bed-rock in an incline from the end of the tunnel at a point 5 feet below the tunnel portal. As determined by aneroid barometer, the collar of the shaft sunk by J. J. Warren is 45 feet vertically above McCormick's tunnel. Bed-rock in the old channel therefore appears to drop 25 feet in about 250 feet, a gradient of 10 per cent. The gradient of Tom creek above the canyon appears to be about 4 per cent. J. J. Warren and associates sank another shaft about 60 feet to the east of the bed-rock shaft, which bottomed on the rim at 55 feet. From the bed-rock shaft a drift was run down-stream a distance of 40 feet, and it is stated that from 75 cubic yards of bed-rock gravels mined from this working 25 oz. of gold was recovered. At the time of inspection another shaft had been started about 225 feet farther down-stream. The collars of all shafts are approximately at the same level, on a meadow, 200 feet vertically above Tom lake.

Tom creek is a large creek, offering a good supply of water for hydraulicking, and it seems likely that further testing, preferably by Keystone-drilling, might disclose good hydraulic possibilities in connection with piping out the old channel. It is, however, essential that the course of the channel down-stream be delimited and some idea of values formed before the possibilities indicated can be accurately gauged. The property is one of distinct promise. The distance by good pack-trail from Takla lake is 19 miles.

Kelly Creek.

This creek flows down the Vital mountains south-easterly into Byrnes lake, a portion of Kenny creek, occupying a wide valley which has suffered from alpine glaciation. The post-Glacial waters of the creek have cut down through the glacial filling on the west side of the valley to or close to bed-rock, and in doing so have made a concentration of placer on either true or false bed-rock. The placer gold is fairly coarse, one $11 nugget having been obtained. Besides gold there is occasionally found placer resembling arquerite, which mineral is also found on the neighbouring Vital creek. The average creek gradient is about 5 per cent.

The discovery of placer on this creek was made by David Alexander, a native, and a number of claims were subsequently staked. The point of discovery is about 1½ miles above the mouth of the creek. All the diggings are shallow and lend themselves to hand-mining methods. The ground is not rich by any means, but its shallowness and the coarse gold found invite prospecting. It is possible that concentrations of placer gold will be found to the east of the present workings in the wide valley. Several whites, natives, and Chinese were working on the creek at the time of inspection in August.

Claim of David Alexander.—This claim is situated about 1½ miles above the mouth of the creek and is the "discovery" claim. The water runs on bed-rock in this region and for some distance down-stream. The actual discovery was made in shallow gravels overlying what appears to be the left rim of the channel.

Claims of J. Donald and Partner (Natives).—These claims immediately adjoin down-stream that of D. Alexander, the creek flowing over bed-rock.

Claims of J. Anderson, S. Young, and Associates.—These four claims adjoin the J. Donald group of claims down-stream. Concentration in this region is entirely on a false hard-pan bed-rock, as far as had been ascertained at the time of inspection. The coarsest gold found was a $2 piece.

Claims of Long Charlie and Associates (Chinese).—These claims adjoin the above claims on the down-stream end and concentration is wholly on true bed-rock. Systematic ground-sluices have been opened up on this ground by the owners, who are experienced placer-miners.

Claims of W. B. Cowan and P. D. Cameron.—These claims are situated about 1 mile above the last-mentioned claims. At the time of inspection the owners had sunk a shaft to a depth of 30 feet through the shallow gravels, which here rest on boulder-clay and silt. The conditions indicate damming of glacial waters by debris and deposition of silt in the lake so formed.

Quartz Creek.

This large creek flows northerly into the Fall river and is reached by a branch from the Takla–Old Hogem trail. The distance by trail from Takla lake is about 38 miles. Activities centre on a stretch about half a mile in length about 1½ miles above the mouth of the creek. In this region the creek occupies a deep wide valley, flows on bed-rock, and is in part contained

in a canyon which has been carved on the west side of a moraine. It is clear that its pre-Glacial channel is buried in the right bank, save at a point about three-eights of a mile above the canyon, where a segment occurs in the left bank. The old channel has been cut twice at this point by the creek. A post-Glacial steep-walled canyon 100 feet in height contains the creek about 1½ miles above the mouth, the canyon being immediately adjacent to a steep morainal ridge. The country-rocks are schistose rocks of Carboniferous age. In the bed of the creek are to be seen numerous quartz veins varying in size from a few inches to a few feet in width. The mining efforts of a few white men and natives are directed to the post-Glacial concentrations on rock benches and to the buried channel.

Property of E. Martin.—This property consists of one bench lease and one claim situated on the left bank of the creek immediately below the canyon. At this place a rock bench 40 feet above the creek is overlain by several feet of gravels, in which values are stated to be sufficient to compensate for the trouble involved in washing. There is no water-supply on the bench. Other benches exist in the near vicinity and, should further testing indicate values, water could be brought by flume and ditch from the old dam-site on the creek about three-eighths of a mile above the canyon.

Claim of Martha Tom.—This claim is situated on the right bank of the creek immediately above the canyon. Quite a wide rock bench, 15 feet above the creek, flanks the creek at this point. It was evidently worked by the early operators, who brought water on the ground by a ditch from a higher point on the creek. Some instream gravels yet remain on which the owner is working.

Claim of T. Hallam.—This claim adjoins up-stream the last-mentioned ground, and in this region the buried channel is exposed at several points. Bed-rock appears to be at about the same level as that of the creek, but no appreciable values on bed-rock have so far been found. The values are apparently confined to a hard-pan false bed-rock at about the same level as the rock bench flanking the creek.

Lease of Alex. C. Clark.—This lease covers the up-stream continuation of the buried channel, and the owner has started a tunnel on bed-rock in the right bank of the creek, and on August 13th this tunnel had advanced a distance of 30 feet, the bearing being S. 13° E. (mag.).

Eastern Area.

Features of interest from the lode-gold standpoint are discussed in the paragraphs immediately below "Manson Section." Many large and well-mineralized veins occur in this area on Blackjack mountain, Boulder and Lost creeks. Trending across the lower part of Slate creek and Manson river in a south-easterly direction is a belt of country containing what seem to be quartz-feldspar sills, wherein are quartz veins of the silver-gold-copper mineralization type. These are exemplified on the *Fairview* mineral claim described below. A general description of veins in this section will be found on pages 57, 58, and 59 of Bulletin No. 1, 1932.

Placer occurrence in this area is more difficult to decipher than in the "*Western Area*," inasmuch as it is apparent that radical changes in drainage have taken place since Tertiary times, nor can the remaining placer possibilities be fully appraised until the probable course of the Tertiary drainage has been established. While all the details of such a problem cannot be worked out without much field-study, there are certain key features which, when considered in conjunction with discoveries to date, appear to offer a solution of the problem. The features referred to are the following:—

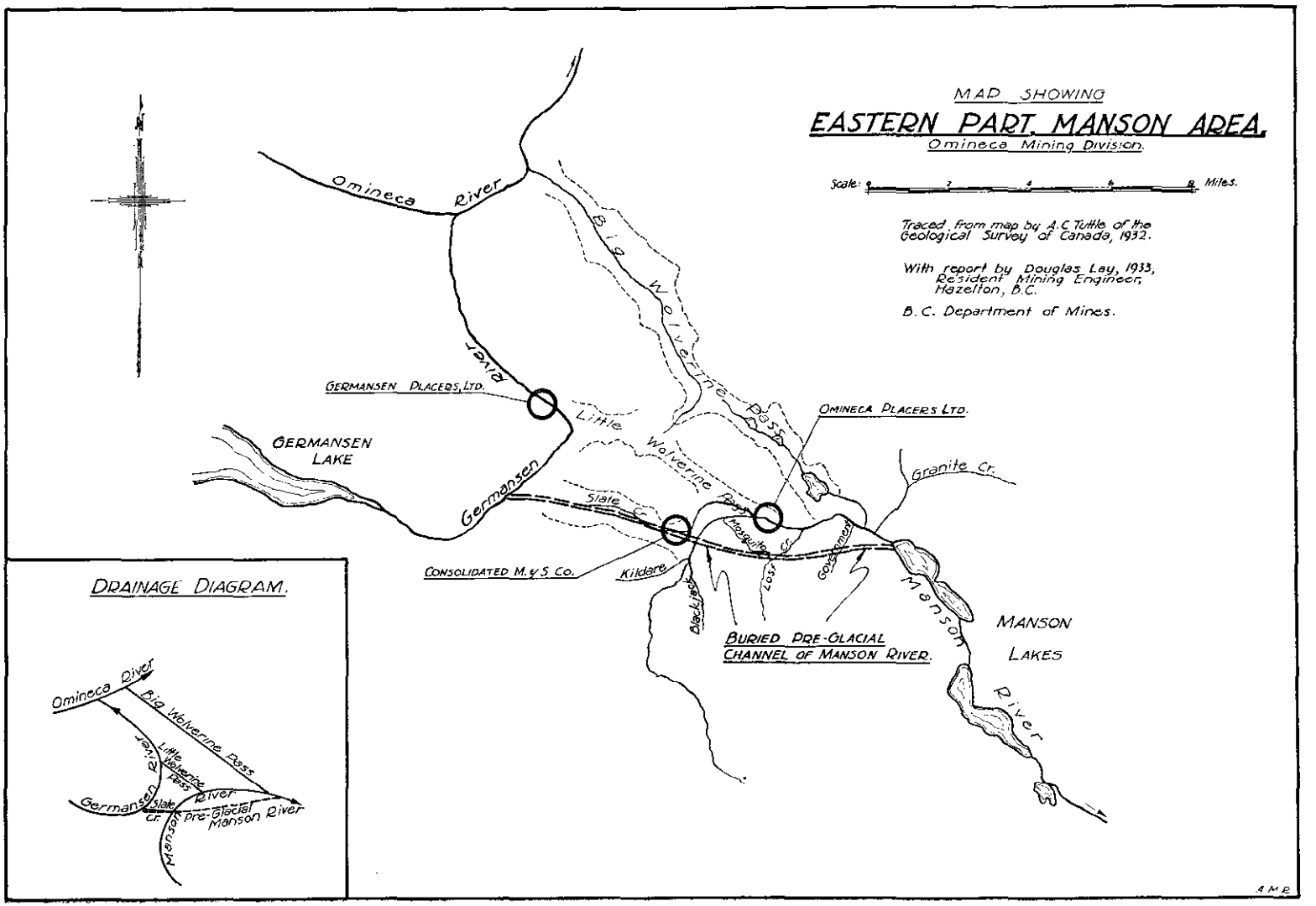
(*a.*) The sharp bends made by the Germansen and Manson rivers in their upper sections and the close juxtaposition of these bends, the distance separating them being only about 4 miles.

(*b.*) These two bends are connected by the broad valley of Slate creek, now occupied by only a small creek.

(*c.*) The pass known as "Little Wolverine" also connects the two hairpin bends.

(*d.*) The pass known as "Big Wolverine," which connects the Manson River valley with the Omineca River valley, is in a direction which is almost precisely in the same straight line as that of the eastern limb of the hairpin bend of the Manson river. Slate Creek valley and the two passes mentioned are closely parallel; are at about the same elevation; and the distance between each is about 2 miles.

By reference to the accompanying drainage map it will be seen that these salient key features can be accurately depicted by a few strokes of the pen. Such conditions suggest that


MAP SHOWING
EASTERN PART, MANSON AREA.
Omineca Mining Division.
Scale: 0 2 4 6 8 Miles.
Traced from map by A.C. Tuttle of the Geological Survey of Canada, 1932.
With report by Douglas Lay, 1933, Resident Mining Engineer, Hazelton, B.C.
B.C. Department of Mines.
Omineca River
Big Wolverine Pass
Germansen River
Germansen Placers, Ltd.
Little Wolverine Pass
Omineca Placers Ltd.
Germansen Lake
Germansen
Slate Cr.
Granite Cr.
Mosquito Cr.
Consolidated M. & S. Co.
Kildare
Gossan Cr.
Manson River
Manson Lakes
Buried Pre-Glacial Channel of Manson River.
DRAINAGE DIAGRAM.
Omineca River
Big Wolverine Pass
Little Wolverine Pass
Germansen River
Slate Cr.
Pre-Glacial Manson River
Manson River
A.M.E.

in early Tertiary times all the waters which now flow via the Germansen river to the Omineca river, from Germansen lake eastwards, flowed via Slate creek and were then in fact the main portion of the Manson river. These waters were captured in later Tertiary times by stream-piracy by Germansen creek, which ultimately became the Germansen river. Quite possibly "Little Wolverine" and "Big Wolverine" passes represent other attempts of the waters of the Omineca river to capture those of the Manson river, which was finally accomplished by way of Germansen creek.

Such a thought implies that the Tertiary Manson river must have crossed its present course somewhat below the mouth of Kildare gulch approximately at right angles and continued eastwards virtually in the heart of the mountains. This might appear unlikely were it not for the remarkable evidence of a large channel in that region and the striking topographic features which exist at the head of Government gulch. These were discovered in 1933 by commendable prospecting by S. Rosetti and A. E. Hayward. It seems indeed remarkable that such striking features of the topography should have escaped discovery—or, at any rate, comment—for so many years.

The view held, therefore, is that the Tertiary Manson river lies buried in the right bank of Slate creek in the down-stream portion of the latter (on the property of the Consolidated Mining and Smelting Company of Canada, Limited). It crosses the present Manson river just below Kildare gulch and Blackjack gulch and is to be found probably approximately below the lakes at the head of Mosquito creek, where the existence of a buried channel crossing Lost creek was pointed out in the 1931 report on this section, Bulletin No. 1, 1931, paragraph 4, page 78. It is next found at the head of Government gulch in the form of a deep gulch at least 150 feet in depth and many hundreds of feet in width. It then crosses Government gulch just down-stream from this point and emerges in the present Manson River valley about 1 mile below the mouth of Government gulch, at the head of the uppermost Manson lake. The approximate course is indicated on the accompanying map. In this region the old channel appears as a deep gorge, only partially filled with glacial debris. A ready explanation is afforded for the reason of this partial glacial filling only at the down-stream end of this channel. The existence of the Manson and Wolverine lakes is strongly indicative of the over-deepening effected by the big valley glacier occupying "Big Wolverine" pass as it travelled south-eastward in that pass down the Manson River valley in the region of the present lakes. This ice-scour doubtless resulted in active post-Glacial rejuvenation in this region effecting considerable discharge of glacial debris in the lower portion of the Tertiary Manson River channel. The buried length of the latter east of the first crossing of the Manson river below Blackjack gulch is approximately 4 miles, and there is evidently considerable extent beyond this lying buried in the right bank of Slate creek. This channel is of large proportions, and immediate preliminary investigation is undoubtedly justified, because the surrounding geologic features presage good bed-rock values for the following reasons:—

(1.) It has previously been pointed out that those veins which show interesting gold values are to be found within a belt of country trending north-west and south-east across Germansen creek, Slate creek, and Manson river. The buried channel of the Tertiary Manson river cuts that favourable terrain.

(2.) No important placer is found on the Manson river above Kildare gulch; on the other hand, "Discovery Bar" on the present Manson river below Blackjack gulch plainly resulted from the present Manson river cutting across its Tertiary channel.

(3.) There seems no reason to believe that this channel has suffered severely from glaciation, because, as has been previously pointed out, the main ice-scour was by way of "Big Wolverine" pass.

(4.) The deep gorge at the head of Government gulch offers a natural means of ingress to this channel by deep-lead mining operations.

After further detailed field-work involving consideration of the channel as a whole, and embracing in particular the country between Mosquito lakes and, say, Kildare gulch, it is quite possible that the advisability of Keystone-drilling will be indicated. This might be commenced on the indicated course of the channel at the head of Government gulch, where the depth from the surface to bed-rock will be least, and continued from that point eastward at sections where the exact course of the channel is most plainly indicated.

Germansen Placers, Ltd.

A full account of the preliminary operations and plans of this company on Germansen creek is given in Bulletin No. 1, 1931, to which reference is invited. Operations in 1932 and 1933 have not been concerned with the major scheme entertained by this company—namely, hydraulicking the bed of Germansen creek—but have consisted in hydraulicking gravels overlying the rock benches on both sides of the creek in the vicinity of the old town of Nabum, about 7 miles above the mouth of the river.

In the spring hydraulicking was interrupted owing to washouts on the flume-line where it crosses a slide, and it was not found possible to utilize the full capacity of the ditch-line (1,000 miners' inches). At the time of inspection (August 24th, 1933) two monitors with 3-inch nozzles were in operation on gravels overlying a rock bench 50 feet above the river on the left bank, where values were stated to be good and where there is evidence of continuation of pay-ground instream. The occurrence of small silt-filled fractures continuous in the gravels and underlying rock is indicative of movement subsequent to deposition of gravels.

A novel method of disposing of large boulders was devised by the manager, R. C. McCorkell. It consists of a stone-boat on skids laid on the rock bench and operated by a Pelton-wheel-driven hoist. The plant is so arranged that the stone-boat was dumped at the edge of the rock bench.

C.M. & S. Co. of Canada, Ltd.

This company late in 1933 completed the installation of a Sauerman drag-line plant, with a 2-cubic-yard bucket, on its property on Slate creek. It is understood that mining operations were then commenced. This plant was hauled in to the end of the existing motor-road in 1932 (in which year a very large amount of road-construction was carried out by this company), and in the winter of that year and early part of 1933 the plant was hauled on snow via a winter road constructed from the present end of the motor-road up the South fork of Germansen creek to the point at which it is now set up, the site of the operations of the Kildare Mines, Limited, many years ago.

The plant is set up to drag first the bed of Slate creek in the more immediate vicinity of the point at which an hydraulic elevator was set up by the earlier operators mentioned and where good bed-rock values are reported. A dam has been erected up-stream from this point, and a tower 75 feet in height, a 200-horse-power boiler and winches, and sluice-flume 600 feet in length are set up on the left bank of the creek. Water from the dam flows by gravity to duplicate centrifugal pumps, each of 750 gallons per minute capacity under 80-foot head. These pumps deliver water to a supply-tank, whence water flows by gravity to dump-box at the head of sluice-flume, which discharges into the dam. The latter acts as a settling-pond and the water, being in a closed circuit, is used over again after settlement. The crest of the dam will be raised as it is filled, the idea being that the lake ultimately formed on Slate creek by this dam will be of such proportions that it will afford a landing-place for aeroplanes both in summer and winter. During the summer season of 1933 supplies were brought in by aeroplane from Stuart lake, landed on Germansen lake, and thence hauled to the camp by teams. The company retains a wireless operator in charge of a transmitting set and contact is established daily with head-quarters at Trail.

The assembling of such a plant in this location was in itself a formidable task and involved a large amount of road-work and the overcoming of many difficulties. The maximum capacity of the plant is stated to be 1,000 cubic yards per 24 hours. W. M. Ogilvie, who carried out the preliminary drilling at this property, has been in charge since the inception of operations.

A description of the original investigation carried out at this property is given in the 1931 report, Bulletin No. 1, 1931, to which reference is invited. It may be briefly stated that this investigation disclosed the existence of five earlier channels on the right bank of this creek, and it is understood to be the intention to mine these in succession as soon as the bed of the creek, on which operations now focus, has been worked out. It is not known to the writer what values were found by preliminary investigation, but it will be clear from the views expressed previously in this report that there is the likelihood that a segment of the buried Tertiary Manson river exists in the right bank of Slate creek on this ground, and, moreover, that bed-rock values therein should be good.

Omineca Placers, Ltd.

This is a private company, of which A. A. McCorkell is manager. It holds leases in "Little Wolverine" pass, previously mentioned in this report, extending from the point of emergence of this pass into the Manson River valley north-westwards towards Germansen River valley. The boom drag-line scraper equipment originally brought into the country by G. W. Otterson was acquired by this

company and converted into a high-line plant of the Sauerman type, with a 1-cubic-yard capacity Sauerman bucket. Track-cable is 1¼ inches diameter, tension-cable ⅞ inch diameter, and load-cable 1 inch diameter. Boiler is of 50-horse-power capacity and the boiler and winch-room with mast is set up at the extreme edge of the pass on the left bank of the Manson river, half a mile or so below the mouth of Slate creek. The track-cable is anchored on the right bank of the Manson river, giving a span of somewhat over 600 feet.

Under the management of A. A. McCorkell, excellent progress was made in 1933 in moving the equipment to its present position; in constructing between 1½ to 2 miles of ditch-line and 1,170 feet of flume for the conveyance of sluice-water from an up-stream point on the Manson river; and in general plant and camp construction; all of which resulted in the property being brought into production early in 1933.

The attention of the early placer-miners was directed to this section of the Manson river where this plant is installed because of the good gold values found at this point. Operations of this company to date have consisted in dragging the gravels on the left bank of the river overlying a narrow deep gutter heading in the actual pass itself. The gravels, especially those on bed-rock in this gutter, are reported to carry good values. The character of the gold is coarse and one 2-oz. nugget was obtained.

Preliminary investigation of prospects in this pass consisted in sinking nine shafts and two drill-holes, the results of which are stated to have been favourable. Bed-rock is stated to have been found at a depth of about 30 feet.

No time was available for the necessary field-study before a fully informed opinion can be expressed as to the exact significance of this pass and of that immediately adjoining, the "Big Wolverine," but it seems quite possible that they represent other attempts of the waters of the Omineca river to capture those of the Manson river, which was finally accomplished by Germansen creek. One fact is evident that the "Big Wolverine" pass was occupied by a large valley glacier travelling south-east, and that ice-scour therein, and in the Manson River valley down-stream from the point of emergence of the pass into the latter, was pronounced. Such over-deepening of the Manson River valley below and rejuvenation at up-stream points would leave the bed-rock channel of the "Little Wolverine" pass hanging, with reference to the Manson River valley, as it apparently now is, because the surface of this pass at its point of emergence is about 65 feet vertically above the Manson river, and from accounts of the depth of bed-rock below surface the latter can hardly be graded to the level of the present Manson River rock valley.

Highly promising placer values are reported by W. B. Steele at the north-west end of the "Big Wolverine" pass in "Big Wolverine," flowing into the Omineca river. Such may of course be post-Glacial concentrations, but time did not permit of their inspection.

The terrain being favourable, there seems justification for anticipating bed-rock placer concentrations in "Little Wolverine" pass such as were found in the closely adjoining Slate creek. Values can only be ascertained by actual testing.

Leases of S. Rosetti and A. E. Hayward.—These leases are situated at two different places on the right bank of the Manson River valley; at the head of the uppermost Manson lake and extending westwards to cover the indicated course of the channel in an up-stream direction; and also in the river-valley below Skeleton gulch. The first-mentioned location will be described first as it seems of major importance.

The owners have spent many years in prospecting in this vicinity, and in 1933 made a discovery of real interest and possible commercial significance, although the following-up of that commendable discovery involves an expenditure beyond the means of the individual. The discovery consists of a large gorge at the head of Government creek, 150 feet or so in depth and some hundreds of feet in width. This gorge trends in an easterly and westerly direction and has every indication of being the down-stream continuation of the filled channel crossing Lost creek. Attention to this latter was drawn in Bulletin No. 1, 1931. Another large gorge was discovered in the Manson River valley about 1 mile below Government gulch. This gorge evidently represents the emergence of this channel into the Manson River valley. There is much evidence supporting the view that these represent the Tertiary Manson river, and the matter is dealt with at some length in the paragraphs under "*Eastern Area*" in this report, which it is unnecessary to repeat.

Gorges of such proportions as those discovered have evidently been carved by a large volume of water and pre-Glacial age is indicated. It seems remarkable that such striking features of the landscape should have escaped discovery or comment for so long.

Particular attention is directed to this ground.

Other ground held by S. Rosetti and A. E. Hayward is situated in the Manson River valley, on the south side of the latter below Skeleton gulch, where encouraging values in placer were found in comparatively shallow gravels. These gravels immediately overlie the rock-valley rim closely adjacent to a depression or channel trending in a north-easterly direction from the indicated course of the Tertiary Manson river described above and emerging in the Manson River valley about 1¼ miles above Government gulch. This seems to merit some further investigation.

Among other placer operators in this section, whose properties it was impossible to visit in the time available, may be mentioned: W. B. Steele, who reports highly encouraging values on Big Wolverine creek, a tributary of the Omineca river; Jas. Dunsmuir on Lost creek; Luke Fowler (native) on Blackjack gulch (this property is described in Bulletin No. 1, 1931); and Ah Lock on Blackjack gulch.

Fairview. This claim is owned by T. Rush, of Prince George, and is situated on Slate creek, about half a mile above its outlet. On the left bank of the creek is exposed what seems to be a large quartz-feldspar sill trending north-west and south-east with the bedding-planes of the host-rocks. Within the sill are developed quartz veins of various sizes, of which the largest is from 2 feet to somewhat over 4 feet in width striking N. 80° W. (mag.), with steep, almost vertical dip. The display of green mineral both in the vein and in the sill is interesting. It is presumably mariposite, as it was tested by the Bureau of Mines and found to give a reaction for chromium. The vein is somewhat sparsely mineralized with chalcopyrite, tetrahedrite, malachite, and azurite. A sample of the more heavily mineralized portions of the vein assayed: Gold, 0.06 oz. per ton; silver, 6 oz. per ton; copper, 0.6 per cent. This vein is well exposed by several open-cuts. The exposures examined are situated close to the creek, and possibly others exist which were not examined, as the owner was not present at the time of examination. Some further investigation of this property would seem to be justified, because in the Manson section it is this type of vein which, as judged by investigation to date, carries the best gold values.

Coal.

The output of coal was 3,403 long tons, as compared with 2,782 long tons in 1932.

Bulkley Valley Colliery.—A description of this property, operated by F. M. Dockrill, will be found in the 1931 Annual Report. This property has been opened up by two slopes following the dip of the 14-foot seam for 48 feet. Mining operations during 1933 were confined to extracting the coal adjacent to the surface in a south-easterly direction. Mechanical haulage in the main slope has been substituted for horse-haulage. The rate of mining is regulated to keep pace with the demands of the market, which continues to expand.

Lake Kathlyn Anthracite Coal Co., Ltd.—An account of the operations of this company for 1932 will be found in the 1932 Annual Report, and a description of the Lake Kathlyn coalfield is given in the 1926 Annual Report. This company has installed a small air-compressor operated by a gasoline-engine, and also constructed a 160-ton bunker by the road to the property. After continuing the tunnel previously started on the Ballard seam for a distance of about 220 feet, and finding that seam interrupted by faulting, a crosscut tunnel was started at a point approximately 250 feet below the Ballard tunnel with the intention of crosscutting all seams on the property. On October 28th, 1933, this tunnel had been advanced a total distance of approximately 400 feet. At 100 feet from the portal a seam 2½ feet in width was passed through, and at 175 feet from the portal a smaller faulted seam was penetrated.

This coal is classed as "Super-anthracite" by the Geological Survey. It is older than the batholithic intrusion which caused uptilting of the coal-measures and the formation of Hudson Bay mountain and the lode-mineral deposits therein. In consequence the coal-seams have been profoundly affected both chemically and physically by the close presence of the hot intrusive.

PEACE RIVER MINING DIVISION.

It was not possible for the Resident Engineer to visit this Mining Division during 1933. Information about it is to be found in the Annual Reports for 1923, 1926, 1928, and 1930. Atten-

tion is particularly drawn to a paper entitled "A Summary of the Mineral Resources of the Peace River Area of British Columbia," by M. Y. Williams, which was read at the Annual Western Meeting of the Canadian Institute of Mining and Metallurgy in November, 1933. This paper was also printed in the January, 1934, issue of *The Miner*. The author was in charge of the field-work at the time the Pacific Great Eastern Railway Lands Survey of Resources was undertaken by the Provincial Government, the Canadian National and the Canadian Pacific Railways.

MOUNT SELWYN.

During the early part of 1933 exaggerated statements concerning the lode-gold possibilities of the Mount Selwyn area were in circulation without the Province. Those who are particularly interested in this area will find a description of the area on pages 186 and 187 of the 1928 Annual Report. In this report the Resident Engineer states: "The spur, which is well covered with timber, is seen to consist mainly of beds of white quartzite underlain by a greenish-coloured schist. At one point a bed of the latter appears to overlie the former. A prominent feature of the landscape is the outcrop of the broad band of quartzite-beds, many hundreds of feet in width over the full length of the spur, which may be 2 miles or more, and between elevations of 575 and 1,850 feet above the level of the Peace river. The quartzite-beds strike about N. 75° W. (mag.) and dip into the mountain to the south-west at an angle of between 45° and 55°. Weathering agencies result in the quartzite-beds becoming detached in large masses, of which the talus at the base of the spur fronting the Peace river largely consists. The quartzite-beds are white in colour and show no material amount of sulphides, and hardly any sign of iron-stain due to oxidation. In the beds occur numerous small quartz gash-veins of varying strike and dip and equally free from sulphides. The presence of such quartz gash-veins is of common occurrence in quartzite and conglomerate beds and does not necessarily indicate any commercial significance.

"As to commercial possibilities, it must be apparent that the presence or absence of gold values in a deposit of this size can only be strictly proved by thorough and systematic sampling, which must occupy many weeks. Much general information may, however, be gained by even a brief inspection. In the first place, the occurrence of gold in such quartzite-beds, while not impossible, is unusual. From the geologic structure it is inferred that gold, if present in the quartzite-beds, is probably of alluvial origin, having been deposited originally in the sands of the then river-bed; the sands with their gold burden having been in the course of the vast stretch of geologic time necessary for the process converted into sandstone and finally metamorphosed to quartzite.

"In the course of examination five samples were taken. These were from widely separated points, which had evidently been sampled by other investigators, and one sample represented a width of 100 feet. They were taken at elevations of 2,920, 3,300, and 3,750 feet (elevation of Peace river at base of mountain 1,900 feet). One sample was taken of a small pile of quartzite crushed to about ¾-inch ring lying by the mill. In all cases assay yielded not even a trace of gold.

"The results of such a few samples taken from such a large deposit do not necessarily indicate that all portions of the quartzite-beds are equally barren. They do, however, indicate that statements as to any widespread existence of commercial values should be treated with reserve until investigated thoroughly. It may be added that such information as has been received from other impartial investigators does not support the view that any material tonnage of commercial ore is to be found in this deposit. This is unfortunate, because there are many features of this deposit, in spite of its distance from transportation, which must appeal strongly to the operating engineer. Such, for example, as the obviously vast tonnage of quartzite, coupled with the ease with which it could be mined and the abundance of water and mine-timber."

It is desired to emphasize the fact that such information as has been received by the Department from impartial, competent investigators does not support the view that any material tonnage of commercial ore is to be found in this deposit. The deposit is owned by the Peace River Mining and Milling Company. In 1933 it was under option to the Gold Mountain Mines Syndicate and for whom James G. MacGregor, well-known mining engineer of Toronto, made a thorough examination during the summer. It is understood that in view of the conclusions arrived at by this engineer the option was not taken up. This report by Jas. G. MacGregor was published in full in the August 24th, 1933, issue of the *Northern Miner* on pages 17 and 18.

CARIBOO MINING DIVISION.

In view of the present interest in the quartz veins of the Cariboo and Quesnel Mining Divisions, the following observations are submitted: Within this area the quartz veins are of two different ages, pre-Mississippian and Jura-Cretaceous. Distinction between veins of these two different ages is important for reasons below given, and while there may be a certain amount of comingling of veins of different ages in certain areas, the two classes of veins mainly occupy different geographic zones. The veins therefore are geographically distributed as follows; those of Jura-Cretaceous age follow two separate zones:—

(*a.*) That of the Central batholith, which, trending south-east in the vicinity of Fraser lake, enters the north-west part of the Cariboo Mining Division, crosses the Fraser river between Hixon creek and Strathnaver, and is continuous throughout the Cariboo and Quesnel Mining Divisions, and last appears at Boss mountain. Places in its path are Ahbau lake, Mosquito creek (tributary of Lightning creek), and Cariboo mountain. The width of this zone is between 15 and 20 miles.

(*b.*) That of the Cassiar-Omineca batholith, which trends south-east through the Manson section and is first prominently exposed at Giscome, in the eastern portion of the Cariboo Mining Division, from which point it continues south-easterly through the Cariboo Mining Division only, although not unroofed to any great extent. The Mount Murray intrusives are probably satellites of this batholith.

Between the two above-mentioned zones occurs an area in which, as shown by the late Dr. W. L. Uglow, are to be found veins of pre-Mississippian age. This area may be defined as a strip of country trending north-west from the Goose Creek mountains, including both Barkerville and Stanley within its confines, and extending north as far as Sugar creek. Within this area, so far as is known at present, auriferous veins are confined to two separate belts, the exact lengths and widths of which are unknown. These belts are parallel and trend north-west and south-east, and are referred to herein as: (1) The Island Mountain-Round Top Mountain belt; and (2) the Stanley-Yanks Peak belt. The pre-Mississippian batholith, as was pointed out by the late Dr. W. L. Uglow, is wholly concealed within this region, but its underlying presence is indicated by certain acid intrusives, known as the Proserpine dykes and sills.

As the result of developments and field-work during 1933, there is reason to believe that intrusives of pre-Jurassic age occur on Spanish mountain and on Hixon creek, so that quite possibly veins of corresponding age occur in these regions as well as veins of Jura-Cretaceous age. The discovery of pre-Jurassic alaskite on Spanish mountain is of considerable geologic interest and possible commercial significance. This is further discussed in the body of this report under *Mariner* group, Quesnel Mining Division.

The late Dr. W. L. Uglow recognized two types of pre-Mississippian veins—the "A" veins striking with the formation, and the "B" veins cutting across the formation. As the result of development during 1933, operators now recognize a third type, the "horsetail" or spur from the "B" vein. These veins have a strike of about N. 35° E., as against the strike of about N. 70° E. of the "B" veins. Still a fourth type of vein might be added—namely, that existing solely within the intrusive, of which the *Home Rule* vein is a well-known example.

As to the pre-Mississippian veins, it may be stated that general surrounding geologic considerations entirely justify the anticipation that zoning will be at a minimum, and any gold values found may be expected to persist in depth. There is no reason to believe that there will be any sudden change in the character of mineralization, as would be the case if the veins passed from one temperature zone to another. Such a statement implies no guarantee as to persistence of any particular vein in depth and involves no purely physical factors.

Reference to the geological map published by the Geological Survey of Canada with Memoir 149 shows that to date all pre-Mississippian veins of importance occur in the Richfield formation of the Cariboo pre-Cambrian series. Furthermore, the creeks cutting through this formation furnished the richest placer deposits of the Cariboo, with the single exception of Cedar creek.

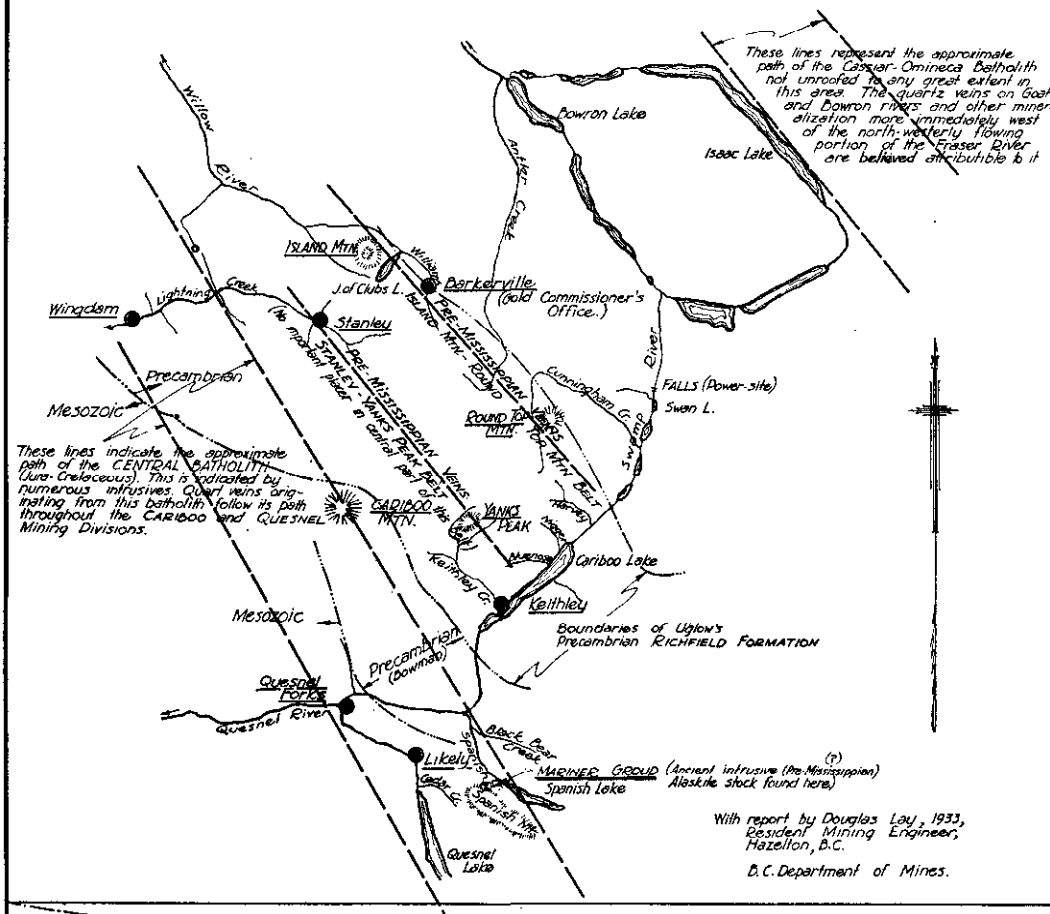
The result of development to date has discovered a number of pre-Mississippian veins which do not appear on the surface. For this and other reasons it is considered by some that underground development in certain areas is justifiable at an earlier stage in preliminary investigation than would ordinarily be considered good practice. It has also been found that faulting in certain areas is frequent, and much expense is involved in deciphering them.

THE CARIBOO DISTRICT.

Scale: 0 2 4 6 8 10 20 Miles.

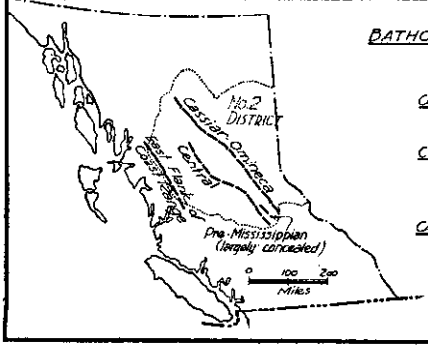
So far as has been ascertained todate:- PRE-MISSISSIPPIAN quartz veins that contain noteworthy gold values exemplify (1) Directional (rather than areal) distribution, and are distributed in one or other of the two belts shown on the map. *Some evidence exists of a third belt trending N.W. through Spanish mountain. (2) Occur only in the RICHFIELD FORMATION.

Placer: With few exceptions the richer placer creeks (1) Erode the RICHFIELD FORMATION (2) cut one or other of the PRE-MISSISSIPPIAN belts shown on the map. (3) Flow north, north-west or north-east. Exception*s are: Cedar creek in MESOZOIC rocks, and Keithley creek flowing south-east.



With report by Douglas Lay, 1933, Resident Mining Engineer, Hazelton, B.C.

B.C. Department of Mines.



BATHOLITHS CROSSING THE NORTH-EASTERN MINERAL SURVEY DISTRICT.

COAST RANGE BATHOLITH: Passes along the western boundary of the District important satellites occur to the east as at Hudson Bay and Rocher Deboule mountains.

CENTRAL BATHOLITH: Outcrops at the following places: N.W. arm of Takla lake, South end of Babine lake, Sinkut mountain; Fraser lake; Hixon and Terry creeks; Abbau lake; Mosquito creek (a tributary of Lightning creek); Cariboo mountain; North Fork Quesnel river; and Boss mountain.

CASSIAR-OMINECA BATHOLITH: Outcrops at the following places: McConnell creek; head of Mesilinka river; Manson area; Mount Milligan; McLeod river; and Discombe.

Note: The aureoles of these batholiths are paths of promise for the prospector, and satellites, or individual intrusions of batholithitic rock between the batholiths are places of potential promise.

A.M.R.

So far as the definitely known pre-Mississippian veins are concerned, it would seem most important to recognize that those veins which show gold values are distributed in two definite belts—the Island Mountain-Round Top Mountain and Stanley-Yanks Peak belt respectively. With regard to the latter, it is to be noted that no important occurrences of placer gold exist in its central portion. Whether this is due to glaciation, of which there is considerable evidence, or to absence of pronounced gold mineralization, or in part to both these factors, is not at present known.

In connection with Jura-Cretaceous veins, it is important that each property should be considered on its own merits, and the same generalizations governing pre-Mississippian veins are quite inapplicable. Zonal distribution of minerals is quite likely in the Jura-Cretaceous veins. This may be favourable or unfavourable from the commercial standpoint and is dependent upon local conditions. It is, however, to be borne in mind that the mining industry of this Province is almost wholly concerned with mineralization of this age, and the large belt of quartz veins which follows the path of the Central batholith throughout the Cariboo and Quesnel Mining Divisions undoubtedly offers a large field for intelligent development.

In preliminary considerations the interdependence of lode-gold and placer-gold occurrence is a most useful fact to remember. Consequently any known placer occurrence of importance naturally raises the question of possible lode-gold significance. In this connection it might be noted that in the Cariboo district as a whole, and in the Manson section, there are very few exceptions to the prevailing general rule that the richest placer-creeks flow northerly; that is north, north-west, or north-east. A southerly-flowing creek may cut a lode-gold terrain of importance, and yet not show much evidence of it in the form of placer. (In the opinion of the writer this is most probably due to the more active alpine glaciation on slopes facing south.)

Among the most interesting features of the developments of 1933 are two facts of much geologic interest and utility:—

(1.) At the property of Cariboo Gold Quartz Mining Company, Limited, about 1 oz. of very coarse gold (of the size of $2 or $3 pieces) per 100 tons of ore is recovered in process of milling.

(2.) At the property of Quesnelle Quartz Mining Company, Limited, on Hixon creek, unwatering of the old shaft, sunk to a depth of 200 feet about half a century ago, has rendered apparent that there is preserved on Hixon creek a large remnant of uneroded terrain which has undergone deep secular decay in Tertiary times, and wherein the quartz veins have been subjected to secondary enrichment.

Consequently it is now evident that the coarseness of placer gold produced in Tertiary times is due partly to primary coarseness of gold within the veins, and partly to the process of secondary enrichment operative at that time.

Lode-mining.

Prince George Section.

Black Hawk. This group of three claims, owned by J. E. Bateman, of Giscome, is situated on the north side of Eagle lake, about 1 mile from Giscome. The south-eastward continuation of the Cassiar-Omineca batholith outcrops prominently on the property and in the near-by region. It intrudes interbedded argillites and andesites. The latter in the vicinity of the western contact-zone are altered and pyritized. Various open-cuts in the vicinity of the contact expose the mineralized rocks. A sample taken of the more heavily mineralized portions failed, however, upon assay to disclose gold or silver values. The prevailing strike of the country-rock is about N. 20° W. (mag.), with steep almost vertical dip. The region is evidently one in which mineralization may be expected and some further prospecting seems justified.

Con Molder. This claim, owned by Roy Spurr, of Giscome, is situated on the right bank of the Willow river, about 1½ miles south of Giscome. Close to the river a 200-foot tunnel was driven by a former operator, following the bedding-planes of the argillite country-rock, which shows seams of pyrite. The objective of this tunnel was apparently a shaft, now inaccessible, lying to the south-east of the tunnel portal. A sample taken of the mineralized seams of pyrite in the tunnel failed to disclose gold or silver values upon assay.

Barbara Ellen. This group, owned by J. F. Wilson, of Hansard, is situated on the left bank of the Bowron river, about 4 miles due south-west of Hansard. The property is conveniently reached from Hansard by motor-boat via the Fraser and Bowron rivers. A short distance from the left bank of the Bowron river a small creek cuts through some quartz veins in schisted argillites, which strike N. 40° W. (mag.) and dip at about 45° south-west. One large quartz vein, probably 24 feet in width, is exposed by open-cut on the left bank of the creek. This vein shows considerable oxidation and at one point is mineralized with chalcopyrite and sphalerite. It appears to conform in strike and dip with the enclosing bedding-planes of the host-rock.

On the opposite side of the creek some smaller veins are exposed. These have the appearance of striking across the bedding-planes of the country-rock, but further work is necessary at this point to positively determine this. Assays of a sample from oxidized portions of the large vein failed to disclose gold or silver values. A sample taken from one of the smaller veins on the right bank of the creek also failed to show gold or silver values. A sample of the mineralized portions of the large vein assayed: Gold, trace; silver, trace; copper, 3.8 per cent.; zinc, 5.1 per cent. It is stated that another quartz-outcrop occurs at the edge of the river. This was covered by the water at the time of inspection.

Tabor. This group, owned by T. Rush, of Prince George, is situated on Six-mile mountain, which lies immediately east of the Prince George–Willow River road, to the north-east of Tabor lake. Flatly dipping sedimentary rocks found in this area are intruded at various places by granodiorite stocks. The sedimentary rocks strike from N. 20° W. (mag.) to N. 40° W. (mag.) and dip at about 15° south-west. A number of approximately parallel quartz veins of varying sizes up to a maximum width of about 8 feet cut across the bedding-planes of the enclosing country-rock and strike from N. 27° E. (mag.) to N. 37° E. (mag.). Some of the veins are sparsely mineralized with chalcopyrite and show copper-stain. A sample taken from selected portions of mineral present in the largest observed vein assayed: Gold, 0.06 oz. per ton; silver, 1 oz. per ton; copper, 0.9 per cent. It is possible that detailed sampling might disclose higher values in some of the other veins. The number of veins within a comparatively narrow belt of country would seem to warrant some superficial investigation at different points. The property is partly a restaking of abandoned ground.

Hixon Creek.

On this creek about half a century ago lode-mining operations were commenced by Quesnelle Quartz Mining Company, Limited, which installed a stamp-mill after sinking a main shaft, two other shafts, and driving various adits. Operations were subsequently suspended, and when interest was revived in the lode-gold possibilities of this region a few years ago the old main shaft-workings, which were under water at the time of Amos Bowman's inspection in 1885, and have since remained in this condition until recently, were the subject of much conjecture as to what they had disclosed. Old reports showed that a certain tonnage of ore of commercial grade had originally been milled.

Additional interest was given to the question in recent years by the fact that various engineers employed by different interests discovered evidence of "spotty" gold values in the tunnel driven on the *Cayenne* group, situated about 3,000 feet east of the Quesnelle Quartz Mining Company's shaft. These values occurred in a rotted schistose rock in which the tunnel was driven, and gave rise to the question as to whether further investigation would or would not disclose that gold values were present in sufficient quantity to enable large sections of the country-rock to be classed as commercial ore.

Further, as the result of placer operations by B. Briscoe in 1932 near the old main shaft of the Quesnelle Quartz Mining Company, there were discovered small quartz stringers in a highly altered rock. These stringers contained spectacular amounts of gold in their upper portions, but these pinched at a depth of but a few feet.

Rock-outcrops exposed along the road up the right bank of Hixon creek for a distance of about 1½ miles show that bands of a highly altered kaolinized rock, and interstratified schistose sedimentaries and phyllites, make up the bulk of the country-rocks of the creek-valley in this region. The kaolinized rocks weather to red, brown, and salmon-pink coloured rocks. The unwatering of the old workings by the Quesnelle Quartz Mining Company during 1933 clearly revealed what happened in this region. The results are of immense assistance locally in

appraising possibilities as to both lode and placer gold, but are of particular general value in affording a clear insight into the operation of those natural processes effective in Tertiary times, which resulted in the formation of truly local bed-rock placer deposits.

It is now apparent that the deeply oxidized and kaolinized rock was originally greenstone, and that this greenstone is interstratified with the sedimentaries and metamorphosed rock. The zone of oxidation extends to about 100 feet below the creek-bed, the whole zone constituting an extensive uneroded remnant of terrain which was subjected to deep secular decay in Tertiary times, and wherein the quartz veins were enriched in their upper portions by alteration.

The identity of the greenstone cannot be exactly determined, because, although easily recognizable in the lower levels of the Quesnelle Quartz Mining Company's workings as greenstone, it is extremely carbonated and altered. It is probably intrusive diorite, injection being *lit par lit*, and inasmuch as it is schistose its period of intrusion antedates the deformation of the sediments. Within it are a network of quartz veins varying in size from a few inches to several feet in width.

The exact extent of this zone of secondary enrichment is not known, but it is found on the neighbouring Terry creek. Its recognition is most important from both the lode-gold and placer standpoint. An absence of any glacial erosion is indicated in this area.

Quesnelle Quartz Mining Co., Ltd.

The president of this company is Norman J. Ker and the office is situated at 1000 Hall Building, Vancouver. The property, comprising six Crown-granted mineral claims, is situated on Hixon creek, about 4½ miles by road from the Prince George–Quesnel road. Under the direction of E. D. Clarke, superintendent, a Diesel-operated air-compressor and Cameron sinking-pump were installed in the late summer of 1933, and the old main shaft and workings therefrom unwatered for examination. The extent of these workings is as follows: Main shaft, 207 feet 9 inches deep; first level at 50 feet depth, 25-foot drift in a westerly direction; second level at 97½ feet depth, 232 feet of drifting west of shaft and north and south of the latter; third level at 145½ feet depth, 81.5 feet of drifting east and west of the shaft; fourth level at 196 feet depth, 240 feet of drifting east and north of the shaft.

A general description of what is disclosed by these workings has been given in the paragraphs immediately preceding. Oxidation persists down to the second level, but below this it decreases and is practically absent on the lowest level. A large number of quartz veins occur in the greenstone, and veins also follow the contact between greenstone and sediments. The property was examined and sampled by P. E. Peterson, who took 216 samples in all. Quartz veins and country-rock were sampled separately. As the result of his sampling he considered that a valuation of $2.04 per ton (gold at $30 per ounce) in gold and silver values might be assigned to a large volume of the altered greenstone, whereas there was no evidence of commercial values in the sedimentaries. To obtain further evidence of commercial possibilities, he recommended that other old workings be made accessible and sampled and that diamond-drilling be then undertaken. If this testing yielded satisfactory results a pilot-mill was advised.

Subsequent to the inspection by the Resident Engineer on October 24th, 1933, an adit was started in the right bank of the creek close to the place where the rich quartz stringers previously mentioned were discovered in 1932. This tunnel is to obtain further evidence of average values in the greenstone within the zone of oxidation.

Cottonwood.

This group of two claims, adjoining the property of Quesnelle Quartz Mining Company, Limited, on the east, is owned by C. H. Colgrove, of Hixon. Three short tunnels have been driven in the right bank of the creek in deeply kaolinized and oxidized rock in which are found angular fragments of quartz, from which material free gold may be obtained by panning. Such material is largely residual and has resulted from alteration of greenstone. The significance of this deep secular decay is dealt with in the preceding text at the head of this section, which is pertinent to this property. In view of the fact that the strike of the greenstone-bands is north-west, a tunnel run in a direction as nearly as topographic conditions permit at right angles to this should give the most information. Recognizing the desirability of gaining depth, the best direction for tunnelling will probably be found to lie between north and north-east. Such investigation is merited.

The owner has constructed a small current-wheel which operates a primitive pilot-mill. The mill embodies a crushing device and a washing plant for recovery of free gold. By utilizing power in the form of an overshot water-wheel and blanket-tables for recovery of fine gold, there

seems no reason why a small pilot plant should not be constructed at small cost, giving results of practical value. It would also give a check on underground sampling.

Brotgold Mines, Ltd.

The office of this company is at 1303 Vancouver Block, Vancouver. The company holds a very large number of claims on Hixon creek, the claims extending from below the falls up-stream for some miles, and surrounding on all sides the two above-described properties. In addition, an option has been acquired on placer-mining rights on lease 2118, owned by E. Hann and J. Strbac (frequently mentioned in the Annual Reports), and adjoining ground.

By way of preliminary work a complete topographic survey of the claims was made by H. F. S. Woolverton. The original *Cayenne* group tunnel was advanced to a point 230 feet from the portal, and another tunnel was started in phyllite on the left bank of the creek about 500 feet up-stream. Driven in a south-westerly direction, the tunnel passed out of the phyllites into altered greenstone in about 15 feet, according to the information given by H. F. S. Woolverton. During process of survey any outcrops of country-rock or veins were examined and plotted on the survey.

It is proposed to drive a tunnel during the winter in the left bank of the creek in the hope of discovering the continuation of the vein or veins, the erosion of which resulted in the placer on Lot 2118. Inasmuch as it now seems clear that this placer deposit is of local origin, and that the white micaceous clay on which the placer rests is country-rock decomposed *in situ*, there would seem every justification for the search now being undertaken. The source of the gold may of course be several small veins which have been subjected to secondary enrichment in their upper portions. It is understood the company proposes to continue the investigation of the gold content of the altered greenstone at an opportune time.

Ahbau Lake Section.

Moosehorn.

This group, situated on Moosehorn creek, a tributary of the Willow river, was originally owned by H. Guthrie, of Cottonwood. It was acquired in the fall of 1933 by Eskridge Syndicate No. 2 (Eskridge Syndicate No. 1 is the syndicate that initiated the development and original financing of property now held by Slade-Cariboo Gold Placers, Limited), of which R. S. Eskridge is manager. This property could not be inspected during 1933 and the information is kindly supplied by the manager. After preliminary sampling of showings a cabin was erected in October, food-supplies packed in, and a crosscut tunnel to penetrate the vein system was started. It is anticipated that this tunnel will pass through five veins in the first 268 feet of its length, at a maximum depth of 238 feet below the surface. There are stated to be twelve veins on the property, one of which is 8½ feet in width. The veins are approximately parallel, striking east and west. A report on this property will be found in the 1920 Annual Report. When results justify, the syndicate intends to incorporate a limited liability company for the operation of the property.

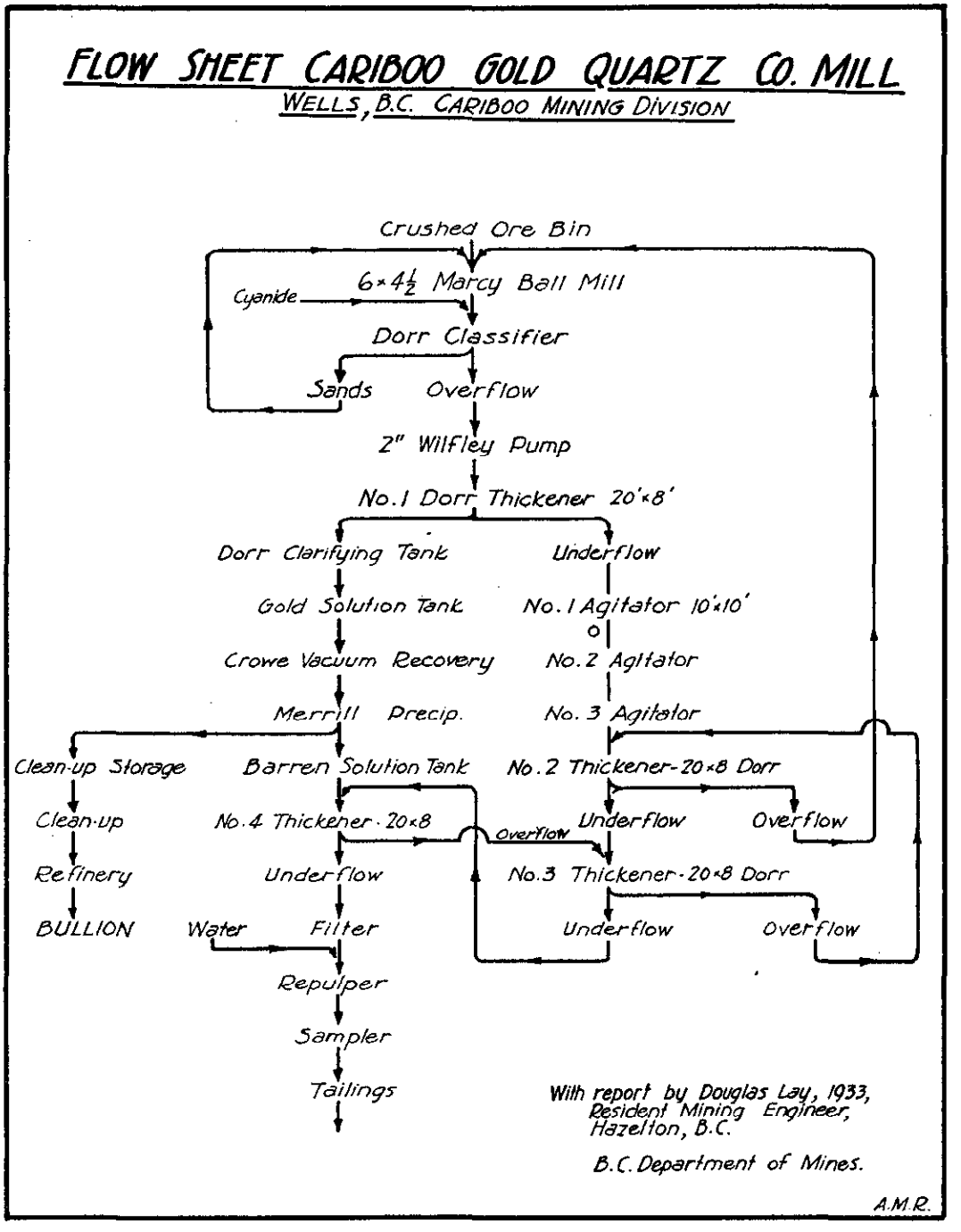
Barkerville Section.

Cariboo Gold Quartz Mining Co., Ltd.

Milling operations were commenced on January 2nd and continued throughout 1933. The milling-rate was increased after the first few months to about 65 tons daily, the average gold-recovery at this scale being about $1,000 daily (Canadian funds). Material expansions and improvements in plant were made during 1933. Diesel-engine power was increased to a total of 533 horsepower and air-compressor capacity to 1,300 cubic feet of free air per minute. Power and air capacities were to be increased early in 1934 to keep pace with the requirements of the development programme. In the mill, zinc boxes were replaced by the installation of the Merrill-Crowe precipitation process. The maximum mill capacity is now 100 tons daily. Accommodation for employees was increased. It is of the most modern description. Electric haulage underground and a mechanical mucker were also installed.

In accordance with the plans of the management, the main crosscut tunnel will for some considerable time to come be the main development artery, and drifts from it will follow the veins met with in the course of development. This main tunnel is to be driven ahead continuously whatever other local development may from time to time be required.

The milling-rate of 65 tons daily will be continued, and there will be no increase in this respect until such is shown to be justified by the results of development. Such a policy reflects a full realization of the best interests of this property.



Underground developments during 1933 were distinctly satisfactory. Among items of much interest are: The very gratifying length of stoping-ground struck on No. 2 vein, reaching a total of 700 feet in October, of which 450 feet was uninterrupted; the great widths of commercial ore, 50 feet and more, disclosed at two or three different points; and the penetration of the downward continuation of the *Rainbow* vein system by the main crosscut at a depth of 600 feet below the surface. The last item was announced by the manager in November, subsequent to

inspection by the Resident Engineer, but in October small veins showing good values were appearing in the face of the tunnel, indicating the likelihood of the strike subsequently made. While the gratifying fact has been announced by the management that several veins containing high-grade ore have been penetrated, it has also been announced that the full significance of the strike can only be determined by further development, and pending such development further information will not be made public. On page 149 of the Annual Report for 1925 will be found an account of the surface appearance of this vein system. The economics of mining may indicate the advisability of mining a block of ground in this region.

One most interesting fact has emerged from operations to date, and while it is not of any great commercial significance, it is of much scientific value in contributing to a proper understanding of the operation of those natural processes in Tertiary times which resulted in the formation of placer deposits of truly local origin. It is found in milling there is trapped in the ball-mill a certain amount of really coarse gold, of the order of $2 and $3 pieces, strictly comparable with really coarse placer gold. The quantity found is about 1 oz. per 100 tons of ore, and it demonstrates that some of the coarse gold in the placers was primary, apart altogether from the fact that doubtless the major portion of the coarse gold was produced by secondary enrichment in the upper portions of the veins.

In the latter part of January, 1934, the appointment of R. R. Rose as general superintendent was announced. Fred M. Wells, late manager, continues to act in an advisory capacity.

Newmont Mining Corporation, Ltd.

This corporation is interested in several properties in the Cariboo district. Operations are conducted under the name of P. Kraft, the resident manager. The total work done during 1933 at the various properties was very considerable, although underground development was mainly confined to the *Aurum* group, owned by C. J. Seymour Baker, situated on Island mountain, and immediately adjoining on the north-west the property of Cariboo Gold Quartz Mining Company, Limited. In October the main crosscut tunnel had been advanced 1,140 feet on a bearing of N. 50° W., at about 80 feet above Jack of Clubs lake. This tunnel was started by the earliest operators of this property many years ago. Its objective is the exploration of the downward continuation of the *Johns* ledges. Various veins were encountered, also one interesting replacement deposit of pyrite in limestone. Appearances generally were deemed sufficiently encouraging in the fall to warrant expansion, and work was then commenced on the construction of additional accommodation necessary for an increase in mine crew and the installation of an air-compressor of 500 cubic feet of free air per minute capacity, operated by a 100-horse-power Ruston & Hornsby Diesel engine.

On the *Proserpine* group, on Proserpine mountain, also owned by C. J. Seymour Baker, a crosscut in October had advanced a total distance of 630 feet on a bearing N. 79° E. The objective here is the penetration of the downward continuation of a "cross" vein on which a shaft had been originally sunk to a depth of 50 feet. The crosscut is 120 feet vertically below the collar of the shaft. Other objectives on this property are the investigation of the vein on which the *Wilkinson* shaft was originally sunk, and the mineralization in evidence on the *Penelope* mineral claim.

On the *Myrtle* and *Morning Star* groups on Barkerville mountain, owned respectively by E. E. Armstrong and F. J. Tregillus, a large amount of surface-stripping was accomplished, but no underground development was undertaken.

Premier Gold Mining Co., Ltd.

This company, under the direction of Bert F. Smith, assistant manager, in 1933 did extensive surface-stripping on the *North Star* group on Sugar creek, owned by A. St. Clair Brindle and associates, and on a large number of claims on *Antler* group, comprising *Discovery*, *Grouse*, *Old Sol*, and *Canyon* groups, and *Royal Coachman* and *Duff*. No underground development was undertaken and operations were suspended, temporarily at any rate, in the fall.

Britannia Mining and Smelting Co., Ltd.

This company has under option the *Black Jack* and *Westport* groups, owned by F. J. Tregillus and T. A. Blair, situated immediately contiguous to Williams creek, and the *Wintrip* real estate, situated on Stouts gulch. On the *Cunningham* group on Cunningham creek an option was held and some work done during 1933, but this option was relinquished. By the end of October a total of 600 feet of underground development, some diamond-drilling, and a large amount of surface-stripping had been done on the various properties.

On the *Black Jack* 138 feet of tunnelling was carried out.

On the *Westport* and *Wintrip* appearances are locally promising and invite development, although it was disclosed by underground development that faulting is recurrent and involves expense in deciphering.

On the *Wintrip* real estate, on the right bank of Stouts gulch, a large "B" vein outcrops prominently in the vicinity of other smaller "B" veins and "A" veins. The outcrop is heavily mineralized and shows the mineral chiviatite. A tunnel, a short distance down-stream from the outcrop, was driven to intercept the vein. It passed through two intersecting faults before finally striking the dislocated south-westward continuation of the vein, which was quite strong at the point of recovery. Followed north-easterly from this point the mineralization weakened, while south-westerly the vein was found to be again interrupted by faulting. Trenching in the left bank of the creek in this region did not disclose evidence of continuation beyond the outcrop north-easterly. Persistence in this region would, however, seem justified, and surface-trenching between this point and the showings on the *Westport* group was contemplated.

These operations were carried on under the direction of C. V. Brennan, assistant general manager of the company, H. F. Eastman being resident manager.

Proserpine Syndicate.

This syndicate, directed by W. R. Wilson & Sons, with C. M. Campbell in charge of operations, has acquired options on the *Independence* group and adjoining claims on Proserpine mountain. After doing extensive surface-trenching, which disclosed a large number of "B" veins, a programme of underground development was commenced. This includes: (*a*) Continuation of the *Warspite* adit under the *Warspite* shaft, giving a depth of 80 feet at the latter point, where encouraging values were originally obtained; (*b*) extension of the *Bell* adit under and through the sheared zone and surface workings where two mineralized "A" veins and "cross" veins are exposed, giving a vertical depth of 90 feet at the objective; (*c*) extension of *Newberry* adit underneath and connecting with No. 1 shaft at a vertical depth of 45 feet, and continuing to intersect the vein on which No. 2 shaft was sunk, giving a vertical depth of 100 feet at the latter point.

It is stated that no high values were encountered in the veins during this work and that the "A" vein system appears to carry as good or somewhat better values than the "B" vein system. A noteworthy feature of this property is the large number of "B" veins disclosed. The property lies directly in the Island Mountain-Round Top Mountain belt and the result of this preliminary development is of much interest.

Cariboo Coronado Mining Syndicate.

This syndicate owns twenty-six mineral claims on Cornish mountain. At or about an elevation of 4,800 feet several "cross" veins striking from N. 25° E. to N. 55° E. (mag.) have been exposed by open-cuts; one vein is close to 9 feet in width. It is proposed to run an adit in a north-westerly direction from a point on the mountain-slopes above Williams Creek meadows to give a vertical depth of about 750 feet below the outcrops mentioned, the estimated length of the crosscut being, it is stated, in the neighbourhood of 2,500 feet. In October, under E. Hanson, active preparations had been made to carry out the contemplated programme. A good branch road half a mile in length, including bridge over the Willow river, had been constructed from the Willow River road to temporary camp, and this road was being continued eastwards to the permanent camp-site in the vicinity of the proposed tunnel.

Shamrock Gold Mines, Ltd.

This company has installed a portable Sullivan air-compressor and is driving an adit on a bearing N. 39° W. at elevation 4,226 feet, just above the Cairn on the outskirts of Barkerville. The first objective is the downward extension of the *Home Rule* ledge exposed about 500 feet vertically above the tunnel on Barkerville mountain. This tunnel is situated about 1,500 feet east of the main tunnel of Cariboo Gold Quartz Mining Company, Limited, and on October 17th was 627 feet long. F. Pardoe Wilson was in charge of operations.

Richfield Cariboo Gold Mines, Ltd.

This company holds a large number of mineral claims extending south-eastwards from Mink gulch, and covering a large area on both sides of Williams creek and extending up Proserpine mountain. On the mountain-slopes above Mink gulch at elevations between 5,850 feet and 6,000 feet are exposed one "A" vein several feet in width and a cluster of veins striking in an easterly and westerly direction. These are much oxidized. Sulphides are sparse, but do occur. To penetrate the downward continuation of the vein system described, a crosscut tunnel has been

started at elevation 5,200 feet at the head of Mink gulch near the old Stanley–Barkerville road. Camp buildings have been erected and a portable Sullivan air-compressor of capacity 300 cubic feet of free air per minute has been installed. The bearing of the tunnel is to be S. 51° 30′ E. for the first 600 feet, and thereafter due south. On October 9th the tunnel had advanced a distance of 421 feet. At 273 feet from the portal some well-mineralized quartz was penetrated on the west side of the tunnel, also at 317 feet a vein of maximum width of 3 feet was disclosed.

Cariboo Central Gold Mines Co.

This company, of which A. G. Larson is manager, holds the *Blue Jay* group immediately adjoining the property of the Cariboo Gold Quartz Mining Company, Limited, and situated immediately west of the upper portions of Lowhee creek and Stouts gulch. In October camp buildings had been erected at the head of Stouts gulch close to Lowhee Mining Company's dam, and preparations were being made to drive an adit due west at this point at elevation 4,870 feet to explore in depth various veins exposed on the surface at higher points of the property. Certain veins exposed in the Lowhee Mining Company's hydraulic pit may also be intercepted by this tunnel.

Cariboo Amalgamated Gold Mines, Ltd.

This company owns nine groups of claims, including the interest of F. M. Wells in the *Hudson* group, and in which an option is held on the remaining interest. All of these groups were located by or under the direction of Fred M. Wells, managing director of Cariboo Gold Quartz Mining Company, Limited. While all of these groups have not been inspected, it is apparent that some are situated in regions of decided potential promise, and attention has been frequently drawn in these reports to the promise exhibited by the *Hudson* group on Cunningham creek. It is understood that A. G. Langley is the engineer in charge of operations and Fred M. Wells is technical consultant.

The groups mentioned are situated at the following places: Group 1, a large number of claims contiguous to Moose creek, tributary of the Willow river; group 2, on Dauntless creek, near Wingdam; group 3, on Red gulch; group 4, in Devils canyon; group 5, on Olally creek; group 6, on Pinkerton creek; group 7, on China creek; group 8, on the slopes of Proserpine mountain, consisting of *Liberty* and *Free Gold* mineral claims; and group 9, consisting of *Hudson* group and adjoining claims. A brief inspection was possible of only groups 2, 4, and 7, at which camps were established during 1933, where preliminary prospecting was done under the direction of J. F. Tener. It is understood that a considerable amount of preliminary work was also accomplished at group 1.

Group 2.—The *Cariboo-Wells* group is situated on Dauntless creek, a southerly-flowing tributary of Lightning creek, about half a mile down-stream from Wingdam. Interest focuses in the quartz veins of the region by reason of the placer deposits in the immediate vicinity on Lightning creek, and while this region is closely adjacent to the path of the Central batholith, there are some grounds for inferring that some of the veins in the region may be pre-Mississippian. The country-rocks in this region are schists of the Cariboo pre-Cambrian series presumably, although it may be noted that somewhat over 2 miles farther west Mesozoic rocks are exposed on Mosquito creek.

Prospecting to date has disclosed numerous veins on this property, but interest centres mainly on one place within a belt of country about 125 feet in width, where six veins are seen to strike across the bedding-planes of the schists at varying angles. The topography is such that an adit-crosscut can be run to great advantage to intercept the downward continuation of these veins at a vertical depth of about 120 feet below the outcrops. This tunnel had just been started at the time of inspection in October.

Group 4.—The *Devils Canyon* group comprises a number of claims situated both east and west of the Devils canyon, through which the Quesnel–Barkerville road runs, and on Burns creek. On the west side of the canyon, on the *Eldorado* claim, it is evident that there are a number of quartz veins in this region, some possibly of considerable size. But on the lower mountain-slopes it is evident that the country-rock is shattered for some considerable distance from the surface, and it was not possible to form an opinion from shallow exposures whether the veins or enclosing rock were in place. As elevation is gained shattering is not so much in evidence. A number of open-cuts, including one shallow shaft and a short tunnel, have been made following a north-west direction across this claim. On the east side of the canyon, close to the road, in the walls of the canyon there is exposed an "A" vein with small spurs.

Group 7.—The *Gold Belt* group covers an area in the vicinity of China and Wolfe creeks in the path of the Island Mountain-Round Top Mountain belt. On Wolfe creek, near the contact of schists and limestones, a prominent andesite-porphyry dyke, apparently a Jurassic intrusive, outcrops prominently. On the right bank of the creek at elevation 4,600 feet an open-cut followed by a short tunnel exposes a shear-zone several feet in width. This trends with the planes of schistosity of the country-rock, with bands of quartz and intensely silicified country-rock alternating. Mineralization of galena and pyrite is in evidence. This type of vein is uncommon in the Barkerville district.

On the steep south-eastern slopes of Antler mountain, a considerable distance south-east of the above-mentioned showing, at 5,060 feet elevation, several small "A" veins which occur in close proximity to one another are exposed by open-cuts in the schisted sediments. These "A" veins are crossed by small "B" veins. Slight mineralization occurs in places.

On the right bank of China creek are exposed several small well-mineralized veins of "A" type up to about 18 inches in width.

Canyon. This group, owned by the Larson Holding Company, of which A. G. Larson is president, is situated on Jack of Clubs creek, about 1½ miles above the mouth. A branch road over which a car can be driven for a portion of the distance leads to it from the Quesnel–Barkerville road west of Jack of Clubs lake.

In the canyon on this creek are exposed three veins, situated about 18 feet apart and varying from 4 to 8 feet in width. They all apparently cut directly across the bedding-planes of the enclosing schistose sedimentaries. These veins are mineralized with pyrite, the exposures being on the north wall of the canyon. Another vein is exposed in the south canyon-wall at this point, but its exact relationship with those mentioned could not be determined owing to the difficulty of crossing the creek. The proportions of these veins, likewise their direction, call for thorough sampling and investigation.

Bridge Island Golds, Ltd. This company owns the *Coulter* group of claims situated on Coulter creek. Under the direction of C. B. Hume, a small crew of men was employed during 1933 in preliminary surface prospecting; after which an adit was started at 5,175 feet elevation, following a wide vein striking N. 72° E. It is understood a small air-compressor to expedite development was to be installed.

B.C. Cariboo Gold Fields, Ltd.—This company, of which V. Dolmage is vice-president, holds nineteen claims on Burns mountain at the head of Burns creek. Preliminary prospecting was done during 1933. The occurrence of placer on Burns creek invites close investigation of the surrounding area.

Aladdin and Mac and Jack. These mineral claims, owned by J. McKenzie, of Barkerville, are situated on French creek. The showings are in the immediate vicinity of the sluice-flume of French Creek Hydraulic Placers, Limited. This sluice-flume is laid in a fault-draw striking N. 65° E. (mag.) in schisted argillites. Immediately adjacent to the fault on the east and over a width of 20 feet is exposed a 3-foot "A" vein and some small intersecting veins, in which a certain amount of mineralization in the form of pyrite is present. There is no marked continuation of the individual veins east of the fault, but one small "B" vein outcrops about 30 feet distant from the fault, and removal of the overburden might disclose additional veins. About 300 yards west of the fault some more small quartz veins outcrop, but none were seen close to the fault. A sample of selected portions of quartz veins immediately east of the fault failed to disclose gold or silver values when assayed.

Stanley Section.

Burns Mountain Gold Quartz Mining Co., Ltd. This company is developing the *Perkins* group on Burns mountain. This is described in Bulletin No. 1, 1932. A 50-horse-power Vickers-Petter Diesel engine and small air-compressor have been installed, and an adit-crosscut tunnel about 200 feet vertically below the original crosscut tunnel had on October 4th reached a length of 1,040 feet. The portal of this tunnel is situated some considerable distance south-east of the original crosscut, and the new adit is being driven on a bearing N. 33° W. with the objective of penetrating the vein system exposed by the earlier workings. The tunnel-face is close to the point at which the members of the vein system may be expected to be cut. A. McLeod is in charge of operations.

Foster Ledge Gold Mines, Ltd.

This company is operating a group of claims contiguous to Chisholm creek, on one of which the old *Foster* shaft was sunk many years ago. This shaft is now full of water. Near by and to the west of the shaft three small mineralized cross-veins occur within a width of 15 feet. About 1,200 feet to the east two intersecting cross-veins are exposed by open-cuts on the surface, one of which shows free gold in its outcrop. A few hundred feet south of the shaft and 80 feet vertically below the collar an old tunnel had been driven about 200 feet in a northerly direction. At the face of this tunnel a crosscut has been run exposing three small cross-veins occurring within a width of a few feet. These are being followed in a drift driven towards the *Foster* shaft. These veins are well mineralized and the sulphides show encouraging gold values. A crosscut is to be run towards the *Foster* vein when the drift mentioned is opposite the shaft. R. MacDonald was in charge of operations.

Cariboo Mountain Gold Mines, Ltd.

This company holds a number of claims on Cariboo mountain, about 23 miles south by pack-trail from Stanley. Although there is evidence of other veins on this property, the chief feature is the *Dominion* ledge, a large quartz vein, probably averaging from 8 to 10 feet in width. This vein outcrops prominently on the summit of the mountain, and although bleached white on the surface, oxidation is apparent at a depth of a foot or so, and free gold can be detected at some points. This vein cuts across the enclosing schistose sediments, which are here intruded by pyroxenite. The company is driving a crosscut tunnel on a bearing S. 25° E. (mag.) to cut the vein at a vertical depth of 160 feet below the vein apex. The distance of the vein in this crosscut is 360 feet, of which 55 feet had been driven on September 9th. The vein strikes N. 60° E. (mag.) and dips steeply south-east. The crosscut tunnel follows the strike of the schistose sediments, which dip at an angle of about 25° north-east. The elevation of the apex of the vein is 6,300 feet. An excellent camp-site exists about 450 feet vertically below the crosscut tunnel, and on this camp buildings adapted to winter conditions were nearing completion on the date of inspection. A force of twenty men under the direction of J. A. McLaughlin is employed.

Dragon Mountain Gold Quartz.

On this and adjoining claims, situated on Timon and Jawbone creeks, a large amount of painstaking prospecting has been carried out by G. W. Bruggy and associates in connection with the numerous quartz veins in these regions. This work is justified by the neighbouring placer-gold occurrences. A good cabin was constructed on the right bank of Timon creek close to the Quesnel–Barkerville road.

Van Winkle.

This group, owned by A. S. MacCulloch and associates, is situated on Lightning creek and covers the area between Perkins and Amador creeks on both sides of the first-mentioned creek. On the south side of Lightning creek, in Spruce canyon, open-cut work at one point has exposed five "cross" veins close together. These vary in width up to somewhat over 2 feet and are seen to be capped with country-rock. They do not extend to the surface, being a type of vein commonly known as "blind," and of which there must be many in the areas contiguous to Stanley and Barkerville. The mineralization present in these veins is pyrrhotite and chalcopyrite, a type uncommon to the area. A sample of selected portions of the most heavily mineralized vein did not disclose gold values upon assay, but it is probable that there are a number of other veins on this group to be found by prospecting. This work is suggested by placer occurrence in the region.

Free Lance.

This group, owned by H. Crooks and Fred Gingras, of Quesnel, is situated on the south side of Lightning Creek valley, about 1½ miles below Wingdam. In schisted argillites striking about N. 75° E. (mag.), dipping south-east, a vein of "A" type is exposed at three different points along its strike by a shallow pit and two open-cuts over a total length of about 225 feet. The vein is well oxidized at a depth of a foot or so below its outcrop and in width varies from 2 to 5 feet. A few other small "A" veins are to be seen in close proximity, and there is evidence of another vein striking about N. 25° E. (mag.) across the schistosity planes of the country-rock to intersect the first vein. It is suggested that prospecting should be directed to the "cross" vein mentioned, and to search for others of this type which may exist on the property.

Canyon.

This claim is situated on the right bank of the Fraser river just below the Cottonwood canyon, at which point the Fraser river cuts diagonally across and through its former ancient channel. This ancient channel is marked by the workings of the *Tertiary* mine on the left bank and by those of the *Canyon* mine on the

right bank of the Fraser river. The claim is owned by J. A. Wade and A. E. McGregor, of Quesnel. Immediately up-stream from the *Canyon* mine-workings a sheared zone of unknown width is apparent in the argillites which form the country-rock. The argillites strike N. 45° W. (mag.) and dip south-west at about 45°. At several places small oxidized quartz veins showing pyrite are developed within the zone of shearing. Samples taken by the Resident Engineer did not disclose material values, but it is stated that samples taken by the owners at different places were more hopeful. Some prospecting in the region is warranted, and the staking is the result of the well-conceived idea on the part of the owners that the placer occurrence in the Tertiary channel of the Fraser river justified local search for the possible origin of such.

Placer-mining.

The production of placer gold for 1933 in the Cariboo Mining Division was 4,897 oz., as compared with 4,155 oz. in 1932.

Placer gold recovered during 1933, especially that recovered from river-bars, as the result of praiseworthy effort on the part of individual prospectors, was greater than for some years past.

Prince George Section.

Fort George Canyon.—Leases held by T. Thompson, Seymour Robertson, and associates cover an occurrence of placer not previously examined. The leases are situated on Lot 4595A, a ranch owned by P. Holzworth, and immediately adjoining the left bank of the Fraser river in the Fort George canyon. The placer occurs in shallow gravels which overlie rock at about 50 feet above the river. It seems quite likely that a large portion of the 80 acres comprising Lot 4595A is underlain at shallow depth by rock, as it is stated that at some points the soil is not deeper than a foot and bed-rock is reached at a further depth of only 2 feet. It is stated that encouraging pans can be obtained at several points over 160 acres. The gold is fine, but pieces up to 13 grains in weight (approximately 50-cent nuggets) have been found. Commercial possibilities can only be ascertained by systematic testing, which is facilitated by the shallowness of the ground. Doubtless the fine gold results mainly from concentration effected by flood-plain waters, but the topography suggests that quite possibly a buried channel-segment exists on this side of the river, for the canyon here is in the form of a detour on the west side of the possible former channel. A definite opinion on this point could be arrived at by further field-study in the region, but for which time was not available on the occasion of this inspection. It is not perhaps a digression to remark that in Tertiary times it seems evident that the Fraser river continued north-west at or about its most northerly point via the Crooked, Pack, and Parsnip River valleys, and its waters in those times were not connected with those of the Nechako river, which then probably more or less coincided with the direction of the southward-flowing portion of the Fraser river from some point somewhat south of Prince George onwards.

Hixon Creek.

Lease 2118.—This lease, owned by E. Hann and J. Strbac, is described on page 164 of the 1927 Annual Report and in succeeding Annual Reports. Early in 1933 it was taken under option by A. J. Schweppe and operated by R. L. Small under a sublease. The latter did much necessary preliminary work in improving the water-supply and in the erection of camp buildings. He subsequently washed a considerable yardage of gravels in testing the ground prior to considering the question of installing a power-shovel. In the fall the option on the property was acquired by Brotgold Mines, Limited, which company also holds lode-mineral rights on this property and adjoining ground.

The hydraulic pit on this property was surveyed by H. F. S. Woolverton, in charge of the operations of the company mentioned. It is stated that the result of this survey, considered in conjunction with actual recoveries of placer gold to date, would indicate that the average values of this ground removed (including all overburden) was 88.8 cents per cubic yard.

This placer deposit is one of interest, because, considered in conjunction with the additional information gained by the recent unwatering of the Quesnelle Quartz Mining Company's shaft, it strikingly exemplifies the operation of those natural agencies in Tertiary times which resulted in the formation of bed-rock placer deposits of truly local origin. These processes of placer formation included deep secular decay resulting in freeing the gold from gangue or rock matter and the formation of residual gold. This was followed by the sorting action of the stream of

water in removing the gangue-matter from the gold, thus effecting the transition of the latter from residual gold to placer. There seems every reason to infer that wearing of the pieces of coarser gold was accomplished by passage of sand and gravel over it rather than by actual transportation of the gold in the stream of water.

It is unnecessary to repeat the detailed information concerning this property which will be found in the report cited above, but the salient features may with advantage be here given, in view of the additional light thrown on the nature of this deposit by recent developments on this creek. A low-lying timbered bench on the left bank of the creek is underlain by about 5 feet of sand and silt, in which are numerous decayed tree trunks and roots. This overburden contains values which are said to be about 15 cents per cubic yard. This overburden overlies 4 feet of gravels and large glacial boulders, which contains high values in coarse gold, much of which is markedly residual in appearance. The pay-stratum immediately overlies a white clay, which also contains good values to a depth of about a foot, with smaller values at greater depth. Originally the owners sank a 32-foot shaft near the creek on the down-stream side of the pit, and although this shaft has never been open to inspection, it was originally reported that white clay was encountered in this shaft to the bottom, where red clay, which is of such frequent occurrence on this creek, was struck.

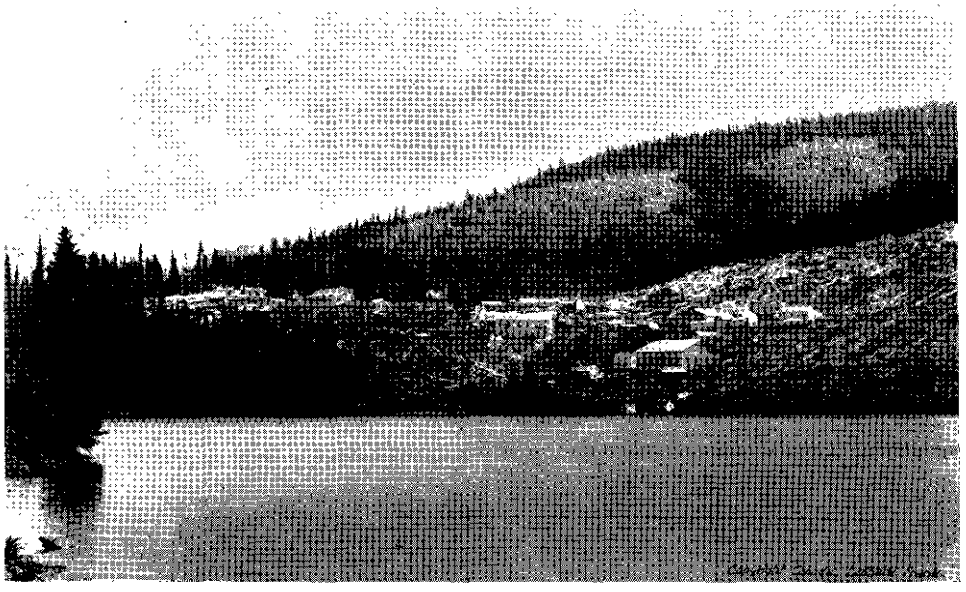
From information gained by the unwatering of the Quesnelle Quartz Mining Company's main shaft-workings, it seems apparent that the white clay on which rest the placer deposits on this lease is residual, and that this and the neighbouring terrain exemplifies a preserved remnant of the deep secular decay which resulted from processes operative in Tertiary times. Therefore the view is held that this placer deposit is of truly local origin and the source of the gold is near by the placer. It seems advisable to carefully examine this creek at other points, the neighbouring region generally, and especially Terry creek, where there is also evidence of preservation of deep secular decay, in the hope of discovering similar placer deposits to this one. In the region specified, apparently barren creek-benches should be tested and should be penetrated to a depth of several feet until residual clay or other evidence of bed-rock is reached. The discovery of this placer is due to the intelligent painstaking prospecting done by the owners, E. Hann and J. Strbac.

Terry Creek.

A general description of placer occurrence on this creek will be found on page 95 of the 1932 Annual Report. The facts that have recently come to light in connection with Hixon creek, generally speaking, apply also to this creek, and must be borne in mind in connection with study of the placer deposits.

Operations of F. L. Shouldice and K. M. Leach.—An option was secured by the operators mentioned on the leases of F. German and G. Lahti, described in the 1932 Annual Report. With the aid of the Department, a rough road was constructed from the main Prince George–Quesnel road to the property. A ½-cubic-yard boom drag-line caterpillar shovel was installed, with a washing-plant designed by K. Nordlund, who is in charge. The power-shovel is operated by gasoline-engine and its estimated capacity is given as 700 cubic yards per two 10-hour shifts; it is in charge of P. O'Brien.

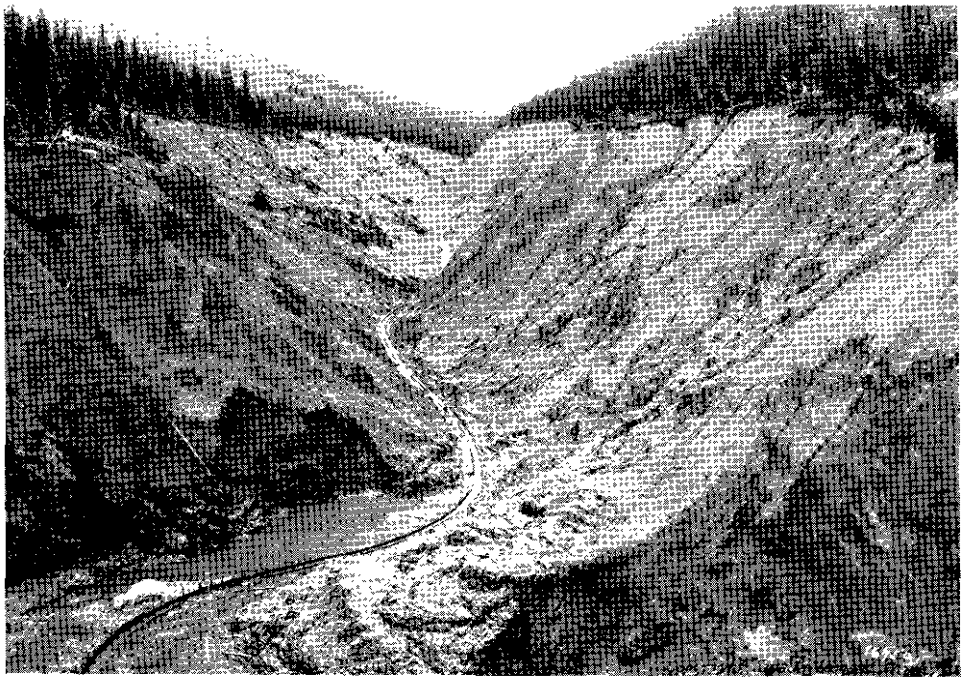
The general *modus operandi* of this plant is as follows: A train of four 1½-cubic-yard cars is loaded by the shovel and is hauled by winch operated by a Novo gasoline-engine to dump-box and washed. Oversize from a 5-inch grizzly passes to waste. The undersize is conveyed by belt-conveyor to a trommel, 10 feet long by 2 feet 4 inches diameter, with ¼-inch and 1-inch screens; trommel-speed is 20 r.p.m. Inside the trommel is a water-spray. The oversize passes to riffled tailings-flume, while the undersize is distributed to three blanket-tables. At the head of each table is a "gold-saving box," designed by K. Nordlund, which is in effect a compacted blanket-table, the idea being to keep the major portion of the recovered gold constantly under lock and key. In each box are two blanket-tables, 39 inches long and 25 inches wide, the tables sloping in opposite directions as in any two-blanket rocker. The grade of the tables is 10 per cent. The blanket-tables, at the head of which these boxes are placed, are each 29 inches wide by somewhat over 32 feet in length, and each table is in three sections, with a drop between each section. The grade of the tables is 12½ per cent. The tables are covered with two plies of expanded metal riffles, 1½-inch mesh and ½-inch mesh, laid on top of cocoanut matting, under which is laid canvas. The same riffling is employed in the "gold-saving boxes." The plant was nearing completion at the time of inspection (September 3rd), but no first-hand information is



Cariboo Gold Quartz Mining Co., Cariboo M.D.

Slate Creek, Omineca—Consolidated M. & S. Co.'s Camp.

Barkerville in 1933. (Copyright Canada, Leonard Frank.)



Lowhee Mining Co., Ltd., Cariboo M.D.

available as to subsequent operations. It is presumed that preliminary testing carried out on this ground disclosed the need for the precautions for saving fine gold, which this plant exemplifies.

Lease of T. H. Campbell.—This lease immediately adjoins down-stream the above-mentioned lease and a description of it will be found in the 1932 and previous Annual Reports.

Leases of G. Lahti and Associates.—These leases are situated down-stream from that of T. H. Campbell and a brief examination only was possible in the time available. Much low-lying bench-ground exists in this region, and promising values are to be found at several different places in the shallow bouldery gravels which overlie what appears to be a false bed-rock of kaolinized rock detritus. Flanking the creek are banks of gravels of assumed inter-Glacial age, inasmuch as small seams of lignite are contained in them, and it would seem that the gold occurrence mentioned resulted from post-Glacial waters cutting down through these inter-Glacial deposits. As previously mentioned, however, placer deposits on this creek must be viewed in the light thrown on the region by recent developments on Hixon creek, and further field-study is necessary to correctly decipher placer occurrence. A close investigation of the "false" bed-rock mentioned seems advisable.

Lightning Creek and Tributaries.

Coldspring. This group of six leases, held by W. C. Slade and K. M. O'Beirn and associates, is situated on the right bank of Lightning creek, contiguous to Lot 443 (known as Coldspring House). This area is of particular interest because low-lying rock benches flanking the creek were extensively worked by the old-time placer-miners, who brought in water by a ditch-line from a higher point on the creek for this purpose, and the general indications are that there exists instream from the creek on this ground a buried pre-Glacial channel, the left rim of which has been eroded by the creek. There are also known to exist post-Glacial superficial concentrations on the higher gravel benches, although these are probably of subordinate importance compared with the channel indicated. In the absence of detailed local field-study, for which time was not available, a definite opinion cannot be expressed as to just what channel is existent on this ground. It may possibly be the down-stream continuation of the channel evident on Mosquito creek, or of another channel, of which there is some evidence, crossing Lightning creek by the foot of "Mexican Hill" on the Quesnel–Barkerville road, or the confluence of both these channels. As having some possible bearing on the matter, it might also be mentioned that down-stream, about three-quarters of a mile from the mouth of Mosquito creek, on the right bank of Lightning creek, there are exposed what appear to be both rims of the pre-Glacial channel on Lightning creek, trending instream.

Detailed field-study in the region would give much information about this ground, and it is considered that the potentialities fully warrant close investigation, which should be followed by some Keystone-drilling.

Leases of G. S. Gagen and Associates.—These are situated on Gagen creek and an account of them will be found in the 1932 Annual Report. Some testing operations were carried out by C. W. Moore and associates, optionees, but it was not possible to visit this property during 1933.

Slade-Cariboo Gold Placers, Ltd. This company was organized in Seattle by R. S. Eskridge, its first president, for the purpose of operating the leases of W. C. Slade and associates situated on Mosquito creek. The president is now M. M. Caldwell, R. S. Eskridge having resigned to devote himself to other interests. W. C. Slade continues as vice-president. A description of this ground will be found in the 1930 and 1931 Annual Reports. During 1933 good progress was made, improvements in the water-supply for hydraulic purposes, on which much was done in 1932, being completed.

The result of piping during 1933 was, it is stated, satisfactory. Considerable coarse gold was among that recovered, and the prospects of an appreciable length of buried channel in the left bank of the creek, on which hydraulic operations are focused, seem favourable. The bed-rock of the buried channel seems to be about 100 feet above the level of Lightning creek, which here occupies a post-Glacial gorge, and dump facilities for hydraulicking are therefore excellent. The rims of the ancient channel are not plainly indicated, but may become more so as piping proceeds. Also there is some evidence of a depression trending more or less parallel to Lightning creek immediately adjacent to the down-stream side of the hydraulic pit. The exact down-stream and up-stream course of the buried channel of Mosquito creek are subjects of much

interest and conjecture, although doubtless local field-study would throw some light on the subject. This property gives promise of long life.

Leases of R. J. Gillis, F. J. Brennan, and Associates.—These leases are situated on Fish creek, a tributary of Sovereign creek, and it is stated that evidence has been found of a buried channel in this region. This ground has not been inspected, but, judging from the photographs taken by the Royal Canadian Air Force, it seems quite possible that the up-stream continuation of the Mosquito Creek buried channel is to be found in this region. The richness of the bed-rock gravels, aside from the question of glaciation, being largely a question of the richness of the terrain eroded, close prospecting in the course of the possible up-stream continuation is justified, as the indications are that Lovett creek has its source in a near-by favourable terrain.

Leases of W. C. Mading and Associates.—These leases immediately adjoin those of Slade-Cariboo Gold Placers, Limited, down-stream on the left bank of Lightning creek. From the hydraulic pit of the latter company a high-lying rock bench is evidently continuous for some considerable distance on the left bank of Lightning creek. The shallow gravels overlying this bench were extensively worked by the old-time miners, and the post-Glacial concentrations of gold thereon were evidently productive, judging from the extent of the old workings. Instream from this rock bench there is evidence of a rock depression filled with glacial debris. This depression trends more or less parallel to Lightning creek, apparently commences on the property of Slade-Cariboo Placer Gold, Limited, about the down-stream edge of the hydraulic pit of this company, and continues through the leases under description. The exact significance of this depression or channel is not clear, and further detailed field-study and work is necessary before a definite opinion can be expressed concerning it. A small creek, known locally as Angus creek, flows into Lightning creek down-stream from Mosquito creek and is stated to flow over bed-rock. This creek should be closely examined from the mouth up-stream, as also should the left bank of Lightning creek, to determine if there is any possible point of emergence of a channel into Lightning creek within the region named.

The operators of this property opened up a ground-sluice in the glacial gravels a short distance down-stream from the hydraulic pit of Slade-Cariboo Gold Placers, Limited. The rock bench at this point is seen to dip down into the hill, and similar evidence was obtained by the early operators in this region. Further information about this depression will doubtless be disclosed as the piping operations of Slade-Cariboo Gold Placers, Limited, progress. It is understood that a company to be known as "Seattle Cariboo Placers, Limited," is to be incorporated for the purpose of operating these leases, and that testing by means of Keystone-drilling is contemplated.

Leases of F. M. Joyce and Associates.—These leases are situated on the right bank of Lightning creek, about three-quarters of a mile down-stream from the mouth of Mosquito creek. Here two well-defined rock rims are exposed. Quite possibly these are the rims of the pre-Glacial channel of Lightning creek, which may have trended in a north-westerly direction from this point down-stream, continuing north-westerly immediately east of "Lover's Leap" on the Quesnel–Barkerville road. There is some evidence of this, and it may be that exposures on the leases of Swan Ackerblade described in the 1932 Annual Report, page 100, are near the left rim of the channel mentioned. The bed-rock of this channel must lie at very considerable depth.

Consolidated Gold Alluvials of B.C., Ltd.

Very gratifying results were obtained at the property of this company during 1933. Considerable expansion of the operations took place and it is now the largest placer enterprise in the district, employing in the neighbourhood of 100 men. In 1932, as recorded in the 1932 Annual Report, preparations were completed to unwater No. 2 shaft, which was originally sunk on Keystone drill-hole No. 15, which had disclosed good values on a false bed-rock at 124 feet depth. Much progress was made in 1933 under the direction of C. T. Docherty, assistant manager. The No. 2 shaft was unwatered. The gold-run on false bed-rock was extensively followed up-stream. The boiler plant was altered to permit the use of oil as a fuel in place of wood hitherto used. One oil-storage tank of 60,000 gallons capacity and three additional tanks each of 8,000 gallons capacity were installed, and a number of additional camp buildings were erected to accommodate the large crew employed.

The false bed-rock run of gold proved quite extensive and appears to exist mainly north of the shaft; that is, in an up-stream direction. On October 21st, 1933, the main drive was over

500 feet from the shaft on a bearing N. 25° E. and was still in good "pay," and on this date neither the up-stream extent nor the width of the deposit had been delimited. It was at that time proposed to Keystone-drill the ground ahead to permit of mining operations being directed to the best advantage. The workings are somewhat above the actual false bed-rock, which is not visible, but the "pay" is contained in gravels in which there is an admixture of clay, and the deposit would seem to be of inter-Glacial age. Workings are dry overhead, inasmuch as the surface waters are cased off by the overlying deposit of boulder-clay. Values are stated to average several dollars per cubic yard, and the rate of mining on the date above mentioned was about 60 cubic yards per day. At that time efforts were being made to increase this rate, so that a profit might be made pending completion of certain preliminary work necessary to permit mining of bed-rock gravels from No. 1 shaft, distant down-stream about 3,000 feet from No. 2 shaft.

The method to be used in mining the bed-rock gravels is novel. It was suggested by the N. C. Jannsen Drilling Company, of Seattle, a firm which has had much experience in drilling. Under this scheme, a steel casing 26 inches in diameter is first put down to bed-rock by means of drilling-tools and powerful jacks. Next a sump is blasted in bed-rock and the lower end of the casing in perforated by means of a special tool. This work is done in the immediate vicinity of the shaft to be subsequently sunk, and a well-pump of adequate capacity is then installed in the casing. Pumping dewaters the adjoining ground, so that an ordinary shaft can be sunk therein without encountering those quasi-fluid pressure conditions which would otherwise be encountered. Conditions may necessitate the installation of three such casings and pumps in any area to be mined, one in the centre of the latter and one at the upper and lower ends.

Such a method is necessarily expensive but possibly less costly than standard methods, and the adoption of either method would only be justified where systematic and thorough testing beforehand by means of Keystone-drilling had demonstrated the existence of commensurate commercial values. In October preparations were being made to put down a 26-inch casing close to Lightning creek and just south of No. 1 shaft.

With regard to the false bed-rock run of gold above described, there can be no question that both the values and indicated extent are highly gratifying. As to the bed-rock values, geologically there appears to be no reason why good values should not be encountered. Bed-rock values are known to be good on the neighbouring Lovett creek, and it is quite possible that the placer deposits in this region originate from pre-Mississippian veins, which have furnished the richest placer deposits in the Cariboo district. At the same time, no first-hand knowledge is available to the Resident Engineer concerning the actual bed-rock values, and it is evident that the final issue at this property must rest largely not only upon the actual results obtained in the course of Keystone-drilling, but upon their correct interpretation. In this connection reference is invited to the subject-matter in the 1930 Annual Report. Alex. Warnerboldt was in charge of sampling and panning, and L. S. Cokely, B.C.L.S., carried out the necessary surveys.

Leases of J. Colley and E. Roalman.—These leases are situated on Pine Grove creek, a southerly-flowing tributary of Lightning creek, a short distance below the forks of the creek. Below this point the valley widens, opening out to a wide flat area at its point of emergence into Lightning Creek valley. Immediately below the forks, and on the right rim of the valley, the creek has cut down to bed-rock through the glacial debris, and the indications are that its former channel lies buried under glacial debris in the more central portion of the valley. A concentration of placer is found immediately overlying boulder-clay, and it is stated that fairly coarse gold (up to $4 nuggets) is obtained. It is also stated, and it is most likely, that quartz veins occur in the bed of the creek. These were obscured by placer operations at the time of inspection.

Leases of John Strand and Associates.—These leases are situated on Lovett creek, a northerly-flowing tributary of Lightning creek situated a few miles west of Beaver Pass House. The ground extends from the mouth of the creek for 1½ miles up-stream. By means of a dam and ground-sluicing, the owner has disclosed that the pre-Glacial channel lies buried in the right bank of the creek a few hundred feet above its outlet. At the point of exposure pre-Glacial gravels and pre-Glacial rock detritus are overlain by about a foot of clay. The latter is overlain by a bank of glacial debris consisting of sand and small angular fragments of rock. The quartz

boulders in the channel gravels contain noticeable amounts of a green-coloured mineral, the exact identity of which was not determined, but which resembles mariposite. It is worthy of mention that a similar mineral, which gives a cromium reaction, is of frequent occurrence in the pre-Mississippian Proserpine dykes in various parts of the Cariboo district and Manson section. The owners are installing a small hydraulic plant (No. 2 monitor) and propose to commence hydraulic operations early in 1934. The available water-head is 160 feet. It is proposed to drift the lower portion of the buried channel as this cannot be hydraulicked. The values in the channel gravels are reported to run up to 1 oz. gold per cubic yard. The northerly flow of this creek, the lack of any evidence of glacial erosion, and the values reported on bed-rock are significant, and the ground has decided promise.

Beaver Channels, Ltd. This is a private company, the funds of which are supplied by N. F. Stevens. Operations at present are confined to prospecting and developing a 6-mile length of Beaver pass from Lightning Creek valley north-west. Thorough and systematic investigation is being undertaken in connection with the delimitation of certain high-channel possibilities on the east side of Beaver pass. An account of properties in this pass will be found in the 1932 Annual Report.

Eldorado Placers, Ltd. This is a private company, of which Colonel W. W. Foster is president and A. F. Procter resident manager. The company holds five leases on the right bank of Lightning creek, from Amador creek up-stream. Operations are being conducted with the rational view that there may be found on this side of Lightning creek the buried up-stream continuation of a segment of that Tertiary high channel, of which the well-known "Butcher's Bench" is a down-stream portion. Grounds for such a view are generally that, inasmuch as one rock bench indicates a portion of a previous higher channel, the existence of other portions of that channel is quite likely, and, more specifically, it is known that Lightning creek was rich in the region immediately below the upper end of "Butcher's Bench." Here the old channel, if existent, would be cut by the creek as it deepened its bed and so cause an enrichment at this point. Also, up-stream from this point below the ground owned by this company, and where the old channel supposedly lies buried, Lightning creek contained only poor values for some considerable distance.

Accordingly a shaft was sunk at a point 230 feet instream from the valley-rim of Lightning creek to a depth of 107 feet through boulder-clay and slum to a depth where water was becoming troublesome, and large glacial boulders were encountered. Owing to the fact that frequently such boulders are met with at about 8 feet above bed-rock, and in view of the pumping problem, it was decided to drive a tunnel from the surface at a point 900 feet down-stream, where the rock-rim of the valley is 4 feet above "Butcher's Bench," and at which point, also assuming a 1-per-cent. gradient of bed-rock, the old channel bed-rock should be found if the shaft was within 8 feet of bed-rock. This tunnel was in progress on the date of inspection (October 5th, 1933).

Extensive ground-sluicing was also done on the old *Spruce* claim below Amador creek, exposing the rock valley-rim of the old channel of Lightning creek (which lies buried in this region), and also what would seem likely to be the pre-Glacial channel of Amador creek. While the speculative element is inherent to this enterprise, it seems based on reasonable assumptions.

Operations of W. C. Slade and K. M. O'Beirn on Dry Gulch.—Dry gulch, trending south-westerly, enters Chisholm Creek valley a short distance above the town of Stanley. At the head of this gulch a well-defined pass is continuous to Perkins creek, trending parallel to Lightning creek, creating the idea that it might be a portion of a high channel of Lightning creek. Such seems quite possible, and it is evident that the natural way to reach this channel is from Dry gulch, in which ground-sluicing was carried on in an attempt to reach bed-rock. Progress was impeded by large glacial boulders in the glacial debris filling the gulch. Two bench leases held by J. Williams, of Stanley, were operated on a royalty basis by the parties named.

Operations were continued at the *Last Chance* on Last Chance creek and at the property of C. M. Sundberg on Donovan (Poorman) creek. Descriptions of these two promising hydraulic placer properties will be found in the 1932 Annual Report.

Mrs. Gertrude Murphy continued operations at the *Cariboo Eagle* on Houseman creek, tunnelling during the winter and hydraulicking when seasonal conditions permitted. A description of this property will be found in the 1931 Annual Report.

Eight-mile Lake.

Summit Creek Syndicate.

Prospecting operations were carried on during 1933 by this private syndicate under the direction of R. W. Haggen on the north side of 8-Mile lake. One prospect-shaft, 20 feet deep, was sunk close to the north shore of the lake with the aid of a pump operated by a gasoline-engine. The top stratum consisted of 8½ feet of blue clay; below this were 6½ feet of gravels which contained some gold, and 5 feet of black silt at the bottom of the shaft. By drilling in the bottom of the shaft it was ascertained that the black silt continued a furher 15 feet. These operations were prompted by the known richness of the inter-Glacial deposit exemplified in the *Thistle* hydraulic pit on the south side of the lake, the view being held, it is understood, that the pre-Glacial course of the down-stream portion of Williams creek might have been via 8-Mile lake and Valley creek to the Willow river. But the richness of bed-rock placer deposits, apart from the question of glaciation, is very largely dependent on the terrain eroded, and the terrain in the upper portion of Williams creek is of much greater promise than that in the region of 8-Mile lake.

Summit Creek.

Operations of J. R. Finlay.—The lease of J. Chouse and adjoining ground, a description of which will be found on page 88 of the 1931 Annual Report, was optioned during 1933 by J. R. Finlay. Under the direction of H. Van Winkle, superintendent, water for hydraulicking was brought on to the ground from 8-Mile creek. A dam 16 feet high was constructed on the latter creek, and from this point 2,200 feet of flume (32 by 20 inches deep) was built to convey water to a penstock which gives a piping-head of 90 feet at the monitor. From the penstock 2,000 feet of pipe-line was installed, size varying from 24 inches at the penstock to 9 inches at the No. 2 monitor.

Piping operations were started at the outlet of the buried channel on Summit creek, indications of which were obtained by the earlier workings of J. Chouse. This was discussed in the 1931 Annual Report. During 1933 additional sluice-water was obtained by damming Summit creek at the point of hydraulicking, but in 1934 it is proposed to dam Summit creek above the canyon, and bring in a ground-sluice on the right bank of the creek over the face of the pit, and thus render the sluice-water available at a point 20 feet higher than at present and afford better dump facilities for tailings.

Lower Antler Creek.

Good results have been reported by individual operators as the result of hand-mining operations on various rock benches which flank the creek below Murray creek. R. B. Herron, after investigation, proposes installation of a power-shovel in 1934 for the purpose of working this ground. The plant will be taken on the ground by a road to be constructed from the Barkerville–Bear Lake road to Antler creek, the road starting from Lot 9546.

California Gulch.

An option has been acquired by the Consolidated Mining and Smelting Company of Canada, Limited, on two leases held on this creek by P. McLanders. Under the direction of W. Aitchison, a water-supply was brought on to the ground from Stevens gulch during 1933 and pipe-line and No. 2 monitor plant were installed.

Nugget Gulch.

W. E. Thompson, H. Brown, and D. McIntyre hold three creek leases on this gulch from the mouth up-stream. At one point on the left rim, unworked gravels left from hydraulic operations carried on some years ago are reported to carry good values and encourage the installation of a small hydraulic plant. At a lower point on the creek there is some evidence of a channel diverging from the present course of the creek on the west side.

Considerable interest attaches to the ground up-stream from the present hydraulic pit to as far as Cunningham creek, which is too highly situated for hydraulicking. In Memoir 149, published by the Geological Survey of Canada, attention is called to this portion of the gulch by W. A. Johnston as having probably been at one time a portion of the main Antler creek, the latter in Tertiary times flowing by way of upper Cunningham creek and Nugget gulch. Stream-piracy in Tertiary times presumably resulted in lower Cunningham creek capturing the upper portion of the then Antler Creek drainage.

The possibilities for bed-rock values in the ground indicated would seem favourable, as it apparently lies directly in the path of the Island Mountain-Round Top Mountain quartz-vein zone, whence have originated many of the richer placer-creeks of the district. Presumably this ground could only be mined by drifting, prior to which Keystone-drilling would be necessary.

French Creek.

French Creek Hydraulic Placers, Ltd.

Due to the fact that this company's application for water rights on Williams creek was opposed by other operators, operations on French creek were held in abeyance pending settlement of this matter. A ditch-line 2,800 feet long has been constructed to convey water from French creek to the penstock at the head of the pipe-line. This gives a head of approximately 300 feet at the monitor, which is set up in the pit near the mouth of the creek. About 550 feet of sluice-flume has been constructed in a cut made in a convenient fault-plane in the schisted argillites which form the country-rock at this point. This gives dump facilities in Pleasant valley. It is proposed to bring in a supply of water from Williams creek to French creek at a point above the ditch-line mentioned. Operations are being carried on under the direction of A. Frankish.

Antler Creek.

Guyet Placers, Ltd.

A description of this property will be found in the 1932 Annual Report. Camp accommodation was improved and enlarged during 1933 and an electric-light plant was installed for the purpose of lighting both camp buildings and hydraulic pit. Further hydraulicking was carried on in the main pit, and in another pit opened up from Antler creek about half a mile up-stream. It is stated that encouraging values in fine gold were obtained in the glacial gravels which here overlie a rock bench some 280 feet above Antler creek, or about 70 feet above the floor of the main pit. The average values per cubic yard in the main pit are not known to the Resident Engineer, but it is apparent that with the supply of water that can be secured low piping costs should be obtained.

Cunningham Creek.

Trehouse.—This hydraulic property is described in the 1931 and 1932 Annual Reports. During 1933 further evidence was obtained of the likelihood of the old channel trending instream into the right bank of the creek.

Grouse Creek.

Barkerville Gold Mines, Ltd.

This company is a reorganization of the New Waverly Hydraulic Mining Company, Limited. Hydraulic operations were continued during 1933 under the direction of C. W. Moore, and the face of the pit is now close to the point at which a Keystone drill-hole was put down in 1931. It is understood this hole showed encouraging values. A description of this property, in so far as recent developments are concerned, will be found in the 1931 Annual Report.

Lowhee Creek.

Lowhee Mining Company, Ltd.—This company continued operations throughout 1933, contributing an important proportion of the total placer production of the district. Details of the pit will be found in the 1932 Annual Report.

Dragon Creek.

Leases of L. Ford and R. McDougall.—A description of this property will be found in the 1930 Annual Report. An option was acquired by the Consolidated Mining and Smelting Company of Canada, Limited, on the run of gravel on this property, which parallels the Willow river. They commenced a programme of Keystone-drilling. Hydraulic operations were continued by the owners in the buried channel of this creek.

QUESNEL MINING DIVISION.

Lode-mining.

Likely Section.

Mariner.

This property, owned by F. Dickson and A. Bayley, of Likely, is a discovery made during 1933. It is situated on the north-eastern flank of Spanish mountain. A car can be taken from Likely to the lower end of Spanish lake in dry weather, from which point a trail about half a mile in length leads to the property.

While but little work has as yet been done on this property, several quartz veins have been uncovered, the outcrop of one showing free gold. It is quite possible that further prospecting will disclose additional veins showing gold values. The discovery of this property is of very informative value, because examination disclosed the existence thereon of a large stock of an igneous rock which closely resembles the pre-Mississippian intrusives of the Barkerville area. It is in this rock that some of the quartz veins on this property occur, and its discovery already explains much that was previously difficult to understand concerning local placer occurrence. Further necessary investigation seems likely to give important information concerning lode-gold potentialities.

At 4,050 feet elevation (Quesnel lake 2,250 feet elevation) open-cuts on this property disclose six quartz veins in a width of about 100 feet. The veins vary from a few inches up to 2 feet in width, one of them, about 8 inches in width, being well mineralized with galena and pyrite, with free gold visible at some points along its outcrop. A sample of this vein assayed: Gold, 0.10 oz. per ton; silver, 1.4 oz. per ton. Further investigation may disclose that some of the neighbouring quartz veins are auriferous, and possibly additional veins will be uncovered.

These veins appear to strike in a magnetic north direction and, as far as can be ascertained from somewhat scanty exposures, they are gash-veins in a stock of alaskite. This alaskite bears many aspects of similarity to the pre-Mississippian intrusives of the Barkerville area. A thin section of this rock was kindly prepared by the Geological Survey of Canada, and a report thereon by George Hanson is appended below. This alaskite intrudes schisted argillites which outcrop in the area at the foot of Spanish lake and on the north-western slopes of Spanish mountain, and it seems quite likely that the boundary-line between the Mesozoic and pre-Cambrian rocks in this region should be shown farther west than is indicated on Amos Bowman's map of the Cariboo district.

At 3,600 feet elevation more immediately below the above-described veins, a trench about 5 feet deep in an area thickly covered with vegetation and timber-growth exposes a large body of considerably oxidized and shattered quartz. A sample across 13 feet at one point assayed only traces of gold and silver. Exposures do not reveal the rock in which this quartz occurs, but near by occurs an outcrop of a white-coloured siliceous rock, with brown spots—a highly altered sediment. A thin section of this rock was kindly prepared by the Geological Survey of Canada, and George Hanson's report thereon is as follows: "In thin section the rock is seen to consist of small quartz grains. There are many small laths of sericite that are the result of alteration. Large pieces of carbonate, probably calcite, replace the rock, but in some instances the replacement is not complete, and in these cases the carbonate contains many small quartz grains. The carbonate alteration is later than the sericite. The thin section suggests that the rock is a fine-grained quartzose sediment."

George Hanson's report of the alaskite mentioned above is as follows: "The thin section shows large areas of limonite and large rhombs of carbonate, probably calcite, in fine-grained material consisting of quartz and sericite. The rock is traversed by narrow quartz veinlets that contain also a little feldspar. The rhombs of carbonate are the result of replacement of fine-grained rock-matter. The quartz and sericite are of hydrothermal nature and have replaced the original rock. The thin section does not disclose the nature of the original rock, but indicates that the rock has been thoroughly replaced by minerals of hydrothermal origin at moderate to high temperatures."

It might be mentioned that the following are striking features of the pre-Mississippian intrusives of the Barkerville area: (*a*) They are extensively carbonated; (*b*) they exhibit a marked tendency to develop auriferous quartz gash-veins of various widths up to several feet; and (*c*) they usually develop a mariposite-like mineral of characteristic green colour.

While this property *per se* clearly warrants further investigation, the stock of alaskite discovered invests this region with a new interest, both as to lode-gold and placer occurrence. While proof is wanting as yet, nevertheless, if the rocks intruded by the alaskite prove to be of pre-Cambrian age underlying the Richfield formation, it may be pointed out that it is precisely in such an area that the presence of a large pre-Mississippian intrusive body is to be expected. It is possible that there may be disclosed a third pre-Mississippian vein-belt trending parallel to the two belts already known, and extending from Spanish mountain north-westwards close to the boundary between the Mesozoic and pre-Cambrian rocks.

The attention of examining engineers is invited to this property and neighbouring region.

Moose. This group, owned by Henry Lukin, A. B. Campbell, and associates, of Likely, is situated on Lukin creek, a small creek flowing north-westerly into Poquette pass. The property is adjacent to the Likely–Keithley motor-road. The creek has cut a gorge in the Mesozoic volcanic country-rocks. Glacial debris is entirely absent, and the unconsolidated material in the creek-valley appears to consist almost entirely of local rock detritus. The andesitic volcanic rocks are oxidized and in places show considerable evidence of hydrothermal alteration, and they contain a large number of small quartz veins, which run diagonally across the creek. On one of these veins a tunnel was driven some years ago, but this was caved and could not be inspected.

The efforts of early placer-miners, and of the present owners of placer rights on this creek, are directed to the recovery of placer by ordinary hand-mining methods. The placer is strictly residual in character and the indicated source is the quartz veins mentioned. Systematic examination of all quartz veins cut by the creek and prospecting in the near vicinity may disclose the existence of veins of commercial proportions and values.

Treadwell. This group, owned by J. Creagh and situated in Cedar Creek canyon, was optioned by Premier Gold Mining Company, Limited, during 1933, and systematic investigation of the auriferous shear-zones was carried out by this company. The result did not disclose persistence of mineralization and the option was relinquished. This was a disappointment, because the mineralization in places showed very encouraging gold values, as will be clear from perusal of the report on this property published in the 1923 Annual Report under *Wonder* group.

Sunshine. This group, owned by C. E. Salisbury and H. Bradley, of Likely, is situated on the north side of the North fork of the Quesnel river, about 1½ miles down-stream from the Spanish Creek bridge. The country-rock is schisted argillites of pre-Cambrian age, which are intruded by a pyritized quartz-feldspar dyke (Jura-Cretaceous). The surface is covered with vegetation and timber-growth to a large extent, and doubtless the outcrops of other quartz veins besides those described are obscured. At one point on the steep right bank of the river an open-cut exposes a large quartz vein, about 12 feet in width, which appears to strike north-west. A considerable amount of galena is present near one wall, but at other points in its width the vein consists mainly of oxidized and shattered quartz. A sample across a width of 4 feet of this quartz assayed: Gold, 0.8 oz. per ton: but it is understood that this assay is considerably higher than that of other samples taken from this portion of the vein.

Somewhat up-stream from this point, it is stated that at seasons of low water a large quartz vein can be seen in the bed of the river. Possibly such is the source of the large amount of broken quartz which lies on the river-bank at this spot.

Bluebird. This mineral claim, owned by A. Garneau, of Likely, is situated on the north side of Cedar creek, about half a mile below the dam. In a gulch trending south-east into the valley of Cedar creek an open-cut exposes a quartz vein of considerable size apparently, although the walls are not uncovered. The quartz shows evidence of shearing and a slight mineralization of galena and pyrite at one point.

Drake. This group, owned by T. Magee and associates, is situated on the North fork of the Quesnel river, on the south side, about opposite Kangaroo creek. The country-rocks in the vicinity are andesitic Mesozoic volcanics, which are pyritized in places. Samples of the more heavily pyritized portions did not dislose any gold values upon assay. This region lies in the path of the Central batholith, and to this source the pyritization mentioned is probably due.

Shaw. This mineral claim is situated west of the *Drake* and is owned by J. Shaw, of Quesnel Forks. On the left bank of the river the Mesozoic volcanic andesitic rocks are pyritized, and at one point in these occur small quartz veins mineralized with galena, sphalerite, and pyrite. A sample of selected portions of the more heavily mineralized veins failed to assay more than traces of gold and silver. Another sample of pyritized volcanics did not disclose either gold or silver values.

Keithley Section.

Time permitted only a brief inspection of properties on Yanks peak, of which a fairly full description will be found in the 1929 Annual Report. The known directional distribution of

such pre-Mississippian quartz veins as show pronounced gold values would seem to indicate the advisability of close prospecting and investigation south-east of Yanks peak towards Bluenose creek, and possibly across Cariboo lake. Evidence of a possible continuation south-eastwards of the Island Mountain-Round Top Mountain belt should also be sought for.

Jane. This property, owned by R. Reinhold, of Keithley, is one that merits detailed examination. Apart from the workings described in the 1929 Annual Report, there are several other points at which investigation is warranted. Just above the bed of the creek a short tunnel has been driven into the left bank, following a vein of considerable size, which conforms in strike, but not in dip, with the enclosing schisted country-rock. A bunch of sulphides was struck at one point, a sample of which assayed: Gold, 0.32 oz. per ton; silver, 0.08 oz. per ton. This vein, likewise several others crossing the creek near by, would seem to warrant investigation.

During 1933 the owner discovered a "cross" vein of "B" type, 22 inches in width, a short distance below No. 2 tunnel. This vein shows free gold in its outcrop. It invites further work, and quite possibly systematic surface-trenching in the area might result in the discovery of additional veins of this type.

Midas. This property, owned by O. J. Pickering, J. Glover, and associates, of Keithley, was taken under option by Britannia Mining and Smelting Company, Limited, during 1933. To date the vein of chief importance is the one about 4 feet in average width which was described in detail in the 1929 and 1930 Annual Reports. The owners have been engaged for some time past in driving a 500-foot crosscut to penetrate this vein at a depth of 130 feet below the outcrop. This tunnel is run on steep grade and apparently reached the north-westward continuation of the vein, but no investigation of the latter has yet been made at this point.

Another vein of considerable strength, where exposed, strikes about N. 30° W. It is about 900 feet north-east of the above-described vein and free gold and a mineral resembling chiviatite were observed at one point in the outcrop. Within a belt of country about 200 feet wide five veins striking about due east and west are exposed. These are considerably smaller in size than the veins mentioned above, and all appear to be of "B" type. Some of these veins show free gold in their outcrops. The schisted rocks in the vicinity of these veins strike about N. 65° W. (mag.) and dip north-east.

Work done during 1933 by the Britannia Company consisted of trenching and open-cutting to give better exposures of the various veins. In the fall preparations were made to establish a winter camp, and to carry on work during the winter with a force of seven men under the direction of G. C. Lipsey.

Cariboo Yankee Belle Mining Co., Ltd. This company, of which J. W. Willoughby is manager, has been incorporated for the purpose of operating the *Yanks Peak* group, a description of which will be found in the 1929 Annual Report. Since then very little mining development has taken place, beyond that described below. A portable compressor was installed in the fall of 1933, and it is proposed to run an adit-crosscut from a point approximately 1,600 feet south of No. 1 tunnel, and at a vertical depth of approximately 400 feet below it. No. 1 tunnel is the uppermost of three short tunnels run some years ago, following veins disclosed in that region, a description of which will be found in the 1929 Annual Report. On September 19th the adit-crosscut mentioned had been driven a distance of 145 feet on a bearing No. 20° W. (mag.). It is understood that some promising veins were struck by this adit, but ground conditions necessitated close lagging of the tunnel, and the veins were not open to inspection on the date of the visit of the Resident Engineer. It is the intention to continue this tunnel during the winter. Suitable camp buildings to accommodate a small crew of men were erected near the portal of the new tunnel. In 1929 a small mill was erected near the portal of the new tunnel, but, as was pointed out in the 1929 Annual Report, it is premature to consider milling until sufficient ore has been disclosed by development; a view appreciated by the present management.

Claims of J. Chester and G. Thomas.—These claims are situated on 4-Mile creek, a short distance above the hydraulic pit of Placer Engineers, Limited. A short sluice-flume was installed by the owners for the purpose of recovering the gold present in the shattered outcrop of a quartz vein, which latter was unfortunately covered by debris on the date of inspection. Fairly coarse

residual gold is stated to have been recovered. The geographic position of the claims is favourable and close prospecting in the vicinity is undoubtedly justified.

Loranga, Fir, and Balsam. These mineral claims are situated at the head of Bluenose creek, which flows into Cariboo lake about 2 miles south of Nigger (Pine) creek. It is understood that preliminary prospecting during 1933 resulted in the discovery of quartz veins. It was not possible to inspect this property, but the geographic position in the south-eastward continuation of the Stanley-Yanks Peak belt is favourable, and close investigation of any veins on this property is justified.

Tillicum, Snowbird, and Pay Boy. These groups, owned by H. Asserlind and A. Sandberg, of Keithley, are situated on Duck creek and cover a large area from about half a mile below the forks of the creek down-stream. The country-rocks are schisted sediments of pre-Cambrian age. About half a mile below the forks the creek enters a canyon immediately below the point where what is presumably the buried channel of the Tertiary Swamp river is crossed by the creek. In the left bank of the creek a short tunnel about 20 feet in length was driven some years ago. This followed a well-mineralized quartz vein about 3 feet in width, striking N. 42° E. (mag.) and dipping steeply south-easterly. The strike conforms closely with that of the host-rocks, which dip in the opposite direction to the vein. A sample of the more heavily mineralized portion of the vein assayed: Gold, *nil*. A similar result was obtained in the case of another sample taken across the full width of the vein. This tunnel is situated on the *Snowbird* group. Mineralization is pyrite.

About 200 feet down-stream from the above-mentioned tunnel, and on the right bank of the creek, a width of about 50 feet of the schisted sediments shows a "stockwork" of quartz veins. The average width of the individual veins is perhaps 1 foot, but the number of veins is large and one is about 5 feet wide. Generally the veins are well mineralized with pyrite. A sample of selected portions of the more heavily mineralized veins showed no gold values upon assay. A similar result was obtained in the case of a sample taken of the largest vein mentioned.

Showings on the *Peacock* group, situated about 3 miles lower down the creek, consist of several "cross" veins cut diagonally by the creek. Two of these veins are about 2½ feet in width. Galena seems to be more abundant in these veins than pyrite. Samples taken showed only traces of gold, but the galena appears to carry silver values up to about 2 oz. per unit of lead. The enclosing schisted sediments are noticeably pyritized, and a sample of the country-rock at one point assayed 1 per cent. copper, but only traces of gold and silver.

Horsefly Section.

A. M. Richmond, Assistant Resident Engineer, Victoria, in 1933 made a reconnaissance trip to the headwaters of the Horsefly river, and his report is given herein, as follows:—

"*Headwaters of the Horsefly River.*—During the winter of 1932-33 a large number of mineral claims were staked by the W. R. Wilson interests, Major Hart, of Williams Lake, and others, in the area adjacent to Fraser, Slide, and Eureka creeks, and on the divide between these creeks and the McKuskey river and Crooked lake. It was reported that interesting lode-gold possibilities had been discovered in this area, which in 1901 and 1902 had once before witnessed a gold-rush; at that time on the strength of reported discoveries of placer gold on the aforementioned creeks. The writer was detailed to visit the area to report on the activity and the possibilities of the district generally.

"It is 115 miles by road and trail to Fraser creek from Williams Lake, on the Pacific Great Eastern Railway, and 50 miles of this distance must be traversed via an indifferent pack-horse trail, from Hockley's ranch at Black creek. Horses were obtained at Black creek and the trip in to Fraser creek took two and a half days. An alternative route into the area is by way of Horsefly lake from near Horsefly to the outlet of Archie creek, and thence by trail over a low divide to meet the main trail at the confluence of the North and South forks of the Horsefly river, some 20 miles from the head of Fraser creek. Parties entering the area via the lake route must arrange for horses to be sent up the main river trail from Black creek, or else take them up the lake on a barge, as no horses are to be obtained up-stream from the end of the road at Hockley's ranch.

"During July, 1933, when the trip was made, possibly twelve men, in five or six parties, were working at scattered points along the upper length of the South fork of the Horsefly river. Several of these parties were sniping and prospecting for placer gold in and about the old placer-workings at the outlets of Fraser, Slide, and Eureka creeks, but in all cases they were dis-

appointed in the results they had obtained up to the date of the examination. Two or three parties working for the W. R. Wilson interests, and under the supervision of C. M. Campbell, had just completed a reconnaissance of the 130 claims staked and held by that organization. The results of this prospecting were stated to be disappointing.

"As to the district in general, the findings of the late W. Fleet Robertson, as reported in the 1902 Annual Report, are still applicable, for there has been no work done in the area since that time. The tunnel-workings reported by W. Fleet Robertson could not be located, due to the caved portals of the same. Nor could the present writer locate as much pyrite mineralization as reported in the 1902 Annual Report. Possibly he visited different parts of the many vein-outcrops.

"Several samples of quartz, partially oxidized, and with evidence of having at one time contained crystals of pyrite, were taken by the writer from the quartz-outcroppings and from quartz float, but in all cases the samples upon assay returned *nil* for both gold and silver.

"The formation on the South Fork area is marked by a well-defined belt of old sedimentary rocks, for the most part black slates and schists, with occasionally argillaceous limestones. These strike in a general N. 50° W. direction. On the western boundary of the sedimentary rocks, near the mouth of McKuskey river, granite-mica gneissic rocks are found occurring inter-bedded as sills in the slates. A large pyroxenite dyke was noted on the eastern end of the belt of sedimentaries, near the head of Fraser creek. Throughout the slates on all the three creeks examined in detail (Fraser, Slide, and Eureka) occur many quartz veins. These quartz veins for the most part are only a few inches to a few feet in width, averaging possibly up to 3 or 4 feet, and occasionally being as wide as 60 feet. They strike N. 60° to 75° W., or approximately with the bedding-planes of the slate country-rock, and dip about 30° to 50° to the west. The veins are practically all composed of white quartz and frequently stand out prominently from the surrounding dark-coloured country-rocks. The largest outcrop examined was on the left side of the basin at the head of Fraser creek. The quartz here has an exposed width of approximately 60 feet and may be traced up the hillside for several hundred feet. It is white in colour and shows very little evidences of mineralization beyond a few scattered patches of iron pyrites. Occasionally the narrower veins contain small amounts of iron pyrites, for the most part much oxidized, or evidences that they at one time contained a small amount of pyrite in the form of crystals.

"The work done to date has been disappointing, in that superficial prospecting has failed to find any concentration of mineral that would be attractive enough to encourage development-work. It is true this work has been of the most preliminary nature, and possibly much of the area could not be properly prospected due to the late departure of the snow from the ground, but the samples taken of outcrops and of float from the three creeks mentioned were certainly disappointing. It would require extensive and systematic prospecting of the area, a search that might well take several months, before any opinion as to the value of the area could be properly given. The favourable factors are the occurrence of many quartz veins, some of which contain small percentages of auriferous pyrite, according to assays by W. Fleet Robertson, in a zone of old sedimentary rocks. A small amount of placer gold can be found in the creeks, though not enough to warrant hand-mining methods, indicating the presence of gold in the area. To offset these factors the problem of transportation is very real. The present trail is passable but not much more."

Big Say. This group is situated on Lot 9686, about 11 miles north of Horsefly, on the east side of the Horsefly river. It was discovered in 1933 by T. O. Hooker, of Horsefly. An unnamed creek flowing westerly into the Horsefly river has cut a deep gorge in the Mesozoic volcanic country-rocks, which are mainly of andesitic type. The latter are intruded by acid igneous tongues, which are well pyritized. The country-rocks in the vicinity are also well pyritized. The mineralization is quite extensive and is evident over a length of about 300 feet in the creek-gorge, but unfortunately assays of samples taken failed to disclose more than traces of gold and silver. Close prospecting in the adjacent region would, however, seem well justified.

Ace High. This group, owned by R. N. Campbell and C. R. Carfrae, is situated on Lemon creek. The South fork of this creek cuts down to a depth of about 50 feet in Mesozoic volcanics, which are here intruded by pyroxenite stocks. Pyrite mineralization follows the bedding-planes of the volcanics, but assays did not disclose gold or

silver values. The presence of intrusives in the region, however, is justification for further prospecting.

Star. This group, owned by E. von Lilliestierna, of Horsefly, is situated about 1 mile east of the East fork of Black creek. A large pyritized quartz-feldspar dyke outcrops prominently on the property and can be traced for a considerable distance. It strikes about N. 30° E. (mag.) and dips south-easterly at about 60°. At one point on the south rim of the high-lying wide depression, which is possibly a former high channel of the Horsefly river, a 15-foot shaft was sunk in the dyke by earlier operators. This working is tightly lagged and was inaccessible on the date of inspection in June. A sample was taken of the most heavily mineralized portions of dyke-matter lying on the dump at the collar of this shaft, but the assay disclosed only traces of gold and silver. The dyke in one place has a width of about 25 feet. It might be mentioned that a similar though smaller dyke is to be seen cutting the rocks at the head of the lower falls on the Horsefly river.

Reconnaissance of the region between Black creek and the Horsefly river at approximately the elevation of this property (4,000 feet), over a distance of about 4 miles, disclosed that the country-rocks consist very largely of andesitic flow-rocks of presumably Mesozoic age, intruded by numerous tongues of pyroxenite. No quartz veins were observed, but it is quite possible, indeed likely, that such occur, but the rock-surface is largely obscured by glacial debris.

Placer-mining.

The production of placer gold for 1933 in the Quesnel Mining Division was 2,772 oz., as compared with 3,338 oz. in 1932.

Attention is directed to Geological Survey of Canada Summary Report, 1932, Part A 1, which contains a summary of the well-known Memoir No. 149 by W. A. Johnston and W. L. Uglow, and also a memoir by W. E. Cockfield and J. F. Walker entitled "Geology and Placer Deposits of Quesnel Forks Area, Cariboo District, British Columbia." The latter contains detailed descriptions of many properties in this Mining Division.

Likely Section.

Bullion. This well-known mine was operated throughout 1933 by Bullion Placers, Limited, the manager being R. F. Sharpe and the foreman W. E. Loveridge. During 1933 hydraulicking was conducted with fewer interruptions than has been the case for some considerable time. In view of the length of life indicated, this property clearly merits close investigation of all criteria affecting commercial aspects to determine if thorough reconditioning is justified, thereby increasing the scale of operations.

Moorehead Mines, Ltd. Hydraulicking was commenced at this property on Morehead creek in the spring and continued while the water-supply remained satisfactory. Operations were suspended later in 1933 and future plans are not known to the Resident Engineer. Descriptions of this property will be found in the 1927, 1931, and 1932 Annual Reports, and also in Geological Survey of Canada Summary Report, 1932, Part A 1.

Operations of T. Henderson and E. Hume.—During 1933 a boom drag-line gasoline-shovel, with a 1-cubic-yard bucket, was installed on a bar on the left bank of the Quesnel river, about 1 mile above the mouth of Morehead creek. A. F. Himelman was in charge of operations. At the time of inspection (September 29th) the exact type of screening and washing plant had not been decided upon.

Operations of Albert Carlson and Associates.—On the left bank of the Quesnel river, about 2½ miles above the mouth of Morehead creek, Albert Carlson, working alone, has constructed a 16-foot diameter current-wheel. This wheel, mounted on a raft in the river, is for the purpose of elevating water used in working the large river-bar in this region. Suitable buckets are attached to the periphery of the wheel, and the form of mounting enables continuous operation independent of the level of water in the river. Water is conveyed from the wheel to point of use by a flume 375 feet long. It was constructed of "shakes" made on the ground. No timber was close at hand for the construction of wheel and flume, and after cutting timber at a point about half a mile distant all the necessary material was carried by this operator to the point of construction—a noteworthy instance of successful accomplishment in the face of great difficulty. The owner seems likely to be compensated for his commendable efforts, as he reports

that portions of the bar afford good "pay." From one place, circular in shape and about 15 feet in diameter, gold to the value of $60 was obtained. The gold is typical fine bar-gold. The washing-plant consists of a dump-box of liberal dimensions, which ensures thorough washing; a grizzly with ¼-inch mesh screen, the undersize passing over a sluice 10 feet long by 1 foot wide, in which ½-inch mesh round-wire screen is laid on top of cocoanut matting. It is of interest to note that the total capital outlay involved in this plant is $11.65, which reflects much credit on the designer.

Lease of S. Prior.—This lease, owned by S. Prior, of Hydraulic, is situated on Morehead creek, about 1 mile above the junction of Little Lake creek. At this point Morehead creek cuts diagonally across a buried channel, and is contained in a rocky gorge both above and below the points of intersection of the rims of the buried channel. The position of the channel is clearly indicated by gravel banks on both sides of Morehead creek at the point of intersection, and by old workings on the superficial post-Glacial reconcentrations made by this creek as it cut down through the buried channel. Factors not apparent are: The original direction of flow of water in the buried channel; the depth to bed-rock; and the values thereon.

This property was optioned during 1933 by L. Ferris and C. R. Henderson, who made preparations to drive a tunnel from the right bank of Morehead creek at a point down-stream from the northern rim of the buried channel in the hope of reaching bed-rock. Technically, Keystone-drilling is indicated as the best preliminary method of determining necessary criteria, but the individual operator is frequently unable to meet the expense involved and is compelled to resort to excavational investigation.

Little Joe. An account of this operation of E. A. Bradley's will be found on pages 112 and 113 of the 1932 Annual Report. During 1933 a shaft was sunk 80 feet through glacial overburden, and continued a further distance of 36 feet in rim-rock, and on September 26th, 1933, a tunnel driven south from the bottom of the shaft had been advanced a distance of 75 feet in rim-rock.

Poquette Creek.—B. Boe acquired the leases of C. Lackie and associates and commenced hydraulic operations on this creek, utilizing water-supply from Poquette pass. The pit was started just above the canyon, and the bed-rock at first followed was lost as a cross-channel was reached, the gravels overlying which are exposed on the right bank of the creek. It is not apparent whether this is a channel continuing west of this point, or whether it represents an older channel of Poquette creek cut through by the stream's present waters. In either case it seems likely that bed-rock will again be found within a short distance by continuing the present hydraulic operations.

C. & S. Mining Co., Ltd. The general features of this property are described in the 1932 Annual Report, wherein a discussion of the buried river-channels of the North fork of the Quesnel river and the preliminary investigation which is considered essential prior to embarkation on actual mining enterprise is presented. A description of this property will also be found in Geological Survey of Canada Summary Report, 1932, Part A 1. The company has now piped off some of the gravels overlying the false bed-rock of slum, but the exact location of the buried river-channel on this property, the depth to bed-rock, and the values thereon are matters which have yet to be determined before further operations can be planned to the best advantage.

Ruby Gold Mines, Ltd. A description of this property will be found in the 1932 Annual Report. Operations during 1933 were restricted owing to lack of funds. G. W. Branston, the manager, states that the scheme of operations contemplated includes the driving of a tunnel at the lower end of the property to pick up bed-rock. Hydraulicking will subsequently be done from this point up-stream. This channel is one of much interest, likewise its up-stream continuation. A detailed topographical map of the area more immediately surrounding this property, including Spanish and Black Bear creeks, supplemented by field-study, would probably aid in deciphering the buried channel systems.

Cariboo-Spanish Creek Placer Syndicate. This is a private syndicate, of which C. S. W. Barwell is manager. The company is engaged in development of the well-known *Standard* group, on which an option has been acquired. There is every indication that an ancient channel lies buried in the right bank of Spanish creek on this property, and it is further known that good values were encountered in the McGregor workings many years ago. However, the exact down-stream course of this channel, likewise the

depth to bed-rock, is largely a matter of conjecture until further testing has been done. A very complete description of this property will be found in the 1924 Annual Report under "Ennis Gold Mining Company," to which reference is particularly invited, also to Geological Survey of Canada Summary Report, 1932, Part A 1. Since 1924, with the exception of the short-lived operations of Spanish Creek Mines, Limited, in 1926, described on page 85 of the Annual Report for that year, very little work has been done on the property until the present year. During 1933 the syndicate started a tunnel from the North fork of the Quesnel river, somewhat up-stream from the mouth of Spanish creek and slightly below river high-water level. Assuming a grade of 2 per cent. for the bed-rock of the buried channel, it was estimated that this tunnel should reach bed-rock about 600 feet from the portal. Late in October, 1933, the tunnel was 400 feet long. At the face a winze was then sunk which reached rock at a depth of 22 feet. This winze was not started when the tunnel was last inspected, and the account of the winze is kindly furnished by the manager. Strata encountered in the winze consist of a thickness of 8 feet of mixed broken country-rock and gravel, overlying about 12 feet of well-rounded grey gravels, mainly limestone, with some quartz gravel, but no gravels of local origin. Some colours were found immediately overlying the rock. It is the view of the manager that the rock struck is the eastern rim of the channel, and it is the intention to install a pump and drift south-westwards. This tunnel seems a justifiable, although naturally speculative, enterprise. The opinion of informed observers is that this property well merits close investigation. Preliminary Keystone-drilling would doubtless disclose much that is now obscure, delimit possibilities more clearly, and indicate how mining operations should be directed to the best advantage.

Black Bear Creek.—Perseverance Gold Mines, a syndicate composed of L. B. Gostling and associates, holds four placer leases situated up-stream from the falls on this creek. They also own lode-mineral rights in this area, in which occur many mineralized quartz veins. The placer possibilities of the region are discussed at some length in the 1928 and 1930 Annual Reports under "Black Bear Creek," to which reference is invited, as details are not repeated herein.

Within the area covered by these leases the buried pre-Glacial channel of this creek is indicated in the right bank, and it is quite possibly the up-stream continuation of the buried channel of Spanish creek, referred to in the description of the preceding property. At the upper end of this property the pre-Glacial channel is apparently completely cut through by Black Bear creek, which in its down-stream portion runs for some distance above the falls on bed-rock immediately adjacent to the left rim of the buried channel. Down-stream from the point at which the buried channel is cut by Black Bear creek, and on the left bank of the latter, there exist some buried drift-filled tributary channels, bed-rock of which is exposed at the creek-level. These are under investigation and during 1933 L. B. Gostling did 125 feet of drifting on one of them. The significance of these tributary channels is not apparent, but quite possibly would be disclosed by further field-study in the region. Encouraging values are reported in the upper gravels overlying the buried channel at the point of intersection on the left bank of Black Bear creek. The major objective in this property would seem to be the bed-rock gravels of the main buried channel, but the value of these, likewise the depth at which bed-rock lies, are at present unknown factors. As has been previously pointed out, the view is held that thorough investigation of this ground is warranted. With the aid of the Department of Mines, L. B. Gostling and D. Dobson (owner of adjoining placer and lode-mineral rights) constructed a much-needed trail to Black Bear creek. This trail follows the right banks of Black Bear and Spanish creeks and connects with the main Likely–Keithley road at the mouth of Spanish creek.

Upper Spanish Creek.—There is stated to be evidence of the existence of a higher channel of Spanish creek on the mountain-slopes on the north side of Spanish lake, but time did not permit of inspection of this region. Down-stream from Spanish lake, Adolf Anderson has for some years carried on much painstaking investigation of the possibilities of a higher channel on the south side of the creek. Recent developments described under *Mariner* group in this report undoubtedly give this region added interest and justify close prospecting.

Leases of J. W. Sims and Associates.—These are situated on the North fork of the Quesnel river, up-stream from and adjoining the leases of T. Malone, H. Bradley, and G. S. Baker, described on page 111 of the 1932 Annual Report. They show much the same features; that is to say, post-Glacial and Glacial gravels overlie a high-lying rock bench. Instream on this ground a buried channel of the North fork is indicated, but the depth to bed-rock is unknown. Various false bed-rock concentrations of gold engage the attention of operators. The country-

rock of the region is schisted argillite classified by Bowman as of pre-Cambrian age. Numerous quartz veins occur in this. At this property a pump-hydraulic plant was installed. It consists of a centrifugal pump with 4-inch discharge-pipe, operated by an automobile-engine. Water for hydraulicking is pumped from the river. Values are found from the surface down immediately overlying a clay false bed-rock, and again under this overlying a second false bed-rock of indurated blue clay.

Lease of F. Wissler, W. Westenheiser, and G. Grinder.—This property, situated on the north side of the North fork of the Quesnel river, immediately opposite the property of C. & S. Mining Company, Limited, is described in the 1932 Annual Report. Time did not permit of its inspection during 1933, but an hydraulic plant was installed on the property.

Leases of A. Hanson and K. Olsen.—These leases are situated on a creek flowing southerly into the North fork of the Quesnel river about 2 miles east of Quesnel Forks, and known locally as 2-Mile creek. This ground is situated on what is indicated as being the buried Tertiary Swamp River channel, described on page 107 of the 1932 Annual Report. This is cut by Duck creek about half a mile below the forks of that creek, and by 2-Mile creek, the general trend of the ancient stream being apparently south-westerly. Both creeks mentioned enter rocky gorges after passing over the left rim of the ancient channel. The owners of the ground under description have constructed a cabin on their property, and propose investigating the bed of 2-Mile creek, in which an old tunnel, now caved, was driven by some early operator. It is quite impossible to form even an approximate idea as to the depth at which bed-rock of the old channel lies, but the surface is about 600 feet vertically above the North fork of the Quesnel river. Consequently, should preliminary Keystone-drilling, which is indicated as being the best means of preliminary investigation, give good results, bed-rock might be reached by an adit-tunnel in the right bank of the river, at a suitable point, say in the vicinity of 2-Mile creek or somewhat west of this.

Claim of G. Edmunds.—This claim is situated on the north side of the North fork of the Quesnel river opposite Quesnel Forks. The coarseness of the false bed-rock gold is one of the features of placer occurrence on this river, and on this claim quite coarse gold up to pieces of a value of 75 cents is found immediately overlying a false bed-rock of tight silt. The latter occurs at a height of about 20 feet above river-level, in a bank of gravels the total height of which is about 35 feet. The bank extends a considerable distance instream, and it is possible that the necessary preliminary testing might indicate justification for installation of a pump-hydraulic plant, as there is no other adequate supply of water available.

Lease of K. H. Thompson.—This lease is situated on the east side of Quesnel lake, about 350 feet vertically above the latter, near the Cedar Creek road turnout from the Likely–Keithley road and the Lackie-Kemp hydraulic pit. Near the road, and within a few feet of the owner's house, the depth of unconsolidated materials overlying rock is very shallow, not much over 2 feet; in places, less. The unconsolidated materials consist of soil, shattered rock detritus, and gravel, and quite good values in fairly coarse gold are found on bed-rock. By damming such seepage-water as is available, the fortunate owner is able to wash virtually on his doorstep such quantity of material as he may from time to time deem expedient. Detailed local field-study is necessary to form an intelligent opinion as to the exact origin and extent of this occurrence of placer, but such is clearly warranted, as it seems quite possible that an hydraulic installation might prove to be justified in this region.

Lease of J. Kayser.—This lease is situated on the right bank of the canyon of Cedar creek, about 1 mile below the dam. It covers what appears to be a drift-filled depression or channel trending more or less parallel to the canyon, and about 150 feet vertically above the latter. A ground-sluice has been opened up from the canyon, and encouraging values are reported in the vicinity of what appears to be the left rim of the depression. Further investigation seems well merited.

Keithley Section.

Leases of R. Reinhold and Associates.—These leases are situated in the Cariboo Lake valley, immediately east of the Keithley Creek confluence and about 300 feet vertically above the lake. A description of them will be found in the 1931 Annual Report. During 1933 some Keystone-drilling was undertaken by A. W. Andriesen. A cross-section of six holes, each 50 feet apart, was drilled and bed-rock was reached in from 8 to 9 feet depth. Another hole was drilled to a depth of 34 feet at a point about three-eighths of a mile up-stream. The last 4 feet of this

hole was in bed-rock. It is stated that the results obtained were not encouraging. Some further drilling somewhat southward, between the two points of drilling, would seem likely to prove conclusive.

Operations of H. T. Jones and Associates.—Property held by these operators is situated on the left bank of Keithley creek, about half a mile above the bridge over Keithley creek on the Likely–Keithley road. Good values are reported in the gravels immediately overlying a rock bench flanking the creek. A pump-hydraulic plant has been installed. It consists of a centrifugal pump of 450 gallons per minute capacity, which is operated by a 60-horse-power automobile-engine. It is quite possible that a buried channel-segment exists at this point.

Placer Engineers, Ltd.

In the 1930, 1931, and 1932 Annual Reports will be found descriptions of this property. As was mentioned in the 1932 Annual Report, hydraulicking on 4-Mile creek was of necessity suspended in 1932 when it became evident that the sluice-flume was above the bed-rock of the buried channel disclosed, and an attempt was made to reach bed-rock that year from the pit-floor by excavational development. Caving of the bank frustrated this attempt, and accordingly this year it was decided to continue hydraulicking from *China* pit, situated some distance up-stream from the *Onward* pit. One or other of these pits presumably represents the downward continuation of the buried channel, the up-stream continuation of which has been proved by operations in the left bank of 4-Mile creek. If *China* pit is not the actual down-stream continuation it probably has some connection with the buried channel, and it is hoped that bed-rock of the latter may be reached by hydraulicking from this pit.

Operations of H. P. Halen and Associates.—A description of this property, situated on Snowshoe creek, will be found in the 1931 Annual Report. Hydraulicking was continued during 1933 with distinctly favourable results. It was estimated by the operators that the total clean-up of gold during 1933 would amount to about 200 oz. An examination of this region and of the lower portion of French Snowshoe creek lends considerable support to the view that the pre-Glacial channel of the latter creek lies buried in the left bank, and that the down-stream continuation of this channel exists instream next to the Snowshoe Creek hydraulic pit of these operators, and that it emerges in Keithley Creek valley at the rich spot of the latter below the mouth of Snowshoe creek. Whether this channel could be hydraulicked, working up-stream from Keithley Creek valley, or whether drifting would be preferable, are matters that can only be decided by close local field-study supplemented by preliminary investigation, possibly Keystone-drilling. In view of the established good values in the region the matter merits thorough scrutiny, as it is quite possible that an enterprise of major importance might be disclosed.

Upper Keithley Creek.—Both pre-Glacial and post-Glacial rejuvenation on this creek has invariably been south of the former channel. There is some justification for inferring that at one or two points buried pre-Glacial segments of this creek may exist instream north of the present creek. This channel would be separated entirely from the latter by the right rock-rim of the ancient channel. One such point lies up-stream from Snowshoe creek in the vicinity of Rabbit creek. The latter creek is contained in a rocky gorge before entering Keithley Creek valley. This and other topographical features, coupled with the fact that Keithley creek was not productive in this region, although both above and below it good values were found, lends value to the view expressed. Leases in this region are held by H. P. Halen and associates and by A. E. McGregor. The former contemplate an hydraulic installation at a point below the mouth of Rabbit creek, where several tunnels were formerly run into the left bank of Keithley creek in search of the old channel, the right rim of which at this point has been presumably entirely eroded by Keithley creek. Somewhat similar indications to the foregoing are presented in the vicinity of Weaver creek. This creek is also contained in a rocky gorge immediately prior to its entering Keithley creek, and a similar possibility calls for investigation. H. P. Halen and associates own a lease in this region down-stream from that of F. L. DeLong, and have started a tunnel to explore the left bank of Keithley creek at this point.

Nigger (Pine) Creek.—The leases of W. Hamilton, T. Bayley, and associates, a description of which will be found in the 1932 Annual Report, were acquired during 1933 by the Pine Creek Mining Company, a private syndicate, of which Colonel J. P. Fell is president and B. Boe manager. An hydraulic plant was installed and piping started near the tunnel run by W. Hamilton and associates last year where good values were met with. The sluice-flume is on

bed-rock. Good progress was made and values were reported as being satisfactory. The short time available did not permit the use of the full water-supply obtainable, and although considerable headway was made in improvements to the water system, the full benefit cannot be felt until 1934. The head then available will be about 150 feet. Bed-rock in the floor of the pit was 175 feet above lake-level.

Harvey Creek.—A description of this creek, likewise an account of the leases of H. Curtis and associates, will be found in the 1932 Annual Report. The latter leases were acquired by B. Boe, and an hydraulic plant installed on the creek in the spring of 1933. The plant was set up below the falls in a portion of the creek where both general features and old workings suggest that the pre-Glacial channel of the creek lies buried in the right bank. The fact that the country-rock is much shattered, and also because the schisted rocks disintegrate in large slabs, not only renders it difficult to distinguish between shattered rock in place and mere rock detritus, but impedes hydraulicking, as material of this nature does not travel well in a sluice-flume, and investigation is therefore inevitably slowed down. Just where this creek enters the Swamp River valley, immediately north of the creek, some old workings are situated, and the possibilities of this region are being investigated by shaft-sinking.

Horsefly Section.

A detailed description of this section and of placer occurrence therein will be found in the 1931 and 1932 Annual Reports.

Leases of R. N. Campbell and Associates.—It is unnecessary to repeat herein the detailed descriptions of this ground, situated on Antoine creek, that will be found in the Annual Reports above mentioned, and in that for the year 1930, when the discovery was made. Pump-hydraulic operations, as described in the 1932 Annual Report, were continued during 1933 by Armstrong & Laing, to which firm the property was optioned. R. N. Campbell was in charge of operations. He states that the gravel washed averaged 50 cents per cubic yard, and that one nugget was obtained of the value of $1.30, and that a prospect-shaft was sunk to a depth of 31 feet from the surface, but could not be continued beyond this on account of water.

While this property was visited during 1933, the operations in progress, likewise those carried out to date, can only be considered as testing operations. The results obtained confirm the view previously expressed that thorough investigation of this property is merited. It is, however, clear, in view of the difficulty attendant on sinking even shallow shafts in this region, that preliminary investigation should be by means of Keystone-drilling, which may disclose large-scale possibilities. It is to be noted that values occur from a point comparatively close to the surface downward, so that a number of shallow holes in the first instance might disclose important results.

Region Mines, Ltd. The operations of this company in drilling for oil a short distance south of Quesnel are fully described in the Geological Survey of Canada Summary Report for 1931, Part A, pages 58A to 65A. Dr. W. E. Cockfield, the writer of the report, expresses an unfavourable opinion as to the possibilities of finding oil in this area.

SOUTHERN AND CENTRAL MINERAL SURVEY DISTRICTS (Nos. 3 AND 4).

Report by Philip B. Freeland, Resident Mining Engineer (Headquarters, Penticton).

INTRODUCTION.

The area included in the ten Mining Divisions of these two districts was described in the 1932 Annual Report. The Osoyoos, Yale, Kamloops, and Greenwood Divisions were the most prominent in mine-development in 1933. A great deal of the work was done in the vicinity of mines which produced many years ago and, up to the present, the results have been gratifying. For example, in the old *Jewel* mine (now owned by Dentonia Mines, Limited) ore was found a short distance north of the old workings and it is expected the company will commence milling early in 1934. On the *Twin Lakes (Parvenue)* and *Grandoro (Oro Fino)*, about 30 miles south of Penticton, new ore-bodies, some of them very rich in gold, were found close to the old tunnels. On the *Morning Star* much higher-grade ore was discovered above No. 1 drift, off the shaft. New work done on the *Waterloo* and *Dictator* at Lightning peak has added materially to the future promise of this camp. In the Kamloops Mining Division, at the *Vidette* mine, a narrow gold-quartz vein is being successfully developed, and this company has pioneered the way for deeper exploration of other quartz veins in that locality. The Nicola Mines and Metals, Limited, is exploring three veins on its property at Stump lake and sufficient tonnage may be obtained from all three veins to warrant milling operations. In the Yale Mining Division the *Dawson* and Home Gold Mines are attracting much attention, due to the continuity of ore at depth. The closing-down of the *Union* mine was a serious loss, but the response to development-work at many properties in the No. 3 and No. 4 Districts has on the whole been distinctly encouraging.

Production.

The increased price received for gold (average for 1933 was $28.60 per ounce) has stimulated the production from small mines in the district, and much low-grade material that at $20 an ounce was not considered as ore has been profitably shipped. The returns from this ore have been of great assistance in the further search for ore. The production of lode gold in Districts Nos. 3 and 4 for 1932 was 21,372 oz., as compared with 6,047 oz. in 1933. The following table shows the mineral production of Districts Nos. 3 and 4 for 1933:—

Division.	Ore.	Gold.	Silver.	Copper.	Lead.	Zinc.	Coal.
	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.	Tons.
Vernon	390	119	18	.....	.....	.....	.....
Grand Forks	3,720	3,144	3,005	.....	7,215	16,498	.....
Greenwood	3,627	427	558,472	.....	381,175	516,262	.....
Kamloops	43	194	.....	848	.....	.....	34
Nicola	9	34	1,053	.....	7,762	1,206	25,886
Osoyoos	2,605	1,799	2,695	.....	112	.....	98
Ashcroft	657	330	638	158	.....	.....	.....
Totals	11,051	6,047	565,881	1,006	396,264	533,966	26,018

Division.	Bentonite.	Clay Products.	Gypsum and Gypsite.	Limestone (Flux).	Mica.	Platinum.	Soda.
	$	$	$	Tons.	$	$	$
Ashcroft	.....	.....	.....	.....	.....	.....	.....
Clinton	.....	.....	.....	.....	.....	.....	650
Grand Forks	.....	2,386	.....	33,164	.....	.....	.....
Kamloops	.....	.....	46,004	.....	.....	.....	2,700
Similkameen	1,363	.....	.....	.....	.....	1,400	.....
Vernon	.....	4,010	.....	.....	853	.....	.....
Totals	1,363	6,396	46,004	33,164	853	1,400	3,350

Placer-gold production for all Mining Divisions in 1933 was 1,512 oz., as compared with 1,141 oz. for 1932.

Prospecting.

Prospecting and exploration in the areas suggested in the 1932 Annual Report have brought to light the fact that there is potential ground in the vicinity of the old mines. During 1934 still better results are anticipated, due to the fact that finances have become available for development. In the Hedley area much ground has been staked and attractive samples of gold-bearing arsenopyrite brought in. Up to the present the gold values in the arsenopyrite found on the diorite-sedimentary contact have been spotty and only spasmodic exploration was done. However, during 1933 deeper developments have shown that gabbro dykes are associated with some of this ore, and as it is well known that the ore on Nickel Plate mountain is genetically connected with augite gabbro, the chances for those prospects found on the diorite-sedimentary contact appear to have improved. In the Fairview and Camp McKinney belts prospectors are warned not to expect to find mineral in all the quartz veins that outcrop, because the ore generally is found only where structural conditions are favourable, such as warping or faulting of the schistose rocks. Many of these potential sections are buried with overburden and a rough survey of the outcrops will assist in outlining the vein-strike. In the Coquihalla area the gold occurs chiefly in the metamorphosed slates, greenstones or serpentines, associated often with numerous narrow bands and a web-like structure of quartz. The whole area east and west of Jessica is worthy of intensive exploration. Numerous quartz veins, some of them mined forty years ago, are found in the vicinity of Monashee mountain, about 50 miles east of Vernon, and the St. Paul and New Monashee Companies will probably be developing their properties during 1934. Gold in arsenopyrite has also been found on Trap creek, which flows into the Kettle river a few miles above the Vernon–Edgewood Road crossing. In and adjacent to Greenwood the gold-bearing quartz-vein systems have been known for years, and although many of them are narrow the increased value of gold brings them within the group of possible profitable operations. On the *Winner* and *Keno* groups, south of Phoenix, the quartz veins found in the quartzites and volcanic rocks contain attractive values and some free gold.

Most of the above areas are well supplied with electric power and transportation, and present conditions warrant their receiving detailed investigation.

Placer-mining.

There were no outstanding finds made in placer-mining during 1933, but many men were able to obtain a livelihood working the different streams. On Scotch creek, which flows into Shuswap lake, some heavy gold was recovered from the benches, and the creek was staked for several miles up from its mouth. In former years a large production of placer gold has been unofficially reported from this source, but the officially recorded production is only $29,500. Work on the old blocked Granite Creek channel near Coalmont has uncovered good "pay" according to the owners. Several of the benches along the Tulameen river are rewarding the operators for their work. On Big creek, which flows into the Chilcotin river a few miles below Hanceville, values in fine gold and platinum were found by the late H. E. Church. Big creek drains a very large area that has only received a cursory prospecting, and it may be worth closer observation in an endeavour to locate the source of these values. Bed-rock has not been reached. Some of the bars on the Fraser and Thompson rivers are being mined with suction-pumps, and as much fine gold is constantly in transit in these rivers the operations may be successful, providing a large yardage can be handled. A high percentage of the gold is microscopic, but free and clean, and amalgamates readily. The streams flowing from the south into the Nicola river below Canford, from the headwaters of which some placer gold has been reported, are worthy of exploration. On Churn creek and its tributaries some placer gold was recovered, but, due to the short season, insufficient work was done to prove the value of this area. On the Kettle river, about three-quarters of a mile below the Vernon–Edgewood Road crossing, old-channel gravel containing comparatively coarse gold was found. The Kettle river and its tributaries here cut through a belt of argillaceous, volcanic and granitic rocks which contain gold-bearing quartz veins, and the area warrants a careful search. On Fourth of July creek, near Grand Forks, some rough-edged placer gold was recovered. This creek and its tributaries drain the area south and east of Phoenix, from where a considerable tonnage of gold ore has been produced in the past. Very little work has been done here.

Coal.

White Lake.

A. Ambrosi and Joe Plate, of Penticton, sunk a 90-foot winze on the coal-seam from the lower tunnel on the old White Lake Collieries ground south of Penticton. The seam, about 4 feet wide, improved in quality and was found to contain less bone. A few shipments were made to local points and the product found to be satisfactory.

Princeton.

The Blue Flame Collieries at Lamont creek were acquired by the W. R. Wilson interests and production continued. The Tulameen mine closed down towards the end of 1933. Negotiations are pending regarding renewed operations at this property.

General.

It has been reported that the coal-seams found on Shorts creek, on the west side of Okanagan lake, are to be worked in the near future.

Non-metallics.

The Clinton and Kamloops Mining Divisions are particularly noted for deposits of non-metallics such as gypsum, sodium carbonate, and sodium sulphate, and reports of these occurrences have been made in former Annual Reports as well as in bulletins issued separately by the Department of Mines. Much valuable information can be obtained from this source by those interested in these types of minerals.

Lectures.

Lectures on mining and prospecting subjects were given at Penticton, Vernon, Armstrong, Kelowna, Summerland, and Oliver. The attendances were very large and much interest was shown by those attending.

Acknowledgment.

The Resident Engineer wishes to thank all the mine operators and prospectors with whom he came in contact for their kindly assistance and hospitality.

Provincial Government Grants.

Financial assistance was given to many different prospectors and mine operators in the building of roads and trails by the Department of Mines. The results have been gratifying, inasmuch that several of the prospects benefited have become producing mines.

GRAND FORKS MINING DIVISION.

Franklin Camp.

Union. (*See* Annual Reports for 1917 to 1922 and 1925 to 1932.) Operation of this mine ceased early in 1933, due to a shortage of developed ore. Late in the season the construction of a small cyanide plant was practically completed, and it is the intention of the James F. McCarthy interests (Hecla Mining Company) to treat approximately 100,000 tons of mill tailings which is estimated to contain: Gold, 0.05 oz. per ton; silver, 2 oz. per ton. During 1933 a total of 3,154 tons was mined, 3,684 tons milled, and 220.39 tons of concentrates shipped to the smelter. Development consisted of 2,567 feet of diamond-drilling, 727 feet of upraising, 1,193 feet of drifting, and 777 feet of crosscutting.

The No. 3 tunnel was extended in a south-westerly direction through what is known as the *Maple Leaf* fault, and numerous diamond-drill holes 300 to 400 feet long were bored in a fan-shaped direction from this level. A great deal of highly pyritized argillaceous tuffs were discovered in these holes, but no ore. A small Mitchell diamond-drill was hired and bort studded bits were successfully used for this work, which cost about $2 per foot of hole drilled. The fault dips 30° to the south-west and it is estimated that the ground to the west of the fault has been thrown only a short distance. The ore mined above No. 1 tunnel ended on a flat fault about 30 feet from the surface on the east side of the *Maple Leaf* fault. The vein above the fault consisted of low-grade or barren quartz. It seems apparent that the ore was formed in many instances along the faults, and it also seems possible, since similar geological conditions

prevail to the west of the *Maple Leaf* fault, that more ore may be found in that direction. The ground between the *Union* and the *Homestake* is covered with conglomerate and lava, so that prospecting from the surface is almost prohibitive.

Homestake. (*See* Annual Reports for 1931 and 1932.) This claim, mentioned in former Annual Reports and bonded by the J. F. McCarthy interests, of Wallace, Idaho, was developed during the greater part of 1933, the work consisting of sinking the shaft 55 feet to the 155-foot level and prospecting the vein system by 400 feet of crosscutting and drifting and 928 feet of diamond-drilling. According to the management, the vein-widths were promising, but only occasional segregations of gold-bearing quartz were found. The structure was badly displaced by faults and no continuous ore-shoots greater than 15 feet in length were discovered. The shaft was sunk under a well-defined hanging-wall dipping 45° to the north-west for 75 feet and then dipping 75° for 25 feet to the first level. The shear-zone containing the quartz vein varied from 10 to 20 feet in width. A drill-hole bored to intercept the vein 300 feet below the collar of the shaft was disappointing. The resumption of work in 1934 on this claim is in doubt.

The ore and the formation in which it occurs is similar to the *Union*, and therefore appears to warrant further exploration. The high-grade gold ore on this claim was first discovered in an old shaft sunk near the top of a knoll at a central point where the vein bent in a south-westerly direction. It is possible that farther away from this point of disturbance ore in place may be found. The suggestion is that the *Homestake* and the *Union* ore-bodies, being similar and only 3,000 feet apart, are in some way connected, and that to the east of the former and west of the latter more ore may be discovered.

Maple Leaf. (*See* Annual Reports for 1917 to 1922, 1925, 1927, 1929, 1931, and 1932.) This group, adjoining the *Union* mine, was optioned by the J. F. McCarthy interests. Crosscutting and diamond-drilling failed to discover any ore, according to the management.

Paulson Section.

Molly Gibson. (*See* Annual Reports for 1917 to 1920, 1922, 1923, 1926, 1928 to 1932.) Oscar Anderson and associates, of Rossland, took a two-year lease on this property, which is situated 4 miles south-west of Paulson. Near the collar of the old inclined shaft a 6-foot width of ore was uncovered, striking north-west and dipping about 40° to the north-east. The ore-minerals are pyrite and chalcopyrite in a gangue of silica and quartz in replaced limestone-beds. A sample from the face of these workings assayed: Gold, 1.40 oz. per ton; silver, 0.30 oz. per ton. One car-load of ore was shipped to the Trail smelter and two more are expected to be shipped soon. The mine is connected with the railway at Paulson by a 4-foot trail, over which ore can be hauled in winter by sleighs. There is a 286-foot crosscut tunnel driven 75 feet below the shaft-collar to connect with the bottom of the shaft so that the ore can be mined by gravity.

Lightning Peak Area.

For convenience, the operations taking place in this section are placed under one heading in one Mining Division. Some of the claims are situated in the Greenwood and others in the Grand Forks Mining Division. (*See* Geological Survey of Canada Report, 1930, Part A.)

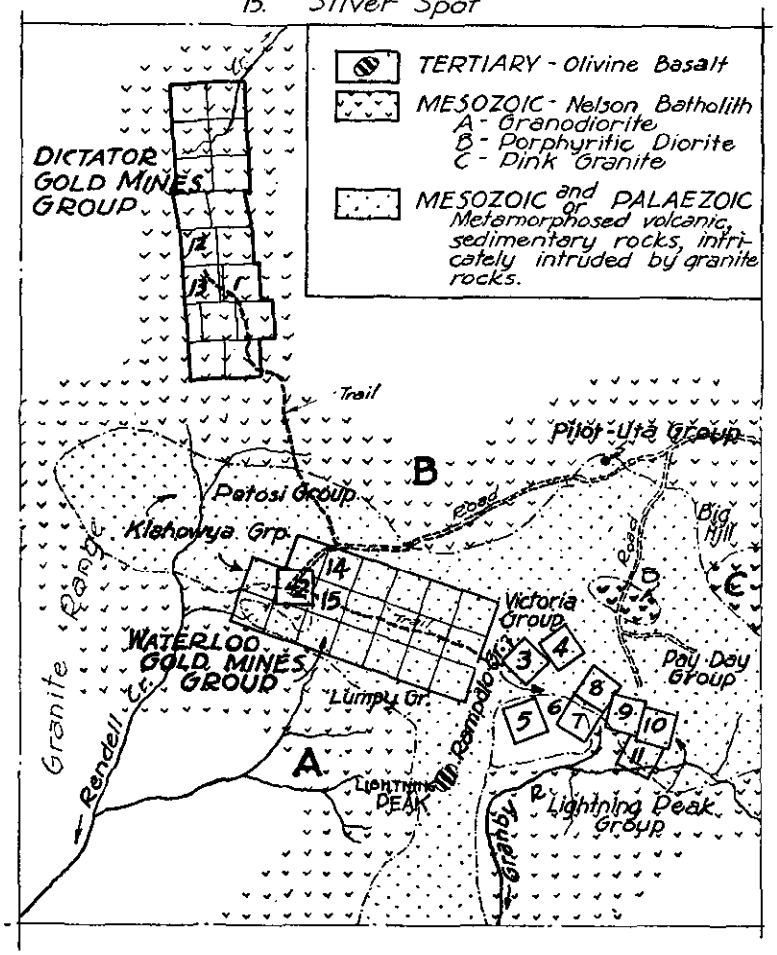
Waterloo Gold Mines, Ltd. (*See* Annual Reports for 1918 to 1922, 1925, 1927, and 1929 to 1932.) During 1933 this company's property (*see* map), situated near the headwaters of Rendell creek, a tributary of the Kettle river, was financed by Colonel Victor Spencer and associates, of Vancouver. J. D. Shannon, M.E., was put in charge of development. No. 4 level, 150 feet vertically below the original ore-outcrop, has been driven approximately 900 feet and follows the general east-west strike of the main shear-zone. Its objective is the intersection of the north-south gold-bearing quartz veins about 900 feet ahead. There is also the possibility of finding more silver-lead-zinc ore en route. Other developments between the surface and No. 4 level consist of: No. 1 tunnel, 150 feet long, 20 feet below the surface; No. 2 tunnel, 338 feet long, 20 feet below No. 1 tunnel; an intermediate tunnel, 30 feet long, 50 feet below No. 2 tunnel; No. 3 tunnel, 50 feet long and 30 feet below the intermediate tunnel. In the No. 1 and No. 2 tunnels a considerable amount of high-grade ore was mined and shipped to the smelter. Low-grade ore was found in the intermediate and No. 3 tunnels.

SKETCH MAP SHOWING GEOLOGY & CLAIM GROUPS
LIGHTNING PEAK AREA.

SCALE 0 5,000 10,000 20,000 FEET.

LEGEND

1	Dictator, C.G.	8	Thunder Hill, C.G.
2	Waterloo, C.G.	9	First Chance, C.G.
3	Rampalo, C.G.	10	West Fork, C.G.
4	Silver Lump, C.G.	11	Jim Hill, C.G.
5	Lost Cayuse, C.G.	12	Morning
6	Lucky Jim Fraction, C.G.	13	Cordova
7	Killarney	14	A.U.
15.	Silver Spot		



With report by P.B. Freeland, 1933,
Resident Mining Engineer,
Penticton, B.C.

B.C. Department of Mines.

A.M.R.

In No. 4 tunnel the ore-lengths in feet are as follows: From portal to 179 feet in, low grade; from 179 to 263 feet in, possible mill-feed; from 263 to 337 feet in, low grade; from 337 to 371 feet in, mill-feed; from 371 to 408 feet in, the drift did not encounter the vein; from 408 to 456 feet in, high-grade silver ore was found with slight indications of pyrargyrite (ruby silver); from 456 to 501 feet in, low grade; from 501 to 567 feet in, ruby-silver ore-shoot, very high grade silver in places; from 567 to 650 feet in, mixed high grade and mill-feed; from 650 to 687 feet in, low grade; from 687 to 777 feet in, possibly mill-feed; from 777 feet to 900 feet in at the face, low grade, possibly mill-feed.

Up to the present the theory is that the ore lies in lenticular bodies having a general rake down to the east. This has not been definitely proven, and because of massive block-faulting and shearing too much reliance should not be placed upon it. At the present time plans are maturing to mine, sort, and ship a car-load of high-grade ore. Some hand samples of the ruby silver assayed as high as 5,000 oz. silver per ton.

Surface work to the east of the No. 4 tunnel near the south intersection has uncovered the extension of the shear-zone, and, although only sparingly mineralized at this point, it shows a permanency that suggests continuity. The shear-zone was formed later than the north-south vein system. About 3,000 feet east of this point, on the *Silver Spot No. 3*, the former owners apparently uncovered the extensions of the same shear-zone and some attractive values in silver were found under a heavy gravel overburden.

Work done on the *A.U.* consisted of sinking a shaft about 30 feet on "D" vein, situated 130 feet south-west of the *A.U.* shaft. The vein is intimately associated with a quartz-porphyry dyke. The values found have not been published.

The Waterloo Gold Mines, Limited, owns a block of about twenty claims to the east and north of the *Waterloo* claim and development-work has been done on only three of these situated near the west end of the group. It seems likely that the silver-lead-zinc shear-zones on the *Lightning Peak* group and *Killarney*, although off strike, have been formed on the extension of the same line of shearing following the toe of Lightning peak. The latter, being a much younger volcanic eruptive, may have been responsible for this disturbance. The close association of the quartz-porphyry dykes and the quartz veins in the shear-zones is particularly noticeable throughout the camp. The inclusion of porphyry remnants within the quartz suggests that the veins followed the dykes after shearing.

Lightning Peak. (*See* Annual Reports for 1918 to 1921, 1924, 1925, and 1927.) This group, consisting of the *Thunder Hill, First Chance, West Fork,* and *Jim Hill,* owned by C. F. Deither, St. Paul, Minnesota, has been bonded by W. A. Calder, of Edgewood. During 1933 work consisted of driving a crosscut in the lower tunnel at a point a short distance beyond the first ore-shoot. It seems likely that the vein was faulted to the south at this point and will be again discovered in this direction. Samples taken by the lessee from the face of the lower tunnel, which cut the extension of the vein, over a 2-foot width assayed 206 oz. silver and 0.40 oz. gold per ton.

Killarney. (*See* Annual Reports for 1919, 1922 to 1925, 1927, and 1929 to 1932.) This claim was again developed by the owner, W. J. Banting, of Edgewood, and a new adit driven 4 feet lower than No. 3 tunnel and 4 feet beyond the old face. The vein at this point measured about 30 inches in width, containing about 6 inches of high-grade silver-lead-zinc ore. The trail was also improved and a car can be driven for some distance beyond the Lightning Peak road junction.

Pay Day. (*See* Annual Reports for 1929 to 1932.) This group, consisting of nine or more claims (*see* map), is owned by A. Williams and Walter B. Johnstone, of Edgewood. Most of the recent development-work has been done on the *Pay Check*, which adjoins the *Joyce J.* claim to the east, on the slope which drains into the headwaters of the Granby river. A 30-foot tunnel and numerous open-cuts have been excavated in a semi-elliptical area approximately 200 feet long on a displaced shear-zone containing galena, sphalerite, pyrite, and jamesonite. Picked samples assay from 50 to 60 per cent. lead and from 3 to 20 oz. in silver per ton. The region within a 100-foot radius has been pushed downhill in a south-easterly direction, probably by glacial agency, and up until September, 1933, the ore had not been found in place. The connection between this discovery and the *Pay Day* shear-zone has not been established, and unless a large section of ground has been moved there seems to be no possibility of this. About 600 feet in a westerly direction from the old *Pay Day* crosscut

a considerable amount of pyrite, manganese, and iron oxides indicate the continuance of the main shear-zone.

Tillicum and Potosi. (*See* Annual Reports for 1921, 1922, 1927, 1930, and 1931; also Geological Survey of Canada Summary Report, 1930, Part A.) These groups, owned by Victor Locke, Penticton, and the estate of James Graham, Spokane, are situated to the west and north-west of the *Waterloo*. A great deal of surface exploration-work has been done along the strike on a series of shear-zones containing quartz striking generally north and south. Only disseminated pyrite and galena have been found, but occasionally some attractive assays in gold are obtained. The permanency of the shears appear to warrant exploration at depth.

Morning No. 2. (*See* Annual Report for 1931; also Geological Survey of Canada Summary Report, 1930, Part A.) This claim, owned by Nels. Melstrom, of Edgewood, and now optioned to the Dictator Gold Mines, Limited, Penticton, has been developed considerably since reported upon by Dr. Cairnes in 1930. The shear-zone has been traced for a distance of 240 feet by shallow shafts, open-cuts, and a short tunnel 8 feet long. In the most southerly shaft, 6 feet deep, the shear-zone strikes N. 30° W. (mag.), dips 68° south-west, and is about 8 feet wide. This width includes 3 feet of quartz, mineralized with pyrite, lesser amounts of sphalerite and galena, on the hanging-wall, and stringers of quartz from 1 to 3 inches wide spread through the sheared gangue towards the foot-wall. In the next shaft, 100 feet north, the shear-zone here is 7 feet 8 inches wide and contains 2 feet 9 inches of quartz and similar conditions to those found in the first-mentioned shaft. About 50 feet north of this shaft the discovery open-cut, 12 feet higher in elevation, uncovered a vein 3 feet 6 inches wide and similar mineralized gangue-matter. About 45 feet farther north an open-cut 22 feet long, with an 8-foot tunnel from it on the shear-zone, uncovered a quartz vein 2 feet 6 inches wide on the south and 3 feet 4 inches wide on the north end of the drift. The top part of the vein on the north side has been displaced down to the east, giving the appearance of a much greater vein-width. About 45 feet farther north a 16-foot cut failed to find the continuance of the vein, although much oxidized shear-zone matter was uncovered. About 300 feet north-east from this cut quartz float was found, and it appears likely that the vein has been displaced in this direction. Chip-samples in the tunnel over vein-widths assayed from 0.20 to 0.16 oz. gold and 2 to 7 oz. silver per ton, with variable amounts of lead and zinc (not assayed). Picked samples of float assayed: Gold, 1.50 to 1.70 oz. per ton. To the south of the workings there are strong indications of the continuance of the shear-zone. The ore-minerals are arsenopyrite, pyrite, galena, and sphalerite. The structural association of the quartz and quartz porphyry are especially noticeable.

The workings in any place do not develop the ore-body at a greater depth than 10 feet, neither do the samples taken over vein-widths assay high enough to be classed as pay-ore. Nevertheless, the permanency of the shear-zones, with the probability of greater quartz-widths and the attractive gold values in float samples, certainly warrant further exploration of this property. In the vicinity of this claim the ground is rolling and generally flat, so that shaft-sinking will have to be resorted to.

Cordova. This claim, owned by Adam Scaia, of Edgewood, adjoins the *Morning* on the south and evidences of the shear-zone continuation have been found. Deep soil saturated with water made prospecting difficult at this point. A short distance farther south and east the owner uncovered some large boulders mineralized with pyrite, galena, and sphalerite, which apparently had not moved far from their source. Beyond this point to the south very little work has been done, but a considerable amount of quartz float strongly suggests that the shear-zone persists in this direction. The country-rocks are Nelson granite.

Dictator. (*See* Annual Reports for 1919, 1931, and 1932.) This claim (Lot 4636), owned by John Glover, Nelson, and under option, adjoins the *Doris Fraction* (*see* map) to the east and was one of the original discoveries in the area. Two shafts, probably 30 and 40 feet deep respectively, now filled with water, as well as numerous shallow pits and trenches have been sunk for about 800 feet along a parallel shear-zone to the one found on the *Morning*. As all the workings were badly caved it was impossible to sample the vein in place. The ore on the dumps consisted of galena, pyrite, and sphalerite in quartz gangue. There is a log cabin on the claim.

Ontario.

This claim, lying 1,500 feet north of the *Morning*, has had very little work done upon it to date. Float quartz found assayed: Gold, 0.30 to 1.97 oz. per ton; silver, 23 oz. per ton; lead, 20 per cent. Exploration-work has been done on this group since an examination was made in September and according to reports the shear-zone continuance has been found.

General.

The strength and continuity of the parallel shear-zones on the Dictator Gold Mines, Limited, property (*see* map), together with the possibility of finding others (suggested by exploratory work on the *Cordova*), and occasional comparatively high gold-bearing float on other claims, presents conditions well worth more surface exploration and deep development. On the *A.U.* north-south shear-zones better gold values were obtained at depth.

Placer-mining.

Some placer-mining was done on the tributaries flowing from the north-west into Fourth of July creek near Grand Forks, and some small rough-edged gold nuggets were found close to bed-rock. The creeks drain an area from which a considerable amount of gold quartz was mined thirty years ago. Due to comparatively shallow depths of gravel on bed-rock, this area should interest individual operators.

GREENWOOD MINING DIVISION.

Wallace Mountain Section.

The general outlook for production from the silver-lead-zinc mines on Wallace mountain seems brighter than ever. Since 1932 developments on the *Highland Lass* have exceeded the expectations of the owners, and according to reliable reports there are two or three years' ore reserves developed in the mine, much of which is high grade. The *Bell*, as usual, has kept up its production for the year and has, from all accounts, a long life still ahead of it. The *Beaver*, adjoining the *Highland Lass* and *Bell* to the east, is also in a better position for future production and, as the workings proceed farther away from the excessively faulted ground in the gulch, more permanent ore-shoots may be looked for. A good ore-shoot was found in the Sutherland tunnel and the top section mined and shipped during 1933. At present the 50-foot level in the shaft is being driven ahead under this shoot with the idea of mining the lower part. Other work consists of driving under a faulted ore-body to the south of the shaft-collar, where more ore is expected. Major Angus Davis is engineer in charge and Henry Lee is consultant. On the *Sally* group recent exploration in a winze below No. 3 level disclosed some high-grade ore which is considered to be a continuation of the "Big Stope" ore, which produced over $500,000 in silver some years ago. Apparently a combination of nearly vertical and flat faults threw the ore down in a south-westerly direction. Another development contemplated is sinking a winze from No. 3 vein tunnel east and above the *Wellington* mine, the latter having uncovered good ore in this vein in the lower workings. The prospects for Sally Mines, Limited, which owns a large block of ground between the *Bell* and the *Wellington*, are much more encouraging. R. H. Stewart is president and engineer; Henry Lee, consulting engineer; and H. B. Morley, Penticton, treasurer and manager. A 100-horse-power Petter full Diesel engine and a Gardner-Denver 2-stage compressor have been installed on the old No. 1 tunnel power-site. Two car-loads of ore were shipped during 1933. On the ground owned by the Wellington Syndicate, of Greenwood, development consisted of 400 feet of drifting from the lowest winze-level, 295 feet of upraising, and 437 feet of diamond-drilling. According to the management, there is lots of ore in prospect and sinking the winze to another level is contemplated. On the *Tiger*, after a considerable amount of surface-stripping, the old crosscut tunnel driven by the Federal Mining Company was extended 90 feet south and the extension of the surface shear-zone found. Ore in this zone varied in value and occasionally 16 inches of high grade was found. About 19 tons of ore was sorted and shipped and another 10 tons is awaiting transportation. According to J. L. Nordman, the lessee, better ore is anticipated when the tunnel is driven directly under the high-grade outcrops.

The *Nepanee* group, owned by E. G. Cummings, Beaverdell, was optioned by Graham, Watson, and Millard, of Vancouver, for about two months during the summer of 1933, but as nothing was done the option lapsed. This group has been reported on in the Annual Reports

for 1917, 1920, 1925, 1928, and 1930. A considerable amount of work has been done on a shear-zone containing silver, lead, and zinc mineralization.

Braemar Mining Co., Ltd.

(*See* Annual Reports for 1923, 1924, 1925, 1928, and 1930, under *Inyo-Ack-worth.*) This company was formed with a capital of 500,000 shares of no par value, with head offices at 800 Hall Building, Vancouver. The old *Inyo-Ackworth* group on Cranberry ridge, nearly opposite and west of Beaverdell, has been developed by extending the lower crosscut tunnel. According to H. W. Fry, the manager, some well-banded quartz from 14 inches to 2 feet wide containing pyrite and galena was struck in the neighbourhood of the north-south fault, which dips 45° to the west. This is probably the same vein that was developed in the upper open-cut and tunnel. No returns from samples have been received.

Canadian-American Mines, Ltd.

(*See* Annual Reports for 1919, 1920, 1922, and 1932.) The development of the *Carmi-Butcher Boy* group at Carmi continued and the west drift was advanced into the *Butcher Boy* ground. According to reports, a shipment of 28 tons was made from the *Butcher Boy* and 270 tons from the *Carmi.* The old shaft near the river was deepened and drifts from this encountered some attractive ore, but insufficient work has been done to prove its extent, according to reports from the head office.

Colby Nos. 1 and 2.

These claims, owned by R. Forshaw and associates, of Greenwood, are situated about 2 miles up Kelly river, which flows into the Westkettle river about 10 miles west of Westbridge. A trail leads to the property on the north side of the creek from the Kettle Valley Railway. The property, once Crown-granted, reverted to the Crown. Numerous open-cuts, a 15-foot tunnel, and several shallow shafts have been excavated on a quartz vein 3½ feet wide near the top of the hill at 3,075 feet elevation. The vein gradually decreases to 14 inches in width downhill in a northerly direction for about 700 feet. To the south, uphill, the vein does not outcrop and may possibly be covered or cut off by the intrusion of granite porphyry which invades the area in that direction. A sample chipped across 2 feet, 30 feet above the tunnel, assayed: Gold, 0.33 oz. per ton; silver, 5.70 oz. per ton. A 3½-foot sample across the face of the tunnel assayed: Gold, 0.03 oz. per ton; silver, 0.70 oz. per ton. Two other samples taken at 500 feet and 700 feet downhill, each across 12 inches of vein-matter, assayed a trace in gold and silver per ton. Mineralization is chiefly pyrite associated with smaller amounts of a dark blue-black mineral in a quartz gangue. There is about 20 tons of ore on the dump. The vein occurs in chlorite-schist.

Enterprise, Teresa, Richelieu.

(*See* Annual Reports for 1901, 1905, and 1916.) This group, situated about 1½ miles by trail up Nelse creek, which flows into the Westkettle river about 2 miles above Rhone, on the Kettle Valley Railway, was optioned by Harry Lazier, broker, 1086 Bute Street, Vancouver. A company called the Golden Kettle Mines, Limited, was formed with a one-million share capital. The company engineers, A. G. Langley and H. V. Warren, after examining the property, advised a certain amount of exploration in No. 3 tunnel, which, according to reports, has not been completed. Extracts from H. V. Warren's report (he examined the property in May, 1933, and his report is mentioned in the prospectus) are as follows: "From the high-grade material found on the dump assays give credence to the statements that pockets have been mined here which were rich in gold and silver. The richest samples showed definite tellurium reactions and assays were run on two samples for this element. Results were as follows: Sample No. 1, 0.70 per cent. tellurium; sample No. 2, 0.30 per cent. tellurium. These samples—No. 1, hand-picked by Eugene Saunier, and No. 25, from No. 2 tunnel dump—carried 23.98 and 11.84 oz. in gold, the values being respectively $565.23 and $278.97 in gold and silver. Hence there appears to be a definite relationship between the gold and tellurium. I cannot say at this time that all the gold is due to a gold telluride."

An examination of No. 2 and No. 3 tunnels showed that the quartz, which occurs in fissures and lenticular bodies of granodiorite, was disconnected and erratic both on the surface and underground. This is due possibly to the invasion of recent granite porphyry and diabase dykes. In No. 2 tunnel, which is about 100 feet long, a 3-foot quartz vein was found and, according to reports, a lens 25 feet long and about 10 feet high produced some high-grade gold ore. This lens gradually "peters out" to the north and, in crosscuts driven 30 feet west and 10 feet east beyond, no sign of the vein was found. A sample across 2½ feet in the bottom of the tunnel

below the old stope assayed: Gold, 0.48 oz. per ton; silver, 5 oz. per ton. The No. 3 tunnel, a short distance below 4 feet of shear-zone matter containing granodiorite, quartz, pyrite, chalcopyrite, and lesser amounts of telluride (?), has been driven in a northerly direction for 65 feet, with a crosscut 36 feet to the north-west. A picked sample of material from this tunnel assayed: Gold, 0.47 oz. per ton; silver, 5.30 oz. per ton. Offshoots from the main mass of porphyry appear to eliminate any chances of finding more than isolated segregations of ore on the north strike. The section to the south towards Nelse creek offers the best chances of finding a repetition of high-grade (?) pockets of gold ore that might be profitably mined and shipped by individuals.

Mogul Mining Co., Ltd.

(*See* Annual Reports for 1917, 1928, 1929, 1931, and 1932.) Development on this company's claims, *Mogul* and others on Horseshoe mountain, 25 miles north of Westbridge, was continued for a short time. The drift from the main crosscut was advanced in a westerly and southerly direction for a total distance of 85 feet, with two diverging tunnels at the end, 35 feet and 20 feet long respectively. In the west drift a considerable amount of faulted mineralization containing occasional values in gold was found over a distance of 30 feet. The company decided, after making a shipment of 4 or 5 tons of ore to the smelter, to stop work until deeper development can be undertaken.

New Monashee Mines, Ltd., and Fire Valley Gold Mines, Ltd.

(*See* Annual Reports for 1897, 1900, 1901, 1903, 1904, 1913 to 1916, and 1921.) These old claims, situated on each side of the summit between a branch of Cherry creek and the waters flowing through McIntyre lake to Kettle river, have been optioned by J. T. Mutrie and Alec Smith, of Vernon. The workings were cleaned out and both properties sampled by Dr. Victor Dolmage for Vancouver interests. The names of the old claims are as follows: *Withrow*, *Field*, *Vernon*, and *Riske* on the New Monashee ground east of the pass, and *Rossland*, *Mascot*, and *Evening Star* on the Fire Valley ground west of the pass. Development on the *Withrow* claim, lying on the south-east side of the valley, consists of three tunnels—No. 1, 260 feet long; No. 2, 325 feet long; and No. 3, 197 feet long—with another tunnel (caved) alongside. No. 1 tunnel was also caved and could not be examined. It is supposed to be 260 feet long and is 190 feet below No. 2 tunnel. The difference in elevation between No. 2 and No. 3 tunnels is about 100 feet. The quartz vein in No. 3 tunnel varies from 1 to 4 inches in width and strikes in a north-west direction. A few feet to the south of the mouth of No. 3 tunnel is a faulted outcrop of a 6-foot quartz vein in which the caved tunnel was evidently driven; the present No. 3 vein being possibly a stringer in the hanging-wall of the main lead. By crosscutting to the south from the face of No. 3 tunnel the larger vein will probably be intersected. In No. 2 tunnel the vein, striking more to the east and west and dipping 34° to the south-east, pinches and swells from 1 foot to 5 feet in width, the widest section occurring near faults. There is a better distribution of mineral for 185 feet from the mouth to an upraise put in close to a fault. The ore-minerals seen with a hand magnifying-glass are pyrite, with minute segregations and isolated crystals of chalcopyrite and galena. Average assays of gold and silver (calculated at $20 an ounce for gold) are reported to be between $7 and $8 per ton. Although not examined, the vein is reported to have been followed over the hill to the east and on to the *McIntyre*, lying approximately 2,500 feet in that direction on the strike. The country-rocks are argillites and metamorphosed volcanics.

On the *Rossland*, across the gulch, besides numerous open-cuts on the vein (probably the same as the *Withrow*) along a distance of 1,500 feet, there are two tunnels driven—one a drift, 170 feet long, with two upraises, 25 and 50 feet respectively, and the other a crosscut about 800 feet long and 450 feet lower, which did not intersect the vein. The strike of the vein on this side is about the same as on the *Withrow*, with a dip of approximately 54° to the south. On the surface, along the first bench above the upper tunnel, the vein is persistent though narrow. Underground, and where stripped down the hill to a short distance above the camp, the quartz-outcrops are very strong, measuring from 4 to 10 feet in width. The reason for driving a long crosscut is not immediately apparent. Mineralization, chiefly pyrite, galena, sphalerite, and chalcopyrite, occurs in small segregations and minute specks through the quartz. The formations in the vicinity of the upper workings appear to be altered volcanic rocks overlain and intimately associated on the contact with sediments.

On the *Evening Star*, which adjoins the *Rossland* on the north-west, a 230-foot tunnel has been driven north of the main workings on a quartz vein from 6 inches to 1 foot wide. This

vein strikes south-west (mag.) and dips nearly perpendicular. The ore-minerals, pyrite, galena, and chalcopyrite, occur in quartz tightly frozen to the walls. The country-rocks are volcanics and mineralization occurs along the bedding and faults to the south-east. Possibly this vein may intersect the main east-west lead to the north-west. Two samples, one across a 1-foot width of vein 20 feet from the face of the tunnel, and another, 8 inches wide, 68 feet from face, carried neither gold nor silver.

The samples taken from the main workings on the *Rossland* assayed 0.02 to 0.38 oz. gold per ton. The good widths and persistency of this vein appear to warrant careful exploration. The strike of the vein into the steep hillside on either group permits development by tunnelling. The claims are situated 47 miles by road from Vernon, or about 36 miles by road from Edgewood, on the Arrow lakes.

Kismet. This group, including the *Kismet*, *Mountain View*, *Iron Ball*, *Snowdrop*, *Dewdrop*, and three other claims, and owned by A. O. Holmes, M. J. Doran, O. L. Willoughby, and associates, of Lumby, is situated on the north side of Trap creek, which flows into the Kettle river from the east, about 5 miles up-stream from the road crossing. The claims can be reached by trail 6 miles long. On the *Kismet*, in addition to numerous open-cuts, a 75-foot tunnel has been driven on a quartz vein in granite. The vein is from 6 inches to 3 feet in width and strikes in a northerly direction, while dipping steeply to the east. At the mouth of this drift the 3-foot vein is much oxidized and free gold can be panned. In the face of the drift the vein, 22 inches wide, contains mostly pyrite, arsenopyrite, and lesser amounts of galena. A chip-sample across the face assayed: Gold, 1.04 oz. per ton; silver, 0.06 oz. per ton. The quartz appears to be widening on a fault in the face. On the surface, about 50 feet above and north of the tunnel, the vein has evidently split and the cuts show several stringers. On the *Iron Ball*, downhill and to the south-west, other quartz veins containing pyrite and arsenopyrite striking slightly east of north have been uncovered. It is possible that these may intersect the tunnel vein to the north. About 700 feet west of the *Kismet* and 200 feet lower, a 30-foot open-cut has uncovered a shear-zone 4½ feet wide containing pyrite, pyrrhotite, and lesser amounts of arsenopyrite in a gangue of quartz and disintegrated granite. On the *Dewdrop*, west of the *Iron Ball*, open-cuts have uncovered north-striking quartz fissure-veins containing similar minerals in granite. Some free gold was panned in the oxidized ore.

Several cuts to the east of the *Kismet* tunnel have uncovered other fissure-veins in the granite, a 3-inch stringer assaying: Gold, 1 oz. per ton; silver, 1 oz. per ton. On the *Mountain View*, adjoining the *Kismet* on the south, downhill, several cuts and a 30-foot tunnel have been driven on an extremely sheared and faulted quartz vein in the altered limestone and argillite beds, remnants of which lie in contact with the granite in an easterly and westerly direction along the foot of the hill sloping towards Trap creek. It appears probable that the section of vein in these workings has been pushed downhill by the granite intrusive and is probably the top part of one of the fissures found above. Picked samples of the ore carry good values in gold and silver. The mineralization seen consisted of pyrite, galena, and jamesonite. A dense, highly altered siliceous igneous rock is found in the neighbourhood of the workings. This may possibly be an offshoot from the granite batholith.

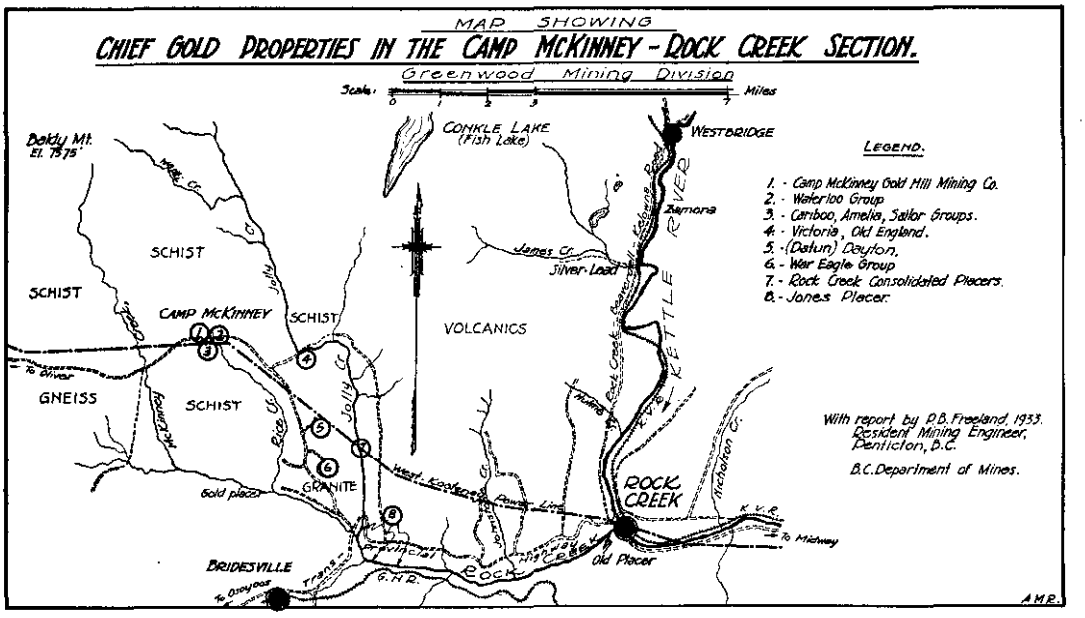
The area covered by these claims and underlain chiefly by granitic rocks has undoubtedly been fissured by numerous quartz veins carrying gold and silver, and, although comparatively narrow, they appear to warrant further exploration in the hope of finding wider ore-bodies that will pay to mine.

Camp McKinney Section.

A considerable amount of activity was noticeable in this section during 1933 and many new claims staked, reverted Crown grants leased, and groups of claims amalgamated prior to more extensive exploration. The chief consolidation appears to be the old Cariboo McKinney gold-mines, *Wiarton*, *Waterloo-Consolidated*, *Fontenoy* group, which embraces the old workings on the *Cariboo-Amelia-Sawtooth* claims, which are about 550 feet deep and 1,700 feet long, as well as the shaft-workings on the *Waterloo*, which are said to be about 300 feet deep and from which some attractive gold ore was found dipping on to the *Fontenoy* ground. Another group, owned by Alec. Broomfield, Jack Malone, *et al.*, of Princeton, and embracing sixteen claims and fractions adjoining the *Cariboo Waterloo* group on the north and south, are worthy of exploration. Indications of the persistency of the quartz-fissures are to be found striking along the right-of-way cut out by the West Kootenay Power Company to the south-east. It is also probable that

the quartz veins found in the *Old England* and *Victoria* claims, several thousand feet east, are a continuation of the *Waterloo-Fontenoy* fissuring.

In the Dayton camp (Datun; *see* map) from some of the oxidized quartz gold can be panned, and although high assays were obtained many years ago in superficial work, no continuous bodies of ore were found. About 40 tons of ore was shipped in 1916 from the *Dayton* (Datun). This ore assayed: Gold, 2 oz. per ton; silver, 5 oz. per ton; and 5 per cent. copper. On the *Le Roy* and *War Eagle* claims, owned by James Copland and associates, of Rock Creek, attractive values in gold, silver, and copper were developed in the new shaft, in a contact deposit between the granodiorite and greenstone. On the Camp McKinney Gold Hill Mining Company ground, adjoining the *Sailor* and extending north-west, developments by shaft-sinking and tunnelling by John Carmichael, 703 Dominion Bank Building, Vancouver, have met with some encouragement. During 1933 a 200-foot tunnel was driven on an east-west-striking quartz vein which varies from a few inches to 2 feet in width, and although carrying low values in gold and silver near the mouth, a considerable improvement has been noticed in the face where denser pyrite mineralization occurs. In the shaft, several hundred feet west of the tunnel, free gold was found associated with galena. A well-mineralized quartz vein also strikes diagonally across this vein about 200 feet west of the tunnel-face.



A new strike has been reported and twenty claims staked on a well-defined quartz vein, said to vary from 4 to 20 feet in width, about 2½ miles in a north-westerly direction from the old Camp McKinney townsite near the toe of Baldy mountain. The double row of claims staked ties on to the old *King Edward*. Picked samples, according to the stakers, assayed from 0.6 to 1.75 oz. gold per ton. Some of the owners are Tom and Charles Shuttleworth, of Okanagan Falls, and H. Leir, M. S. Peacock, and Max Ewart, of Penticton, etc.

A great many outcrops of the veins in Camp McKinney are barren quartz or nearly so, and it is apparently for this reason that so little development has been done beyond the region immediately adjoining the old *Cariboo-Amelia* workings. Although it has been impossible to examine the underground workings on the latter, due to water, maps appear to portray the fact that structural conditions have played an important part and there is also a distinct rake to the ore-bodies down to the west. Reliable reports state that in parts of the lower workings the quartz is 6 feet wide carrying values of 0.275 oz. in gold per ton. The ore mined had to be handled six times through winze, drifts, shafts, and surface tramways before it reached the mill, a procedure which would add very materially to the mining costs. That comparatively high values were lost in the mill tailings is also known from samples taken of the residue.

Fairly good values are also reported from the old *Sailor* mine-workings, which are not nearly as extensive as the *Cariboo*. These workings could be unwatered and examined at low cost. A road either from Oliver or from the Rock Creek–Bridesville highway; the high-tension electric power-line passing through the camp; and the Great Northern Railway at Bridesville, about 8 miles distant, will very materially facilitate mining operations.

GREENWOOD SECTION.

Dentonia Mines, Ltd. (Jewel).

(*See* Annual Reports for 1913, 1926, 1927, 1928, 1930, 1931, and 1932.) This company, formed in 1931 with an authorized capital of 1,500,000 shares of no par value, has the following directors: Nelson S. Smith, of Olds; H. E. G. H. Schofield, of Calgary; Dr. A. G. Scott, of Bassano; Charles Ingram, of Calgary; A. C. Galbraith, of Calgary; C. E. Snider, of Calgary (all of Alberta); and A. G. Langley, of Vancouver. Angus Davis is in charge of development at the mine. The claims controlled by this company are as follows: *Jewel, Enterprise, Anchor, Ethiopia, Patience, Perseverance, Anchor Fraction, Gold Drop, Gold Drop Fraction, Gold Drop Extension, Gem Fraction, Imperial, Massachusettes, Denoro Grande, O'Connor, Ruby, Emerald, Smith, Diamond, Topaz, Davis Fraction, Hanna, Black*, and *Hanna Fraction* (*see* map). The Jewel Lake camp, in which these claims are situated, lies about 8 miles by road from Greenwood and about 7 miles by road from Eholt, both stations on the Canadian Pacific Railway. Early reports on the property are under the name of *Jewel*.

Until 1933 practically no development was done by the company. Underground work commenced under the management of Angus Davis, to whom much credit is due, about the middle of August, 1933, and No. 1 tunnel was extended and connected with the Rowe shaft south drift. In this shaft two levels were run formerly, one south from the bottom of the shaft and another north 39 feet higher in elevation. To take advantage of this work a connecting upraise and ore-pocket was made between the two levels and the north drift extended under the *Enterprise* shaft, where another connecting upraise was put in. At the time of examination (January 8th, 1934) the drift-face was about 20 feet north of the latter shaft. Ore mined between the *Enterprise* and *White* shafts will be trammed and dumped into the *White* shaft pocket and thence trammed outside, where for the present trucks will haul it to the mill (old site) on the *Perseverance*. Later, if developments warrant it, a 1,350-foot crosscut will be driven to intersect the vein extension on its dip, about 300 feet below the present level on the *Enterprise*. The portal of this crosscut will be about 1,000 feet from the top of the mill.

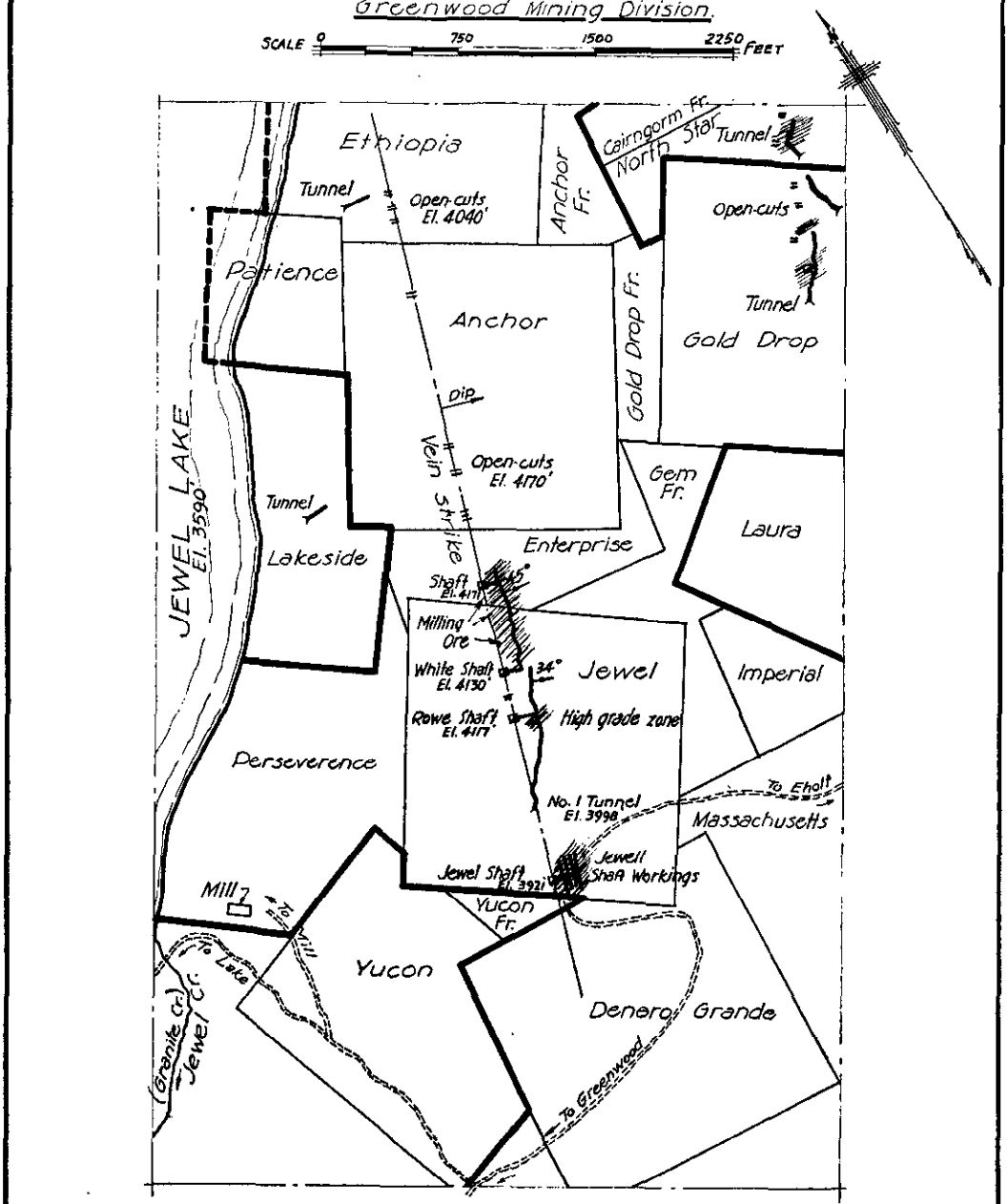
According to the management, there is a section of about 400 feet of ore between the *White* and the *Enterprise* shafts averaging 6.5 feet in width and carrying 0.40 oz. gold per ton and 2 oz. silver per ton. This block above the level contains approximately 40,000 tons of milling-ore, with a probability of additional tonnage below the level. About 370 feet north of the *Enterprise* shaft on the *Anchor* claim a surface cut 2.5 feet wide assayed: Gold, 0.40 oz. per ton. This may be the continuation of the same ore-shoot or a separate one. Another surface open-cut between the Rowe and *White* shaft, about 160 feet above the level, across 7 inches assayed: Gold, 1.25 oz. per ton. Adjoining this sample 5 feet assayed: Gold, 0.16 oz. per ton. Other cuts show good widths and satisfactory values. In the Rowe and *Enterprise* shafts average values were obtained. Other opportunities of obtaining ore not included in tonnage estimate are: A section of quartz in the area south of the Rowe shaft, where spasmodic samples over widths varying from 1 foot to 2.3 feet assayed: Gold, 0.84 to 3.36 oz. per ton. In the old *Jewel* shaft, 539 feet deep on dip of the vein, there is a section of quartz in the bottom, 2 feet wide and 120 feet long, that will average 0.40 oz. gold per ton. Above the 230-foot level, along the boundary of the *Jewel* and *Denoro Grande*, according to the old assay-maps, there is another section that contains attractive values. On the *Ethiopia*, which lies north of the *Anchor*, a narrow high-grade vein has been uncovered by open-cuts.

Two samples were taken in the present workings at the time of examination. No. 1 sample, across the 3-foot 8-inch vein in the face of the drift, 20 feet north of the *Enterprise* shaft, assayed: Gold, 0.74 oz. per ton; silver, 4 oz. per ton. No. 2 sample, a picked sample from across 4 inches on the foot-wall, 10 feet north of the same shaft, assayed: Gold, 3.60 oz. per ton; silver, 20.5 oz. per ton. The ore-minerals are chiefly pyrite with lesser amounts of galena, chalcopyrite, and native gold, the latter often occurring in isolated segregations. The gangue-minerals are quartz, chlorite, calcite, and sericite. No tellurides were seen, but they may

MAP SHOWING

UNDERGROUND WORKINGS DENTONIA MINES LTD.

Greenwood Mining Division.



With report by P.B. Freeland, 1933, Resident Mining Engineer, Penticton, B.C.

B.C. Department of Mines.

A.M.R.

possibly be present as they are frequently found associated with the ores in this camp. The vein strikes N. 15° E. and dips 45° south-east in the neighbourhood of the *Enterprise* shaft and 35° south-east near the *White* shaft, so that there is a distinct flattening of the vein to the south.

Very little is known at present regarding the ore deposition, but it seems likely that the warping and waving on the strike and dip of the quartzite-schist, in which the ore occurs on the north end of the property, has played an important part, and judging by surface and underground values there is a distinct rake to the north. This also is noticeable in the map of the old *Jewel* workings. The ore in the bottom of the latter is reported to be in granodiorite. This rock also invades the area south of the *Jewel* mine. The vein cuts both igneous and metamorphic rocks. In the neighbourhood of the Rowe shaft the vein is badly displaced by the intrusion of a porphyry dyke containing coarse crystals of feldspar and isolated crystals of biotite in a dense grey ground-mass. Numerous lamprophyre dykes have also caused vein displacement. There has undoubtedly been intense shearing in the vein after mineral-deposition.

At the mine a 60-horse-power Crossley engine driving a 320-foot Diesel-Rand compressor has been installed and a fully equipped blacksmith's shop built. The old mine quarters are being used for the present to house and board the men. Later a camp may be built at the lake.

A 100-ton daily capacity milling plant is being installed in the old mill building on the *Perseverance* claim close to the lake. The flow-sheet of the mill is as follows: Bin, 50 tons; picking-belt, 6 by 30; jaw-crusher (10 by 20) to crush to 2½ inches; grizzly; gyratory crusher, ½-inch to ⅝-inch product; conveyor to fine-ore bin (75 tons capacity); belt feeder to 6 by 6 ball-mill; 3 by 16 Dorr classifier; Denver sub-A flotation units; settling-tanks (filter bottom); Wilfley pump. A 90-per-cent. saving is estimated when making a 16 to 1 concentrate. A 2-stage centrifugal pump will lift water 155 feet to the mill-head. The West Kootenay Power Company will supply the mine with power over a new 7-mile line from Greenwood. Mill cost is estimated at $30,000; the saving made by using old mill structure will probably amount to $20,000.

It seems likely that this mine will be in production by the end of March, 1934, a very creditable achievement, since operations in the mine only commenced in the middle of August, 1933.

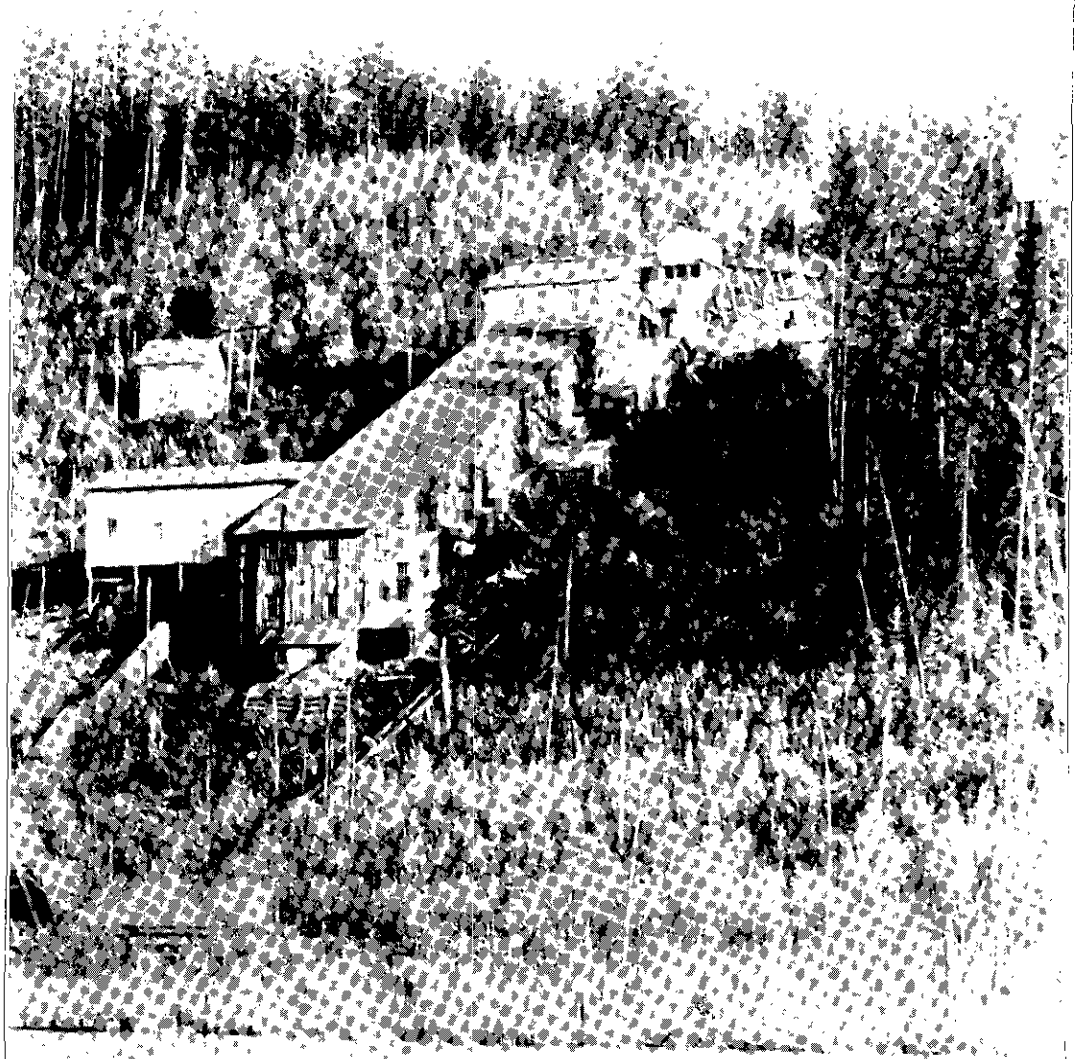
The parallel vein on the *Gold Drop* is not being developed at the present time. During the year lessees of this property as well as the *North Star* made shipments of ore to the smelter. Similar ore conditions to those found on the *Jewel* property may be looked for in the *Gold Drop*.

Brooklyn-Stemwinder. (*See* Annual Reports for 1896, 1897, 1918, 1919, 1926 to 1930, and 1932.) These claims in the Phoenix camp were optioned by Vancouver interests and small payments made to the owner, Robert Forshaw. No developments took place since the option was ratified. According to the statement in lieu of prospectus, a company called the Brooklyn-Stemwinder Gold Mines, Limited (N.P.L.), address c/o Soskin & Levin, Inns of Court, Howe Street, Vancouver, has been formed to develop the *Brooklyn*, *Stemwinder*, *New York*, *Standard*, and *Montezuma* claims at Phoenix. The company proposes to issue 400,005 shares for cash and 335,000 shares as purchase price for the said mineral claims. The directors or proposed directors of the company are: Harold Darling and A. Campbell Black, Vancouver; R. K. Paton, North Vancouver; M. Soskin and David Zimmerman, of Vancouver. Apparently the following contracts have been made: Contract between R. Forshaw and S. F. Flater and W. J. Colclough, dated May 9th, 1933; contract between S. F. Flater, W. J. Colclough, and Wm. Genser and David Zimmerman, dated June 2nd, 1933; contract between S. F. Flater, W. J. Colclough, Wm. Genser, David Zimmerman, and Greenwood Securities, Limited, dated June 2nd, 1933; contract between Greenwood Securities, Limited, and Brooklyn Stemwinder Gold Mines, dated July 7th, 1933; and agreement between R. Forshaw and Greenwood Securities, Limited, dated August 14th, 1933; and agreement between Greenwood Securities, Limited, and Brooklyn Stemwinder Gold Mines, Limited, dated September 7th, 1933.

Winner. (*See* Annual Report for 1932.) This group, owned by George Walters and associates, of Greenwood, includes the *Winner*, *Legal Tender*, *Wren*, and *Good Luck Fraction* and lies a short distance south-east of Phoenix and Hartford Junction close to the old road. Development during 1933 included sinking the new shaft through the fault to about 50 feet in depth. The vein is about 2 feet wide and in places shows free gold. The strike of the vein through the *Winner* and *Legal Tender* is persistent and the vein in places is 6 feet wide and warrants further exploration. Evidently the ore found in the shaft is the top of a shoot which probably rakes south.

Similkameen Valley at Hedley.

Falkland—Gypsum Quarry, Kamloops M.D.



Dentonia Mines, Ltd.—Jewel Mill, Greenwood M.D.

Rattler. This old Crown-granted claim, Lot 1265, situated in the South Wellington camp about 3.6 miles south-east of Greenwood, and, it is believed, owned by the J. N. Connacher Estate, c/o Northern Trust Company, 333 Main Street, Winnipeg, has lain idle for many years and the numerous workings were caved, so that an examination was almost impossible.

A shallow shaft near the trail has uncovered a 6-inch quartz vein impregnated with pyrite and smaller amounts of galena. The vein strikes N. 65° E. (mag.) and dips perpendicular. Several open-cuts and pits 250 feet north-west of this have developed what appears to be a strong though narrow quartz vein, striking N. 25° W. (mag.), containing similar minerals. The ground in the vicinity of the old workings was heavily covered, so that little could be seen. The country-rock in the immediate vicinity is pulaskite porphyry and it seems likely that the mineralization is associated structurally with this rock. The claim can be reached by road 3 miles from the highway and three-quarters of a mile by trail.

Keno. (*See* Annual Report for 1925.) This group, adjoining the *Winner* on the south and consisting of the *Keno, Evening Star, Ophir,* and *Keno Fraction* claims, is owned by Sam Bombini and J. Pasco, of Greenwood. Development consists of a 35-foot shaft, at 4,525 feet elevation, on a banded quartz vein varying from 3 inches to 3 feet in width and striking north-south (mag.). The vein has been traced for 800 feet and contains pyrite, sphalerite, gold, and silver. About 150 feet south of this shaft a crosscut was started with the idea of intersecting the shaft-vein about 150 feet south and 25 feet lower in elevation. Whilst this work was in progress some quartz pebbles were noticed in a gopher-hole about 25 feet north-east of the tunnel portal, and after stripping the surface another strong lead was found striking diagonally across to the shaft. An open-cut on this vein uncovered 4 feet of mixed banded quartz and gangue, the former varying from 2 inches to 2.5 feet wide. Sample No. 1, across 2.5 feet at the face, assayed: Gold, 0.10 oz. per ton; silver, 9.5 oz. per ton. Sample No. 2, taken 12.5 feet south of the face in floor of the cut, assayed: Gold, 0.16 oz. per ton; silver, 5 oz. per ton. Sample No. 3, across 8 inches next the hanging-wall about 20 feet from face, assayed: Gold, 2.20 oz. per ton; silver, 18 oz. per ton. The last sample was taken in one of the best mineralized zones. The ore-minerals are pyrite, chalcopyrite, galena, sphalerite, and copper carbonates. In the immediate vicinity of the workings the formations are a fine-grained quartzite in which the veins conform to the strike of the bedding. Undoubtedly there are two separate veins converging or crossing in the neighbourhood of the shaft. This group warrants exploration.

Fanny Joe. This Crown-granted mineral claim lies a short distance north-east of the *Rattler* and is owned by Charles H. Tye, of Greenwood. Several open-cuts and a shaft 10 feet deep have been sunk on a 4-inch quartz vein. This vein is traceable for 300 feet and contains pyrite and lesser amounts of galena. It strikes in a northerly direction and dips steeply to the east, in andesite close to the granodiorite-contact. Most of the quartz near the surface was leached. Work done since June, 1933, according to the owner, included sinking the shaft another 10 feet to where a considerable amount of manganese occurred. About 300 feet uphill another north-south vein has been uncovered and similar conditions found. Values up to the present have been low. The elevation of the claims is about 4,600 feet.

On the *Dynamo* and *Starve Out*, owned by Portman Bros. and Oli Lofstad respectively, of Greenwood, several strong quartz veins occurring in the greenstone and underlying granodiorite have been uncovered and stripped for several hundred feet. Shipments of ore have been made from the *Dynamo* that carry good gold and silver values, but up to the present the segregations have been small. On the *Starve Out* a 3-foot quartz vein, containing pyrite, chalcopyrite, and galena, strikes N. 28° E. (mag.) into the *Dynamo* ground and should cut the latter vein on its north-west extension. This intersection, although buried under surface soil, may be worth prospecting.

Golconda. (*See* Annual Report for 1921.) This Crown-granted claim, Lot 2149, situated about 1½ miles south-west of the Deadwood camp, is owned by Oli Lofstad, Greenwood. Many years ago a shaft was sunk 65 feet (?) and 100 feet of stripping done on an oxidized zone 5 feet wide. This zone strikes S. 60° E. (mag.) and dips 68° north-east. Certain bands within the shear-zone contain quartz, pyrite, and arsenopyrite. A sample across 5 feet, 25 feet south of the shaft, assayed: Gold, 0.24 oz. per ton; silver, 0.80

oz. per ton. A letter from the owner since the examination was made states that recent stripping to the south uncovered a similar type of ore-body assaying: Gold, 0.65 oz. per ton. The elevation of the shaft-collar is 4,200 feet. Some 240 feet lower a long crosscut has been driven in an attempt to cut the downward extension of the shear-zone, but apparently it did not reach its objective. Another crosscut, 110 feet long, was driven to the north about 190 feet lower than the shaft-collar, but it still lacks 200 feet of being vertically under the shaft. Apparently better opportunities for ore lie to the south, and before continuing the crosscuts it seems advisable to unwater the shaft and examine conditions at the bottom.

Republic. (*See* Annual Reports for 1897, 1898, 1904, and 1922.) This group, situated on the west side of Boundary creek, between Boundary Falls and Anaconda, south of Greenwood, and embracing the *Last Chance* (Lot 644), *Republic* (Lot 426), *Non Such* (Lot 389), *Hidden Treasure*, etc., was optioned during 1933 by Vancouver interests and some development-work contemplated. The situation of the claims is attractive, being close to railway transportation, with a considerable amount of dead-tunnel work already done and electric power readily available.

D.A. Fraction. (*See* Annual Reports for 1924 to 1926.) Some development was done upon this group by R. Crowe-Swords, of Vancouver, and it is understood that the shaft was sunk some distance lower on the vein. A small shipment of ore was made to the smelter.

Riverview-Rainbow. (*See* Annual Report for 1926.) This group, situated about 3 miles north-west of Midway, is owned by D. Murray, of Beaverdell, and associates, of Midway. A lot of work has been done near the surface and mineralization has been traced for some distance on the *Rainbow* on a highly serpentinized peridotite containing stringers and lenses of pyrite, galena, and sphalerite. Remnants of this old rock, weathered to a brown colour, occur at intervals over a large area, and occasionally segregations of the above minerals and chromite and platinum are found. Samples taken from the main cuts assayed:—No. 1: Gold, a trace; silver, 3.4 oz. per ton. No. 2, mostly specimens, assayed: Gold, 0.10 oz. per ton; silver, 7.7 oz. per ton. On the *Riverview* some spectacular samples were obtained from a 2-foot cut, which assayed 12 oz. gold per ton. Another piece sent to this office and supposed to be similar to the above assayed: Gold, 1.08 oz. per ton; silver, 41 oz. per ton. A 6-inch sample taken by an independent engineer in the same hole assayed: Gold, 0.02 oz. per ton; silver, 0.60 oz. per ton. Another picked specimen of the best ore assayed: Gold, 0.10 oz. per ton; silver, 4.3 oz. per ton. It seems likely that there is free gold present which might account for the erratic results.

Placer-mining.

Kettle River.

About three-quarters of a mile below the Edgewood–Vernon crossing on the east side of the Kettle river, two leases staked by C. H. Martin, Frank Layman, and associates, of Lumby, were hydraulicked in a small way along the benches. One cut 125 feet long by 25 feet high uncovered some well-layered gravel which was slightly cemented for a few feet above the granite bed-rock. The owners after careful testing claim this section will average 45 cents a cubic yard, and nuggets up to $1.50 were found. The gravel on and above bed-rock had all the appearances of an old channel-run. Other test-pits put in at intervals outlined an area 1 mile long and ½ mile wide on the east side. Above the road other lessees are said to have found encouraging prospects. About 2 miles below, in and at the mouth of the canyon, some coarse gold values were mined. The gentle grade of the Kettle river above this point will necessitate a long ditch if a worth-while hydraulic head is to be obtained. Many gravel moraines cover the river-banks.

Rock Creek.

On Jolly creek (North fork of Rock creek) (*see* Annual Reports for 1930, 1931, and 1932; also Bulletin No. 1, 1931) placer-work was somewhat desultory and confined chiefly to exploration and assessment. The Puget Sound Bridge and Dredging Company took an option on the Rock Creek Consolidated ground above the road crossing, and two or three 6- by 8-foot shafts were sunk in the creek-bed a short distance below the bench-workings, under the supervision of Wm. Baueris. The results of the work are not forthcoming, but some values are understood to have been found. A Continental pump with a capacity of 300 gallons, maximum lift 60 feet,

driven by an 18-horse-power gas-engine, was used to handle the water. A considerable amount of quicksand and saturated gravel as well as a few large boulders were encountered. The Parma pump handled the water satisfactorily.

The leases directly below the road crossing and above the canyon were explored by J. F. Jones & Sons, operating for Lynch Bros., of Seattle. A drag-line scraper hauled by a donkey-engine dumped the gravel over a grizzly, bar-spaced to 6 inches. A 10-inch Byron-Jackson Rock suction-pump, with a rated capacity of 90 cubic yards of 10-per-cent. solids per hour, pulled the undersize residue from a sump below the grizzly into the sluice-boxes. Two 6-cylinder Continental gas-motors of 56 horse-power each, with a 50-foot head capacity, operated the plant. Some trouble was caused by rocks sticking to the 10-inch pump intake under the grizzly. The installation of an open-link chain driven by a worm-gear is expected to eliminate this difficulty.

With the acquisition of other leases below the ground held, the same company plans to install a 1¼-yard Bucyrus shovel operating in conjunction with a sky-line equipment for loosening the gravel, and two 12-inch sludge-pumps. The surface water will be carried past the ground to be worked by fluming. As the excavation proceeds up-stream and clearance is made, a bed-rock flume will be installed. The operation closed down in the early winter, due to frost. This operation was chiefly for testing purposes and only a small quantity of gold was recovered.

On McKinney creek (South fork of Rock creek) several individual lease and claim operations about three-quarters of a mile up from the McKinney Creek road crossing produced satisfactory results and a living was obtained by hand-mining methods. On lease No. 98, owned by M. D. Kinney, fairly coarse gold was mined on benches a few feet above the stream on the east side. The gravels on the benches here averaged 50 cents a cubic yard. At a point about 2 miles up-stream near the mouth of Rice creek, other leases, owned by A. Eddy, of Bridesville, and worked by R. A. McWhirter and F. Jenks, produced some fine gold on a high point of bed-rock. About 500 feet above the mouth of Rice creek and adjoining this lease, three claims, one 250 feet square, the others 250 by 400 feet, were worked by the owners, F. H., D. H., and J. H. Kirby, of Bridesville, who found coarse gold on bed-rock. These claims are staked on a flat about three-quarters of a mile long and 200 feet wide just above a small canyon. Work done on a low bench from 6 to 10 feet above the present creek consists of long cuts and drains where the gravel varied from 2 to 8 feet in depth, and in which many boulders up to 2 cubic yards were found resting on cemented gravel close to bed-rock. On the east side a deep cut was put in, and from information obtained it seems likely that the old channel flowed along this side or on the opposite side to the present stream-bed. Several shallow shafts in the area returned gold on panning, and this prospect, which is covered with comparatively shallow gravel and has available gravity water-supply from either Rice or McKinney creek, offers excellent chances. A Penticton syndicate has been formed to work the ground in 1934.

On Boundary creek, above Norwegian creek, the Siems Spokane Company, 412 Realty Building, Spokane, Wash., did some testing on the west-side benches and three shafts were sunk at various points. No. 1 shaft, 26 feet deep, with values at 10 cents per cubic yard, was not sunk to bed-rock. No. 2 shaft, on the extreme west side of the valley, encountered sloping bed-rock at 15 feet depth and tested 42 cents per cubic yard. No. 3 shaft, on the opposite side, was sunk 30 feet through barren ground. Guy G. Harvey, in charge of the work, considered bed-rock too deep to be economically mined, except by gravity draining from a point possibly 2,200 feet below the lower limits of their ground.

On the Dr. Lang and associates leases below Norwegian creek, a private company, called the Boundary Creek Mining Company, Limited (N.P.L.), has been formed, the holdings comprising 2 miles of placer-ground under leases Nos. 79, 85, 86, and 88. Work during 1933 consisted of enlarging the open-cut commenced in 1932 by means of a small drag-line scraper. About 2,000 cubic yards of gravel was worked and from this $2,267 in gold was returned. According to the management, the overburden averages about 22 feet deep and contains fine gold from the grass-roots down to 1 foot above bed-rock, where much coarser gold and richer gravel was found. A rough estimate of the top gravel of between 20 and 25 cents a cubic yard was made over the area covered by the leases. The richer gravel extends from a foot above to about the same distance below bed-rock, the latter being easily broken up with picks. Values of $10 per square yard are estimated for this 2 feet of ground. In 1934 the company plans to build a dam, and flume the present creek about 3,000 feet down-stream, so that the proposed gas-shovel will only have the usual ground-waters in the gravel to contend with.

Leases lower down the creek near the old road crossing were worked by individuals. A small dam was built, the creek-water flumed off, and the bottom of the creek mined for a short distance. About $200 worth of coarse gold is reported to have been saved.

OSOYOOS MINING DIVISION.

Dividend-Lakeview.

(*See* Annual Reports for 1913, 1927, 1928, 1930, 1931, and 1932.) This group, including the *Dividend*, *Lakeview*, *Orient*, *Manx*, *Little Manx Fraction*, *Dividend Fraction*, *California*, *Bulls Eye Fraction*, *Treasury*, and *Whistler*, has been acquired by the Northern Syndicate, Limited, of Calgary, and later the Osoyoos Mines, Limited, of Calgary, was formed. Work done in 1933 consisted of driving the No. 2 *Dividend* tunnel ahead; cleaning out and reconditioning the second tunnel on the *Lakeview;* and extending the *Manx* upper tunnel; besides thoroughly sampling the property. J. O. Howells, of Calgary, was in charge of the work.

Several hundred feet of tunnels, upraises, shafts, and open-cutting have been excavated on the *Lakeview*, and, on the surface, indications of a mineralized area extend for 500 by 200 feet in a south-easterly direction to the contact of the Palæozoic rocks and the granodiorite. In the cuts and shafts at different elevations there appear to be definite beds of oxidized material of variable thickness which strike north and dip flatly to the west. Underground the mineralized bodies, which in places are 5 feet wide, although badly faulted and warped, suggest the same attitude. In the lowest crosscut (caved and not examined) no ore is reported to have been found, and it seems likely that these workings have not been driven far enough to the west to intersect the dip of the lead, or that the ore-bodies may roll and be faulted, retaining the same horizon. Insufficient work has been done to prove the theory that there are several parallel mineralized beds and more exploration appears warranted. The ore-minerals are pyrite and chalcopyrite, and former dump samples showed appreciable gold values.

The formation in which the ore occurs in the *Lakeview* is a highly altered dense-green or grey-coloured rock often well mineralized with pyrite and tentatively assigned by R. A. Daly to the Upper Palæozoic. The granodiorite, or its gneissic derivative, invades these rocks to the south-west. In extending No. 2 tunnel on the *Dividend* more ore was found.

On the *Little Manx Fraction* the upper tunnel was extended 25 feet, making it 200 feet long, with a 30-foot offset. At the mouth of the tunnel a narrow quartz vein, from 2 to 6 inches wide, striking east (mag.) and dipping from 45° to 70° north, fissures the limestone (Palæozoic (?)) and along the contact numerous small lenticular bodies of garnetite occur mineralized with pyrite, chalcopyrite, and malachite. The tunnel follows the foot-wall of the quartz vein for about 150 feet, where a south-west fault causes a 30-foot displacement to the south. Beyond the fault a massive siliceous band of pyrite about 6 feet wide follows the quartz, and samples across this, according to the management, assayed: Gold, 0.50 oz. per ton. A crosscut east of the fault into the hanging-wall should intersect the continuation of this ore-body. The tunnel has been driven in the face of a bluff and possibly 200 feet of backs overlie this development on the dip of the vein.

There has been some trouble between the present company and Charles Antonson and Dave Loney, of Oroville, Wash., who held an option from the original company for several years, but it is expected this will be cleared up shortly. During the winter a car-load of ore supposed to have been mined from the *Dividend* was shipped by Loney and Antonson to the Tacoma smelter.

Morning Star (Fairview) Gold Mines, Ltd.

(*See* Annual Reports for 1896, 1897, 1901, 1903, 1904, 1914, 1920, 1923, 1924, 1927, 1928, 1930, and 1932.) According to the statement made in lieu of prospectus by this company, eleven claims have been acquired—namely, *Morning Star, Black Diamond, Evening Star, August, Ocean Wave, Morning Star Fraction, Evening Star Fraction, Black Diamond Fraction, Princess, Duchess*, and *Star*. In addition, the *Ontario* and *Rattler* have been purchased from the Federal Mining Company. All the claims are situated about 2½ miles by road south-east of Oliver. The company is capitalized for 3,000,000 shares: 750,000 shares and $25,000 cash to be paid for the above property. Directors are: R. L. Clothier, mine manager, of Penticton; G. F. Strong, M.D., F. B. Monteith, G. E. Housser, R. H. Tupper, C. C. I. Merritt, and A. H. Ray, all of Vancouver.

About thirty-six years ago the *Morning Star* was operated by Steve Mangott and associates, and, according to reports, several hundred tons of comparatively rich gold quartz was mined

from the vein-outcrop near the present workings. This ore was crushed with stamps and amalgamated. Subsequent development, including sinking and drifting on the west vein and similar workings on the east or parallel vein, but not to the same depth, did not uncover ore of high enough value to permit shipping or profitable reduction by amalgamation. Since then, until the spring of 1933, when the present company was formed, nothing was done. After unwatering the west vein shaft and reconditioning the 100-foot level, R. L. Clothier sampled the vein and, according to his report, obtained a general average assay of: Gold, 0.2877 oz. per ton; silver, 1.17 oz. per ton, across drift-widths along a length of 180 feet. The first 35 feet of drift north of the shaft was not included in this average, due to the intense shearing and consequent intermixing of quartz and schist. In the face of No. 1 or 100-foot level a 29.5-foot crosscut has been driven from hanging to foot wall. A sample across 13 feet of quartz measured from the hanging towards the foot wall assayed: Gold, 0.66 oz. per ton; silver, 0.87 oz. per ton. A picked sample, heavily mineralized with pyrite and galena, assayed: Gold, 3.20 oz. per ton; silver, 4 oz. per ton; lead, 7.7 per cent.; zinc, 2.5 per cent. Another picked sample of pyrite from the crosscut assayed: Gold, 0.70 oz. per ton; silver, 0.70 oz. per ton. The better gold values are evidently associated with the galena.

Later the shaft was unwatered to the 200-foot level and samples taken at intervals assayed low in gold and silver. An upraise was driven from No. 1 tunnel to the surface, about 50 feet south of the first crosscut, and some good ore, considerably faulted, was found. About 1,586 tons of ore was stoped and shipped to the smelter from above a sub-level commenced a short distance south of the first crosscut and driven 165 feet south, about 25 feet above the No. 1 level. New development consists of extending the No. 1 level for a total distance of 405 feet, or 185 feet beyond the first crosscut. From this level two upraises have been put in—one 350 feet north of the shaft, 20 feet high and containing 12 feet of quartz, 6 feet of which carries about 0.50 oz. gold per ton, according to the management, and the other raise, 50 feet south of this, has developed 10 feet of quartz averaging 0.24 oz. gold per ton. From the No. 2 or 200-foot level, which was extended a short distance, a diamond-drill hole bored east cut a 4-foot vein at 158 feet. The results of this sample are not at hand. An upraise driven between the No. 2 and No. 1 levels made a connection a short distance south of the first crosscut. For some distance below No. 1 level a considerable amount of mineralization was found, and later sub-levels will be driven from the raise to explore this.

It is the opinion of the management, who have employed C. C. Starr to geologically examine the mine, that finding ore in the new No. 1 tunnel raises north of the first crosscut, and also in the collar of the No. 2 tunnel raise, suggests the possibility of an ore-body raking flatly down to the south from a point above the No. 1 raises, instead of from the south down to the north. Only low-grade ore was found on the No. 1 level from a short distance north of the first crosscut. The warping and faulting of the schists has evidently been responsible for the richer ore-deposition and will play an important part in the future ore developments. The granite-contact represented by finger-like offshoots lies a short distance to the west of the workings. The veins occur in the quartzite-schist.

The claim map of this camp shows plainly the direction of the vein-strike, and it will be seen that the centre of the vein-curve lies on the *Ontario*, indicating a warping of the schists between the *Morning Star* and *Silver Crown*. Since similar conditions elsewhere have been responsible for ore, it appears likely that this section has potential possibilities.

The old head-frame over the shaft was renovated, and additional construction included the building of a dry, bunk-house, cook-house, blacksmith-shop, warehouse, general office, assay office, staff-house, and ore-bin at the mine, and ore-loading platform at Oliver. Machinery installed included: Two Holman compressors, 303 and 160 cubic feet capacity, driven by a vertical 60-horse-power Ruston-Hornby engine; a horizontal Ruston-Hornby 30-horse-power engine, driving the hoist, which is designed to lift a 2-ton load; a No. 4 Ingersoll-Rand steel-sharpener; and a Holman oil-furnace for steel-heating. A 6 by 4 by 6 Smart-Turner duplex pump of 60 to 78 gallons per minute capacity is used to unwater the shaft. Three Holman machines, one stoper and two drifters, and three Hudson 16-cubic-foot cars are used in the mine. A 6-horse-power engine drives a travelling sorting-belt on the surface near the shaft-collar. About twenty-five men are employed and two shifts are worked in the mine. Trucks haul the ore from the mine to the railway at Oliver.

Fairview Amalgamated Gold Mines, Ltd.

(*See* Annual Reports, under *Flora*, for 1899, 1900, and 1901.) This company, with head offices in 605 Stock Exchange Building, Vancouver, has bonded or made other arrangements to option, according to the management, the following claims, situated about 6,000 feet north-west of the *Morning Star:* The *Flora, Gold Bag, Comet, Western Girl, Oro Bastante, Western Hill, Manton Fraction, Virginia, Roberts, Baden Powell, Buller* (Lot 554s), *Fairview, Haligonian, Shamrock, Randolph, Homestake,* and Lot 6895, lying in a block to the north-west and adjoining the *Stemwinder* group.

Former development, most of which was done on the *Flora*, comprised a tunnel (elevation 2,750 feet) 820 feet long on a quartz vein from 1 to 8 feet in width and striking N. 50°–70° W. (mag.) and dipping from 22° to 30° to the north-east. The vein conforms to the dip and strike of the schists. A crosscut tunnel about 500 feet long has been driven to the south-west from the main drift. About 171 feet of this crosscut is in schist and the remainder is in granite. Some narrow, sparingly mineralized quartz veins were intersected in the schist and on the contact, and another one was found fissuring the granite in the direction of the tunnel. About 80 feet of well-mineralized quartz 6 feet wide occurs in the main drift north of the crosscut, containing, according to the management, some attractive values in gold. This ore has been formed where the schistose rocks bend to the west and apparently roll on the dip. Sections, containing ore, such as this one are typical in the Fairview camp and are worth exploring by upraising and sinking to ascertain the rake, etc. A contract for 100 feet of crosscut to be driven north was let late in 1933 with the idea of intersecting at depth a parallel vein uncovered on the surface. This tunnel encountered a tongue of granite which outcrops a short distance to the north-west of the main drift. It seems likely that the schist will be again found in this direction. About 225 feet higher and several hundred feet to the north-west of the main tunnel, another drift has been driven for 360 feet (?) on a parallel quartz vein varying from 2 inches to 2 feet in width and containing concentrations of pyrite and galena in the main fractures and faults. Another strong parallel vein-outcrop 200 feet north was traced on the strike by open-cutting for about 1,500 feet on to the *Western Hill.* A 40-foot shaft on the same vein uncovered a considerable amount of oxidized quartz. On the *Virginia*, which lies about 1,500 feet north-west of the *Flora*, a 100-foot inclined shaft has been sunk on a section of the vein, from which it is reported several tons of high-grade gold ore was shipped in the past. A dump sample assayed: Gold, 0.30 oz. per ton; silver, 5 oz. per ton. The relation of this dump to the main *Flora* vein is not definitely proven and it seems likely that there are three separate parallel fissures. A surface survey of the outcrops, paying particular attention to locations where the vein curves off the strike, is recommended. The ore-minerals are chiefly pyrite, with lesser quantities of galena and sphalerite in a quartz gangue. The formations, chiefly quartzite-schist, have been invaded by offshoots from the granite batholith.

Baloney-Ballyhoo-Fair Prospect.

This group, owned by Steve Mangott, J. O. Steeves, and associates, of Oliver, is situated on Dominion mountain, about 2 miles in a southerly direction from the *Flora*, near the head of Tinhorn creek (*see* map). Development-work consisting of various open-cuts done near the summit many years ago uncovered a quartz vein 1,000 feet in length and varying from 2 to 20 feet in width, lying in and conforming to the strike (easterly and westerly) and dip of the schists. Average samples from the cuts were low grade in gold and silver. The mineralization observed was chiefly pyrite, galena, and sphalerite. On these claims the same strike and dip conditions as those found to contain "pay-ore" in other parts of the Fairview camp may be looked for. The topography in this locality will permit exploration by tunnelling.

Mak Siccar Gold Mines, Ltd. (N.P.L.).

(*See* Annual Reports, under *Tiger*, for 1928, 1930, and 1931.) This company, with head offices at 124 Pacific Building, Vancouver, which was formed to take over the Tiger Gold Group Syndicate holdings, is capitalized at 750,000 shares of no par value, with 300,000 shares issued, of which 200,000 are held in escrow. The following are directors: A. T. Miller, president and managing director; R. Kerr and O. J. Fitzgerald, of Vancouver; J. Gaul and P. J. Snyder, of Bellingham, Wash.

The property has an area of 625 acres and includes the *Kruger, Iowa, Strathcona, Kitchener, Eclipse Fraction, Ellen, Otter, Bobs, Buller, Crown, French,* and *Apex* claims, situated about 3½ miles south of Similkameen, on the Great Northern Railway, close to Manery creek (*see*

map). The claims were not examined during 1933. The following is a progress report submitted to this office at the end of 1933:—

Progress Report, Period May 1st to December 31st, 1933.—The taxes on the Crown-granted claims have been paid to date and sufficient work done on them during the period to exempt same from taxation for another year. The other mineral claims are in good standing.

A small crew has been continuously engaged on the property since early in July, following out the suggestions of B. W. W. MacDougall, consulting engineer; this work being mainly of an exploratory nature, opening up some promising showings. Drifting to the extent of 120 feet was carried out on the *Buller* claim, besides some shaft-work, trenching, and prospecting.

Some 28 feet of drifting was done on a stringer or narrow vein located on the trail near the main *Buller* workings. An average of this lead from five assays gave values for shipment and could be sorted easily to give higher values. This showing is very promising and warrants attention. By sinking here this vein could be opened up to best advantage.

At the entrance to the No. 2 level of the *Buller* claim, where high values have been obtained, a quartz lead is exposed 4 feet in width. A start was made at sinking a shaft, and across 1 foot of the lead (foot-wall side) assayed 8.40 oz. of gold and 4.80 oz. of silver per ton, with copper values in addition; this is equivalent to 2.1 oz. of gold and 1.2 oz. of silver per ton across the full width of 4 feet. This ore will prove to be valuable shipping-grade. A crosscut has been driven to the west under the rock-slide for 50 feet to pick up this lead, but it is not yet completed. This crosscut went through a narrow stringer which assayed 4.70 oz. of gold per ton and carried 15.70 per cent. of copper. This stringer was 6 inches in width. The high gold values are apparently associated with the chalcopyrite.

The No. 2 level is being driven on the vein to a point just east of the portal of the level; 40 feet has been driven to date, with approximately 15 feet to go to reach objective. This vein is 2½ feet wide and is well mineralized, and an assay of 1 oz. of gold per ton across 2½ feet obtained.

A very promising ore-shoot has been encountered at the top of the shaft in No. 1 level of the *Buller* claim. This ore-shoot is 4½ feet wide and consists of 2½ feet of solid sulphides on the hanging-wall and 2 feet of a mixture of sulphides, carbonates, and quartz on the foot-wall side of the vein. Across the full width of 4½ feet gave assays of 1.66 oz. gold and 0.84 oz. of silver per ton. A trial shipment from here will be made early in the year (1934), provided the steep trail down to the highway is passable for pack-horses.

A showing on the north-west side of the group of claims, 20 feet from the boundary-line of the *I.X.L.* claim, was uncovered, and across 2½ feet gave an assay of 0.44 oz. of gold per ton, with small copper values; no time was available to open up this showing.

A granite-contact on the upper sector of the property (*Ellen* and *I.X.L.* claims) has not yet been investigated, but undoubtedly justifies attention later.

The underground workings of the *Buller* claim have opened up a wide quartz lead with exceptionally well-defined walls, having a few inches of gouge on the foot-wall. The sulphides generally have been oxidized, leaving mainly carbonates and the values leached to some extent. At depth it is expected that the sulphides will be found in an unaltered state. To avoid expensive sinking operations it was planned to drift on the main lead at a lower elevation. On the *Kitchener* claim, at an elevation of about 3,400 feet, a start was made to intercept the main lead by sinking an open-shaft in the slide-rock. The shaft is through 24 feet of overburden and slide-rock, and when bed-rock is reached a crosscut will be driven to the main lead and another lead which is exposed on the *I.X.L.* claim. This operation, however, would not be advisable until a power plant is available. It is planned to have a power plant located near this sector; a portable unit would be the best type for this operation.

The operations to date have been carried out by hand-drilling in order that the fullest information be derived before deciding on the best location for power plant and main camp.

The veins on this property are similar to those found in the Fairview camp and, judging from former examinations made, further development is warranted. If a large tonnage is developed, connection can be made to the railway by means of an aerial tram about 1½ miles long.

Tinhorn.—Reports on these groups (*see* map), situated along the east side of this belt, can be seen in the Annual Reports for 1897, 1898, 1899, and 1900. No work or examinations have been made since.

Big Horn (Horn Silver). (*See* Annual Reports, under *Horn Silver*, for 1917 to 1929.) Since these reports were written the mine and mill have been dismantled and very little of value for mining or milling purposes remains. According to newspaper advertisements, the Madison Oils, Limited, has taken a controlling interest in the *Horn Silver* mine. Before commencing development it may be advisable for the company to read the former Annual Reports of this Department, especially that for 1928, wherein a geological report by Alfred R. Whitman appears. The gold values present will assist the operation.

Torres. This group of twelve claims, situated close to the old Fairview–Cawston road summit and about 6 miles north-east of the latter village, is owned by W. Long, L. V. Newton, and associates, of Penticton. Numerous open-cuts, shallow pits, and an inclined shaft 30 feet deep have been excavated along a distance of 500 feet

on a quartz vein which varies from 2 to 8 feet in width. The vein strikes N. 54° E. (mag.) and dips 44° north-west. Several cross-faults have displaced the shaft-vein uphill to the south-east. Quartz float is reported to have been found along the strike for a distance of over a mile. The fissure occurs in a fine-grained grey granite. Since the property was examined the owners claim to have found two veins a short distance apart, one between 3 and 4 feet wide and the other 6 feet wide, containing pyrite and galena. A picked sample assayed: Gold, 8 oz. per ton; silver, 80 oz. per ton. A chip-sample 6 feet wide across the cut assayed: Gold, 0.24 oz. per ton. A selected sample from the shaft assayed: Gold, 0.90 oz. per ton; silver, 11.5 oz. per ton. The veins found on this group are typical of those found elsewhere in this belt and many sections of the vein are low grade. Being close to transportation, electric power, and the use of water from Blind creek, they appear worthy of further exploration.

Horseshoe and Standard.

These groups of claims lie about 1½ miles slightly west of north from the *Torres* and adjoin the Grandoro Mining and Milling Company's ground on Oro Fino mountain. The owners of the *Horseshoe* group are H. W. Foreman, W. A. Roadhouse, and A. E. Patton, of Penticton, and the owners of the *Standard* are A. S. Hatfield and associates, of Penticton.

Exploration by means of open-cuts and shallow pits has uncovered a series of quartz veins varying from 2 to 6 feet in width and striking north-east and north (mag.). Insufficient work has been done to prove the value of these properties, but since they are typical of the district—that is, with good widths and being very persistent in length, with occasional fault sections of high-grade ore—they are worthy of development. The ore-minerals are pyrite, galena, and free gold; the country-rocks are granite and quartzite-schist. The topography is such that the veins can be developed by tunnelling, and water for mining purposes, most important in this area, can be obtained in Ripley lake adjoining the property. A rough road has been built from the Fairview–Cawston road on the east side of the summit to Ripley lake.

Grandoro Mining and Milling Co., Ltd.

(See *Oro Fino* and *Independence* in Annual Reports for 1896, 1898, 1920, 1922, 1923, 1930, 1931, and 1932.) This private company, under the direction of W. R. Somerville (head office, Penticton), with 100,000 share capital, has been financed by the Colonel Victor Spencer-David Sloan interests, of Vancouver. The company's ground, including the *Oro Fino* and *Independence*, totals twenty-four claims on Oro Fino mountain, about 25 miles by road south-west from Penticton. A 36–42-horse-power semi-Diesel Petter engine and an 8 by 6 Gardner-Denver compressor, with an auxiliary 1½-horse-power paraffin Petter starting-engine, have been installed. Two oil-tanks having a total capacity of 1,200 gallons, ore-bins, blacksmith-shop, engine-house, etc., have been built on the west slope of the hill and new bunk-house, cook-house, and general living-quarters have been built on the east slope of the hill close to a water spring. The extension of what is called the *Independence* tunnel on the west slope developed an ore-shoot about 90 feet long between two faults dipping 45° and 60° to the south-west and south. From a centre section of this shoot a winze was sunk for 240 feet. The vein, varying in width from 3 to 6 feet, dipped about 45° for 50 feet and then flattened out, the difference in elevation between the tunnel and the bottom of the winze being 60 feet. Numerous faults were encountered in these workings, dipping generally in a south to south-westerly direction, and the vein was badly block-faulted. In spite of this, the management expects to mine several hundred tons of comparatively high-grade gold ore from this section. Besides 1,000 tons or more of milling-ore on the dump, 220 tons of ore averaging 1.77 oz. gold per ton was shipped to Trail. The ore-minerals are pyrite with lesser amounts of galena and occasionally free gold. An analysis of the ore is as follows: Sulphur, 4.5 per cent.; silica, 83.8 per cent.; iron, 6.2 per cent.; lime, 1.4 per cent.; besides gold and a small amount of silver. The lower tunnel at 4,883 feet elevation has been driven about 300 feet in a south-easterly direction, and it will probably be extended through the hill to connect with the downward extension of the vein found in the *Oro Fino* tunnel at 4,970 feet elevation. Some good values in gold over 4-foot widths have been found in this *Oro Fino* tunnel. A diamond-drill hole bored several years ago about 240 feet in a southerly direction from the *Oro Fino* tunnel intersected the vein at 292 feet. Values and vein-widths are not recorded. Although the veins on the *Oro Fino* and *Independence* are slightly different in strike, the general direction is north-easterly, with a dip on the former vein to the south and on the latter, apparently in the opposite direction. The veins are about 380 feet apart, and it seems likely that they are parts of the same vein that has been distorted by some deep-seated igneous agency which

has caused extreme faulting and subsequent enrichment. The formations in this area, named by Dr. Bostock, the metamorphic complex, are composed of bands and detached areas of rock similar to the quartzite-schists and a great number of small intensive igneous bodies varying in composition from hornblende-rich gabbros and diorites to granodiorites. The whole of the complex is much recrystallized and metamorphism is so intense as to render the original form of rocks open to question. W. Somerville is managing the property.

Twin Lakes Gold Mining Co., Ltd. (N.P.L.).

(*See* Annual Reports under: *Juniper* and *Huntsman* group, 1924; Summit Section, 1928; B.E. Mining Company, Limited, 1929, 1930, and 1931; Parvenu Mines, Limited, 1932.) This company is capitalized for 3,000,000 shares, no par value. H. Leir is president and M. S. Peacock and W. A. Woodward, secretary-treasurer and directors, are of Penticton. This property, formerly owned by the Parvenu Mines, Limited, includes twenty claims and adjoins the *Grandoro* on the north and north-west. Arrangements have been made with the Colonel Victor Spencer-David Sloan-Ben Smith interests, of Vancouver, to finance exploration.

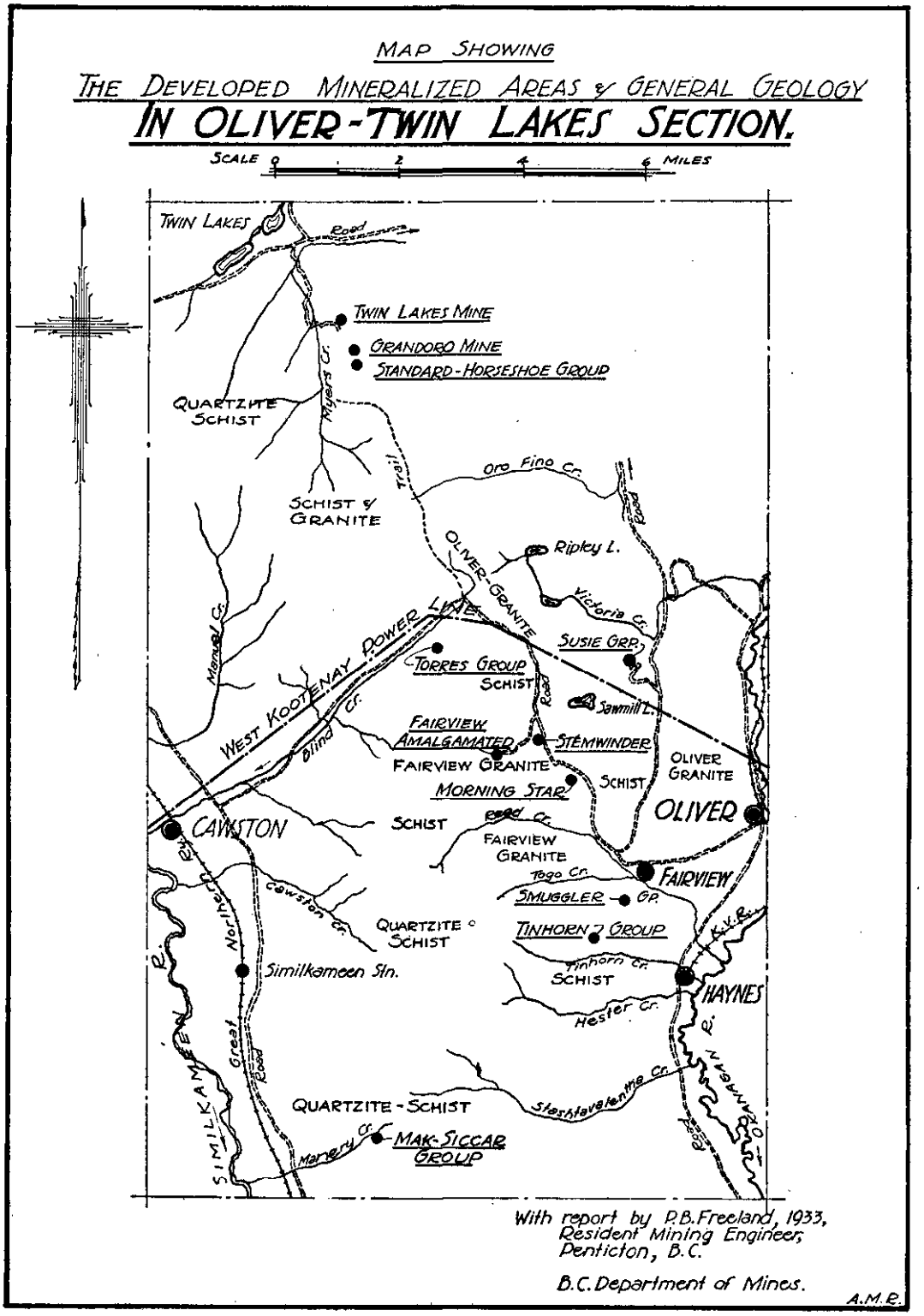
Developments consist of a new crosscut tunnel 350 feet long (January 20th, 1934), which was started 300 feet south-west of the mill and about 400 feet lower in elevation than the *Summit* shaft. At the end of 1932 the ore in the bottom of the latter shaft had been displaced by a 63° normal fault. Sinking was continued down the fault for about 35 feet, and the vein, 7 feet wide, was found in the hanging-wall. Samples taken from this ore by the management assayed about 5 oz. in gold per ton. The drifts from the shaft have been extended south a total distance of 43 feet and 50 feet respectively and have been connected by a raise. New construction includes: Bunk-house for fifty-two men, cook-house, assay office, power-house, mill building, and head-frame at *Summit* shaft. Machinery installed includes: 100-horse-power Petter engine, a 12 by 12 Gardner-Denver compressor, a 20-k.w.a. generator, and a hoist at the shaft. The new mill has been built alongside the old one, and the machinery, not yet installed, will include: Jaw-crusher, crushing to 1 inch; Bryan-Chile mill, 55 tons (from *Pioneer* mine), plates, blankets, and Wilfley table. A water-tunnel in the gulch below the camp obtained a flow of water sufficient, according to the management, to supply a 60-ton mill. The mill-heads will probably average 0.60 oz. gold per ton. The ore is to be crushed to 50-mesh, as that has been found to be an economical size; the tailing-loss being just as large from material crushed to 60 and 100 mesh. Probably the tailings will be cyanided later. The road up to the mine has been much improved by aid from the Department of Mines and a new road built from the mill to the *Summit* shaft. About forty-six men are working on three shifts in the new crosscut tunnel. Several shipments of ore were made to the smelter.

Oliver.

(*See* Annual Reports for 1896 and 1932, under *Victoria*.) This group, consisting of the *Oliver*, *Oliver Fraction*, and *Silver Spoon* and adjoining the *Susie* group to the north, is owned by Al. Carmichael, K. D. Woodworth, *et al.*, of Oliver. Development-work done during 1933 consisted of driving an open-cut from the east and taking an 8-foot lift 30 feet long from under the old tunnel approach; also open-cutting some east-west stringers. Apparently the vein, which strikes N. 24° E. (mag.), on the surface has been faulted to the east, and the ore, from 2 inches to 2 feet wide at the tunnel-mouth, is enriched in the fault-planes. About 100 feet south of the 8-foot tunnel an old inclined shaft of unknown depth has been sunk on another fault. To the south-west of this a considerable amount of quartz float was seen, but no vein was found in place. The vein occurs in granite and the ore-minerals observed were pyrite, galena, and some free gold. A shipment of 3 tons of sorted ore was made to the smelter.

Hedley Gold Mining Co., Ltd. (Nickel Plate).

(*See* Annual Reports for 1917, 1918, 1919, 1923, 1927, 1929, and 1930.) The Hedley Gold Mining Company's holdings were optioned to J. W. Mercer, of New York, in 1932. In July, 1933, the Kelowna Exploration Company, Limited, was formed to take over the property. The name "Kelowna," meaning grizzly bear in Indian, was chosen for the name of the company. Exploration-work continued in the upper levels of the *Nickel Plate* and *Sunnyside* claims, and a total of 3,300 feet of drifting, crosscutting, and raising as well as 2,930 feet of diamond-drilling was done. From August to December 15th, twenty-four men were employed, besides four diamond-drillers, after which the crew was reduced to fourteen. Power was furnished by the Hedley hydro-electric plant on the Similkameen river. The underground work, supplemented by drilling, indicated a satisfactory amount of ore, but definite figures as to grade and tonnage are not yet



With report by P.B. Freeland, 1933,
Resident Mining Engineer,
Penticton, B.C.

B.C. Department of Mines.

A.M.E.

available. Paul Billingsley and Augustus Locke made an extensive geological survey of the upper part of the mine and a large part of the adjacent surface. The ore is found associated with an augite-gabbro dyke.

Stemwinder Mountain Mines, Ltd. (N.P.L.). (*See* Annual Reports, under *Whirlwind* and *Peggy*, for 1923, 1926, 1928, 1930, and 1932.) This private company, with headquarters in Room 14, 342 Pender Street West, Vancouver, has a bond on the *Whirlwind* group of claims, situated on Stemwinder mountain, about 2 miles north-west of Hedley, between Hedley (20-Mile) creek and the Similkameen river. The former owners were Dan McKinnon, Ed. Baxter, and associates, of Hedley. A new frame camp was built about three-quarters of a mile from the workings and a water-supply piped to the cook-house. The old "go-devil" road was reconditioned to the mine.

Development consisted of driving the "Red tunnel" ahead a total distance of 140 feet. In this tunnel the ore (mixed sulphides and oxides) occurs in alternating bands and segregations varying from 1 to 6 feet in width, lying nearly flat in the limestone-beds. The ore-minerals are pyrite, arsenopyrite, and chalcopyrite in a siliceous gangue. Samples of the oxidized matter assay anywhere from 0.43 to 1.50 oz. gold per ton. The sulphides generally carry about 0.50 oz. gold per ton. About 300 feet ahead of the tunnel, a diamond-drill hole bored some years ago intersected 3.3 feet of ore assaying: Gold, 0.33 oz. per ton. Another diamond-drill hole about 150 feet north-east of the same tunnel intersected 1 foot of oxidized material assaying: Gold, 0.12 oz. per ton. This was adjacent to 1 foot of material which assayed: Gold, 0.50 oz. per ton. A further 1½ feet of oxidized vein-matter adjoining this assayed only a trace of gold. A drill-hole about 150 feet west of the tunnel struck ¾ inch of mineralization which assayed: Gold, 0.20 oz. per ton; silver, 0.20 oz. per ton; copper, 0.92 per cent. This hole passed through diorite from 330 to 363 feet; then mixed lime silicates in which the ore occurred at 398 feet. At 510 feet solid diorite was encountered. It seems evident that the limestone-beds in which the ore occurs have been intruded and warped by offshoots from the diorite batholith which forms the core of Stemwinder mountain. On the Hedley Creek slope some high-grade gold ore has been found under similar conditions on this company's ground. The claims are partly staked on the Indian reserve and full permission to operate has been obtained from the Indian Agent. Railway and road transportation, as well as the West Kootenay Electric Power line, pass within 2 miles of the property.

General.

A belt of country lying between Keremeos creek and Hedley, commencing a short distance north of Apex mountain (Independence) and following a hook-shaped line along the summit at the headwaters of Cedar creek, Olalla creek, and Bradshaw creek, warrants close investigation. The general geology of this area has been described by H. S. Bostock in the Geological Survey of Canada Summary Report for 1929, Part A, as follows: "Hedley district lies in an area of westward-dipping Triassic sedimentary rocks which have been intruded and almost surrounded by large bodies of igneous rocks of later Mesozoic and early Tertiary ages. Roughly, 6 miles to the east and separated from Hedley by large batholiths of these intrusives lies a section of other sedimentary strata, dipping steeply south-easterly and apparently of slightly greater age. Farther south-east lies an area of highly metamorphosed strata containing still older rocks, and to the east of this again, on the west of Vaseaux lake, the nearest outcrops of the gneissic rocks of the Shuswap terrain occur. The remnants of a once continuous blanket of sedimentary and volcanic strata of approximately Eocene age cover most of the bordering Interior plateau to the east, north, and west, and are sparsely patched over the higher ground in the vicinity of Hedley upon these folded and truncated strata and igneous bodies. An area of these rocks lies 3 miles north-west of Hedley. Thus Nickel Plate mountain stands in an area of the older rocks exposed by the erosion of a part of this blanket. It forms a part of the west limb of a large anticlinal fold whose axis strikes roughly north-south, and the east limb of which lies some miles to the east of the mountain, the continuity of the strata of the fold being broken by large bodies of igneous rocks located along its axis and about the west side particularly."

In the Apex basin the workings on the *Nelson* group of claims (*see* Annual Reports for 1922, 1924, and 1926) have uncovered lenses of gold-bearing arsenopyrite and pyrite up to 4 feet in width, in the highly altered sediments and brecciated volcanics associated with a gabbro dyke. At the headwaters of Cedar creek, on the *Star of Hope* and *Eclipse*, belonging to the Richter Estate, Keremeos, a considerable amount of mineralization in the volcanic breccia containing

bands of arsenopyrite has been uncovered. Values up to an ounce in gold have been obtained. At the headwaters of Bradshaw creek, on the old *Yuninan*, similar mineralization and high values in gold have been found. The old workings on these properties have by no means delimited the ore possibilities. The *Nelson* group may be reached in summer by a branch road from the *Nickel Plate* road, which ends about half a mile from the workings. The *Star of Hope* group is situated at the summit, about 6 miles by trail up Cedar creek. A trail 5½ miles long from Bradshaw's ranch leads to the *Yuninan* group.

COAL.

White Lake Collieries.

(*See* Annual Reports for 1920 to 1923, 1926, 1927, and 1931.) Tony Ambrosi, Joe Plate, and associates, of Penticton, sunk a 90-foot winze on a 50° dip from the old 550-foot tunnel on this property, situated at White lake, and a 4-foot seam of much cleaner coal was found on the way down. A considerable amount of this product is being sold in the Okanagan Valley with satisfactory results.

SIMILKAMEEN MINING DIVISION.

Gold Mountain Mines, Ltd.

(*See* Annual Reports, under *Pollock*, for 1909, 1910, and 1913. This company, with headquarters at 1104 Standard Bank Building, Vancouver, has a capitalization of 1,000,000 shares, par value $1. The directorate is Lieut.-Colonel J. P. Fell, president; W. E. Burns, K.C., W. W. Southam, G. A. Birks, E. F. Riddle, of Vancouver, and C. E. Wilson, of Victoria. Arthur Lakes is consulting engineer. The following claims are held under option: *Daisy No. 2*, *Daisy No. 44-S*, *Maple Leaf No. 43-S*, *Maple Leaf No. 2*, *Martin No. 45-S*, and *Pine Knot No. 46-S* from Victor Locke and Herbert Guernsey, of Penticton. The *Gold Mountain*, *Gold Mountain No. 2*, *Gold Mountain No. 3*, *Gold Mountain Fraction*, *Maple Leaf No. 3*, *Maple Leaf No. 4*, and *Dullemore Fraction* have been acquired by purchase. The *Minnehaha* is held under lease from the Crown.

On the *Maple Leaf*, where practically all development was done during 1933, a crosscut tunnel was driven 151 feet in an easterly direction; then 75 feet in a southerly direction, with an offset 45 feet to the west. Both the latter crosscuts intersected ore and a drift 75 feet long has been driven on a north-westerly and south-easterly strike connecting them. Indications of ore were found in a 15-foot winze, 55 feet in from the mouth of the main crosscut on the diorite-argillite contact, and 4-foot samples assayed: Gold, 0.15 oz. per ton and 0.14 oz. per ton. Beyond this, stringers of quartz calcite, pyrite, and arsenopyrite were found in the diorite striking east and dipping 40° south. After turning the crosscut to the south, much oxidized gangue-matter over drift-widths containing bands of arsenopyrite was encountered. Samples taken by A. Lakes over 3- and 4-foot widths assayed: Gold 0.28 oz., 0.08 oz., and 0.16 oz. per ton. Drifting for 70 feet on the shear-zone in diorite produced assays varying from 0.04 to 1.12 oz. gold per ton over widths from 1 to 5 feet, giving an average of slightly over 0.40 oz. gold per ton over 4-foot widths. On the surface, about 75 feet above and to the north of the tunnel, the shear-zone, varying from 2 to 12 feet wide, has been traced by open-cutting for about 700 feet. Future exploration is to consist of diamond-drilling beyond the north drift-face, also vertically above and below the main crosscut and beyond the south drift-face to ascertain continuity, widths, and values. The shear-zone drifts underground are to be extended north-west and south-east on the strike. Advice from the management states that the ore in the north-west face is in the form of a wedge, being 3 feet wide at the top of the drift and 5 feet or more at the bottom, indicating the possibility of a lens widening with depth.

On the *Pine Knot*, *Daisy*, and *Martin*, work done formerly consists of crosscuts, tunnels, and shafts on a quartz vein in the argillites striking south-west, dipping about 70° north-west, and approximately 1,200 feet to the east of the *Maple Leaf* workings and 550 feet lower. This vein, varying from 8 inches to 9 feet in width, has been traced on the strike for a distance of 600 feet, and it appears to be associated structurally with a greenish andesitic dyke. Occasional samples taken over 1-foot widths in the south tunnel varied from 0.12 to 1.20 oz. gold per ton.

The strong shear-zone which has been developed on the *Maple Leaf*, containing sections of pay-ore over minable widths, warrants further exploration. If the upper *Maple Leaf* workings show promise of continuity a crosscut will be driven from below and to the south. A narrow steep road was built from the Great Northern Railway up to the proposed site of the crosscut.

A log camp was constructed near the old cabins close of Henry creek and a portable gas-compressor and all equipment for extended development is on the ground.

Hedley-Sterling Gold Mines, Ltd.

(*See* Annual Reports, under *Patsy*, for 1927, 1928, and 1931.) Developments on this company's holdings, which includes the *Patsy* group on Sterling creek, owned by Dan McKinnon, of Hedley, were financed by the Canada Lode Gold Mines, Limited, Victoria. The upper crosscut was driven a total distance of 120 feet, 50 feet below the old cut. About 2 feet of oxidized vein-matter was struck 95 feet from the portal. This carries low values in gold. From 111 feet in to the face a 9-foot shear-zone containing bands of arsenopyrite, and probably the downward extension of the ore in the upper cut, was intersected. Samples taken by the management assayed about 0.45 oz. gold per ton. About 75 feet below, an old crosscut tunnel 15 feet long opened up 3½ feet of mineralized shear-zone matter. Another old crosscut about 30 feet lower developed 9 feet of oxidized material containing quartz and bands of arsenopyrite. About 75 feet lower, near the creek, the new crosscut was driven about 196 feet. At 80 feet from the portal a shear-zone 9 feet wide was found containing bands of pyrite, arsenopyrite, and chalcopyrite in a gangue of cherty greenstone and quartz. Four samples taken in 2- and 2½-foot sections across 9 feet on the south side of the tunnel carried only traces in gold and silver. A picked sample of pyrite and arsenopyrite 4 inches wide from the roof of the tunnel assayed: Gold, 0.30 oz. per ton; silver, 0.10 oz. per ton. The manager, Dan McKinnon, stated that much heavier mineralization occurred at the bottom of the drift. The shear-zone strikes north (mag.) and dips 63° east.

Unless some unforeseen faulting occurs, there are four shear-zones dipping from 40° to 70° to the east into the hill and towards the diorite-contact and striking northerly. Possibly the two shear-zones between the upper and lower tunnels may be offshoots from the upper one, and the lower crosscut will not intersect them until it reaches the main body. Development in the Gold Mountain Mines, Limited, property, about 2 miles east, has shown that the shear-zones occur not only in the sedimentary and volcanic rocks, but also in the diorite, and are stronger in the latter, so that on Sterling creek exploration may have to be extended into the diorite. Values are generally erratic in these shear-zones, and when drifting on the strike careful sampling every few feet should be resorted to. A small Diesel engine and compressor were installed on the property below and across Sterling creek from the lowest crosscut. An extension of the road was built for about a mile beyond the camp to the mine.

Newton Creek.

This group, comprising ten claims recorded as *Newton No. 1* to *No. 10*, owned by W. R. James and associates, of New Westminster, is situated on Granite and Newton creeks, about 4½ miles up-stream from Granite creek. The claims start at Cameron's cabin, including the *Vera No. 1* claim, once held by the Coalmont Gold Mines, Limited (Annual Report, 1929), and thence in a south-westerly direction towards Newton creek. Exploration consisted of open-cutting an oxidized shear-zone for a distance of 3,000 feet, in which some low values in gold were found. The zone appears persistent enough to warrant diamond-drilling, and this is to be undertaken by the owners in 1934. On one of the claims on Newton creek, owned by E. T. Salmon, 2564 Oxford Street, Vancouver, some coarse gold associated with quartz was found in the creek-bed. This is surmised to have come from an 8-foot quartz vein in the vicinity. Diamond-drilling will also be done on this in 1934. The *Dora* (Annual Report for 1929), once operated by the Coalmont Gold Mines, Limited (now defunct), lies to the south-east of the *Vera No. 1*, on which a considerable amount of work was done on a strong quartz vein. Some high, though erratic, gold values were found. Exploration will continue under the management of E. T. Salmon.

The rocks in which these veins occur are correlated as Triassic and include andesite, breccia, limestone, and argillite. The latter sediment appears to be more favourable and contains high-grade, though narrow, gold-quartz veins in some localities. Granite creek produced about $100,000 a mile in placer gold which was generally well worn and possibly transported into the narrow canyons by glacial agencies. The source of this gold, possibly still in place and not entirely eroded, has never been found.

Cousin Jack.

(*See* Annual Reports for 1901, 1905, and 1908.) This group of nine claims, about 2 miles directly west of Manning, on the Kettle Valley Railway, on the Elliott Creek slope of Spearing mountain, includes the *Cousin Jack*, *Yankee Girl*, *Ottawa*, *Homestead*, *Canadian Girl*, *Florence*, and *Wisconsin*. It has been acquired by Jack Osborne and associates, of Tulameen and Blakeburn. Development-work was done on

certain claims of this group prior to 1901, and from then spasmodically until 1933, when the new owners cleaned out the workings and, according to reports, found five parallel veins within a distance of 2,400 feet, striking north-west and dipping about 75° south-west into the hill, with a difference in outcrop elevation of approximately 200 feet. According to a plan, an old crosscut tunnel, now reported to have been driven 300 feet at an elevation of approximately 4,600 feet, will intersect the downward extension of these veins, if continuous, at a depth on No. 1, 100 feet; No. 2, 125 feet; No. 3, 250 feet; No. 4, 265 feet; and No. 5, 325 feet, at a distance in from the portal of 600 feet, 1,200 feet, 2,200 feet, 2,400 feet, and 3,000 feet respectively. No. 1 vein is 4 feet wide and has a shaft of unknown depth sunk on it. No. 2 vein is 4 feet wide and contains some galena. No. 3 vein is 2 feet wide, mostly quartz, and a 75-foot tunnel across it. No. 4 vein is reported to be 6 feet wide and contains values in gold, silver, lead, and zinc in a quartz gangue, amounting to $37.66 per ton. A 75-foot crosscut tunnel has been driven through this vein close to the surface. About No. 5 vein there is no record of widths or values. The veins occur in and conform to the bedding of the schistose rocks, which are assigned by Camsell to the Tulameen series (Triassic (?)). Other similar types of veins are found on the *Ottawa*, about 4,000 feet west of the above outcrops, and may be an extension on the strike. When this area was visited in 1922 a cursory examination was made of the *Cousin Jack* group, and although the workings were caved the amount of oxidation was impressive. Samples taken by the Provincial Mineralogist in 1901, presumably over a 6-foot width, assayed: Gold, 0.12 oz. per ton; silver, 0.60 oz. per ton; so it seems likely that recent samples taken by the owners included fairly high percentages of lead and zinc. The latter mineral apparently carries the gold, because all samples containing a high percentage of zinc are correspondingly high in the precious metal. The attention of those interested has been called before to the strong indications of mineral following the contacts of the Otter, Boulder granite, and Eagle granodiorite, and the Tulameen series of rocks (*see* Camsell's map 46A), which make their appearance on Rabbitt mountain, Spearing mountain, and at Law camp, as well as in other sections throughout this region that appear to warrant some exploration.

Railway transportation is comparatively close.

Placer-mining.

E. T. Salmon and J. Barker Leases.—These leases are situated on Cedar creek, which flows into the Tulameen river from the south about 1½ miles up-stream from Tulameen village. Two dams were built across the creek, and by means of a high ditch sufficient water was obtained for ground-sluicing. Some coarse gold and platinum weighing 2, 3, and 4 pennyweights were recovered amongst finer dust.

Sootheran Leases.—These leases, staked on the Tulameen river a short distance below the mouth of Eagle creek, were worked by twelve men. A considerable amount of gold and platinum was recovered, but exact data on the amount are not forthcoming. The owner, Garnet Sootheran, permitted these men to keep whatever they recovered.

International Placers, Ltd.—This private company, with head offices in 716 Hall Building, Vancouver, was formed to operate the *Swan* lease No. 143 on Granite creek and lease No. 144 on the Tulameen river, just below the bridge at Coalmont, owned by W. H. Holmes, of Coalmont.

It has been a theory for many years that Granite creek originally flowed in the direction these leases are staked, or nearly due north, instead of in its present channel to the north-east. In the workings of the *Swan* lease the old blocked channel is said to be lying between two canyon-walls trending north and south; hence the theory. Bed-rock was found below the road near Coalmont, with rim-rocks of sandstone on each side. Work done at this end within the past few years produced some good values in fairly coarse gold. The present company is drifting from both ends and, according to reliable reports, "pay-dirt" in the *Swan* workings is averaging about $1 a cubic yard. K. B. Gillie has taken charge of the property.

Siwash Creek.—Siwash creek, flowing into Hayes (5-Mile) creek, north-east of Princeton and about 3 miles west of Jellicoe, on the Kettle Valley Railway, drains an area from the north about 20 miles long and 6 miles wide. Over a period of years individual placer-miners have found small lots of comparatively rough-edged gold both in the creek and along the benches. During 1933, Lohse, J. Cole, and T. C. McAlpine, of Princeton, installed a Scandia semi-Diesel 20-horse-power engine and a Fairbanks pressure-pump with a capacity of 400 gallons per minute at an elevation of 280 feet. They hydraulicked a 50- by 75-foot cut on a bench about 10 feet

above and on the west side of the creek on the *Holden* lease, about 7 miles up from its mouth, and recovered values, according to their estimate, of $3 a cubic yard. There is no doubt that there are several similar benches between an elevation of 10 feet and 50 feet above the creek that have all the appearance of being old-channel remnants with considerable yardage possibilities. Numerous pits and cuts have been put down between Teepee and Galena creek and north in various places and colours in gold found. Judging by the work done, there appears to be a likelihood of encountering a fairly large percentage of glacial boulders, so that if hydraulicking operations are contemplated it will be essential to have proper tailing-disposal. There is a possibility of damming the waters of Galena creek about 3 miles back from its confluence with Siwash creek, where there are some small lakes about 500 feet higher than the benches (according to the topographical maps), which would give a satisfactory head. Before the installation of any plant it is advisable to churn-drill or sink shafts on the potential gravel area and thoroughly test the possibilities of the ground.

General.

According to reliable reports and due to the increased value of gold, further testing of the Tulameen and Similkameen gravels will be done during 1934. The reconsideration of the possibilities of known areas that in the past did not contain high enough values to warrant mining may be made, and if production can be brought in quickly this may be recommended.

Several small groups and individuals made a living on Granite creek, the Tulameen and Similkameen rivers, where the percentage of iridium in the platinum found assisted considerably. A total of about 232 oz. of gold and 40 oz. of platinum was reported to have been received by the banks and local stores. Undoubtedly much more was sold elsewhere.

YALE MINING DIVISION.

A.M. (*See* Annual Report for 1930.) This group of fifteen claims, owned by the Consolidated Mining and Smelting Company, of Trail, and situated on the South fork of Cedar creek, about 33 miles by trail and road from Hope, has been developed by extending No. 1 tunnel a total distance of 107 feet and No. 2 crosscut 140 feet, the latter being about 50 feet lower in elevation and 700 feet south-east of No. 1. In No. 1 tunnel 65 feet of ore was found assaying: Gold, 0.05 oz. per ton; copper, 1.5 per cent. No. 2 tunnel-face is close to the ore-zone. The country-rocks in which the ore occurs are brecciated quartzites and other altered sediments replaced by silica containing chalcopyrite, pyrite, and arsenopyrite.

Dawson Consolidated Gold Mines, Ltd. (N.P.L.). (*See* Annual Reports, under *Dawson* and *Emancipation*, for 1915 to 1928, 1930, and 1932.) This company, with head offices at 404 Pacific Building, Vancouver, was incorporated in May, 1933, with the object of acquiring the properties held by the Dawson Gold Mines, Limited; the Verona Gold Mines, Limited; and the Aurum Gold Mines, Limited. The properties named in the prospectus are the *Director*, *Instructor*, *Liberator*, *Emancipation*, *Awakening*, *Maple Leaf*, *Victory*, *Rochester*, *National*, *Aviator*, *Mohawk*, *Packard*, *Big Five*, and *Emancipation Fraction*, all situated about 2 miles north-west of Jessica, on the Kettle Valley Railway.

When the mine was examined in August, 1933, development-work on the property had ceased pending other financial arrangements, and the bottom of the workings could not be seen on account of water. A winze from No. 2 tunnel on a 20° westerly incline is said to have been sunk 60 feet, with a drift at 30 feet, 35 feet long, and a crosscut at the bottom, 20 feet in length. A considerable amount of ore was stoped between the 30-foot level and No. 2 tunnel. This ore was sorted and shipped to the smelter. The vein, averaging about 18 inches wide, contained chiefly pyrite, arsenopyrite, and lesser amounts of free gold. No. 4 tunnel, which is approximately 185 feet lower than No. 2 tunnel, was driven a total distance of 570 feet, with crosscuts at intervals to the north and south. In the face of the tunnel the quartz vein, measuring about 11 feet in width, was interbanded with country-rock containing calcite, and appeared to be much disturbed by faults and minor slips, probably causing a duplication of widths on the dip. In the crosscuts slightly mineralized stringers and lenses of quartz were intersected. The centre of the vein at the face was well mineralized with fine-grained pyrite and arsenopyrite, and a chip-sample across 8 feet assayed: Gold, 0.40 oz. per ton; silver, 0.10 oz. per ton. Developments since September, 1933, consist of driving No. 4 tunnel a total distance of 750 feet, the face of

which, according to deductions, should be nearly under the ore-body in the No. 2 winze. A picked sample taken by the management from the face assayed: Gold, 2.12 oz. per ton. Ore has been stoped from No. 2 tunnel and conveyed by aerial tram to the mill.

The rough mill flow-sheet is as follows: Ore-bin—product fed by hand through a ⅝-inch grizzly to an 8- by 10-inch jaw-crusher to fine-ore bin—product transported by a feeder-conveyor to a 4- by 4-foot ball granulator in close circuit with a Dorr classifier. A small jig is installed in the ball-mill circuit between the mill discharge and classifier. Concentrates are removed periodically and are amalgamated or sacked. Overflow from the classifier passes over blankets which are washed every three hours and the residue is sacked. Blanket tailings pass into a conditioning-tank and the residue is fed to a flotation unit. Concentrates are sacked. Tailings are passed over a Wilfley table. Rough concentrates from the table are pumped back to conditioner. The capacity of the mill is 25 tons daily and numerous adjustments are being made.

A water-storage system with a capacity of 30,000 gallons and 10,000-gallon fuel-oil tanks have been installed, as well as a 4½-kw. electric-lighting (Lister) plant, a new cook-house, and a dining-room. A 95-horse-power Petter Diesel engine drives a 550-cubic-foot capacity compressor which is connected by a 3,000-foot, 3-inch air-line with the mine. A. C. Ward is mine superintendent and E. G. Galloway mill superintendent.

Home Gold Mining Co., Ltd. (N.P.L.).

(*See* Annual Reports, under *Pipestem*, for 1922, 1924, 1927, 1928, 1929, and 1932. Geological Survey of Canada Summary Reports, 1920, Part A; 1929, Part A; and Memoir 139, 1924.) This company, with head offices at 730 Standard Bank Building, Vancouver, continued development in the Coquihalla area and drove another crosscut tunnel 410 feet long and about 187 feet lower than the No. 2 level. At 380 feet from the portal in the crosscut the ore-body was intersected and two drifts were driven—one to the north for 15 feet and west for 49 feet, which should have cut the vein, but encountered only low-grade material; and the other, an extension of the north drift for 33 feet, and then north-west for 80 feet struck sections of ore, in which J. J. Fagan, the manager, reports the presence of free gold. A sample taken at the intersection of the main crosscut and the vein assayed: Gold, 0.70 oz. per ton; silver, 0.01 oz. per ton, over a 4½-foot width. Another sample adjoining this across 9 feet on the foot-wall assayed: Gold, 0.40 oz. per ton; silver, 0.10 oz. per ton. The new work to the north-west was not done at the time of examination, but from the maps submitted it seems likely that either block-faulting has displaced the ore or there are several mineralized bodies raking down south-east and up, north-west, *en échelon* along the strike. No upraises have been put in. Where the No. 3 tunnel cut the vein the quartz formed a web-like structure embracing small particles of pyritized slates over a width of 9 feet, and adjoining this there was 4½ feet of densely mineralized quartz containing arsenopyrite and pyrite. Up to the present, ore has been found on the surface as well as in No. 2 tunnel, approximately 160 feet south-east, and in No. 3 tunnel, about 340 feet in the same direction, at a difference in elevation of between 400 and 500 feet. The camp has been moved down to the original power-house site and a new dam constructed, so that a more uniform pressure is obtained for the Pelton wheel. Some of the picked sacked ore was sent to the Dominion Ore Dressing and Metallurgical Laboratories, Ottawa, and results showed that the type of ore sent, containing over 50 per cent. sulphides, through which the gold was scattered in minute grains, required roasting, followed by cyaniding, to make an indicated minimum extraction of 88.9 per cent. The suggestion was made that a better ratio of concentration would be obtained if the average ore mined contained only 10 per cent. sulphides, which will very likely be the case. The ore-minerals are pyrite, arsenopyrite, pyrrhotite, and chalcopyrite in a gangue of quartz with fine stringers of impure carbonate. Native gold was found both in the pyrite and arsenopyrite.

Home X.

This group of eight claims adjoin the Home Gold Mines, Limited, ground on the north and most of the claims are staked over the divide and on the Siwash Creek slope. The present owners are T. Elliott, 402 Pender Street West, Vancouver; F. Elliott, B. Sprange, and Fred Hartley. The *Home 8*, staked next to the *Pipestem*, was open-cut in several places for a distance of 500 feet, and numerous quartz stringers mineralized with pyrite and specks of arsenopyrite varying from 1 to 6 inches in width were found in the slates striking easterly and westerly and dipping slightly towards each other. Insufficient work has been done to prove the value of these veins, which often occur in the slates in this area. Since the veins dip towards each other better widths may be obtained at depth.

Star. This group, including the *Star*, *Ladner No. 1*, and *Ladner No. 2*, adjoining the Home Gold Mines, Limited, property on the south, is owned by Bert Richmond and associates, of Hope. Development consists of three open-cuts on the *Star* and one open-cut on the *Ladner No. 1* over a distance of 700 feet, in addition to stripping, on a 7-foot sheared zone containing 4 feet of quartz and 3 feet of pyritized slate which strikes north-west and dips 50° south-west. Values of about 0.05 oz. gold per ton were obtained on the surface and in certain places some free gold was panned. The shear-zone is very strong and much oxidized and appears to warrant further development in this section, which has responded well to exploration.

Master Ace. (*See* Annual Reports for 1930 and 1932.) This group, situated near the headwaters of Peers (Pierre) creek and owned by E. Rice, L. Fripp, and associates, of Coalmont, was further developed by open-cutting the vein extension on the *Sitting Bull*. This work uncovered a 12-foot mineralized zone containing pyrite and arsenopyrite. About 2½ miles easterly from the main vein system, about 40 feet of oxidized quartz was found that assayed, according to the owners, about 8 oz. in silver per ton on the surface. Although only comparatively low values have been found in this area, the persistency of the quartz veins both in the granite and sedimentary rocks warrants further exploration.

St. Patrick. This group, embracing the *St. Patrick*, *Golden Gate*, *Cheerful*, *Gold Full*, *M.P.P.*, *Tillicum*, and *Faultless* claims, situated about 3 miles up Sowaqua creek, on the south side, from its junction with the Coquihalla river, is owned by J. D. Fulbrook and associates, of Jessica. Development-work on the *St. Patrick* consists of a 40-foot tunnel on a narrow quartz vein near the contact of quartz-diorite and serpentine rocks, from which the owner obtained gold values. On the *M.P.P.* some stripping and open-cutting has been done on a serpentinized shear-zone about 200 feet wide in which quartz stringers occur. Gold has been panned in certain sections of this shear. Work done since the examination was made consists of extending the 40-foot tunnel to a point within 25 feet of where the main vein is located, as well as stripping another shear-zone about 300 feet wide and 600 feet up-stream. Due to the fact that fairly coarse placer gold is found in the creek below and not above this point, it is considered likely that the source of supply is located somewhere in this vicinity.

Brett Gold Mines, Ltd.—(*See* Annual Report for 1929.) This company's property, situated on 15-Mile creek close to Jessica, was not examined, but advice received from the owners states that some high-grade arsenical gold ore has been found.

B.C. Nickel Mines, Ltd. (*See* Annual Report for 1930.) This company has been taken over by the Colonel Victor Spencer-Dave Sloan interests. The properties are situated at the headwaters of Emory creek, which flows into the Fraser river from the west near Choate. This year an 8½-mile road was constructed from the latter place to the mines and camps were built. A 360-horse-power hydro-electric plant was installed on Texas creek, which is expected to take care of power requirements for initial development. A main exploration and working tunnel is being driven from an elevation of about 3,600 feet, which will prospect the larger ore-bodies found on the surface at a depth of from 300 to 800 feet. A second tunnel, now driven 60 feet, was started to prospect other large outcrops on the Texas Creek side of the mountain. Diamond-drilling will also be done from the lower tunnel to delimit the ore possibilities. A geological survey of the area was commenced late in the autumn, but snow prohibited completion of the work. The deposits, which appear to be extensive, are described as a nickel-bearing pyrrhotite occurring in a wide basic dyke, possibly pyroxenite, which has intruded the granitic rocks invading the area. Samples taken formerly from some of the surface cuts vary between 2 and 3 per cent. in nickel, and higher-grade material was found in some of the drill-holes.

PLACER-MINING.

Consolidated Mining and Smelting Co.—This company has been testing and Keystone-drilling the flats adjacent to the Skagit river a short distance north of the International boundary-line and about 40 miles by road and trail from Hope. Up to the present, bed-rock has not been reached in any of the holes put down, the deepest being 150 feet. Some values in placer gold are said to have been found.

Coquihalla River Section.

A great deal of testing was done on this river and attempts made to interest capital in a large-scale operation without any definite results reported. It seems likely that there is placer

gold in the Coquihalla river, which drains a belt having some prominence as a producer of rich gold quartz. The presence of boulders and the fear of mining in a creek that is subject to sudden freshets has had, no doubt, a derogatory effect. In a great many of these mountain streams boulders are spread over the creek-surface, having been torn from the glacial morainal material in high water. As often as not from a short distance below the surface to bed-rock, very few boulders large enough to cause interference are found.

On Peers creek a small hydraulic plant was operated about 3 miles up-stream from the Coquihalla river and some coarse gold nuggets recovered. Here bed-rock is covered with comparatively large boulders, which hinder an operation that has an insufficient head of water and very little room for tailings-disposal.

Numerous snipers earned a living on Ladner creek and its branches and on some of the old channel benches of the Coquihalla.

NICOLA MINING DIVISION.

Nicola Mines and Metals, Ltd. (N.P.L.).

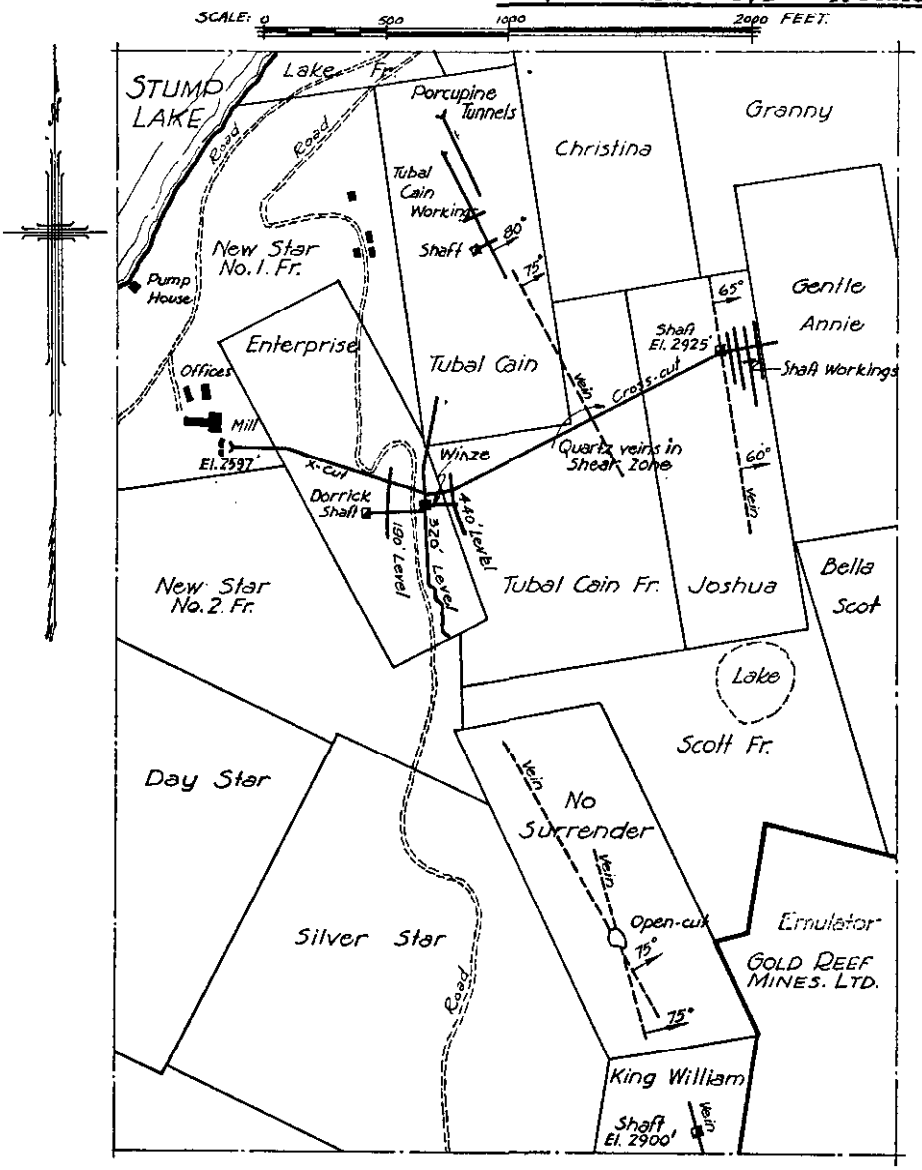
(*See* Annual Reports for 1916, 1920, and 1927 to 1931.) This company, with headquarters at 1015 Rogers Building, Vancouver, which has, according to its statement in lieu of prospectus, acquired the holdings of the Big Canuck Mines, Limited (N.P.L.), was incorporated on December 15th, 1928. In 1916 the Donahue Mines Corporation acquired eight Crown-granted claims, including the *Joshua* and *Tubal Cain*, and did a considerable amount of work thereon. The company was incorporated under the laws of the State of Washington, U.S.A., and registered in British Columbia as an extra-provincial company. The claims owned by this company were purchased under option in July, 1931, by P. L. Bancroft, who in turn apparently sold his option to the present company. The capital of the Nicola Mines and Metals, Limited, is stated as $2,500,000, divided into 6,000,000 shares of the par value of 25 cents each and 2,000,000 shares of the par value of 50 cents. The directors are C. A. Moon, Seattle, Wash.; P. L. Bancroft, L. Bancroft, M. E. Erdofy, P. A. Adams, A. Benson, and I. A. Schiller. Major Moon is general manager and George A. Shaw resident mining engineer at the mine. The following claims are owned by the company: *Iowa Fraction, Lake Fraction, Christina, Granny, Tubal Cain, New Star Fraction, Enterprise, Tubal Cain Fraction, Joshua, Gentle Annie, Bella Scott, Scott Fraction, No Surrender, King William, Day Star, Silver Star, Planet, Silver King, Silver King Extension, Planet Extension, Entente Cordial, New Emblem, Big Sandy, Empire*, and *Maiden*. They are all situated near Stump lake, about 30 miles south of Kamloops.

New development in 1933 consisted of extending the crosscut on the *Enterprise* 320-foot level for 1,365 feet to connect with the *Joshua* workings on the 400-foot level (*see* map); drifting approximately 81 feet north on the *Tubal Cain* vein from the 320-foot level crosscut; unwatering and retimbering some of the *Joshua* shaft down to the 400-foot level and sinking to the 550-foot level. The 550-foot level (*Joshua*) has been driven 45 feet south and the 400-foot level 53 feet south and 143 feet north. On the *Enterprise* the 320-foot level has been extended 266 feet south, the winze sunk to the 440-foot level, and a drift made from the bottom for 72 feet south. On the *Tubal Cain* the shear-zone has been drifted on from the 320-foot crosscut for 81 feet north, and, according to the management, the ground is still more or less broken, but a considerable amount of fragmentary vein-matter, some of which is well mineralized, has been found. Evidently the fault crossed the *Tubal Cain* vein at an acute angle and farther north more permanent conditions may be looked for. The work done formerly can be seen on the accompanying map.

The strike of the *Joshua* vein, a few degrees west of north, should intersect the *Tubal Cain* vein extension, striking more westerly at a point about 1,750 feet south of the *Joshua* shaft. Likewise the *Enterprise* vein should cut the *Tubal Cain* vein about 875 feet north of the latter shaft. These points of intersection may mean nothing, but it appears possible that a greater degree of permanency and possibly more uniform widths of quartz may be found beyond, where the chance of dissipation would be less due to confinement within the walls of one shear-zone. No development was seen in the neighbourhood of the projected vein crossings. Where the 320-foot crosscut intersected the *Tubal Cain* vein extension at about 400 feet below the surface, the entire zone, over 50 feet wide, had been subjected to intense shearing and faulting and only occasional isolated displaced pieces of quartz were found. This may be caused by a strike-fault and conditions to the north and south improve. Before reaching this point in the crosscut, numerous stringers and banded veins of quartz up to 2 feet wide, striking north-east and dipping

Map Showing Part of the

NICOLA MINES & METALS GROUP & UNDERGROUND WORKINGS.



With report by P.B. Freeland, 1933, Resident Mining Engineer Penticton, B.C.

B.C. Department of Mines.

A.M.R.

towards the *Tubal Cain* shear, were found. A 60-foot drift has been driven south on the widest of these veins. An intermediate vein found between the *Tubal Cain* and *Joshua* workings has been drifted on for 59 feet. The vein on the 320-foot level on the *Enterprise*, from which most of the ore in the mine was formerly stoped, pinches and swells from 4 to 46 inches in width, and probably averages about 18 inches in width. To the north the vein appears to split or bend off strike, or the tunnel has followed a mineralized slip. To the south the new work done encountered numerous faults, but the vein was again found in place at the end of the drift. In the *Joshua* workings the vein in the shaft and drifts behaves in a similar way, except widths up to 5 feet were occasionally found. The shaft on the *Tubal Cain*, which is supposed to be 216 feet deep, with levels at the bottom and at 116 feet, could not be examined on account of water, but the tunnel from the surface from the north-west driven on the main shear-zone encountered only a short section of ore. The remainder of the tunnel showed some crushed quartz associated with sheared pyritized country-rock and highly altered dyke-matter. This is a very strong shear-zone and the ore on the dump from the shaft was well mineralized. In the *Joshua* shaft, about 45 feet below the 400-foot level, the vein dips at a steeper angle and a crosscut has been driven 44 feet into the foot-wall towards the intersection.

According to the management, who had very thoroughly sampled and assayed the ore in the *Enterprise* and the upper levels of the *Joshua*, there were certain sections of the vein that carried values varying from 0.80 to 1 oz. gold per ton, as well as small amounts of silver, lead, and copper. Other sections varied from 80 cents to $2 per ton, so that in the aggregate the ore is comparatively low grade, with gold at $20 an ounce. With the precious-metal prices higher, more ore will become available. The vein examined September 26th, 1933, was generally too narrow, except in short sections, to be mined in itself and will probably have to be stripped first, unless it is sorted after being broken. With the idea of finding better vein-widths and higher average values, the *Joshua* shaft will be sunk, according to arrangements, to the 1,000-foot level and a crosscut to the other veins made from that elevation. Faulting and warping of the vein is generally attended with better vein-widths and values. The walls on all these veins are well defined.

The average number of men employed varies between forty-five and fifty. Surface work and improvements during 1933 included: Complete overhauling of the Diesel engine; construction of a transmission-line from the *Enterprise* plant to the *Joshua* shaft: installation of a 200-kw. generator; the addition of two small electric-driven compressor units; installation of larger air-lines; general repairs to camp buildings; installation of electric hoist at *Joshua* shaft; installation of a 5-horse-power suction or blowing fan; installation of metal piping in mine; installation of a voltage-regulator; and purchase of new rock-drills and steel.

Gold Reef Mines, Ltd. (N.P.L.). This company was formed to acquire a group of twenty claims, nineteen of which are stated as being owned outright, the remaining one being under option to purchase, adjoining the Nicola Mines and Metals, Limited, ground near Stump lake, 30 miles south of Kamloops. The capitalization is 1,000,000 shares of $1 par value. Directors are General J. Duff Stuart, president; W. Leek, E. C. Daugherty, A. St. Clair Brindle, and Colonel J. E. Leckie.

Three or four men were employed stripping and open-cutting on the possible vein extensions. Late in December, 1933, according to reports, the properties owned by this company were purchased on a royalty basis by the Reward Mining Company, Limited (N.P.L.); head office, 919 Stock Exchange Building, Vancouver; with C. P. Riel managing director.

The extension of the different veins found on the Nicola Mines and Metals, Limited, property to the south, if persistent, will strike through the ground owned by this company. The prospects on the *Emulator*, which lies approximately 2,300 feet south-east of the *Joshua* shaft, are attractive.

Jennie Long. This old 600- by 1,500-foot Crown-granted claim is situated about 3 miles south-east of Stump lake, on the east side of the Kamloops–Merritt highway, and can be reached via a by-road. Interests represented by J. Herron and E. W. Watson, of Calgary, cleaned out a 70-foot (?) 64° inclined shaft and, according to E. W. Watson, some attractive values were found over minable widths. When the property was examined in June the shaft was full of water and a crew of four men was not working. A frame camp had been partly erected in addition to a new shaft head-frame and blacksmith-shop.

Several open-cuts and a shallow shaft, probably 20 feet deep, but now caved, have exposed a slightly mineralized quartz vein for about 500 feet along the strike, north-west and south-east from the shaft. The width of the vein could not be seen. A dump sample of quartz containing pyrite, chalcopyrite, and galena from the 70-foot (?) shaft assayed: Gold, trace; silver, 1.2 oz. per ton. The vein occurs in the highly altered dense green-coloured volcanics of the Nicola series of rocks. There were many other outcrops of quartz in the vicinity striking at different angles.

PLACER-MINING.

Several leases were staked just below the junction of Spius (Petit) creek on the Nicola river by the F. C. Porter interests, of Vancouver, who also sank a 30-foot shaft on the south-west river-bank. Before bed-rock was reached the shaft was lost in quicksand. The owners claim to have obtained 1 cent a pan in gold values from this shaft. Samples of this sand stored in bunkers did not substantiate this reported find.

For a mile up Spius creek the flats are approximately half a mile wide; then they converge to about 200 feet width. Beyond this point and for several miles south many similar flats occur. The creek, according to maps, is approximately 30 miles long and, with its branches, drains an area from which gold-quartz discoveries have been reported. Prospecting for placer gold nearer the headwaters may be recommended.

ASHCROFT MINING DIVISION.

Vidette Gold Mines, Ltd. (N.P.L.).

(*See* Annual Reports, under Vidette Mines, Limited, 1931 and 1932.) This company, with headquarters at 744 Hastings Street West, Vancouver, and capitalized for 1,000,000 shares of no par value, acquired the holdings of the Vidette Mines, Limited, the name of which had been changed to Explorers Mining Company, so that the former name could be made available. Gordon F. Dickson is managing director and H. A. Rose superintendent at the mine.

The property is situated near Vidette lake, about 43 miles north of Savona, on the Canadian Pacific Railway, and can be reached by a narrow road up Deadman creek and over the summit to Vidette lake. The names of the claims are: *Comstock, Wabbly, Thomas Paine, Monument, Myrta, Percy, New Hope, Valley No. 1* and *No. 2, Searcher Fraction No. 2, Searcher Nos. 1, 2 3, 4, 5, 6, 7,* and *8, Monarch, Searcher Fraction No. 1, White Pass,* and *Vidette Fraction.* Most of the work has been done on the *Searcher No. 1* and *Searcher Fraction.* A summary of the general progress to December 15th, received from the management, is as follows:—

Sinking of the main inclined 3-compartment shaft was started during the last week of September and has reached a depth of 320 feet. The shaft, which is being sunk in foot-wall country, is situated 280 feet south-east of the main winze, from which development below the tunnel-level has so far been done. The present objective is a depth of 500 feet, with levels at 150-foot intervals. Crosscuts have been extended at No. 1 and No. 2 levels, the former connecting with the first level workings from the Tenford workings. The winze has been sunk to a depth of 193 feet below the tunnel-level. A raise was extended on the vein from the tunnel to the surface above the winze and a pocket excavated to facilitate hoisting and handling of ore and waste. Drifting will be done from the winze at No. 2 level on the vein while the main shaft is being sunk to 500 feet. No. 3 level will be opened from the main shaft and will be the main hoisting-level. A total of 600 feet of drifting has so far been done on the vein at No. 1 level in these workings. The average (gold) value for the whole distance is 0.75 oz. per ton for an average width of 15 inches.

Drifts north and south are being extended from the Broken Ridge shaft at the same horizon as No. 1 level in the Tenford workings. The former is in a faulted zone, and is being driven direct on line to connect with the crosscut from the main shaft and has been advanced 60 feet. The latter has been extended 60 feet in ore averaging 3.45 oz. per ton over an average width of 12 inches.

A summary of development to date is as follows: Tunnelling, 455 feet; drifting, 1,120 feet; crosscutting, 265 feet; raising, 150 feet; sinking main shaft, 320 feet; sinking main winze, 192 feet. The average number of men employed is 55.

A milling test of 517 tons from development ore gave an average gold value of 0.79 oz. per ton. The original treatment by blanket concentration, followed by flotation, was changed to direct flotation. There has since been added to the plant a Symons cone-crusher, additional flotation-cells, a Wilfley table, and Oliver filter. A larger improved type of Dorr classifier has also been ordered and will shortly be installed. It is anticipated that with improvements made the mill will have a capacity of 40 tons per day. The mill started on December 7th, running one shift on development ore, at which rate it will continue until the middle of February, 1934, by which time the present increased development scheme will be completed and necessary power will be available for ore-extraction.

Other additions to plant consist of full machine-shop equipment, lathe, screw-press, drill-sharpener, etc. Extensive additions to buildings include new bunk-house, dining-room, and staff quarters, which

have modern heating, plumbing, etc.; new assay office and warehouse, and also steam-driven sawmilling plant with capacity of 5,000 feet of lumber per day.

When the property was examined in June the main winze had been sunk 78 feet at a point about 300 feet in from the Tenford tunnel portal and drifts had been driven 115 feet south-east and 150 feet north-west. Vein-widths in the Tenford tunnel varied from 7 to 20 inches and averaged 10 inches. Values averaged about 0.80 oz. per ton in gold. On the lower levels the vein-width averaged about 18 inches and values increased. The Broken Ridge shaft, 100 feet deep (then full of water), is situated about 150 feet south-west of the Tenford workings and appeared to be sunk on a faulted section of the latter vein, which strikes in a south-easterly and north-westerly direction and dips about 45° to the north-east. About 800 feet south-east of the Broken Ridge workings, across Vidette lake, two tunnels had been driven on what appeared to be an extension of the vein, which had a maximum width of 6 feet in one section, but was generally only a few inches wide and of comparatively low grade. The workings are reached by crossing the lake on a cable-float bridge. The ore-minerals are chalcopyrite, pyrite, a telluride, possibly petzite and free gold in quartz.

The vein occurs in the greenstone geologically assigned by G. M. Dawson to the Triassics and has a volcanic origin embracing diabase porphyrites (occasionally amygdaloidal) and diabase tuffs, etc. In the mine a considerable amount of shearing and consequent slickensiding has taken place, and this appears to have caused an overlapping of the quartz vein. Cross-shearing was also observed in the region of the Broken Ridge shaft, which may possibly account for very high values found in the neighbourhood.

The old mill, with a capacity of 24 tons per day, was originally constructed as a pilot unit for testing purposes, and it was used for some time with minor additions by the present company to procure some monetary return from development-headings, even though a considerable loss was made in the tailings due to the presence of telluride. The flow-sheet consisted of one 8 by 12 crusher; a 4-foot Marcy mill grinding to 100 mesh; classifier in closed circuit; blankets, which were washed every half-hour, the residue being put in amalgam-barrel and pounded; residue dumped over plates and overflow passed through four Denver sub. A flotation-cells, tailings to small jig-table.

A 60-horse-power and a 115-horse-power Vickers-Petter engine drives two 220- and 278-foot compressors for mine and mill air requirements. A Sullivan steel-sharpener is used. A Myers pump elevates water from the lake to the mill. Domestic water is piped from a small creek at the head of the lake. Some work on the other claims situated on the north side of Vidette lake uncovered narrow quartz veins in the greenstone and oxidized replacement-zones on the limestone-contact, from which occasional colours in gold could be panned.

Last Chance-Sylvanite. This group, under the direction of E. Inglis and associates, of Vancouver, adjoins the Vidette Gold Mines, Limited, property to the north-west on Hamilton creek. Several open-cuts were excavated on some narrow displaced quartz veins striking generally north-west and south-east, associated with porphyry dykes and a fine-grained intrusive rock containing a large percentage of hornblende. A crosscut was driven 40 feet long and 200 feet lower than the vein-outcrops, and it should intersect one vein 30 feet ahead of the face. The ore-minerals are pyrite, chalcopyrite, and perhaps telluride. A well-mineralized stringer a short distance ahead of the crosscut-face assayed: Gold, trace; silver, 2 oz. per ton. No telluride was present. Other discoveries, some carrying gold, 0.80 oz. per ton over 18-inch widths and traceable for several hundred feet, have been reported to have been found a few miles north-east of Vidette lake. The area embraced by the Triassic greenstones appears to be well worth while investigating, taking special notice of structural conditions.

Sharp's Claims. (*See* Annual Report for 1929.) This group of eight claims—namely, *Eclipse*, *Bluff*, *Old Spot*, *Calumet*, *Nevada*, *Pal*, *Stork*, and *Quick*—is situated about 3½ miles up Criss creek from its junction with Deadman river and approximately 13½ miles north of Savona by road and trail. The owners, H. C. Sharp, 4435 Walden Street, Vancouver; A. McDonald and associates, have trenched, open-cut, and driven short tunnels over an area several thousand feet long and half a mile wide on the west side of the creek between an elevation of 3,060 feet and 2,000 feet on numerous widely fractured shear-zones striking in many directions, but chiefly north-east and south-west. In nearly all the workings many fractures contain specularite, cinnabar, orpiment, realgar, stibnite, pyrite, azurite, and malachite

in a gangue of calcite, quartz, and chalcedony. According to the Geological Report, the deposits occur in the volcanic members of the Nicola series of rocks of Triassic age, but are situated close to several centres of Tertiary volcanics which are regarded as the source of the mercury. The rocks in which the mercury is found are green and purple porphyritic andesitic breccias. These have been fractured in three main directions. Along the veins, and for several inches away from them, the breccias are highly altered and their original colour, texture, and composition almost completely obliterated. Some samples taken from the new workings and sent to the Mines Branch at Ottawa contained small percentages of arsenic, sulphur, titanium, antimony, vanadium, and as high as 8.22 oz. per ton in silver, but no mercury. The owners have retorted quicksilver from several of the workings and as high as 4.5 per cent. mercury was found in places. An old road, impassable for cars, leads to the property. A log cabin near a water spring has been built about half a mile uphill from the road.

Ashcroft. (*See* Annual Report for 1931.) This group of twenty-seven claims, situated 1.8 miles north-west of Martel, on the Canadian National Railway, approximately 8 miles from Spences Bridge, and owned by E. A. Jamieson, F. C. Elliott, Geo. G. Fleming, and associates, 211 Pemberton Building, Victoria, has been optioned to the Rufus Argenta Mines, Limited.

A campaign of exploration-work consisting of open-cuts, trenches, and tunnels, followed by diamond-drilling, was carried out on a series of quartz veins varying from a few inches to 6 feet in width and conforming to the strike of the volcanic and schistose rocks (Cache Creek series) in which they occur. According to E. A. Jamieson, manager, eleven veins had been found altogether. Development-work was done on the lower series only. As usual in deposits of this type, the quartz veins swell and pinch, and in certain faulted zones much oxidized pyrite is in evidence. Some free gold is said to have been obtained in panning. Due to extreme shearing and faulting, some of the drill-holes were lost and the results are not to hand. Two narrow roads lead to the property from the Ashcroft–Spences Bridge highway. A frame camp constructed to accommodate twelve men was built and water piped to the camp.

Placer-mining.

Deadman River.—Several unemployed men staying at the relief camp on Indian Reserve No. 10 (1877) on the river mined the gravel between high and low water, just below the junction of the Deadman and Thompson rivers, approximately 1 mile below the outlet of Kamloops lake. They recovered from 25 to 45 cents and occasionally up to $1 a day for short periods. Some tests-pits put down about 3 feet below the surface near Deadman river, about three-quarters of a mile up from the outlet, panned very fine gold. Further work was stopped because the miners had not an Indian Reserve licence. The river for about 3 miles up from the mouth averages a quarter of a mile in width, with the exception of a canyon about 600 feet long about 1½ miles up. Barometric elevations taken along the river show a difference in head of approximately 340 feet. Between the canyon and the mouth the difference in elevation is 170 feet. There is plenty of water for sluicing operations. Bed-rock has not been tested. There is only a few acres of poorly cultivated alfalfa near the Canadian National Railway, all the other Indian Reserve ranches being above the 3-mile limit. The ground could be easily tested and worked and is apparently virgin, as there is no sign of old workings.

Criss Creek.—At the junction of Criss creek and Deadman river some placer-mining was done several years ago by the Branch Ranch Mining Company, and several shafts were sunk, one to the depth of 35 feet. Gold was also mined by the Chinese at an earlier date a short distance up the creek. The Thompson River Mining Company sunk shafts in the same area to 35- and 40-foot depths without reaching bed-rock. All these explorations were instigated by the theory that the original channel of the Thompson river crossed the country about 5 miles up Criss creek, and that the placer gold, if any, would be concentrated somewhere in the lower reaches of the creek. Owing to the depth of bed-rock, drilling appears to be the only sure way of testing the ground. This is outside the Indian reserve.

General.

Near the headwaters of Skeikut creek, which flows into the Nicola river opposite Clapperton, on the Kettle Valley Railway, about 9 miles above Spences Bridge, several prospectors report finding placer gold. The locations were not examined, but some coarse gold was seen which

supposedly came from there. Other finds were reported from Shakan creek, about 4 miles farther up the Nicola river on the same side. The Spences Bridge Gold Mining Company, of 306 Credit Foncier Building, Vancouver, employed several men testing the possibilities of the Thompson River gravels a short distance south-west of Spences Bridge, with the idea of operating a suction-dredge in conjunction with a drag-line scraper. According to the owners, the ground tested sufficiently well to permit the installation of a plant to handle the boulders as well as the gravel.

A total of about 320 oz. of placer gold has been reported as saved from different small operations. Possibly much more was sold indirectly.

Non-metallics.

According to reports, the *Basque* cleaning and recrystallizing Epsom salts plant at Ashcroft was reassembled, and the old company intended to ship some of the refined product from its property a few miles west of Ashcroft.

CLINTON MINING DIVISION.

Grange Mines, Ltd.

(*See* under Big Slide Mining and Developing Company, Limited, Annual Reports for 1896, 1897, 1928, 1930, 1931, and 1932.) The Grange Mines, Limited, Pacific Building, Vancouver, took over the assets of the Big Slide Mining and Developing Company, Limited, for a 51-per-cent. interest and, according to reports, formed a syndicate headed by W. L. Gilbert. This organization reduced the capital structure from 8,000,000 to 2,000,000 shares and advanced sufficient money to develop the mine further.

Since the property was examined last spring by A. M. Richmond, Assistant Resident Engineer, the No. 5 level tunnels of that date have been advanced 39 feet and 50 feet respectively in south-easterly and north-westerly directions, and short crosscuts have been driven to test the foot-wall side of the vein at points 42 and 100 feet south from the winze and at 40, 75, and 98 feet north of the winze. A foot-wall section of the vein was picked up, but unfortunately was under water at the time of examination and could not be inspected. The company's engineer, A. F. Gaul, sampled this recently discovered foot-wall vein and obtained the following results: "First crosscut south-east on each side across 22 and 24 inches of vein: Gold, 3.06 oz. and 0.36 oz. per ton. Along the drift at intervals to the south-east across 18, 20, 12, and 12 inches, the samples assayed: Gold, 4.48 oz., 5.20 oz., 0.45 oz., and 0.24 oz. per ton, respectively. Samples taken in the north-west drift crosscuts assayed: Gold, 0.36 oz., 0.62 oz., 0.30 oz., and 0.92 oz. per ton over 27-, 27-, 40-, and 36-inch widths, respectively. A sample in the face of this drift assayed: Gold, 0.15 oz. per ton over 36-inch width. Four samples were taken in the winze, two on each side, which assayed: Gold, 0.52 oz., 0.40 oz., 0.98 oz., and 0.83 oz. per ton over 30-, 36-, 10-, and 24-inch widths, respectively." From the above it will be seen that the values are erratic, but so high grade in spots that an average will probably be obtained that will pay to mill. No upraises have been put in to determine the height to which this ore extends above the No. 5 level. In the winze the ore-widths were also very erratic, due possibly to shearing within the walls. The better values in the foot-wall vein in the lowest (No. 5) level over greater widths are an attractive feature and warrant deeper exploration. In No. 1 level, 210 feet higher than No. 5 level, one mineralized shoot in the stopes 60 feet long averaged about 8 inches in width and contained average values in gold of 0.04 oz. per ton, as well as minor amounts of silver. Another shoot, 100 feet long, averaged 11 inches in width and contained: Gold, 0.17 oz. per ton. In No. 3 level, 108 feet above No. 5, a mineralized shoot 45 feet long averaging 17 inches in width contained: Gold, 0.18 oz. per ton. Another shoot, 15 feet long, averaged 7 inches in width and contained gold values of 0.20 oz. per ton. A third shoot, 50 feet long, averaged 12 inches in width and carried values in gold of 0.32 oz. per ton. All of these shoots contained small values generally below 1 oz. per ton in silver. In No. 1 level the stopes average 12 feet in height above the level, and in No. 3 level about 15 feet above the level.

Apparently there are two veins—one, the foot-wall vein, intersected at a point about 200 feet from the portal of No. 3 crosscut, and dipping flatly; the other, the hanging-wall vein, intersected and drifted on at 240 feet in on the same crosscut. The crosscuts from No. 5 north-west level into the foot-wall intersected what is considered to be the foot-wall vein within about 10 feet, which suggests that this vein, which is much the stronger of the two, is dipping

nearer to the perpendicular than when crosscut above. At deeper elevations the foot- and hanging-wall veins should unite. The hanging-wall vein outcrops for 1,000 feet or more on the strike in the bluffs several hundred feet above the workings. An upraise will be put in between No. 3 and No. 2 tunnels and the ore hoisted and trammed to the mill from that elevation. The veins occur as fissures in a highly metamorphosed diorite. The ore-minerals are pyrite, chalcopyrite, and arsenopyrite in a quartz gangue. A map of the workings appears in the 1932 Annual Report.

The water-power available in Kelly creek has been used to drive power-installations for the mine and mill plants. The water from the creek flows into a wooden tank 500 feet in elevation above the camp. From this tank a 600-foot length of 12-inch wood-stave pipe delivers the water to a 36-inch Pelton wheel, which drives a 550-cubic-foot Ingersoll-Rand 2-stage air-compressor. Another Pelton wheel, added at a later date, drives a 150-k.v.a. generator, which supplies electric power at 440 volts to the mill. There are therefore separate power units for the mine and the mill.

The 25-ton mill, designed by P. E. Peterson, was built well above the Fraser river and to the north-west of the mine. The flow-sheet is briefly as follows: The ore from the mine is placed in a 50-ton storage-bin; from this bin it passes via a 10 by 16 Blake crusher and belt-conveyor to the fine-ore storage-bin of 50-ton capacity. From this ore is fed to a 25-ton Hardinge ball-mill working in closed circuit with a Peterson rotary classifier. The overflow from the classifier passes to two blanket-tables, the concentrate being passed to the clean-up barrel. The overflow from the blanket-tables passes to a Southwestern matless-cell flotation unit, the concentrates from this unit being shipped to the smelter. Settling-tanks are used to reduce the moisture content of the flotation concentrate.

A frame bunk-house for twenty-two men, a dry with hot and cold shower-baths, cook-house and dining-room, and a 4-roomed superintendent's house have all been built at the mine. A narrow road, 3 miles long, follows down Kelly creek from the Clinton–Lillooet highway, and from the end of this road a 2-mile length of steep trail leads down to the mine at the Fraser river.

Pavilion Gold Mines, Ltd.

This property, adjoining the Grange Mines, Limited, ground to the south, and controlled by the same company, consists of the *G. & R.*, *Lady Luck*, *Smokey*, *Memphis*, *Mountain View*, *Gold Rock*, *Bonanza*, *Placer View*, *Pine View*, *River View*, *Memphis Fraction*, *Big Shot Fraction*, *Nugget*, *Pip*, *Jasper*, and *Big Shot*. The Fraser river flows through the last four claims; part of the ground extending across and to the west of the river.

Development-work consists of a nearly vertical shaft 170 feet deep, with a 75-foot drift on the vein at the 75-foot level, and a 10-foot crosscut on a fault at the end of it. At 165 feet depth a 45-foot crosscut has been driven to the vein, upon which a 120-foot drift has been driven close to the boundary of the *Lady Luck* and *Memphis* claims. The vein dips very gradually out of the shaft to the south-west. Surface indications of vein continuance have been uncovered for several hundred feet on the strike north-west and south-east, but the vein at this horizon appears to be narrow and fractured. In the shaft-workings, at 75 feet depth, the vein was much oxidized and varied in width from 6 inches to 3 feet. On the 165-foot level the vein measures between 2 and 3 feet wide. The mineralization consists of pyrite, chalcopyrite, and possibly arsenopyrite in a quartz gangue occurring in fissures in diorite. A considerable amount of hornblende, possibly a dyke, was noticed associated with the veins. This condition also exists at the Grange Mines, Limited, property. Later reports from the management state that a crosscut tunnel was driven 75 feet on the *Nugget* claim at an elevation of approximately 1,000 feet lower than the shaft-collar. A contract is to be let to extend this tunnel 1,000 feet under the upper workings. At the mouth of the crosscut a network of quartz veins was found, but this is not to be prospected further for the present. Samples from the shaft-vein assayed from 4 to 5 per cent. in copper, with occasional high values in gold.

A portable one-machine gasoline compressor and Tugger hoist was used for the shaft-work. Eight men were employed. The Pacific Great Eastern Railway is within 3,500 feet uphill from the workings. Moran is the closest station.

General.

Discoveries of high-grade gold ore over good widths have been reported as made in the vicinity of the Taseko river.

Placer-mining.

A considerable amount of mining in a small way was done on Watson Bar creek, Fraser river, Churn creek and its tributaries, Fairless and Poison Mountain creeks, from which about 100 oz. of gold has been reported as found. A. M. Richmond, Assistant Resident Engineer, examined this area and his report is given below.

On Big creek the late H. E. Church discovered fine gold and platinum on his leases about 4 miles north of Big Creek Post-office. A great deal of ditching and a 30-foot shaft did not reach bed-rock, so that the value of the ground still remains in doubt. The leases cover an area about ½ mile wide and 3 miles long between two canyons, where the stream has cut through the lavas.

POISON MOUNTAIN CREEK AREA.

Report by A. M. Richmond, Assistant Resident Mining Engineer, Victoria.

Introduction.

Placer gold was discovered near the headwaters of Churn creek, on Poison Mountain creek, late in the summer of 1932 by Julian Fenton, an Indian sheep-herder's wife, and by the end of the season the creek had been staked from source to outlet by the local inhabitants of Big Bar and Jesmond. More than seventy placer-mining claims were staked along the 3½-mile length of the creek, and at the time of the writer's examination of the area late in June, 1933, approximately sixty men and women were actively engaged in the establishment of camps, prospecting for placer gold, and in some cases recovering small quantities of the precious metal in small-scale, shovelling-in placer operations.

Eleven days were spent in making the trip, sizing up the placer possibilities of the creek and adjoining streams, and making a reconnaissance of the lode-gold possibilities of the Poison Mountain and Quartz Mountain sections. Several gold prospects were also examined near the head of the First North fork of Watson Bar creek during the trip out from Poison mountain. Watson Bar creek has been known for some years past as a small but rich placer creek and it is located a few miles to the south-west of Big Bar.

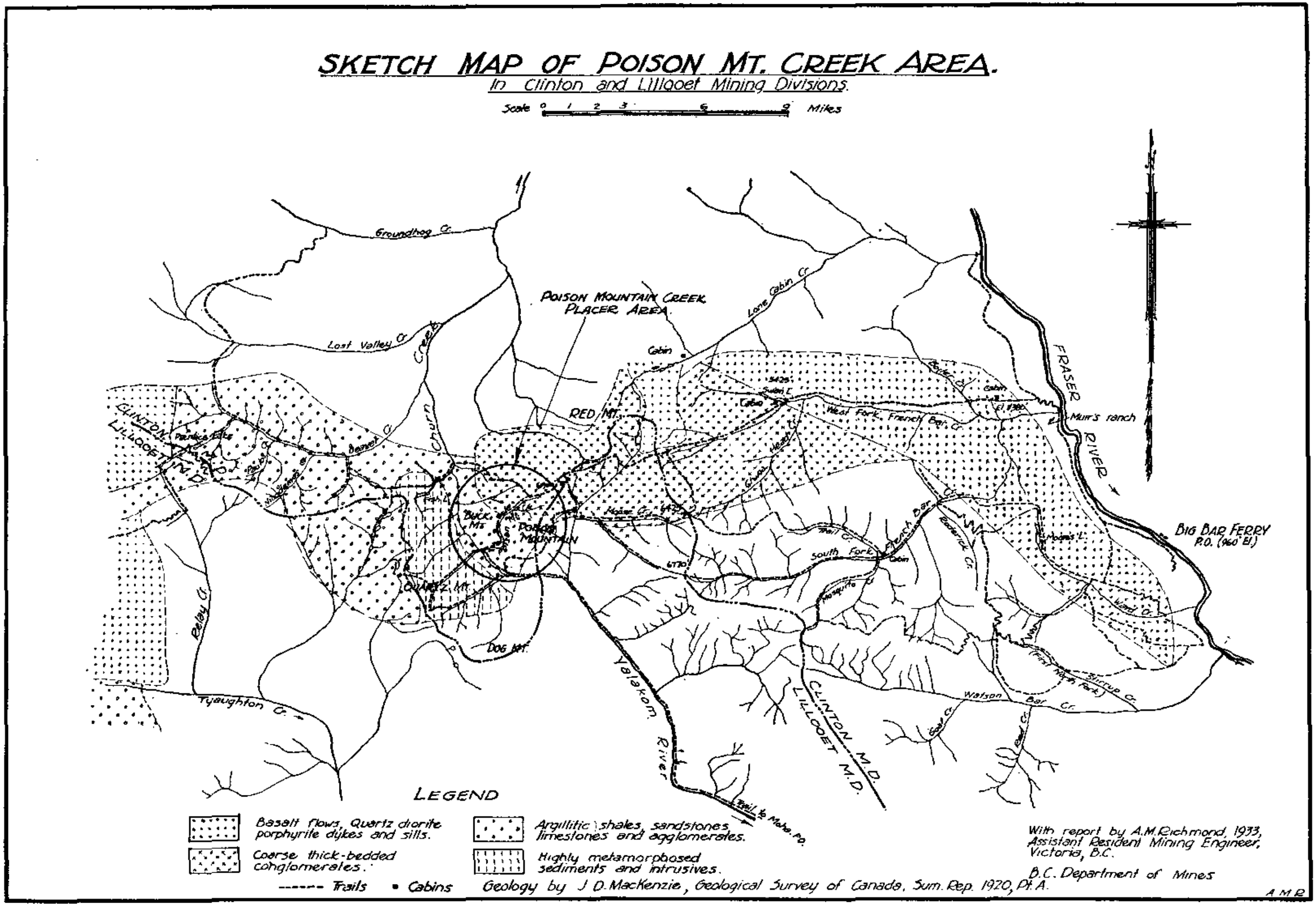
Location and Transportation.

The geographical position of Poison mountain is clearly shown on the accompanying sketch-map, which has been compiled from a map first published by the Geological Survey of Canada Summary Report, Part A, 1920, with J. D. MacKenzie's report on part of the area and from information obtained by the writer. Poison mountain is on the dividing line between the Clinton and Lillooet Mining Divisions, but the creek of that name is a short tributary of Churn creek and lies wholly within the Clinton Division.

Poison Mountain peak is only 23 miles in an air-line due west of Big Bar, a post-office at one of the ferry crossings on the Fraser river, but the shortest trail into Poison mountain is 37 miles long and follows up the Fraser river from Big Bar ferry crossing to Muir's ranch, and thence westward up the North fork of French Bar creek to the divide separating French Bar creek from the Yalakom river. The trail then follows down the Yalakom river for 5 miles to its junction with a south-easterly-flowing tributary of the Yalakom river, up which it follows to the summit of the divide into Poison Mountain creek. This divide has an elevation of 6,900 feet above sea-level. Two days are required for the trip in from Big Bar ferry.

A second route from Big Bar ferry may be taken by following up Ward creek and then crossing over into the South fork of French Bar creek, and ascending it to the divide into the Yalakom river and joining the first-mentioned trail about 5 miles from Poison Mountain creek. This trail has the disadvantages of being slightly longer, crossing over a summit that is higher than the summit crossed by the North Fork trail, and generally being through rough-trail-building country.

The third route into the area, and that considered to be the best for other than residents of the district adjacent to Big Bar, follows up the Yalakom river from Moha, a post-office at the northern end of the road from Lillooet, to a low divide which crosses into Churn creek a short distance from Poison Mountain creek. The trail is about 10 miles longer than either of the first two routes mentioned, but the advantages of easy trail-building grades, a low divide into Churn creek, and nearness to the Pacific Great Eastern Railway at Lillooet led to the Department of Mines making this trail passable during the summer of 1933.


SKETCH MAP OF POISON MT. CREEK AREA.
In Clinton and Lillooet Mining Divisions.
Scale 0 1 2 3 6 9 Miles
POISON MOUNTAIN CREEK PLACER AREA
Groundhog Cr.
Lost Valley Cr.
Churn Creek
Lone Cabin Cr.
Cabin
RED MT.
West Fork, French Bar Cr.
FRASER RIVER
Muir's ranch
BIG BAR FERRY P.O. (960' El.)
CLINTON M.D.
LILLOOET M.D.
Poison Mountain
Quartz Mt.
Dog Mt.
Relay Cr.
Tyaughton Cr.
Yalakom River
South Fork
French Bar Cr.
Watson Bar Cr.
Stirrup Cr.
Ward Cr.
Trail to Moha P.O.
LEGEND
Basalt flows, Quartz diorite porphyrite dykes and sills.
Coarse thick-bedded conglomerates.
Argillitic shales, sandstones limestones and agglomerates.
Highly metamorphosed sediments and intrusives.
Trails • Cabins
Geology by J. D. MacKenzie, Geological Survey of Canada, Sum. Rep. 1920, Pt. A.
With report by A. M. Richmond, 1933, Assistant Resident Mining Engineer, Victoria, B.C.
B.C. Department of Mines
A.M.R.

As indicated, access to the area is by pack-train, and horses are obtainable at either Big Bar or in the vicinity of Moha. Many gold-seekers walked in with heavy packs during the early part of the 1933 season.

Geophysical Information.

Poison mountain rises to an elevation of 7,650 feet above sea-level and is the source of Churn creek and several of the headwater tributaries of the Yalakom river; the latter river being often called the North fork of Bridge river. The country to the west and north of the mountain stretches out for several miles as a wide, more or less level, river-basin valley that is characterized by the occurrence of many low-lying rounded hills. Farther to the west rise the rugged peaks of the Whitewater area. South of Poison mountain are to be seen the rugged snow-covered peaks comprising the Shulaps range that rise between the Yalakom river and Marshall creek, both tributaries of the Bridge river. To the east is the high, deeply scored territory which flanks the Fraser river to the west.

The stream-valleys in the vicinity of Poison mountain are young and show the characteristic V-shape. Poison Mountain creek proper rises on the western slope of the mountain of the same name and in its 3½-mile length drops from 6,900 feet to 5,440 feet elevation, the upper 2½ miles of the creek averaging slightly over an 8-per-cent. gradient, with the lower mile on a 3.5-per-cent. gradient. In the lower section of the stream, where the grade is less, the valley of the stream widens out into meadow land from 300 to 600 feet in width.

The upper sections of the streams are devoid of timber and only below about 6,000-foot elevation is there any timber suitable for mining purposes. The timber is small in size and limited in species, mainly small spruce and pine, with occasional fir-trees, and it is not of merchantable value except for small-scale mining operations.

The season suitable for placer-mining is comparatively short, opening about the end of the second week of June and closing about the end of September each year.

Water for washing is limited in quantity, and after the first heavy snow-water run-off early in June and July the streams dry up to a comparatively small volume. There is enough water on Poison Mountain creek for small sluice-box operations for the season, provided the water is conserved and used over by each succeeding operator down the creek, but there is not sufficient water for hydraulicking except on a very small scale near the lower end of the stream, at the expense of the operators located higher up the creek.

General Geology.

The general geology of the Poison Mountain area has been briefly described by J. D. MacKenzie in Part A of the 1920 Summary Report of the Geological Survey of Canada. On the upper half of Poison Mountain creek are to be found outcropping massive, thick-bedded coarse boulder conglomerates which are interbedded with fine-grained feldspathic sediments, bedded limestones, and argillaceous rocks. This formation is characterized by a large percentage of well-rounded boulders, originally igneous rocks of the Coast Range mountains. The boulders, from 6 inches to 1 foot in diameter, are found making up coarse conglomerate-beds of from 10 to 100 feet in thickness. On the lower half of Poison Mountain creek the rocks exposed are principally coarse-grained feldspar "bird's-eye" porphyry that are occasionally cut by narrow stringers and veinlets of quartz well mineralized with pyrite and containing gold in small amounts. Several such pyritized quartz veins of very narrow width have also been uncovered in several of the bed-rock cuts on the creek near its source.

To the south of Poison Mountain creek, and forming part of what is locally known as Quartz mountain, are to be found rocks of the Bridge River series. Massive hornblende diorite in contact with blackish-green serpentine, the latter associated with magnesite and chalcedony, are conspicuous members of this series on this mountain. A wide "dyke" of magnesite, chalcedony, and calcite striking N. 60° W. across the northern slope of the mountain is a prominent physical feature of the topography, and it occurs in association with the serpentine. Beds of crumpled argillite and quartzite are also found and several discoveries of quartz carrying gold have been reported.

The local geology of the First North fork of Watson Bar creek is somewhat similar to the Quartz Mountain section, except that the sedimentary rocks are much more altered in their appearance. The sediments, which for the most part are thinly bedded argillites and occasionally limestone, have been highly metamorphosed, tilted and uplifted by intrusions of gabbro

and coarse-grained hornblende diorite. The gold mineralization in this section occurs in small narrow quartz veins which have been deposited along the bedding-planes of the argillaceous sediments.

Placer Gold.

The placer gold in Poison Mountain creek occurs at and in the bed-rock cracks of the present narrow stream-bed. At places along the creek remnants of an older and slightly higher narrow channel have been found to contain small gold values. There is a complete absence of glacial debris in the stream-valley, and the bed-rock gravels are composed of weathered material from the coarse boulder conglomerates and thin-bedded argillaceous sediments of the immediate vicinity. The gold found in the creek is considered to be local in origin and was in all probability derived from the weathering of the narrow pyritized quartz veinlets and stringers mentioned above.

The overburden on bed-rock varies from 2 to 3 feet of gravel at the upper end of the stream to possibly as much as 20 feet at the outlet into Churn creek. At a point about 1 mile above the lower end of the creek and just above the meadows a bed-rock cut shows the overburden to be 10 feet in thickness. There is very little clay in the overburden and it can be readily moved by ground-sluicing or washing in the sluice-boxes.

Approximately 17 oz. of placer gold, worth $300 at $17.50 per ounce (value based on gold 1,000 fine at $20.67 per ounce), had been saved up to the time of the writer's visit. The largest nugget found to that time was worth $1.85, and while several slugs varying in value from 30 cents to just over $1 had been recovered, the general size of the gold varies from the size of a pin-head to as large as a grain of wheat. There is little fine or flour gold recovered, partly on account of the scarcity of it in the original gravel, but mainly because of the inefficient methods of gold-recovery employed by the various operators. For the most part they are inexperienced placer-miners, and as the lumber for sluice-boxes is all of local manufacture it is not surprising that only short sluice-boxes were being used last June. Whipsawed lumber is expensive to make and difficult to obtain in sufficient quantity for proper sluice-box construction, with the result that instead of a 72- to 84-foot length of 12- by 10-inch sluice-box being used, it was found that the average box was only 24 to 36 feet in length, a length which will permit the escape of most of the fine gold if the box tailings are not carefully watched.

The gold recovered is rough, with an occasional piece being well worn and flattened, and apparently it has not travelled far from its original source in the rocks of the area. In colour it is characteristically of a dark bronze-golden shade. Only small amounts of black sand are recovered with the gold in the sluice-boxes.

Placer-workings.

All placer-mining operations on the creek were by shovelling-in from bed-rock to small sluice-boxes of whipsawed lumber (12 by 12 inches and 24 to 36 feet length) placed on a grade of 6 inches to the 12-foot box-length. Water for sluicing is conveyed to the working-cuts through side-hill ditches that start near the upper boundary-line of the properties. These ditches are made large enough in section to carry the entire flow of Poison Mountain creek, except for the early spring snow-water floods, with the result that wing-damming has not been required to keep the working-faces comparatively dry for cleaning up bed-rock. Small earth and brush dams divert the stream-flow into the short ditch-water systems.

As previously stated, the entire creek-bed was staked in the fall of 1932. The official season for placer-mining on the creek in 1933 opened during the time of the writer's visit, and while most of the owners were on their ground, or, alternately, had arranged their holdings into groups with representatives on the ground, it can be readily understood that only a few of the claims, or groups, had been worked on any appreciable scale up to the time of the examination. Several bed-rock cuts had been completed and a small amount of placer gold recovered, but most of the miners were busy establishing camps, prospecting, cutting lumber for sluice-boxes, digging ditches, and otherwise preparing for the recovery of placer gold.

The descriptive notes which follow give conditions as they were late in June, 1933, and deal only with the claims, or groups of claims, on which actual mining had taken place. They are given in order, starting with the discovery group, which happens to be nearest the stream source, and working down-stream to the Butler ground located just below the confluence of Poison Mountain creek with Churn creek.

Poison Mountain Group.—This group of eight placer claims includes the two 500-foot discovery claims owned by David Jones and Wiley Holt, in addition to claims owned by G. Haller, W. Fenton, Lance G. Hartman, H. C. Caldwell, and Harry Marriot. The two discovery-claim owners were working the bed-rock on the lowest of their claims with a short sluice-box of whipsawed lumber and shovelling-in methods. The overburden, of 2- to 3-foot depth, had been removed from a section of the bed-rock by ground-sluicing with water directed through a short ditch. Total recoveries from approximately 300 square feet of bed-rock had amounted to 3 oz. of gold. The bed-rock in the cut is smooth, lies almost horizontal in attitude, and is for the most part an argillite. The gold was found to occur in patches in small depressions in the bed-rock and not in any well-defined pay-streak along the channel.

Fenton's Claim.—This claim, which adjoins the Poison Mountain group on the down-stream end, was being worked by Walter Fenton and cousin. A side-hill ditch to give a small head of water for ground-sluicing was nearly finished at the end of June and the owners expected to get into actual production early in July. The bed-rock had not been exposed nor had any testing of the overlying gravels been done prior to the construction of the ditch system, the owners relying on the evidence of testing done both above and below their ground.

Mary Ann Claim.—This claim, owned by A. McDonnell, adjoins the Fenton claim on the south and in June last was being worked by the owner and two partners. Several shallow cuts had been started for bed-rock, but high water and lack of ditching around their workings had prevented the workers from making any gold-recovery. Sluice-lumber was being prepared and expectations were that a serious attempt would be made in July to get out gold sufficient to purchase necessary food-supplies.

Craig and Boyd Claims.—The third and fourth claims below the *Mary Ann* are owned by F. Boyd and C. Craig. They were being assisted by Olson and Johnson and had removed a section of the overburden from the lowest of the claims by ground-sluicing, and were almost ready to start working the bed-rock gravels. No recovery had been made at the time of the visit. Well-constructed sluice-boxes and miner-like methods were being used in the operation of this property.

Nygren's Claim.—Next below the Craig claim and owned by J. Nygren, this claim was being worked by the owner under serious difficulties. A cut to bed-rock and a short ditch were being started when the ground was seen, but no gold-recovery had been made, the owner being seriously handicapped by lack of equipment.

Simpson's Group.—This group of three claims, owned by D. Johnson, G. Simpson, and H. Whitehead, are the fourth, fifth, and sixth claims below Nygren's claim. Approximately $90 in gold (just over 5 oz.) had been recovered from shovelling-in operations in a cut to bed-rock 60 feet long by 10 feet wide under an overburden of 6 feet of washed gravel and soil. The "pay" came from the deep cracks in the bed-rock rather than from the gravels immediately overlying. No definite pay-streak was found, and the gold, rough and fairly small in size, was irregularly distributed in patches along the bed-rock cracks in the working-cut.

Riley's Group.—This group of two placer claims, owned by J. Riley and J. I. MacDonald, is situated a short distance down-stream from the Simpson ground, and at the time of the examination the owners were busy sawing lumber for their sluice-boxes and constructing a ditch from the top end of the ground to by-pass the creek and provide a small head of water for ground-sluicing. No gold-recovery had been made other than a few small pieces from test-panning.

Quartz Mountain Group.—There are eight placer claims in this group, which adjoins the Riley group on the down-stream end. The owners, in order down-stream, are J. Murdock, M. Holt, J. Moses, A. Murdock, C. Murdock, W. Schrader, E. W. Borine, and M. Payne. A small gold-recovery had been made from a 60- by 10-foot cut on Schrader's claim, but as this cut had not reached bed-rock, and as several feet of gravel remained to be removed before a proper clean-up could be made, it is impossible to give an idea of the value of the ground. Several of the owners were on the ground preparing to go ahead with this work.

Black Horse Claim.—Next below the Quartz Mountain group is the *Black Horse* claim, owned by F. Michel and worked by R. Butler. Small gold-recoveries from a shovelling-in operation by Butler were being made, mostly from the argillaceous rim-rock. Preparations were being made to divert the creek with a side-hill ditch so that bed-rock might be reached.

Butler Claim.—This claim, owned by R. Butler, is located about a quarter of a mile below Poison Mountain creek on Churn creek. The owner, with the aid of several partners, has moved

and washed approximately 750 to 800 yards of gravel from a 9-foot creek-bench by shovelling-in to sluice-boxes. The bed-rock is flat, with erratic depressions and bed-rock cracks containing the most of the gold recovered therefrom. Due to only a 3-per-cent. grade in Churn creek, the owners have experienced difficulty in getting rid of boulders and tailings from the workings. The total gold-recovery could not be obtained accurately, but is believed to be in the neighbourhood of $125 and $150 (7 to 8.5 oz.), or roughly 5 to 6 cents per square foot of bed-rock uncovered.

Between the *Black Horse* and Butler claims there are several groups of placer claims, including those held by Chisholm, the Olson Bros., Hinkes, Adamson, Brown, Robertson, Pollard, Smith, Dempster, and Boyd, but in every case, with one exception, the amount of prospecting and excavation has been negligible. On the Olson group a cut partially through the heavy overburden had penetrated a depth of 10 feet without getting down to bed-rock. Most of the owners were on the ground and planning to work by means of shovelling-in methods.

Several parties of prospectors were working up the various creeks tributary to both the Yalakom river and Churn creek, and a discovery of pay-ground was reported from two small creeks rising on the Yalakom side of Poison mountain shortly after writer had left the area.

Conclusion.

From a study of the five or six bed-rock cuts on Poison Mountain creek and Churn creek, and a knowledge of the recoveries made to the date of the examination, the conclusion was reached that the placer-diggings will not be a bonanza creek in any sense of the word. On the other hand, it is considered that on sections of the creek favourable bed-rock conditions will be found, particularly where the argillitic shales cross the stream, and that at least small wages will be made by some of those working.

It is emphasized that all the ground on Poison Mountain creek has been staked and outsiders going into the area to prospect will have to confine their prospecting to the other small creeks of the district. The small tributaries of the Churn rising on Poison mountain are recommended for prospecting.

Lode Prospecting on Quartz Mountain.

Two days were spent by the writer making a reconnaissance of the territory to the south of Poison mountain. Several quartz discoveries from which good gold assays were reported, but unfortunately when a trip was made to them the ground was found to be covered with several feet of snow at the points of discovery and it was impossible to form any opinion of the prospects. The general rocks of the area, members of the Bridge River series, are massive hornblende diorite and serpentine. Prospecting to the south of Quartz mountain and on Dog mountain, both peaks in the Shulaps range, was recommended to several prospectors in the area, but what results were obtained the writer so far has not been informed. The rocks here in contact with the igneous members of the Bridge River series are old and highly altered sediments, mainly argillites and bedded limestones.

First North Fork of Watson Bar Creek.

For the past fifteen years or more the First North fork of Watson Bar creek has been a small but steady producer of placer gold. Production has ranged up to $3,500 per year in placer gold at the rate of $6 per day per hand working. The best pay-ground has not necessarily been worked out, but most of the shallow ground has, and during the summer of 1933 only a few men were busy on the creek.

The operations of the Watson Bar Syndicate, under the supervision of W. E. Johnston, did not prove as successful as anticipated, and due to financial difficulties this group remained idle for a large part of the productive season. Lack of water-storage facilities prevented the satisfactory working of their small hydraulic plant. Arrangements were being completed for the further working of the ground by F. Schulthiers, of Seattle, the principal owner.

The M. Daly ground down-stream a short distance from the syndicate holdings still had several hundred feet of good pay-ground available and no doubt was worked during the summer months, but at the time of examination the owner had gone prospecting in the Poison Mountain Creek country on the strength of good reports from that section. The Daly property is worked by ground-sluicing during the early spring months, when the water is high. At this period the 12- to 14-foot overburden is removed and washed, and when the water-supply decreases the top

18 inches of an 18-foot wide bed-rock pay-streak is removed and washed. The "pay" averages about $250 to $300 per 12 lineal feet (a box-length) of channel and comes mainly from the bed-rock section of the pay-streak. The owner for several years has made a comfortable living from his individual efforts.

Below the Daly ground the 10-per-cent. stream-gradient flattens off to approximately 2 per cent. and the ground for a distance of 4,500 feet along the creek is covered by three leases held by Webber, Harris, and Adams. This ground is considered to be well worth serious prospecting by means of shafts to bed-rock, and in the event of favourable prospects being found it could be best opened up and worked by drift-mining methods. The depth of overburden on this section of the creek has not been ascertained, but a short distance above the leases, on M. Daly's lease, it was over 20 feet thick, and at one place about the centre of the three leases a shaft and test drill-hole down 35 feet in the overburden did not reach bed-rock.

Several men were operating small shovelling in lays along the creek above the Daly ground on remnants of low-grade rim-rock gravels left by the original miners. In most cases they were taking out sufficient gold to pay for supplies and occasionally doing much better.

The placer gold recovered on the creek is valued at $18 to $19 per ounce (pure gold at $20.67). It is rough and angular in shape and toward the head of the creek it is generally found in fairly coarse pieces which in many instances are attached to vein-quartz. It is stated by the old-timers on the creek that gold from the top placer claim on the creek was found associated with gold tellurides in small nuggets that showed practically no evidence of travel or abrasive wear. The gold is bright golden-yellow in colour.

The abrupt manner in which the placer pay-streak ended, together with the coarse, unworn, quartz-gold nugget nature of the "pay" that had been recovered in placer-mining, led the owner, W. Trimble, to prospect the adjoining hillsides for deposits of gold-bearing vein-quartz. These he was successful in finding and on his discoveries he located seven claims known as the *Astonisher* group.

Astonisher.

This group of seven claims—the *Confidence*, *Clinton*, *Clinton No. 1*, *Clinton No. 2*, *Independence*, *Kootenay*, and *Columbia*—owned by W. Trimble, F. W. Engeman, C. Robinson, and N. Evans, is situated on the north side of the head of the First North fork of Watson Bar creek. Access to the claims is over a 12-mile trail from Big Bar ferry, the end of the road from the Pacific Great Eastern Railway at Kelly lake.

The country-rocks in the vicinity of the workings are very old and very much altered metamorphosed argillites occurring in contact with a coarse-grained hornblende diorite. The argillites are in the main thinly bedded, have a north-south strike and dip to the westward at 15° to 20°. A fine-grained feldspar-quartz dyke has been uncovered in several of the open-cut workings in contact with the intrusive and lying between it and the sediments. In the argillites and a short distance above the diorite-contact are found narrow veins and stringers of quartz mineralized with gold, both in the free state, and in association with iron pyrites.

The development-work on the property, practically all of which has been done by W. Trimble, working alone by hand methods, consists of several short crosscuts and open-cuts into the hill along and slightly above the diorite-contact. A 100-foot crosscut at N. 15° E. has been driven into the argillites near the creek-bottom, and from a point 75 feet from the portal an 80-foot winze has been sunk. At the bottom of the winze a 12-foot drift to the south-east was being extended at the time of examination.

At the face of this short crosscut a 2-inch black stringer of rock was sampled at several points, the assay return showing: Gold, *nil;* silver, *nil.* This stringer was believed by the owner to carry high silver values. In the same working-face a 2-foot section of the silicified argillite of the foot-wall of the black stringer was channel-sampled. This sample as cut contained a small amount of iron-sulphide mineralization, but the assay results were: Gold, *nil;* silver, *nil.* A sample of oxidized quartz and argillite taken from a dump at the highest working-cut, and in close association with the quartz-feldspar dyke, returned, upon assay: Gold, 0.5 oz. per ton; silver, 0.1 oz. per ton. Many samples of oxidized quartz have been crushed and panned by the owner, and in the majority of cases he reports obtaining a string of colours from ¼ to 1 inch or longer in the pan. Many such samples were shown to the writer, and in all cases the gold appeared to be identical in character to that found in the placer-diggings located just below the mine-workings.

Chisholm. This group of recently staked mineral claims, in which T. Chisholm, J. L. Webber, *et al.*, are interested, adjoins the *Astonisher* group to the west, and covers the ground at the headwaters of both the First North fork of Watson Bar and Ward creeks. Several hundred lineal feet of trenching had been completed by the owners on the dividing ridge between these two creeks (6,300 feet elevation) in prospecting several narrow quartz veins which lie embedded with the altered argillites. Most of the trenching has been done on the *Sunbeam* and several narrow stringers have been uncovered. A sample from a 1-ton dump of oxidized quartz and argillite at the edge of the deepest cut was assayed and found to contain: Gold, 0.16 oz. per ton; silver, 0.04 oz. per ton. The hope here would seem to be in locating either a widening in the narrow quartz veins and the location of ore-shoots in the same, or else in finding a series of the veins so closely spaced that they could be combined with the country-rock to give a minable grade of ore over a minable width.

J. Fletcher was busily engaged in prospecting on the ridges at the headwaters of these creeks when the area was visited.

Buster. This group of claims, owned by R. F. Butler, was staked on the Ward Creek side of the dividing ridge between Watson Bar creek and Ward creek many years ago. The open-cut workings lie a short distance to the west of the trail connecting Watson Bar placer-diggings and Big Bar. No samples were taken of the ore, which, it is reported in the past Annual Reports, consists principally of antimony in association with silver. A 5-foot vein assaying 47 per cent. antimony and several ounces in silver to the ton has been reported by the owner, but as there was no one in the vicinity to act as a competent guide over the showings the writer was unfortunately unable to find this particular showing.

KAMLOOPS MINING DIVISION.

Allies. (*See* Annual Reports for 1924 and 1931.) This group, now extended to embrace thirty-five claims and situated on the Middle fork of Tranquille creek (Cannell creek), has been financed by Vancouver interests under the direction of Gordon F. Dickson. Douglas B. Sterrett, of Kamloops, was instrumental in promoting the present development.

A 12-horse-power gasoline-engine hoist was pulled in to the property under its own power, and a shaft sunk 39 feet in gravel and boulders, probably the old creek-channel, on the flat, a short distance west of the creek, and near a porphyry-outcrop in which some high-grade gold-quartz ore was discovered. A 37-foot drift, as well as 6-foot drill-holes in the face, driven east from the bottom of the shaft, proved that the above find was not in place, and only large boulders and angular blocks of porphyry in blue clay were encountered. About half a mile to the south-west and 200 feet higher, a tunnel was driven 175 feet, which intersected 25 feet of serpentine, 100 feet of porphyry, and 20 feet more serpentine. At 145 feet a band, 12 inches wide, of pyritized quartz and porphyry enclosed in serpentine was found carrying low values in gold. The 100 feet of porphyry assayed from a trace to 0.04 oz. in gold per ton. In a 50-foot tunnel, 60 feet higher and about 200 feet south-west, much oxidized quartz assaying: Gold, 0.20 oz. per ton; silver, 0.40 oz. per ton, associated with porphyry, was found. Since the examination was made a new "North-west Tunnel" has been driven 65 feet, a quarter of a mile directly west uphill from the shaft, and it will be continued in a westerly direction to crosscut the formations in an endeavour to locate the source of the quartz in porphyry found displaced near the creek. About 4 miles of rough road were built and a car can be driven in dry weather to within a mile of the property. Two log buildings 18 by 22 feet, a root-cellar, and a blacksmith-shop were constructed. A crew of twelve men was employed in the summer and six men in the winter.

Windpass Gold Mining Co., Ltd. (Windpass Mine). (*See* Annual Reports for 1917, 1921 to 1927, and 1930; also Geological Survey of Canada Summary Report, 1921, Part A.) This mine, situated about 8 miles from Chu Chua, which is 55 miles north of Kamloops, and developed over a period of years, was reopened by the A. B. Trites-W. R. Wilson interests, of Vancouver. In the 1925 Annual Report will be found a full description and map of the workings, while the geology is described in Geological Survey of Canada Summary Report, 1921, Part A.

During 1933 development consisted of unwatering the winze and preparing for stoping operations above No. 1 level. Two car-loads of crude high-grade gold-bearing ore were shipped to the smelter. A 45-foot right-of-way 2½ miles long was cut from Dunn lake to the mine to

protect a 2,300-volt power-line, as well as a telephone-line and gravity aerial tram. The tramway, carrying eighteen 250-lb. buckets of 1,250-lb. capacity, and travelling on 1-inch traction with ⅝-inch haulage-cables, has a rated speed of 500 feet a minute. At the mine, elevation 4,766 feet, there are two Diesel Petter engines, a 60-horse-power and a 200-horse-power, driving the compressors. Later generators will be installed. A large clearing has been made at the north end of Dunn lake, elevation 1,704 feet, and the main camp and mill constructed at this point. Buildings include a horse-barn, power-plant building, a kitchen with sleeping-quarters above for twenty men, garage, and office. An 8,000-gallon water-tank supplying gravity water to the mill and camp is filled from the lake by a 105-gallon-per-minute Triplex pump. A warehouse has been erected at Chu Chua, on the Canadian National Railway. At the time of examination the mill flow-sheet was only tentative and subject to change; the proposed machinery and equipment consisting of a 15 by 10 Blake crusher, grizzly, 100-ton crushed-ore bin, 6-foot ball-mill to crush 2-inch material, 4-foot ball-mill to crush fines, 60-mesh to pass over Wilfley tables, middlings to 4-foot ball-mill, concentrates to be shipped, classifier to work in closed circuit with 6-foot ball-mill, slimes to probably four flotation-machines, Dorr thickener, and Oliver filter. Flotation tailings to be dumped near lake; then sand-pumped to ball-mill for regrind to 200 mesh; then cyanided. The mill was expected to be of 50-ton daily capacity. The ore consists of bismuth telluride, pyrite, chalcopyrite, sphalerite, galena, quartz, and calcite. Byron Wilson is superintendent, K. Stewart assayer, and A. Smith electrical engineer.

Albreda Holding Co., Ltd.

(*See* Annual Reports, under *Blue Ice* and *War Colt* groups, for 1919, 1920, 1923, 1924, 1926, 1927, 1929, and 1930.) This private company, controlled by Vancouver interests, with offices in Suite 64, 553 Granville Street, holds the *Blue Ice* group of twenty-seven claims and the *War Colt* group of thirty-six claims, the former group situated around the headwaters of Fredwells creek on the east side of Hobson creek, and the latter near the headwaters of the Azure river. Detailed reports were made in the Annual Reports for 1923 and 1929.

These claims were not examined in 1933, but a full report was made on both properties by O. D. Frith, of Vancouver, for the company. His findings on the *Blue Ice* group were that there were many large bodies and veins of quartz in the sericite-schists exposed by stripping which were not sufficiently uncovered to permit systematic sampling, but wherever the mineralization (pyrite and chalcopyrite) occurred, attractive returns of gold, silver, and copper were obtained. The main veins conform to the strike of the schist, N. 70° W., and the smaller veins at right angles to it.

On the *War Colt* group, similar, only larger, bodies of quartz were found not only on the strike of the schist, but in the opposite direction. Assay returns under similar conditions were also higher and included some lead and zinc. A selected sample taken over a width of 25 feet, according to O. D. Frith, assayed: Gold, 2.13 oz. per ton; silver, 8.4 oz. per ton; copper, 1.9 per cent. Another 12-foot moiled sample by Frith assayed: Gold, 0.10 oz. per ton; silver, 5.70 oz. per ton; copper, 1.6 per cent. A chip-sample from the ore-dump from a tunnel-mouth assayed: Gold, 0.05 oz. per ton; silver, 15 oz. per ton: copper, 4.20 per cent.; lead, 21.1 per cent.; zinc, 3 per cent. A similarity to the geology and vein systems in the Cariboo is suggested.

The above assays do not check generally with those taken by A. W. Davis and H. G. Nicholls, former Resident Engineers, but since these reports were made more work has been done and possibly better ore exposed. All appear to agree that the area is an interesting one and some of the quartz-exposures carry sufficiently high values in gold to warrant more development-work being done.

The claims can be reached by trail from Gosnell Siding on the Canadian National Railway, a distance of 45 miles, or from Raush, on the Canadian National Railway, a trail follows the Raush river to the headwaters, and thence down the Azure river, about 40 miles long. They can also be reached via Quesnel lake, Hobson lake, and Hobson creek to the *Blue Ice* property.

Adams Plateau.

King Tut.

(*See* Annual Reports for 1930, 1931, and 1932.) Reports from the owners of this group, F. C. McLeod and associates, of Salmon Arm, are to the effect that exploration consisted of stripping and trenching near the lower workings, and that from 12 to 36 inches of high-grade silver-lead-zinc ore was uncovered. Similar results were found by other owners on adjoining claims.

On the *Barlow*, *Black Rock*, and *Joyce*, owned by J. R. Thornton and associates, of Salmon Arm, similar types of mineral were found.

Constant. This group, consisting of eight claims and situated about 9 miles south of Kamloops, is owned by H. Stephens and associates, of Kamloops. A considerable amount of development by trenching, open-cutting, and shallow shafts (old work) has been done on numerous quartz veins. These veins are sparingly mineralized with pyrite and vary from 2 to 14 inches in width. They are found in the Cache Creek series of schistose rocks, spread over an area about 4,000 feet long and 1,500 feet wide. None of these veins outcrop on the strike for any great distance, and all of them appear to have been subjected to very severe faulting and shearing. In an 18-foot shaft sunk on an oxidized sheared zone about 6 feet wide, the quartz vein, striking N. 60° E. (mag.) and dipping 45° south-east, varies from 2 to 14 inches in width from the collar down, and samples taken across it assayed: Gold, 0.70 oz. per ton; silver, 11.5 oz. per ton; and: Gold, 2.1 oz. per ton; silver, 1 oz. per ton, showing a wide difference in values. Within a distance of 200 feet, two other sparingly mineralized veins, one 6 inches and the other about 6 feet in width, strike N. 65° W., and will intersect the shaft-vein about 300 feet north-west near a small bluff where tunnelling operations could be carried on. The shaft values are sufficiently interesting to warrant further exploration.

General.

According to reports, the *Queen Bess*, on the North Thompson river, is to be reopened by the Region Gold Mines, Limited, a private company recently reorganized into a public company, Region Mines, Limited. In the 1917, 1918, 1919, 1924, and 1929 Annual Reports this mine is mentioned. The ore is silver-lead-zinc.

Placer-mining.

Louis, Noble, Jamieson, Heffley, and other creeks flowing into the North Thompson river from both sides north of Kamloops were worked chiefly by men holding provisional free miners' certificates. No outstanding discoveries were made, but a living was obtained in most cases. On Noble creek an old channel remnant about 15 feet above the present creek produced some fairly coarse gold, and on the adjoining lease up-stream the same type of gold was found in occasional bed-rock "guts." On Louis creek, for 2 miles up-stream from its outlet, sniping was carried on near the old hydraulic workings and on some of the old Tertiary gravel-beds. On Jamieson creek, although attractive values were found in pockets, the heavy glacial overburden, generally low grade, prevented successful mining. From Heffley creek and the streams flowing into Heffley lake good values are reported as found. This area was not examined in 1933.

On Scotch creek, which flows into Shuswap lake from the north a few miles above its outlet, much placer-mining was done by individuals and small syndicates, and although probably only 100 oz. of gold, some of which was coarse, was recovered, work was done to prove the existence of some old channels 200 feet above the stream. These may pay to work if a proper head of water can be obtained without pumping. The creek and its tributaries drain an area extending for 25 miles north of Shuswap lake, and past local history indicates that a considerable amount of placer gold was mined between the years 1880 and 1900 by Chinese and Europeans. Evidence of very old work can be seen on the creek as far up as the 21-Mile post. Preliminary testing of some of the bench-gravels showed the possibility of obtaining values from 25 cents to $1.50 a cubic yard.

Non-metallics.

B.C. Sodium Syndicate. (*See* Annual Reports for 1930 and 1932.) Under the name of this syndicate, C. W. Austin and associates, of Kamloops, mined, cleaned, and shipped about 300 tons of sodium carbonate for use as sal soda to the Royal Crown Soaps, Limited, in Vancouver and Calgary. This sodium carbonate was obtained from their deposit, situated about 2½ miles west of Cherry creek, a northerly-flowing tributary of Kamloops lake. A road was built between the sodium carbonate and the sodium sulphate lakes, about three-quarters of a mile long. Facilities for producing soda were improved. Much experimenting was done with a view to producing salt cake (anhydrous sodium sulphate) and possibly soda ash. A small testing plant was built on the ground and information obtained should ensure the best possible choice of process and type of plant for the purposes mentioned.

Canada Gypsum and Alabastine, Ltd.—(*See* Annual Reports, under "Non-metallics," for 1923 to 1930 and 1932.) This company's operations at Falkland continued on part time during 1933 and the product was shipped to Port Mann for manufacture into plaster of Paris, plaster boarding, wall-board, gypsum wall-blocks, and many other gypsum products.

VERNON MINING DIVISION.

Skookum. (*See* Annual Reports for 1931 and 1932, and Bulletin No. 1, 1932; also Geological Survey of Canada Summary Report, 1931, Part A.) This property, consisting of nine claims, situated 4½ miles by trail from a point on the Vernon–Westbank road on the west side of Okanagan lake, has been optioned by V. Locke and W. J. Armstrong, of Penticton, from H. J. Blurton, the owner.

Most of the development-work has been done on the *Skookum* in a highly metamorphosed section of slates close to the granite batholith, and associated with a much-altered porphyritic intrusive rock. The main workings consist of deep open-cuts from 10 to 25 feet long in disintegrated rock. In one of the cuts a 33° inclined shaft has been sunk 50 feet, and a 10-foot drift and a crosscut from it, 21 feet long, have been driven. The quartz vein is highly fractured and varies in width in the workings from 2 to 4 feet. About 35 feet down the shaft the vein flattens and passes into the hanging-wall. At the close of 1933 the vein had not been found. The vein has been traced for about 1,000 feet north-east along the strike. In one cut 4 feet of oxidized quartz and pyrite was found. Downhill to the south the topography suggests that there may have been a series of east-west faults in that direction, displacing the vein several hundred feet. The lowest exposure of quartz is probably the top section of the vein. The ore-minerals observed were pyrite, tetrahedrite, chalcopyrite, malachite, and free gold. A general sample of well-mineralized quartz from an old shaft-dump near the incline assayed: Gold, 0.10 oz. per ton; silver, 12 oz. per ton. In some of the cuts east of the inclined shaft gold could be panned quite readily from the fractured quartz. To the north-east some persistent veins of good widths have been uncovered in much less disturbed rocks, and although apparently low grade on the surface they warrant exploration.

Pre Cambrian Gold Mines, Ltd. (*See* Annual Reports for 1921 to 1924 and 1927 to 1932; also Geological Survey of Canada Summary Report, 1931, Part A.) This company, with headquarters in Smith Tower, Seattle, continued development of its property near Ewings Landing on the west side of Okanagan lake, and sunk the inclined shaft to a point approximately 200 feet vertically underground. From this elevation crosscuts will be driven to ascertain values and widths, and an upraise between the 200- and 100-foot level and an ore-pocket will be excavated. Work is continuing this winter and prospects for better ore appear to be good.

Some changes were made in the mill, and the altered flow-sheet is as follows: 10 by 14 Blake crusher; 4 by 4 ball-mill; primary classifier, 27 inches by 11 feet; secondary classifier, 27 inches by 14 feet; overflow of minus 80-mesh from classifier to flotation; rougher concentrate to settling-tank; middlings to cleaner-cell; tailings to waste-dump; cleaner concentrates to settling-tank; cleaner tailings to ball-mill regrind. All cells Forrester-type Southwestern Engineering Company. Concentrates settled to 15 per cent. moisture and dried on platform. The ore varies from 75 to 90 per cent. pyrrhotite, some pyrite, telluride, and free gold. The concentrate is principally pyrite, telluride, and gold, with a small amount of pyrrhotite.

About 390 tons of ore mined and milled from around the collar of the old vertical shaft assayed from $3 to $12 per ton in gold and silver. Average gold content of all concentrates shipped from this trial run was 3.61 oz. per ton.

Blue Hawk. This group, consisting of the *Rainbow*, *Bluebird*, *Blue Hawk*, *Night Hawk*, *Glow Worm*, and other claims, belonging to the F. B. McConville, W. S. Brown Syndicate, of Kelowna, is situated about 2 miles south-west of Wilson's Landing on the west side of Okanagan lake.

Much surface exploration has been done, the work consisting of shallow pits, stripping, and short tunnels on a series of faulted quartz veins in severely altered volcanic tuffs, breccias, and cherty argillites. This area, about 3,000 feet square, is bounded on the north and south by granite, and in addition is intruded by isolated irregular bodies of dense grey-coloured hornblende rocks. The veins vary from a fracture to 4 feet in width, but seldom persist where uncovered for more than 20 feet on the strike, without displacement and dissipation into the

country-rocks. From one of the shafts, 10 feet deep, a streak up to 7 inches in width, of well-mineralized quartz containing pyrite and lesser amounts of galena, produced, according to the owners, assays up to $32.25 in gold and silver. A sample across 2 feet 6 inches, including the above 7 inches, carried only a trace in gold and silver. A picked sample of ore from a 25-foot tunnel, 200 feet east of the above, assayed: Gold, 0.20 oz. per ton; silver, 0.40 oz. per ton. Unless the veins are found more in place, the cost of mining would probably be excessive. The claims can be reached by an old logging-road traversing the north-east side of Lambley creek to the summit of the hill.

MacIntosh or McIntyre. This old claim, situated on the South fork of Cherry creek, about 33 miles east of Vernon, is owned by J. Cameron and J. H. Fallow, of Vernon. In the Geological Survey of Canada Report for 1887–88, page 68, an account of a strike of rich silver ore on Cherry creek is stated to have been made by G. M. Dawson. The owners at that time were named the Hidden Treasure Mining Company, and the present operators claim that this discovery was made on the *MacIntosh* claim.

Unfortunately, when examined, the old shaft, supposed to contain the ore and to have been sunk about 1887, was full of water and the vein at the bottom could not be seen. Two other shafts—one 25 feet south, also full of water, and another 25 feet north of the above and 6 feet deep—have been sunk since. The quartz vein, conforming to the strike of the argillites in the bottom of the latter, measured 12 inches in width and was sparingly mineralized with pyrite and galena. About 70 feet north-west of this shaft a tunnel has been driven 40 feet on several quartz stringers, also conforming to the north-west, south-east strike of the argillites. Some of the ore from the oldest shaft-dump supposed to be discarded from a shipment made, which contained pyrite, galena, sphalerite, and tetrahedrite (?) and antimony, assayed: Gold, 0.20 oz. per ton; silver, 0.40 oz. per ton; and 0.6 per cent. lead and no copper. The key to the situation lies in the bottom of the oldest shaft, which, according to the size of the dump, should not be deeper than 30 feet. The suggestion is made that this working be unwatered and more information about the size of vein, values, and vein-strike obtained before any other developments are contemplated.

Across the creek in an easterly direction a quartz vein about 6 feet wide, striking north-south and cutting the argillites, has had a few open-cuts excavated upon it over a distance of 200 feet. Only low-grade gold ore has been found up to the present, but its strength and evident continuity appear to warrant further exploration, especially where the veins across the creek intersect it. Vancouver capital, it is understood, has become interested in the property and will develop it in 1934.

St. Paul. (See Annual Reports for 1923, 1927, 1928, 1930, 1931, and 1932; also Geological Survey of Canada Summary Report, 1930, Part A.) This group, owned by New Westminster interests, was again being developed, this time by driving a 90-foot tunnel west and north-west from a point about 110 feet from the face of the lowest crosscut on the contact of the diorite and argillites. At a point about 45 feet in this tunnel a definite shear-zone or fault striking north-west was struck and it was drifted on for 45 feet. In the drag of this zone, near the tunnel-face, which is located just below the ore-body in No. 2 adit, pieces of high-grade ore were found. In 1934 a connection raise 70 feet long will probably be made between the two workings, and this will give some idea as to the direction of the ore-movement. In the upper workings the ore occurs almost entirely in the argillites. In the lowest or No. 4 adit similar minerals were found in a quartz vein close to the contact of the diorite and argillites. The connection between the two has not been definitely established to date, but it appears likely that there has been a strong thrust at the east end of the workings which has displaced the vein possibly 100 feet to the north.

Placer.

Further development in the lower drift was done by Eley, Hall, and others on the old high channel to the east of Woods lake between Vernon and Kelowna, and some placer gold recovered from near bed-rock. This is a very interesting occurrence of an old high channel possibly a mile or more long and a similar distance across, and from 200 to 300 feet thick, lying on a monzonite bed-rock and covered by lavas. The commercial possibilities depend upon whether or not a sufficient thickness of gravel can be found containing gold values. Up to the present a thickness of at least 25 feet is indicated. The ground in the two tunnels—one, 130

feet long, with a winze 25 feet deep at the end of it, and the other, 50 feet below and approximately 300 feet long, about 7 feet above bed-rock—encountered well-rounded partly cemented, mostly quartz and quartzite pebbles, from which comparatively coarse placer gold has been taken. The bed-rock appears to dip very gradually to the east and north. The section in which the work has been done has undoubtedly been subjected to severe stress from the overlying lavas, and possibly the gravel and bed-rock may not be in place. About 800 feet below the leases the Canadian National Railway traverses the east side of Woods lake, so that transportation and water are immediately available should a large volume of profitable gravels be developed.

General.

On Mission and Cherry creeks numerous small operators managed to make a living sniping and working over parts of the ground left by the miners in 1865. On the North fork of Trout creek some fine gold was recovered from the low bench-gravels on the west side of the stream.

Coal.

The coal leases on Shorts creek belonging to W. Forester *et al.*, of Vernon, have, it is understood, been optioned by Vancouver interests and some work is contemplated in the near future.

EASTERN MINERAL SURVEY DISTRICT (No. 5).

REPORT BY B. T. O'GRADY, RESIDENT MINING ENGINEER (HEADQUARTERS, NELSON).

INTRODUCTION.

Briefly summarizing the year's activities, pronounced interest in lode-gold mining has been sustained throughout District No. 5, resulting in a large aggregate amount of development and exploratory work, accompanied by a substantial increase in gold production. This is chiefly derived from the Nelson and Trail Creek Mining Divisions. The Nelson output is the best since the year 1913, and the Rossland production, which showed a marked increase since August, when the well-known gold-copper properties of the Consolidated Mining and Smelting Company were made available to lessees, is the largest recorded from this area since 1925, when large-scale production by this company languished.

While interest in the yellow metal, stimulated by its increased price, has been the means of creating a substantial amount of new employment in the aggregate, the largest factor in the general mining industry of the district is the advancing price of silver and associated base metals due to higher sterling exchange values. This is of importance in connection with the outstanding production of silver, lead, and zinc made by the Consolidated Mining and Smelting Company, as they raise wages as metal prices advance. The Trail plant is being operated 85 per cent. of capacity in the lead department and 50 per cent. in the zinc. This is in accordance with production ratios established by the International Cartel, which regulates output. This company's annual pay-roll amounts to $5,000,000 at present and 3,800 men are employed.

An important contribution to silver-lead-zinc production of the district was that made from the *Monarch* mine, near Field, of the Base Metals Mining Corporation during the last five months of 1933. In anticipation of higher prices, revived interest in silver has recently become apparent and new deals are being negotiated in several cases, from which activities should result. In the Slocan camp, including portions of the Slocan and adjoining Ainsworth Divisions, lessees at a number of properties have been accumulating ore for shipment when it can be disposed of more advantageously. A large aggregate amount of ore is awaiting shipment from this source, while in some cases small shipments have been made at intervals during 1933.

GEOLOGICAL SURVEY WORK.

Information relating to District No. 5 published by the Geological Survey of Canada during 1933 includes: "Some Mineral Occurrences in the Vicinity of Cranbrook," by C. E. Cairnes, and "Brisco-Dogtooth Map-area," by C. S. Evans; both of these being contained in the Summary Report, 1932, Part A 11. The special report by J. F. Walker on the Salmo Map-area, with accompanying geological map, is expected to be published during the spring of 1934.

PRODUCTION.

Mine or Group.	Tonnage.	Character of Ore.
Fort Steele Mining Division—		
Midway	40	Gold, silver.
Sullivan	1,401,061	Silver, lead, zinc.
Golden Mining Division—		
Monarch	35,612	Silver, lead, zinc.
Lardeau Mining Division—		
Pool Mountain	1	Gold, silver, lead.
Nelson Mining Division—		
Arlington	32	Gold, silver, lead, zinc.
Boulder City	57	Gold, silver.
Bunker Hill	50	Gold, silver.
California	91	Gold, silver, lead, zinc.
Columbia	23	Gold, silver.
Granite	552	Gold, silver.

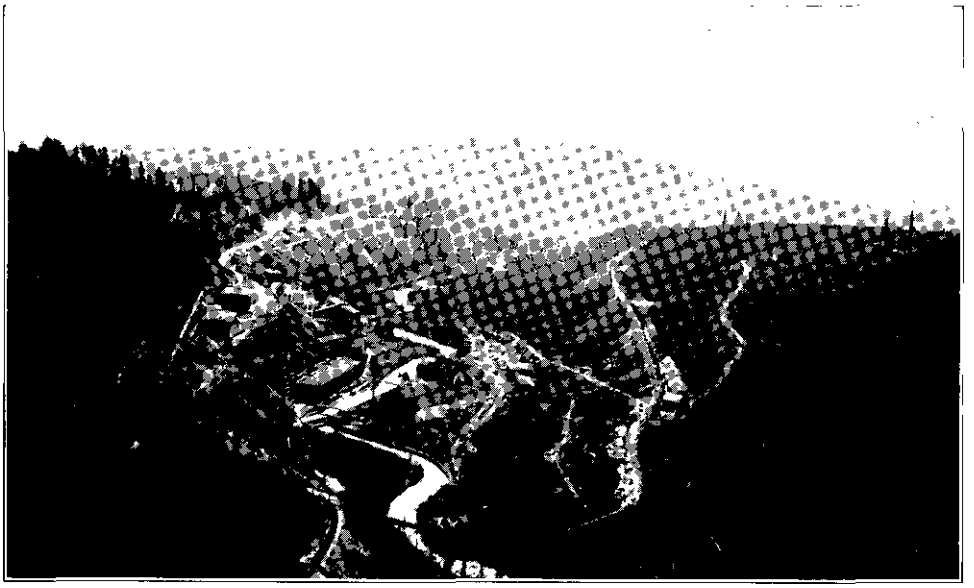
PRODUCTION—*Continued.*

Mine or Group.	Tonnage.	Character of Ore.
Nelson Mining Division—*Continued.*		
Humming Bird	25	Gold, silver, lead, zinc.
Keystone	315	Gold, silver, lead, zinc.
Kootenay Belle	673	Gold, silver.
Perrier	292	Gold, silver, lead, zinc.
Queen	150	Gold.
Reno	21,967	Gold, silver, zinc, lead.
Royal Canadian	27	Gold, silver.
Sanca	323	Gold, silver.
Second Chance	2	Gold, silver.
Second Relief	4,082	Gold, silver.
Vancouver	127	Gold, silver.
Venus-Juno	29	Gold, silver.
Wilcox	1,694	Gold, silver, lead, zinc.
Yankee Girl	13,488	Gold, silver, zinc, lead.
Tamarac	52	Gold, silver.
Slocan Mining Division—		
Bosun	61	Silver, gold, lead, zinc.
Grey Copper	2	Silver, lead, zinc.
Mammoth	29	Silver, zinc, lead.
Molly Hughes	7	Silver, zinc, lead.
Rio	38	Silver, gold, lead, zinc.
Ruth	124	Silver, gold, lead.
Silversmith	390	Gold, silver, zinc, lead.
Standard	67	Silver, gold, lead, zinc.
Victor	65	Silver, gold, lead, zinc.
Slocan City Mining Division—		
Chapleau	9	Gold, silver.
Gold Viking	6	Silver, gold.
Little Daisy	8	Gold, silver.
Trail Creek Mining Division—		
Cliff	29	Gold, silver.
Daryl	1	Gold, silver.
Evening Star	53	Gold, silver.
Georgia	18	Gold, silver.
Gold Drip	25	Gold, silver.
I.X.L.	272	Gold, silver.
Midnight	141	Gold, silver.
O.K.	30	Gold, silver.
Rossland properties (leasers)	10,833	Gold, silver, copper.
Spring Creek	39	Gold, silver.
Velvet	519	Gold, silver, copper.

GOLDEN MINING DIVISION.

Monarch. At this mine of the Base Metals Mining Corporation, near Field, work was resumed in July under the direction of F. R. Eichelberger and regular shipments of lead and zinc concentrates were maintained to European smelters. Production started in August, when 4,137 tons of ore was milled, and was stepped up to about 8,300 tons in December, with a total of 35,885 tons milled for the five months. Lead concentrates amounted to 6,076 tons, zinc concentrates 7,326 tons, with 51,619 oz. silver. The production incline drift in the *West Monarch* was extended slightly and production ore-pockets put in, the incline being equipped with side-dump cars working in balance.

In the mill the following equipment was installed: A weightometer; an automatic sampler and distributer; a 36-inch double-spiral Akins classifier with capacity to handle a circulating load of 2,000 tons per day; six zinc and six lead-cleaner flotation-cells; and necessary pumps and other equipment required to take care of increased tonnages and change in the mill circuit. Development-work was vigorously pushed and another ore-body was reported found in the extreme south end of the *West Monarch* workings. As this ore-body had just been tapped at the close of 1933, no estimate as to size is available. Two new warehouses and a tank-house have been built, and numerous other surface improvements were also made on the property.



Sullivan Mine—Portal on Mark Creek, Fort Steele M.D.

Sullivan Mine—Concentrator at Kimberley, Fort Steele M.D.

Sullivan Mine—Concrete Pillar.

Sullivan Mine—Barring-down in Stope.

PLACER-MINING.

Some activity materialized in connection with holdings on Canyon creek, south-west of Golden, including the undertaking of the Canyon Creek Syndicate (Hallowes and Poffenbarger); work done on his lease by W. H. Tallis, of Golden; and others waiting for the open season to commence operations.

WINDERMERE MINING DIVISION.

There was no lode-mining activity to record in this Division during 1933, other than the usual prospecting and assessment work. A limited amount of placer-mining activity is reported to have occurred on Dutch creek, including the undertaking of P. McGrath, of Cranbrook. A shaft is reported to have been sunk by him to a depth of 17 feet, where frozen gravel was encountered. The shaft is sunk close to the head of the canyon, above which the creek widens out into a valley with sloping side-hills covered with bunch-grass.

FORT STEELE MINING DIVISION.

A contribution to the literature outlining the economic possibilities of the Fort Steele Division is contained in the Summary Report of the Geological Survey of Canada for 1932, Part A 11, "Some Mineral Occurrences in the Vicinity of Cranbrook, B.C.," by C. E. Cairnes. This became available during the period under review. Lode-mining with crews of men, apart from the large operation at the *Sullivan* mine, has only occurred at the *Midway* prospect (B.C. Cariboo Gold Fields, Limited), near Aldridge, other activities being chiefly limited to that by prospector-owners. Placer-mining, however, kept many men usefully employed in the Fort Steele-Cranbrook-Lumberton area. New activities were initiated following the discovery of gold on Hellroaring creek, near St. Mary lake. Placer-mining activities are summarized at the en dof this report.

Sullivan. There has been practically no change in the scope of operations at this mine, the property of the Consolidated Mining and Smelting Company of Canada, at Kimberley, and there was no construction of importance during 1933. Development-work in the mine was continued as usual and included 2,321.5 feet of raising, 455 feet of sinking, and 1,800 feet of crosscutting and drifting, or a total of 4,576.5 feet for the year. The inclined shaft, or 3,901 winze, sunk from the 3,900-foot level, is now down 1,000 feet. The new raise being driven from S 11 stope is nearly through to the surface, 600 feet above the ore-body. This will be used both for ventilation and for the introduction of gravel for stope-filling worked-out areas. Five additional 156-cubic-foot-capacity Granby-type cars with double trucks were added to the underground haulage equipment, giving satisfactory results. The electric furnaces for sharpening and tempering drill-steel continued to give good service. During the year 1,400,886 tons of ore was shipped to the concentrator and 12,532 tons of crude lead ore was shipped to the Trail smelter. At the time of writing (early 1934) the daily output from the mine is at the rate of 5,450 tons. Other undertakings of the Consolidated Mining and Smelting Company in the Fort Steele Division included one month's operation of the Crow phosphate-deposits, about 2,109 tons having been shipped to the Warfield chemical-fertilizer plant, near Trail, for experimental purposes. A comprehensive description of the phosphate-deposits in the Canadian Rockies, by L. Telfer, is contained in the December, 1933, bulletin of the Canadian Institute of Mining and Metallurgy.

Quartz Mountain.* At this group of claims, situated at the headwaters of Sawmill creek, a short tributary of Perry creek, near Cranbrook, an interesting discovery of quartz, mineralized with gold-bearing iron and copper sulphides, was made late in 1932 by Elmer Rice and associates, of Kimberley. There are at least two massive quartz-outcrops on the property. The westerly showing lies up the hill from the camp at 6,400 feet elevation and averages 50 to 75 feet in width. Its continuity has been fairly well established for a length of several hundred feet by two series of trenches and numerous outcrops. Sampling of this showing indicates the quartz to be auriferous but of too low grade to be commercial. About 600 feet to the east downhill from this massive showing, and separated from it by a stock, or dyke, of diorite, is the second and most important of the showings. Here the owners have completed a 150-foot trench in the shape of a T, and while insufficient work has been done to positively determine the attitude of the quartz-outcrop disclosed, it

* Report by A. M. Richmond, Assistant Resident Mining Engineer, Victoria, B.C.

would appear that the top bar of this T-shaped trench (105 feet long) has been made along the dip of the vein, which here apparently lies almost conformably with the mountain-side slope, and dipping into it slightly. Careful channel-sampling along the length of this trench has established a value of slightly over 0.25 oz. gold per ton for the 105-foot length. One section of 20-foot length in this 105-foot length, where surface oxidation is most pronounced, and from which free-gold specimens were obtained, assayed over 1 oz. gold per ton. The short 45-foot trench to the east of the centre of the main trench shows the vein to be cut off by a diorite stock. There is no evidence of constriction to the west for several hundred feet, and further prospecting will be required to indicate the dip length and the thickness of the quartz. The surface showings might be one of several parallel quartz veins such as was indicated in the western showing, and this could best be tested by crosscutting into the hill, either by tunnelling or with a diamond-drill. The occurrence is interesting and worthy of serious prospecting and preliminary development at least. During 1933 several scouting engineers examined the ground, but up to a recent date the owners had not concluded a satisfactory deal with any of the interested parties.

Lead. At this prospect, reached by trail from the end of the Findlay Creek road at Jeffrey's ranch, prospecting-work was continued by the Blake Bros., of Fort Steele. They now report having sunk an inclined shaft 30 feet on a new showing which is in quartzite at its hanging-wall contact with a granite sill (*see* Annual Report for 1932). This work disclosed numerous loose aggregates of solid galena, with which silver and some gold values are associated, in decomposed material, the fragments of galena being up to 15 lb. in weight. The discovery, in an area of altered sediments, with which granitic sills are intercalated, has not yet been mapped geologically. The Aldridge formation is said to have been traced northerly to Doctor creek, a tributary of Findlay creek.

Dibble. This group of claims, at the head of Lost creek, a tributary of the Kootenay river, below Fort Steele, has been acquired by Calgary interests and some preparatory activity occurred. The only available description is that by the late W. Fleet Robertson in the Annual Report for the year 1898. The veins are reported to consist chiefly of two types—high-grade veins, up to 1 foot in width, carrying tetrahedrite in a quartz gangue with usually good values in gold and silver associated with the copper mineral: and veins of milky quartz, up to 4 feet in width, carrying low values in gold and silver. The rocks in the vicinity are said to consist of schistose argillites, the strike of the schistosity being N. 60° E., with vertical dip, and with one exception the veins are reported to follow the strike and dip of the schist. A sill of diorite is said to outcrop half a mile north of the property.

Midway. At this prospect, adjoining the highway near Aldridge, a siding south of Moyie lake, new activity was initiated late in 1933 by the B.C. Cariboo Gold Fields, Limited. The new undertaking, which was temporarily discontinued at the end of 1933, is of considerable interest, the auriferous vein occurring in the Aldridge quartzites, the lowest member of the Purcell series of pre-Cambrian age, which, in the Fort Steele Division, and in the Coeur d'Alenes district in Idaho, contains silver-lead-zinc deposits of outstanding importance. Although placer gold has been found in the adjacent area, underlain by similar rocks, no appreciable production has hitherto been made from gold-quartz veins. Five claims were optioned by the B.C. Cariboo Gold Fields, Limited, and some sixty-five others were staked, extending across the wide flat bottom of the Moyie valley and up to the summits of the mountains on either side. The tunnel being advanced on the vein is within a few hundred feet of the Southern Trans-Provincial highway and of the C.P.R. tracks. The new mine-camp buildings are located on the roadside just below the tunnel and the compressor equipment is housed at the tunnel-mouth.

The deposit consists of a quartz vein heavily mineralized with pyrite and small amounts of lead, zinc, and copper sulphides. It strikes north-westerly into the mountain and dips 45° to 55° to the north-east. In width the ore-shoot varies from 5 to 8 feet, and near the face of the tunnel, when last seen by the writer in October, a width of 8 feet was exposed, but the hanging-wall had not been reached, so that at that point the width is somewhat greater than 8 feet. The vein has now been followed for about 300 feet by the tunnel and has been traced on the surface for over 800 feet. Mineralization in the section of tunnel driven since the property was visited by the writer is reported to be as follows: After passing a fault, just beyond the wide ore section referred to, the vein has varied in width from a seam to 3 feet, but is always

in the same strongly sheared zone. As the sheared rock required much timbering in the vein-zone, the tunnel was driven in the hanging-wall country parallel to the vein, which was to be tested at intervals with an X-ray drill or with cuts in the tunnel-wall. At 290 feet in from the portal the vein was 18 inches wide, with similar intensity of mineralization as in the ore-shoot south-east of the fault, where the sulphides constituted probably 30 per cent. of the total volume. The gangue consists entirely of quartz with minute amounts of siderite. In places the quartz has been intensely brecciated and recemented. The sulphide content is mainly pyrite, with only minute amounts of zinc-blende, galena, tetrahedrite, and chalcopyrite. Arsenopyrite has recently been identified. An analysis of the ore showed, besides iron, copper, lead, and zinc, small but definite amounts of tin. The principal value is in gold, but silver is invariably present and in places in important amounts. Assays of selected ore have run from 1 to 1.86 oz. of gold per ton and up to 10 oz. of silver per ton. All general samples taken to date range from $3.30 to $18 per ton, calculated on a gold price of $20 per ounce. Owing to the character of the ore it is difficult to strike an average value, but for this purpose a car-load of 40 tons of ore was shipped to the Trail smelter. This assayed: Gold, 0.32 oz. per ton; silver, 2.5 oz. per ton. The analysis was: Silica, 59.2 per cent.; sulphur, 16.8 per cent.; iron, 17.1 per cent.; lime, 0.5 per cent.; arsenic, 1 per cent.

The continuity of the mineralization exposed throughout the limits of the work done, the uniform character of the ore, and gold and silver values so far obtained, warrant a large amount of development-work to explore for the possible occurrence of large ore-bodies. The ideal transportation facilities and exceptionally favourable geological conditions combine to make this prospect of unusual interest. The tunnel being driven gains a foot of backs for each foot of advance.

The writer is indebted to V. Dolmage, consulting geologist, for the following details: "The quartzites are fine-grained thin beds of great extent and uniformity. They are strong, brittle, and capable of sustaining fractures for great distances. The next overlying member of the Purcell series is the Creston formation, similar in many respects to, but, on the whole, more argillaceous and therefore somewhat softer than the Aldridge formation. The Creston beds occur near the summit of the hill in which the tunnel is being driven. Occurring in the Aldridge formation and in the base of the Creston formation respectively are two gabbro sills. Sufficient geological work has not yet been done to determine precisely either the stratigraphic position or thickness of these sills. They do, however, conform exactly with the attitude of the quartzite-beds, which dip 20° to 30° to the north. This attitude causes the tunnel to cut higher and higher beds as it is driven along the vein into the mountain, so that at points not yet determined it will cut first the lower sill, then the upper sill, and finally pass into the overlying Creston formation. This will be several thousand feet from the present portal and an exact survey is now being made which will determine with considerable precision the various distances at which the two sills and the Creston formation will be crossed by the tunnel.

"The quartzites of the Aldridge formation in this part of British Columbia and in the adjoining parts of the State of Idaho are exceptionally favourable for ore-deposition and contain several of the greatest deposits in the world. Their favourable character is due to two causes—namely, their ability to sustain large uniform fractures for great distances, and, second, the susceptibility of certain of the beds to replacement by mineralizing solutions. To the former habit may be attributed the immense veins of the Coeur d'Alenes district of Idaho, such, for example, as the *Bunker Hill* and *Sullivan* and more notably still the *Morning* vein, which has been followed down the dip continuously for about 1 mile. To the susceptibility of certain of the beds and the resistance of adjacent beds to replacement by mineralizing solutions may be attributed the great ore-body of the *Sullivan* mine, situated just 30 miles distant from Moyie. The *Sullivan* ranks with the greatest ore-bodies of the world. Because of these demonstrated habits any vein occurrence in the quartzites warrants the most thorough and extensive testing. In view of these facts there is a strong probability that the *Leask* vein, having a known width up to 8 feet or more, will persist for long distances in both horizontal and vertical directions, and it was with this probability in mind that such a large area was staked along the strike of the vein.

"Should the vein persist to the north far enough to intercept the above-mentioned sills and the softer beds of the Creston formation, it is probable that a change in conditions will be found resulting in some interesting possibilities. Should the sills sustain the fracture with a

greater facility than the quartzite-beds, the dip of the vein will almost certainly change, and such changes in dip frequently cause marked increases in the size and value of ore-bodies. Should the softer beds of the Creston formation be found to have failed to sustain the open fracturing, there is a probability of their having acted as an impervious roof and thereby caused the ore solutions to spread out in the underlying easily replaced beds to form a large tabular ore-body of the *Sullivan* type.

"No body of granitic rock from which the mineralizing solutions might have emanated is exposed anywhere in the vicinity of the property, and it is presumed that, as in the case of the *Sullivan* mine, a body of such rock underlies the vein at some depth. The proximity of the *Midway* to the *Sullivan* deposit and the presence in each of the rare metal, tin, suggest the probability that the same or closely related bodies of granitic rock underlie each deposit."

Some diamond-drilling was done to test the vein at depth. Installations include: A suction-fan with 8-inch air-line; a Delco plant supplying electric light to all buildings; a trestle, chute, and 140-ton bunker. A road was graded to the bunker for shipping to Aldridge, where a loading-platform was under construction. C. S. Lord was in charge and C. P. Riel is managing director of the company.

Pay Roll.

This group of claims of the Upper Moyie Mining Company, Limited, of which Maurice Quain, of Vancouver, is president and manager, is situated on Nigger creek and is reached by a 4-mile branch road from Lumberton. Past references to the property are contained in the Summary Report of the Geological Survey of Canada for 1899, "Operations of the Geological Survey," by James McEvoy, and in the Annual Reports for 1898 and 1927. The property was inspected by the writer to record progress of work done at intervals since 1927. Summarizing conditions: The immediate area is underlain by beds of massive grey quartzites striking a little north of east and dipping flatly, or about 20°, to the north, the beds being cut by a northerly-striking diorite dyke. The following workings are described from north to south: A 65-foot tunnel driven S. 70° E., in quartzite, develops a vein-fracture dipping 65° to the south. Along the northern wall, for a length of 40 feet back from the face, quartz showing occasional spots of chalcopyrite, 7 to 10 inches wide, is exposed. A sample of this material assayed: Gold, trace; silver, trace; copper, 0.5 per cent. At points 15 and 36 feet back from the face respectively quartz stringers branch off from the vein into the south and north walls. The last-mentioned stringer, from 4 to 12 inches wide, is composed of partially decomposed quartz containing pyrite and chalcopyrite. A sample across a section 4 to 8 inches wide assayed: Gold, 0.16 oz. per ton; silver, 2 oz. per ton; copper, 5.8 per cent. A selected sample from the southern stringer, 6 inches wide, assayed: Gold, 0.34 oz. per ton; silver, 1.56 oz. per ton. A selected sample from the main fracture 42 feet in from the portal assayed: Gold, 0.12 oz. per ton; silver, 0.70 oz. per ton.

About 125 feet southerly from the 65-foot tunnel there is a shaft, approximately vertical, said to be 150 feet deep, which, when inspected, contained water below the 45-foot point. A tunnel 122 feet long, at the 100-foot level, and a 60-foot drift to the east, at the 148-foot level, are said to have been driven. Just below the collar a tunnel extends south-easterly and then easterly for a total distance of 22 feet. This working, in quartzite, cuts a zone of mineralized fractures striking from S. 30° to 40° E. and dipping to south-west at from 65° to 75°. Near the shaft a narrow diorite dyke cuts the quartzite. A sample taken over a width of 10 inches at the junction of two stringers assayed: Gold, 0.30 oz. per ton; silver, 0.8 oz. per ton. The same vein-zone is said to have been cut at the 148-foot level with seven stringers in a width of about 10 feet. About 800 feet farther south, and at about 75 feet higher elevation, a crosscut 109 feet long penetrates first quartzite and finally the diorite dyke 30 feet wide. At its inner end short drifts in both directions, with a winze and raise, these being inaccessible, develop a quartz vein 5 feet wide striking N. 40° E. and dipping at 35° to the south-east. This vein is iron-stained, shattered, and decomposed, with gouge on both walls. A sample across 5 feet in the south-western drift gave only traces of gold and silver per ton. Above this working a short tunnel and an open-cut develop the outcrop of the same vein, which here is about 4 feet wide, decomposed, and rusty-looking from oxidation of iron sulphides. Farther south, near a little pond, a tunnel 246 feet in length is first driven in a direction N. 50° E. and then turns S. 50° E. to where a short drift extends N. 5° W. along an 18-inch quartz vein in which no mineralization is visible. A sample of selected quartz from the dump at the portal assayed: Gold, 0.11 oz. per ton; silver, 0.12 oz. per ton.

The following is an extract from James McEvoy's report in the publication aforesaid: "A small vein on another part of this property, cutting across the dyke, showed, in a specimen examined by Dr. Hoffmann, rust-stained quartz, carrying a little telluride of lead (altaite) and some particles of free gold. The specimen is undoubtedly rich in gold, and although there was no gold in the specimen of telluride actually examined, the presence of altaite affords reason to anticipate the discovery of some of the tellurides of gold with which it is frequently associated."

Summarizing the results of exploration, no definite ore-body has yet been indicated. The well-defined quartz vein paralleling the dyke from which good assays are said to have been obtained in places where galena accompanied pyrite, does not show any ore in exposures accessible at the present time. The veins cutting the quartzite, well mineralized in spots over narrow widths, warrant further exploration for the possible occurrence of ore-shoots at more favourable geological localities, such as the contact of the quartzite with the overlying dyke. Any mineral occurrence in the quartzites of the Aldridge formation warrants careful investigation.

Placer-mining.

In the aggregate a considerable amount of employment was provided by placer-mining undertakings in the Fort Steele Division and many otherwise unemployed have maintained themselves and kept off relief. Preparations for the coming season indicate more intensive exploitation of the placer areas than has occurred for many years.

Wild Horse Creek.

The principal activity in this area was that by J. H. Norman and J. H. Dixon, both of Calgary, who acquired a continuous chain of creek leases from the mouth of the stream to a point above where Boulder creek joins it. In the leases are included those of J. F. White (262), W. A. R. Angus (450 and 449), N. Gosselin (448), R. H. Gunther (263, 265, 270, and 272), A. J. Williams (457), S. Kemp (454), A. Bell (465), and T. C. Miller (455). The operators built half a mile of V-shaped flume, with 6-foot sides, and a timber seepage-dam at a point 4 miles above Fort Steele. The flume is expected to take all the water nominally in the creek after flood periods. This work was practically completed and an early start to excavate the creek-bottom is anticipated for 1934, a contract having been let to McDonald & Foster to excavate a minimum of 50,000 cubic yards of gravel. The contractors' camp is already set up, their equipment consisting of a 1-yard gas-shovel feeding on to a 36-inch endless belt which leads to a grizzly-covered bin. Material over 3 inches in diameter will be conveyed by belt to a dump about 100 yards away and finer material will be fed from the bin by a 24-inch belt into twin 36-inch sluice-boxes, water being taken from the flume for the latter. Work is also expected to start on two other sites in connection with the same holdings, one about a mile down-stream and the other a mile or so above the present location. From twenty to twenty-five men were employed during the construction of the dam and flume.

There were also numerous minor activities by individuals and partnerships, of which the most profitable is understood to have been the undertaking of A. Suran & Sons on Boulder creek, which flows into Wild Horse creek at the upper end of its productive area. No appreciable production of placer gold is known to have been made on the main stream above Boulder creek, but the limited amount of work done and deep ground may account for this.

Perry Creek.

At the property of G. M. Bell, of Calgary, referred to in past publications of this Department, a crew of men has been employed continuously. Above Old Town the leases of A. Hurry and associates, of Cranbrook, are reported to have been turned over to Portland, Oregon, interests, who expect to start work as soon as climatic conditions permit.

Palmer Bar Creek, Moyie River and Tributaries.

Activity is planned for the coming season in connection with the twenty-five leases on Palmer Bar creek, controlled by J. F. M. Moodie, of Calgary. At the falls on Moyie river J. Ewin and D. Oscarson worked all winter and have completed a 300-foot tunnel in solid rock, pay-dirt having just been reached. There were other minor activities in the same general area, some of which were suspended for the winter.

Hellroaring Creek.

Following the discovery of placer gold in this area, new activities were initiated, including that by J. F. Huchcroft and D. W. Speers on the creek above St. Mary lake, and that by the Grizzley Gold Mines, Limited, of Calgary, on the main creek above its South fork. The syndicate includes G. Lancaster, R. V. Price, M. P. Johnston, and the late "Grizzley" Dan McDonald, who made the discovery. Considerable testing is reported to have been done with favourable results.

Miscellaneous.

Minor activities, previously mentioned, were continued on Fish Lake creek. Early in the spring Keystone-drilling to test ground for dredging was done at several points by the Yuba Consolidated Goldfields, of California, with L. D. Gassaway in charge. Two holes were put down on the Kootenay River gravel benches near the railway-station at Skookumchuck; one hole on the G. M. Bell leases on Maus creek; three holes on Perry creek at points below and above the Staples tie camp; and seven holes on the Wild Horse Creek delta between the bridge on the Bull River road and the Kootenay river. These drill-holes were to check the drilling done by J. R. Finlay and E. W. Watson, previously referred to in Bulletin No. 2, 1933. The check-holes were found to be practically barren, Kootenay River gravels being chiefly encountered in this area near the mouth of Wild Horse creek.

SLOCAN MINING DIVISION.

In this Division, formerly responsible for a large aggregate production of silver-lead-zinc ore and concentrates, company operations are still marking time pending improvement in metal prices. Lessees at a number of properties have been accumulating ore for shipment when it can be disposed of more advantageously. At least fifty car-loads of ore are available for shipment from this source, while in some cases shipments were made, as from the following properties: *Silversmith*, by A. Olsen and associates; *Victor*, by E. Doney; *Ruth-Hope*, by J. Tattrie, C. P. Lane, and C. Stewart; *Rio*, by W. R. Roberts and associates; *Mammoth*, by J. Rowlands and R. Mills; *Standard*, by F. Mills and partner (from the *Alpha* workings) and by C. Towgood and associates from the No. 5 level; *Molly Hughes*, by H. Dimock (silver-gold ore); *Little Daisy*, by A. Jarvis (gold ore); and *Grey Copper*, near Sandon.

In the Sandon camp leasing activities are being continued: At the *Ruth-Hope* by the same lessees; J. Fauntine has two car-loads of ore out and C. Stedile has about 200 tons awaiting shipment; at the *Victor*, E. Doney has about ten car-loads out and is still taking out ore; at the *Payne*, J. P. Wilson, in Sandon for the winter, has developed a pay-streak which has a good chance of improving; at the *Cinderella*, A. Forsyth and J. MacDonald are taking out ore; at the *Best* above the *Rambler* mine, C. Lundstrom is leasing and extracting ore; and at the *Rio* two lessees are continuing work. At the *Bosun*, near Silverton, T. Avison and three associates are working No. 6 tunnel dump, using a drag-line scraper and three jigs; E. Betteli and two partners are starting to work the stope-fillings on the No. 6 level with three jigs; R. Crelline and J. Pendray have opened up the old prospect-tunnel to the east of the large fault which cut off the *Bosun* vein in this direction; and six other lessees are working in various parts of the mine. W. S. Ellis is in charge of the *Bosun*, where about 600 tons have been accumulated for shipment by lessees.

The well-known *Van Roi* silver-lead property, on Silverton creek near Silverton, has recently been acquired by the Helena Gold Mines, Limited, as announced in the press.

At the *Standard* F. MacDonnell and partner are leasing on the No. 2 level. It is to be expected that, with improving prices for silver and lead, company operations in the Slocan will be resumed in due course. In addition to the leasing and shipping activities at silver-lead-zinc properties as mentioned above, there has been prospecting and investigation of gold-ore occurrences such as on Vevey creek, south of Silverton, where the *L.H.*, *Little Daisy*, and *Rockland* are situated. In connection with the *L.H.*, described in detail in the 1915 Annual Report, and owned by A. R. Fingland, of Silverton, negotiations are said to be proceeding for a deal.

SLOCAN CITY MINING DIVISION.

Prospecting was active in connection with gold and gold-silver prospects on Lemon creek and its tributaries, and similar "dry-ore" occurrences on Springer creek. Trial shipments

were made from the *Chapleau* by J. W. Greenwood and associates and from the *Gold Viking* by G. Henderson.

Kilo.*

This property, owned by Mrs. N. F. McNaught, of Silverton, and under option to T. Anderson, of the same place, is situated on Chapleau creek, a tributary of Lemon creek, at about 15 miles by road south-east of Slocan City. During 1933 some underground repair-work was done and a few surface improvements made. As this property is typical of a number of deposits in this area a few notes are considered advisable.

The formation in the vicinity of the mine-workings is granite of the Nelson batholith. The vein, which is a strong, well-defined quartz-filled fissure in the granite, averages 2 feet in thickness and strikes N. 25° E., with a dip of 30° to the south-east. It has been traced up the hill to the south-west of the point of discovery for a distance of several hundred feet. The vein-filling is white quartz of massive texture which is mineralized with small amounts of sulphides, principally pyrite, with occasionally galena, and associated gold.

The vein has been developed underground by five tunnels and one inclined shaft. The lowest tunnel, No. 0, at 4,780 feet elevation, is the most recent development and when stopped had just reached the downward continuation of the vein as exposed in the upper levels. It would have to be driven to the north-west along the vein for approximately 250 feet before reaching a point under the ore-shoot exposed in the next tunnel above, the No. 1 tunnel at 4,800 feet elevation. This work would give an additional ore-back of less than 20 feet. At the inner end of the No. 1 tunnel, 235 feet long, one of the two ore-shoots in the mine so far discovered is partially developed. The ore was stoped above this level for about 70 feet by past operators, but below the level it is still in place and could best be developed by sinking a winze in ore from the inside end of the present No. 1 tunnel. Above the No. 1 tunnel there are three other levels—the No. 2 level at 4,970 feet elevation, 135 feet long; No. 3 level at 5,092 feet elevation, 355 feet long; and No. 4 level at 5,200 feet elevation, 250 feet long. At about 5,350 feet elevation an incline shaft, now filled with water and possibly caved, was put down 166 feet on the vein in the second ore-shoot discovered in the property.

In the workings the vein is strong and regular, and while the average value of such a vein can best be determined by bulk-sampling and mill-tests, and by closely spaced channel-sampling, the following sample results obtained by the writer in 1933 are indicative at least:—

Description of Sample.	Gold. Oz. per Ton.
(1.) One 26-inch channel sample in raise off No. 4 level, 12 feet from top of raise on left side, and across full width of vein	0.04
(2.) One 26-inch channel sample across vein-width 20 feet out from raise to surface on No. 4 level	0.20
(3.) Two 18-inch channel samples across vein-width at 55 and 65 feet from face of No. 4 level (combined)	0.86
(4.) One 10-inch channel sample across vein-width on No. 3 level, 165 feet from face	0.24
(5.) One 26-inch channel sample across vein-width on No. 2 level at foot of raise to No. 3 level	0.12
(6.) One 22-inch channel sample across vein-width 60 feet out from sample 5 on No. 2 level	0.02
(7.) One 22-inch channel sample across vein-width at top centre of stope off No. 1 level	0.06
(8.) Two 23-inch channel samples (combined) across vein at top right side of stope off No. 1 level	0.30
(9.) One 26-inch channel sample across vein 10 feet out from face of No. 1 level	1.70

Past shipments from the property, made mostly in 1912 and 1913, totalled 1,494 tons, from which 595 oz. gold and 346 oz. silver were recovered. About 100 tons of this total, containing 240 oz. gold and 294 oz. silver, was sorted and shipped by N. F. McNaught, the owner, in the years 1900 and 1905.

The property is worthy of further development, but any development-work which might be started would have to be conducted with a maximum of efficiency and economy.

* Report by A. M. Richmond, Assistant Resident Mining Engineer, Victoria, B.C.

ARROW LAKE MINING DIVISION.

There was no mining other than prospecting, assessment-work, and investigation of silver and silver-gold prospects such as on Bostock creek, near Burton, in this Division during 1933.

AINSWORTH MINING DIVISION.

In this Division silver-lead-zinc company operations, as in the area west of Kaslo, adjoining the Slocan Division, are also marking time pending improved metal-price conditions. Meanwhile work continues by leasers as at the *Whitewater*, *Wellington*, and properties in the Jackson basin, together with minor activities by claim-owners in the adjacent area. Gold occurrences in the Woodbury Creek section were actively prospected. Outside interest recently developed in connection with silver properties and negotiations for deals are proceeding in several instances. Among lode properties recently acquired under option are the *Dary* and *Dismuth* on Bear creek, upper Duncan river, owned by the Tapanila Bros.; and the *St. Patrick*, near Argenta, owned by Jean Brochier, of Kaslo. Both properties, described by H. C. Gunning in Geological Survey of Canada, Memoir 161, "Lardeau Map-area," are under option to H. J. Hodgins, of the Monarch Investments, Limited, of Vancouver. In the upper Duncan River area placer-miners were busy at intervals near the mouth of Hall creek.

West of Kaslo.

Whitewater. At this property, near Retallack, work under company management has been discontinued for some years, but activity has been maintained in connection with the Sid Ross lease, a Nelson syndicate, which takes in the area between the 300-foot level, at 4,300 feet elevation, and the apex of the vein-outcrop. In these upper workings, when the property was visited in the summer of 1933, a considerable tonnage of ore had been put in sight, of which about 700 tons of high-grade silver ore, containing grey copper, galena, and sphalerite, had been sorted for shipment when metal prices improve. Of this accumulated ore, 300 tons was hauled to the railway siding early in 1933 and the remainder was stored in piles and in bins at the portal of the 300-foot level.

Wellington. At this property, west of the *Whitewater*, also under lease to Sid Ross and associates, work has been continued by hand in the *Matheson* tunnel since October, 1932. At that time this crosscut, at 4,542 feet elevation, was in about 300 feet and at the end of July, 1933, it was in over 800 feet. The main heading is being advanced to cut the possible western extension of the *Whitewater* vein, which is possibly farther north than was thought when the deep level *Hazel* crosscut was driven before work was suspended under company management. A recent study of geological conditions in the westerly drift of the *Myrtle R.* prospect-shaft, near the western end of the *Whitewater* ground, is said to indicate a vein-strike of N. 80° W., or a bend of about 10° to the north, which would place the projected position of the *Whitewater* shear-zone beyond the end of the hole which was diamond-drilled from the inner extremity of the *Hazel* crosscut. Exploratory work has also been done by Ross on this deeper level, at 3,746 feet elevation. Other lessees have been at work in the upper workings of the *Wellington*.

Contact. At this group, near 14-Mile west of Kaslo, and described in the Annual Report for 1931, A. J. Curle has continued his systematic surface prospecting of the ground between the easterly and westerly workings. At a point about 500 feet easterly from the western group of workings he reports having uncovered a showing of mixed carbonates and galena for a length of 22 feet and a width of 8 feet. The new exposure, which is along the foot-wall of the limestone-band, appears to be extending in both directions under heavy surface wash, for which timbering was necessary. At the westerly workings mineralization was found extending up the hill above the hanging-wall of the limestone, substantially increasing known widths of ore. Good results are also reported from prospecting at other points on these claims.

Phoenix. Investigations have recently been made in connection with this gold prospect on Lyle creek, owned by M. J. Mahoney, of Retallack, and some activity is expected. The deposits occur in a sheared and silicified zone up to 15 feet wide, striking north-westerly and dipping steeply to the south-west. The country-rocks are members of the Kaslo Volcanics formation. Three open-cuts, at elevations from 5,675 to 5,735

feet, expose the quartz-outcropping, from which good assays in gold were obtained. At 5,575 feet elevation a tunnel has been driven for a length of 325 feet on the foot-wall side of the sheared zone, which, as exposed in two crosscuts, is up to 15 feet in width. Good values have been obtained in places on the surface and in the tunnel over widths of from 3 to 4.3 feet. The full width of the mineralized zone is not fully exposed at the inner end of the tunnel.

Texas-Cowboy. At this property, owned by A. T. Garland, of Kaslo, and situated at the head of Robb creek, 3 miles by trail from Blaylock Siding, exploratory work on a small scale has been continued at intervals since the last mention in the Annual Report for 1926. The geology of the area, by C. E. Cairnes, is shown on Map 273A, Geological Survey of Canada. The author's full report on the Slocan camp, based on field-work conducted between 1925 and 1928, is still awaiting publication. The *Texas* group consists of the *Cowboy, Garland Fraction, Minnie Fraction, Carbonet, Texas,* and *Clearwater* claims.

The basin at the head of Robb creek is underlain by sediments, consisting of limestone and calcareous rocks, schists and shales, intruded by granite and porphyry in the vicinity of the deposits, which occur principally in limestone adjacent to the contacts with the intrusives. The veins vary in strike, replacement of limestone being apparently an important factor in the mineralization of the area. Structural conditions of the sediments are irregular, the strikes on the opposite sides of Robb creek varying considerably.

Recent work done on the upper part of the *Texas* claim includes a crosscut 30 feet long driven to cut the south-eastern extension of a shear-zone in black limestone exposed higher up the hill in an open-cut and a large surface excavation. The distance from the inner end of the crosscut to the upper showing is about 150 feet. In this excavation, where the strongest mineralization is exposed, the vein-strike is about N. 30° W., with a steep dip to the south-west. Disseminations of galena, in iron-stained ledge-matter containing quartz and calcite, occur in streaks up to 2 feet in width. On the same claim, at a lower elevation, are situated the group of workings described in the Annual Report for 1926, consisting of, first, a prospect-shaft, from which 17 tons of high-grade ore was extracted in a depth of 70 feet. This shaft is connected with the surface by an adit-level 125 feet long. At the inner end of this tunnel a winze, caved and inaccessible, was sunk about 90 feet in the shaft ore-shoot containing galena and carbonates. The shear-zone, in limestone, strikes N. 60° W., with a steep dip to the south-west, and the porphyry-contact is exposed at the portal of the tunnel where the contorted limestone strikes about N. 30° W. and dips at 45° to the south-west. At about 100 feet lower elevation than the 125-foot or No. 1 tunnel, two unconnected tunnels, driven from different directions, cut the same shear-zone as in the upper workings, but continue beyond into dyke-rock. The vein at the shaft-collar has a limestone hanging-wall and dyke foot-wall, with blocky argillites below the dyke, and the same relations are in evidence in both the lower or Nos. 2 and 3 tunnels. The vein intersection at the fork in the No. 2 tunnel, being the nearest to the objective, should be driven to the north-west to get under the old winze in the ore-shoot below No. 1 tunnel.

On the *Fourth of July* claim, south-west of the *Texas*, and also described in the Annual Report for 1926, the underground workings now consist of a crosscut to a vein, striking N. 40° to 50° W., with approximately vertical dip, which has been drifted on for a short distance in both directions. The north-westerly working contains a raise, 30 or 40 feet up, and the south-easterly drift has a winze with a raise above it. The vein, from 4 to 5 feet wide, is very strong and well defined and contains streaks and bands of galena-sphalerite mineralization. No stoping of appreciable extent has been done. The dump at the portal of the crosscut contains a considerable proportion of zincky material with occasional galena and iron sulphides. Selected material from this dump assayed: Gold, trace; silver, 9 oz. per ton; zinc, 18 per cent.

On the eastern side of Robb creek, opposite the *Fourth of July*, several tunnels have been driven, only the lowest of which was inspected. This working, about 70 feet long, driven S. 70° E. in calcareous rock, follows a well-defined vein which dips steeply to the south. A winze, partly filled with water, has been sunk at 60 feet in from the portal. Opposite the winze-collar a 60-foot crosscut extends to the south and at 30 feet in from its portal short crosscuts are run in both directions. At the latter point zincky mineralization, concentrated towards the foot-wall side, is up to 13 feet wide. At the 60-foot point mineralization of disseminated character extends over a width of 18 feet. Porphyritic intrusive rock is in evidence at points in the foot-wall country as at the *Texas*. At the present stage of exploration it is not possible to correlate the various veins with accuracy. The outcrop of the *Fourth of July* vein, however, is very similar

to the outcrop above the lowest *Boadicea* tunnel, although their respective strikes vary considerably. A vein on the *Carbonet* claim, not visited, is reported to have a north-easterly strike similar to the majority of the productive veins of the Slocan camp.

The ground covered by the *Minnie* claim is of interest, lying between the well-defined *Fourth of July* and *Boadicea* (lowest tunnel) veins. It is considered that a survey to correlate the workings on the two claims might throw some light on the connection between the respective veins and where, as a consequence, they might be expected to cross the *Minnie* ground. The porphyry-lime contact near the bed of the creek below the lower *Boadicea* tunnel has also been suggested for further investigation. The intimate association of the sediments and intrusives in this area is similar to that encountered in well-mineralized sections of the Slocan.

* At the *Mountain Goat-Zuni* property, situated a short distance to the west, geological conditions are similar in many details to those found at the *Texas-Cowboy* group. The Slocan sediments, here mainly shaly limestones and slates, are badly crumpled and broken with intrusions of acid porphyry dykes. The vein exposed in shallow surface stopes on the *Zuni* claim was worked many years ago. At that time a tunnel about 310 feet long and 120 feet lower in elevation than the open-cut workings was driven in an easterly direction with the hope of picking up the downward extension of the ore exposed above. This old work was surveyed in 1933 and it would appear from the maps afterward prepared that the tunnel had stopped short of its objective. Late in 1933 L. N. Garland started to drive the tunnel ahead, using hand-mining methods, and he expected to reach the vein with less than 15 feet of drifting in a south-easterly direction from the end of the old tunnel.

Keen Creek.

Joker. This group of Crown-granted claims, reached by trail from the end of the Keen Creek road, is situated along the eastern side of the Joker (Twin) lakes in a large area of porphyritic granite related to the Nelson batholith. The general geology of the district, by C. E. Cairnes, is shown on Geological Survey of Canada Map 272A, "Slocan Sheet." During the period between the years 1898 and 1900, inclusive, numerous claims were staked adjacent to the lakes and a large aggregate amount of work was done at widely separated points. The area was then known as Camp Mansfield and operations were conducted by two companies, the Klondike Champs d'Or Company and Excelsior Gold Mines, Limited. References by the Mining Recorders to these activities are contained in the Annual Reports for 1898, 1899, and 1900. All mining was done by hand, double-jacking, and access was by trail from Slocan lake. The elevation at the end of the road, where the *Joker* trail starts, is about 4,800 feet. On the eastern side of the southern lake, at 6,700 feet elevation, and close to the north-east corner post of the *Tony* Crown-granted claim, Lot 3894, there is a crosscut tunnel. This tunnel is said to be between 700 and 900 feet in length and was driven about N. 62° E. in hard porphyritic granite containing large phenocrysts of feldspar, typical of the formation of the area. This tunnel, somewhat difficult of access due to caving near the portal, was not driven far enough to reach its objective, a vein outcropping on the mountain-slope above. At 7,275 feet elevation there are two old cabins, still used occasionally by visitors to the Kokanee glacier, which lies to the south-west. These cabins are on the *John A.* claim, Lot 4119, close to its southern boundary and just above and west of Joker creek. About 1,500 feet up-stream, at 7,460 feet elevation, on the *Joker*, Lot 3891, there is a caved inclined shaft said to be 96 feet deep on a 65° slope. Selected quartz, containing pyrite, from the shaft-dump assayed: Gold, 1.20 oz. per ton; silver, 1.6 oz. per ton. On the side-hill just above the shaft-collar an old tunnel is said to have been driven westerly on a cross-vein mineralized with iron, lead, and zinc sulphides, but the portal of this working is completely obscured by slide-rock and vegetation. Going northerly a few hundred feet along the supposed extension of the shaft-vein, and at about 7,440 feet elevation, there is an open-cut (obscured by snow when inspected) on the *Treadwell*, Lot 4118. A sample of selected quartz, containing pyrite, galena, and sphalerite, from a small pile adjoining this working assayed: Gold, 2.70 oz. per ton; silver, 1.5 oz. per ton. Continuing northerly the outcrop is covered by slide-rocks for some distance. Near the northern boundary of the *Treadwell*, and at 7,350 feet elevation, there is a tunnel driven N. 10° E. for a length of 65 feet along a fracture, dipping 65° to the east, in which there is here no appreciable vein-filling or mineralization. At 55 feet in from the portal there is a 10-foot winze full of water.

* Report by A. M. Richmond, Assistant Resident Mining Engineer, Victoria, B.C.

Above the inner extremity of this working there is an open-cut exposing quartz and oxidized material, up to 20 inches wide, striking N. 15° W. and dipping at 65° to 70° to the east. Some 1,500 feet farther north and near the northern boundary of the *John A.*, at 7,380 feet elevation, there is an old crosscut tunnel, driven easterly, which could not be inspected owing to deep water backed up by caving at the portal. There is no quartz or mineralized material on the dump at the portal, indicating that this crosscut did not reach its objective. There are said to be showings on the bluffs above and to the east which could not be inspected in the limited time available.

REVELSTOKE MINING DIVISION.

Activities in the Big Bend area were seriously handicapped by the big slide which took out a long stretch of the highway near 14-Mile, and severe damage to three bridges, between the 20- and 22-Mile points, caused by ice and snow conditions. As a consequence the investigation of areas of gold occurrences, such as on Carnes creek and in the Groundhog basin, were postponed until late in 1933.

Cyanite. In regard to the occurrence of cyanite, on the western side of the Columbia river below Death rapids, Report No. 472 of the Division of Ore Dressing and Metallurgy, Department of Mines, Ottawa, entitled "The Concentration of Cyanite from Death Rapids, B.C., by R. K. Carnochan, was made available in April, 1933. The cyanite was tested for ceramic use and concentration tests were also made. As the full report can be obtained from Ottawa, only the following extracts are quoted herein:—

Testing for Ceramic Use.—The hand-picked cyanite and all flotation concentrates were sent to the Division of Ceramics and Road Materials for testing. Their report was as follows: This material is similar to several other cyanites which have been studied for use in the ceramic industry. It converts to mullite ($3Al_2O_3.2SiO_2$) with a drop in specific gravity from 3.62 to 3.04, and specimens containing from 88 to 98 per cent. cyanite showed linear expansions of from 8 to 16 per cent.

Microscopic examination showed that the material upon burning maintained its original platy structure to a marked extent. The material is worthy of further study for use in the production of refractory products. The difficulty in the use of this material has been not that it requires calcination before use, but due to the poor success met with in developing binders for the calcined material.

Conclusions.—(1.) The only methods of concentration found suitable were hand-picking and flotation.

(2.) Hand-picking could not be used commercially unless the cyanite occurred in larger pieces than those in the sample received.

(3.) The concentrates made by flotation were very good, but the recoveries were low. It is believed that this could be improved by further test-work.

A and E. At this group of eight claims, situated on the southern side of the upper end of the North fork of Carnes creek, 10 miles by trail from the Big Bend road at the 26-Mile board, A. Kitson, of Revelstoke, continued prospecting-work. The geology of the area is shown on Map 237A accompanying Geological Survey of Canada Summary Report, 1928, Part A, "Geology and Mineral Deposits of Big Bend Map-area," by H. C. Gunning. The rocks in the vicinity of the deposits, which are exposed at points through a vertical range of from 6,000 to 7,200 feet above sea-level, are crystalline limestones and schists of pre-Cambrian age. They are the north-westerly extension of the sedimentary series which crosses the main line of the Canadian Pacific Railway in the Albert Canyon-Flat Creek area and which contains practically all the known metallic deposits of importance in this part of the Revelstoke Division. The workings developing the main zone of mineralization consist of a tunnel at 6,000 feet elevation and open-cuts along the outcrop to the south-east. The vein is formed along the contact of grey marbleized limestone (on the hanging-wall) and black schist striking N. 17° W. and dipping from 45° to 50° to the north-east (in the tunnel). The contact lead stands out prominently in the precipitous bluffs on both sides of a glacial basin. According to H. C. Gunning, the sulphides have apparently replaced the limestone along the contact shear-zone and are arranged along the zone as lenticular bodies. Solid sulphides from 20 to 42 inches in width can be seen at numerous points, indicating continuity of mineralization. The sulphides consist mainly of pyrite, sphalerite, and galena, with some arsenopyrite. Gold and silver values fluctuate considerably, the presence of galena and (or) arsenopyrite being apparently good indicators of gold values. In the tunnel, 98 feet long, solid sulphides were encountered 67 feet in from the portal and followed to the face, the width of the pay-streak varying from 10 to 24 inches in width. A sample across 20 inches, 5 feet back from the face, assayed: Gold, 0.10 oz.

per ton; silver, 11 oz. per ton; lead, *nil;* zinc, 7.5 per cent.; and a grab-sample from a pile of selected material at the portal assayed: Gold, 0.20 oz. per ton; silver, 13.6 oz. per ton; copper, 0.2 per cent.; lead, 11 per cent.; zinc, 8 per cent. On the foot-wall side of the pay-streak the rock contains disseminated sulphides and quartz stringers over a width of from 18 to 36 inches. Going south-easterly from the tunnel across the basin there are three open-cuts proving the continuity of the vein. The first two open-cuts, about 700 and 850 feet to the south-east respectively, expose 3 feet of decomposed oxidized material containing remnants of sulphides. About 300 feet farther to the south-east in an open-cut, at the lower end of a showing 100 feet long or more, as exposed in the bluffs at the top of a rock-slide, there is a band of sulphides of irregular width up to 3.5 feet. Over the summit, a claim-length away, an open-cut exposes a similar width of massive sulphides. A parallel mineralized zone, mentioned by H. C. Gunning, was not inspected, due to snow-storms which occurred when the property was visited late in 1933. Extensive and systematic sampling to delimit the zones of better gold and silver values would be necessary for assessing the economic potentialities of the deposits, and the metallurgy of the ore would be an important factor. The continuity of the vein and the numerous exposures of mineralization are impressive.

Exploratory work of a preliminary nature was done at the *Roseberry*, on Carnes creek, by W. Reavley and associates; and at the *Mastodon*, recently made accessible by trail to the Carnes Creek outlet, under the direction of D. H. Lougheed, of Vancouver. Both the above properties have been described in Geological Survey of Canada Summary Report, 1928, Part A, and in past Annual Reports. The *Mastodon* undertaking is in connection with the recently incorporated Fawn Mining Company, Limited, which has also acquired the *Golden Fawn* gold prospect in the Nelson Mining Division.

Limestone Dyke.—Information has just come to hand that this group of eight claims, situated at the head of the Middle fork of Woolsey creek, is to be operated by the newly incorporated Alico Silver Mines, Limited, of which N. S. Lougheed is president. A description of this prospect is contained in the 1931 Annual Report.

Placer-mining.

Under this heading considerable activity by individuals and partnerships developed along the Columbia river, on Goldstream and tributary creeks, and also to some extent in the Carnes Creek area. The hydraulic operations of the French Creek Development Company, Limited, were continued on French creek, where a crew of men was employed under the direction of N. Remillard.

Camp Creek.

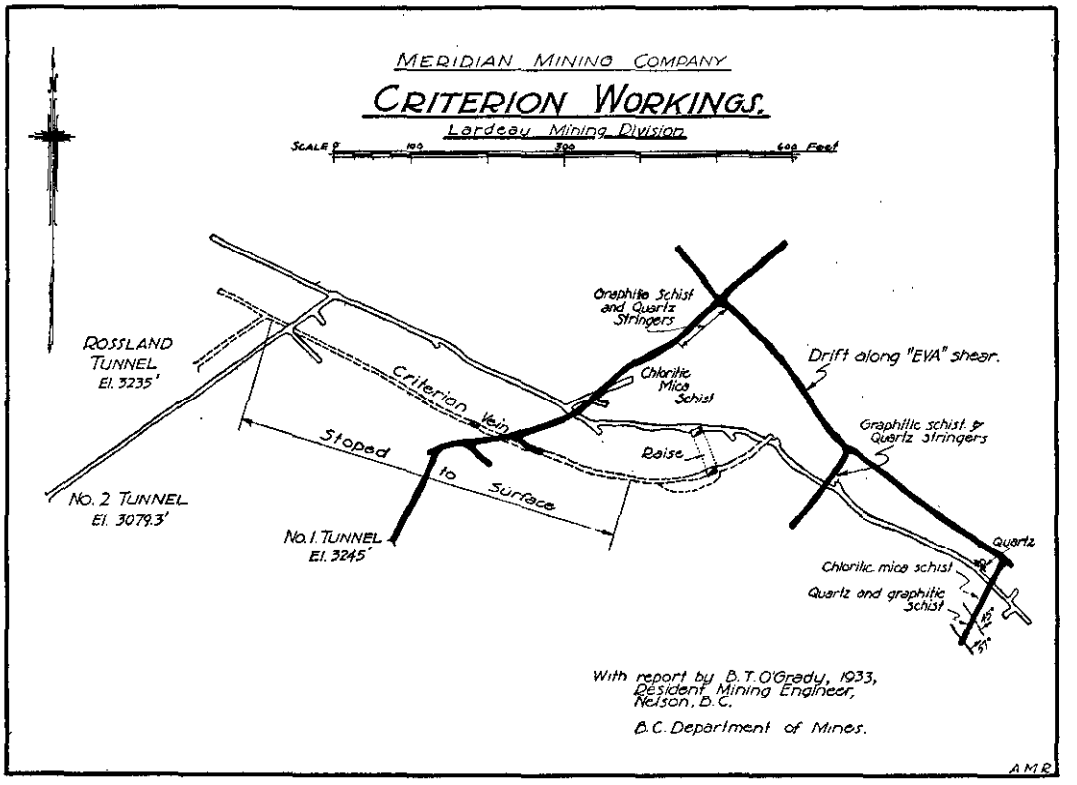
Employment for eight men was afforded in connection with the undertaking of J. B. Coughlan, of Calgary, which includes four creek leases on Camp creek, a camp having been established 1 mile up this stream from the Big Bend trail. After staking and preliminary investigation in 1931, work was started by Coughlan and associates in 1932, in which year 112 oz. of gold was recovered from about 1,000 cubic yards of gravel. In 1933 about 111 oz. is understood to have been recovered from about 700 cubic yards of gravel. The first work was done by ground-sluicing just above the falls at the upper end of the canyon. Subsequently, rich ground was encountered about a quarter of a mile above the canyon, where all work has since been done with shovel and wheelbarrow. When the property was visited late in 1933 a hand-planed, split lumber sluice-box 100 feet long was in use, and the gold-bearing gravel was being obtained from an old run on bed-rock above the level of the present stream and adjoining its eastern rim. The area worked here by the present operators was about 300 feet long, 25 feet wide, from quite shallow to a maximum depth of 12 feet. The total gold recovered, including that from a limited amount of work done at the canyon, is reported to be 243 oz., worth $18.69 per ounce at the old standard value of $20.67 per fine ounce. The bed-rock at the upper workings is mica-schist and at the canyon, where shallow rock-cuts were made for ground-sluicing, it is limestone. A rock tunnel could be driven cheaply in the canyon and would seem to offer the most efficient and economical method of exploiting the ground in view of the encouraging results of the work accomplished by laborious shovel and wheelbarrow methods. The old auriferous wash-gravel along the eastern rim contains many quartz pebbles and boulders, apparently derived from the quartz veins of the Groundhog Basin area, to which the placers of McCulloch and French creeks are attributed. Since the writer's visit it is reported that the sluice-boxes were extended 50 feet up-stream and

good ground was found on bed-rock 7 feet lower than the bed-rock previously worked, 16 oz. of gold being recovered.

LARDEAU MINING DIVISION.

Meridian Mining Co., Ltd.

During 1933 development-work on this company's *Eva* and *Criterion* properties at Camborne has been carried on continuously. The power-installation on Pool creek, detailed in the Annual Report for 1932, included the laying of 3,500 feet of 24-inch wood-stave pipe, construction of a new intake, raising the height of the old dam, and building the power-house. This work was completed in January, 1933. At this time the old *Criterion* workings were cleaned out, air-lines were reconditioned, and preparations made for the ensuing development campaign. The plant includes an Ingersoll-Rand D2 compound air-compressor of 1,881 cubic feet rated capacity. At present only the high-pressure cylinder, rated at 800 cubic feet, has been installed. The 13-foot 3-inch over-all diameter Pelton wheel is directly connected to the compressor. A new air-line, consisting of



3,500 feet of 2-inch pipe, was laid from the *Criterion* to the *Eva* No. 7A level. Rock-drilling equipment consists of three Ingersoll-Rand drifters and a stoper, and auxiliary equipment includes a steel-sharpener and oil-furnace. During 1933 development-work has been conducted on the Nos. 1 and 2 levels of the *Criterion* and in the No. 7A tunnel of the *Eva*. These properties are about two-thirds of a mile apart and separate camps are conveniently situated near the workings mentioned. The principal mine buildings are below the No. 2 *Criterion* level and include the cook-house, bunk-house, and dry, providing accommodation for twenty-five to thirty men, and office. The camp is electrically lighted, and power is supplied for the motors controlling ventilation by the recent installation of a 20-kw., 60-cycle, 440-volt generator. A telephone-line connecting with Arrowhead has been constructed.

Information concerning past operations is contained in the Annual Report for 1914 and the general geology of the area is described in Geological Survey of Canada Summary Report for 1903 and Memoir 161, "Lardeau Map-area." During the summer an extended examination

of the company's holdings was made by A. G. Langley and his report was accompanied by a detailed geological study by H. V. Warren. A brief digest of the latter report follows: The general geology is simple; schists, phyllites, and allied rocks of late pre-Cambrian age underlying the area. These all belong to the Lardeau series of the Windermere group. Microscopic study of these various rocks shows that no rocks of igneous origin are definitely present. They belong to a series of mixed sediments composed of impure shales and sandstones which have been altered by intense regional and thermal metamorphism. Briefly, after careful study of the area, the conclusion was arrived at that the mineralization on the *Eva* hill could all be related to a complex group of faults, which in turn can be related to the core of a tightly folded anticline forming the backbone of the ridge, the most likely place for ore-deposition being where cross-fracturing intersects this anticlinal core. The rocks, which have been referred to as dykes in reports on various properties in this district, may be present as sills, but metamorphism has altered their original components so completely that an exact determination is impossible. The old *Eva* mine-workings are shown in cross-section on page 253 of the Annual Report for 1914. This shows the footage driven and areas stoped, with estimated values of tonnage extracted at various points. The following description of the *Eva* mine-workings is extracted from the report of A. G. Langley to the directors, dated August 15th, 1933: "These workings consist of a series of adits driven into the hillside along the strike of the *Eva* shear-zone. It will be noted that ore has been stoped to the surface from the upper level for a distance of slightly over 300 feet, while a considerable tonnage was mined from a zone of cross-fracturing by 'glory-hole' methods in the vicinity of the *Highland Mary* shaft. This vein area is probably the most important on the *Eva* ground, yet it has not been explored at depth. This may be accounted for by the fact that the mine was not properly equipped to carry on underground work at long distances from the source of ventilation; the compressor only being installed shortly before the property was closed down.

"The upper levels are caved in and beyond repair. Of the lower levels, the 5A is caved at the portal, but access can be gained by the raise from 6A level. The 5B level is open and the 7A level is in condition to carry on mining. Strong quartz-exposures may be seen in all of these tunnels, but stoping has only been carried on in 6A at a point where two veins intersect. On the 7A level the downward continuation of this quartz is more strongly developed and its extent is not delimited by the present workings. Near the portal of the 5A level a considerable tonnage was mined from this area of the vein, so, with the exception of the small amount of stoping done on the 6A level, there is a virgin piece of ground lying between the 5A and the 7A levels having good ore potentialities. It is proposed to advance the No. 7 level along the *Eva* shear for at least 450 feet with the objective of exploring at a vertical depth of 630 feet the downward projection of the ore-zone in the vicinity of the *Highland Mary* shaft."

This work has been proceeded with and in December, 1933, the No. 7 tunnel, elevation 2,790 feet, had been advanced about 600 feet, to a point beyond the objective, and crosscutting was then undertaken. At the time of the writer's visit on October 2nd, about 270 feet of drifting had been done along interbanded quartz and schist, 2 to 2½ feet wide, in which mineralization with iron, lead, and zinc sulphides occur in streaks. Specimens shown the writer contained visible gold. No information is available at this time concerning the average assay value of the section examined or portion of the tunnel since driven in which similar mineralization is understood to have been encountered.

On the *Oyster-Criterion* property, south-east of the *Eva*, work done during 1933 on the Nos. 1 and 2 and *Rossland* tunnel-levels amounted to about 2,400 feet of drifting, crosscutting, and raising. The old workings are described in the Annual Report for 1914, page 255. The principal work of the past operators was done on the *Criterion* vein, which was stoped for a length of over 500 feet between the *Rossland* tunnel and the surface.

On the No. 1 level, elevation 3,245 feet, new work done includes the northerly extension of the main crosscut tunnel for 115 feet. At a point 325 feet northerly from the *Criterion* vein intersection, where a strong shear in graphitic schist is encountered (believed to be the easterly continuation of the "A" wall of the *Eva*), drifting was done to the west for 85 feet and 520 feet to the east. Towards the main crosscut the drifts follow a massive quartz vein. At 255 feet and 505 feet respectively along the eastern drift two crosscuts, both about 120 feet long, have been driven southerly. The first of these, going east, is in graphitic schist, with quartz stringers for the first 45 feet and then cuts through chloritic mica-schist to the face. In the

inner end of the most easterly crosscut a body of quartz with graphitic-schist inclusions, 28 feet wide, was cut. In places, chiefly in the central portion, the quartz contains streaks and disseminations of iron pyrites. A pure specimen of the iron sulphide is reported to have given an interesting assay in gold, and extremely fine gold is said to have been panned from some of the quartz. It is understood that subsequent bulk-sampling has indicated that the values do not constitute commercial ore. Whether it is a lenticular mass or has continuity, laterally or vertically, is not yet known. It is possible that with further development the proportion of auriferous sulphide might increase and make ore.

On the No. 2 *Criterion* level, which gains a depth of 165 feet below the No. 1 level, the old workings consisted of a crosscut tunnel 475 feet long, with about 170 feet of drifting along the *Criterion* vein. At December 1st the drift had been extended over 1,000 feet, the total length of drifting then amounting to about 1,185 feet, of which 175 feet is westerly from the crosscut and 1,010 feet is driven easterly to where this tunnel extends below and some 80 feet beyond the easterly crosscut on the No. 1 level containing the 28-foot quartz-showing previously mentioned. While the vein is continuous throughout the length of the drift inspected, no assay-plan was available. The vein is mineralized in places, as in the western drift, with galena, zinc-blende, and iron pyrites, but values over minable widths were understood to be below commercial grade. According to N. W. Emmens, in the Annual Report for 1914, the 14,000 tons stoped above the *Rossland* tunnel yielded bullion averaging $3.75 per ton, the figures of the tailing loss not being available. The *Rossland* is the old drift-working started at an elevation of 3,235 feet, or 10 feet below the elevation of the portal of No. 1 level, which crosses over it where the *Galena* vein faults the *Criterion* vein and displaces it for a short distance to the north. A raise recently driven from the No. 2 level east drift connects with the *Rossland* tunnel at a point about 265 feet easterly from the No. 1 level main crosscut. Beyond the raise the *Rossland* tunnel has been extended in a north-easterly direction. Since tunnelling operations were begun by the present operators on the *Oyster-Criterion* and *Eva* properties the total footage driven amounted to over 3,000 feet to the end of 1933.

Regarding the other adjoining properties of the Meridian Mining Company, Limited, the following information is quoted from A. G. Langley's report:—

"*Lucky Jack Group.*—This group adjoins the *Oyster-Criterion* to the east and south. The *Lucky Jack* vein as exposed by surface-trenching is a strong, well-defined, quartz-filled fissure, striking north-westerly and dipping at 55° to east. The open-cuts definitely trace it for about 700 feet and if trenching were continued it would probably be found to be continuous for as many more. A limited amount of underground work has been done by means of a 50-foot shaft and 50 feet of drifting. A cross-section of the vein as exposed in these workings shows heavy pyritization of the quartz in places and along parting planes. The pyrite is auriferous and a good milling-grade of ore might be expected on further development. As yet, of course, the property has not passed the preliminary stage of exploration.

"The *Cholla* is also in the prospect stage and requires further exploration before any definite conclusions can be arrived at either regarding tonnage or values. This applies to other strong quartz-exposures such as those on the *Red Horse*, *Imperial*, and *Balfour* claims, to say nothing of others which may be of equal importance, but the main thing to consider at the present time is the development of a tonnage of ore for a mill, and this can best be done by first concentrating efforts on the *Eva* and *Criterion*."

It is understood the company proposes to place its operations at Camborne under the direction of a competent mining engineer, and no doubt information based on the results of systematic surveying and sampling will be prepared to show the progress made towards assuring an adequate supply of ore for milling operations.

Since compiling the above notes, the reports of B. W. W. McDougall and N. W. Emmens have been made available in the press, and some lengths, widths, and assays are given in connection with the *Eva* No. 7A level; the *Criterion* vein in *Rossland* level; Nos. 1 and 2 *Criterion* and *Rossland* workings; and *Lucky Jack*.

Gillman. This property and adjacent claims, situated on the north side of the East fork of Mohawk creek, at an elevation of 6,000 feet, has been acquired by H. Beeching, of Vancouver, and the Poole Mountain Gold Mines, Limited, has been incorporated. B. W. W. McDougall, of Vancouver, is consulting engineer. The *Gillman* and

adjoining gold and gold-silver prospects are described in the Annual Report for 1914, no appreciable amount of work having since been recorded. Preliminary work was done late in the fall of 1933, including sampling of the showings described by Newton W. Emmens in the report above mentioned. A bulk sample shipped to the Trail smelter gave the following assay and analysis: Gold, 2.04 oz. per ton; silver, 2.6 oz. per ton; lead, 2.9 per cent.; zinc, 3.1 per cent.; sulphur, 25.2 per cent.; silica, 41.6 per cent.; iron, 22.2 per cent.; lime, 0.9 per cent.

Goldfinch. This gold prospect, on Menhinick creek, has been acquired by the Dalhousie Gold Mines, Limited, of Victoria. Late in 1933 preliminary work was started and included the erection of camp buildings, construction of trail connections, and other preparations. R. H. Smith, of Victoria, was in charge. Past references to the property are contained in the Annual Report for 1914 (N. W. Emmens), and in Geological Survey of Canada Annual Report, 1903, Part A (under *Camborne* group, by R. W. Brock). Numerous quartz veins and banded zones of quartz veinlets are present in the area, with interesting gold values in places, such as in an open-cut at elevation 3,715 feet, and in No. 1 tunnel farther to the south-east at 3,695 feet elevation. A. G. Langley investigated conditions on behalf of the company, and it is understood that systematic prospecting has been recommended as a first step in the development of the property.

Ferguson and Trout Lake Areas.

Gold Bug. At this property, situated on Lardeau creek, near 7-Mile, leasing activities on a substantial scale were started late in 1933 by J. Flagel, of Ymir, and associates, constituting the Gold Bug Mining Syndicate. This prospect was described by A. G. Langley in the Annual Report for 1919 under *Gold Bug-Rambler*.

Winslow. This property, situated on the north-east side of Trout lake, has been acquired under lease and bond by E. H. McDaniel, E. Johnson, of Nelson, and associates. A start has been made by reconditioning the old workings and a trial shipment of gold quartz is to be made to the Trail smelter. The *Winslow* is described in the Annual Report for 1914, no activity having occurred there for many years.

Lucky Boy. This property, situated on Trout creek, west of the Trout Lake settlement, has been acquired under lease and bond by J. M. Robertson, of Nelson. When this property was visited early in October, 1933, preliminary work was proceeding with a crew of six men. Camp buildings were being erected and supplies were being packed in for winter operation. A 3-drill compressor and other equipment had been landed at the adjacent wharf. The property, consisting of six Crown-granted claims and two other claims, is reached from Trout Lake by a wide trail 3 miles in length on a good grade, the elevation at the mine being a little over 4,000 feet. The geology and general conditions surrounding the deposits were described by Newton W. Emmens in the Annual Report for 1914 and by R. W. Brock in Geological Survey of Canada Summary Report, 1903, Part A. The ore contains high silver values, the associated minerals being galena, tetrahedrite, zinc-blende, chalcopyrite, pyrite, and occasional native silver, in a quartz gangue. Of recent years intermittent work has been carried on by the owner, George Yuill, of Trout Lake. Past shipments are reported to have included 400 tons of sorted ore, shipped prior to 1906, which assayed between 200 and 300 oz. in silver per ton, with from 20 to 35 per cent. lead. In 1912, after a period of inactivity, 28 tons, assaying about the same, was shipped. The country-rocks are of late pre-Cambrian age, being members of the Lardeau series of the Windermere group as shown on Map 235A accompanying Geological Survey of Canada Memoir 161, "Lardeau Map-area." Briefly summarizing conditions in the workings examined, the vein is from 1.5 to 6 feet in width and strikes easterly and westerly, with a dip to the south varying from 15° to 25°. It cuts the dip of the country-rocks, consisting of silicified schist and limestone, almost at right angles, the formation having a similar strike but very steep dip to the north. The workings, following the contour of the hillside and distributed over an outcrop-length of about 500 feet, consist of three shafts and some open-cuts. The main working is an inclined shaft about 200 feet deep, with two levels on which drifting and stoping has been done. On the No. 2 level, 150 feet down, the easterly drift is about 140 feet long and develops the quartz vein, here up to 6 feet wide, and containing pay-streaks and disseminations of grey copper, galena, zinc-blende, and carbonates. In the

westerly drift, about the same length, the vein, from 1.5 to 2.5 feet wide, contains streaks of similar high-grade ore. Samples of selected material from these drifts assayed as follows:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Selected sulphides, with abundant grey copper present....	0.04	476.0	20.0	13.0
Selected quartz with sulphides.....	0.02	163.0	20.0	5.0

The mineralization persists in the drifts below the partially stoped areas, but the short section of the shaft below the 150-foot level was not conveniently accessible for inspection. The dumps of the other workings, mostly lying easterly from the collar of the main incline, all show quartz more or less mineralized with the same sulphides. The present operators started work in September, erecting bunk and cook houses, shaft-house, ore-shed, stables, etc., and towards the end of the year underground work was in progress extracting ore for shipment. Plans of the management include power-installation, followed possibly by the erection of a small reduction plant to treat the lower-grade material accumulated in the old stopes and surface dumps as a result of past operations.

Magnet. In connection with this group of claims, on Mobbs (Canyon) creek, 2.5 miles by trail from Gerrard, renewed activity has been initiated by the owners, the Thompson Bros., of Willow Point, and associates. References to the property are contained in the Annual Report for 1926 and in Geological Survey of Canada Memoir 161, "Lardeau Map-area." In the latter publication, in the section devoted to economic geology, by H. C. Gunning, it is stated that the shear-zone is large and the grade of ore good, and that the property seems worthy of careful investigation. Recent work included sinking a winze 15 feet deep from the drift-tunnel, which, together with the former workings, expose an ore-shoot, 1 to 3 feet wide, at intervals for a length of 150 feet. The drift is about 200 feet long and the winze mentioned was sunk at 50 feet back from the face. At about 20 feet in from the portal there is a short crosscut to the north containing an old winze, said to be 40 feet deep, from which a small tonnage of high-grade silver ore was extracted in past years. The following samples were taken:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.	Tin.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Grab-sample from sacked ore.....	0.10	17.0	0.2	13.5	22.0	*Nil*
Selected ore from outcrop, edge of creek, outside tunnel portal	0.08	25.0	0.5	13.0	33.0	Trace

In the Annual Report for 1914, under *Senorita*, selected samples containing grey copper are stated to have assayed as high as 1,000 oz. in silver per ton.

Placer-mining.

There were placer-mining activities at points on Lardeau creek near 10-Mile and above Trout Lake. At the latter point, 1.5 miles from the settlement, Roy Jacobson had some success in March when he recovered gold to the value of $188 in five days, the nuggets being up to 21.5 dwt. weight, with several over 10 dwt. weight. Subsequently he constructed a substantial cement dam and a flume to divert the creek from the ground to be worked.

NELSON MINING DIVISION.

Gold production in this Division is the best since the year 1914, when a severe set-back to gold-mining was caused by the uncertain economic conditions and the high cost of labour and supplies during the war years. From the year 1899 to 1913 a very consistent annual output averaging 21,000 oz. was made. Gold production is resuming its former importance in this

Division and should expand considerably, judging from the increased production to be expected from the *Reno*, *Yankee Girl*, *Second Relief*, *Kootenay Belle*, and other properties. Information concerning the gold areas is contained in Bulletin No. 1, 1932, which summarizes the available bibliography. At the time of writing, new deals are being negotiated and new undertakings will probably result in some cases. The full report on the Sheep Creek Map-area, by J. F. Walker, of the Geological Survey of Canada, is expected to be published in May, 1934, and is awaited with interest. Silver-lead-zinc exploration has been undertaken at several properties, as at the *Aspen* by the Salmo-Malartic Mines, Limited; at the *Red Rock* by the Michaely Silver Lead Mines; and at the *Lakeview* by F. Staples and E. G. Timmons. These activities are detailed in the body of this report.

NEAR NELSON.

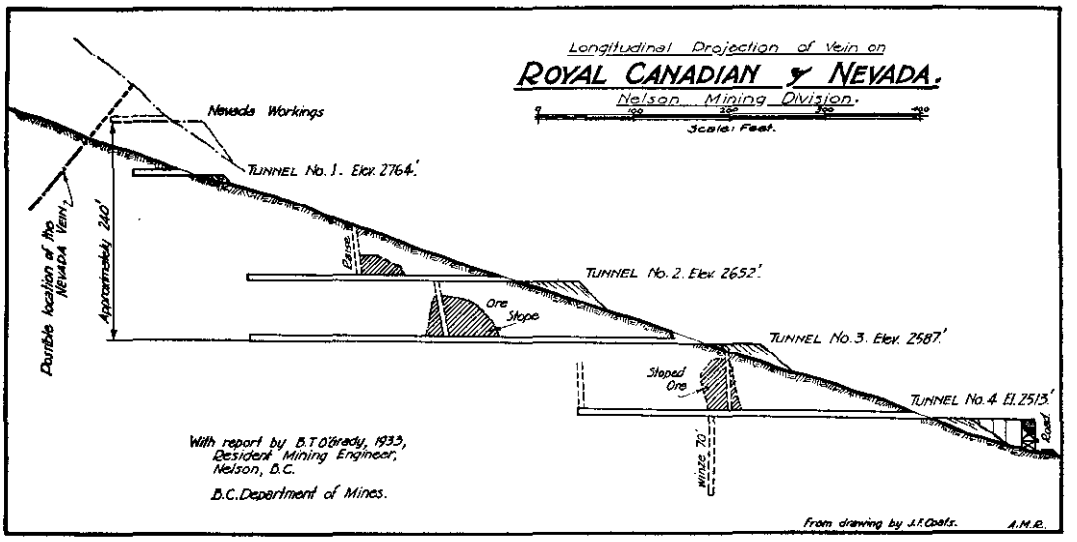
Noble Five Mines, Ltd. At this company's *Athabasca*, *Venus*, and *Juno* gold properties, south of Nelson, development was started at the beginning of March, 1933, the first work being done on the No. 2 level of the *Juno*, where the vein was drifted on for a length of 325 feet. Of this a length of 270 feet, 20 inches wide, is stated to average about 1 oz. gold per ton. Assuming that this exposure is the raking downward continuation of the ore mined from the surface in 1932 by G. Allen and J. C. Allison, the backs would be about 150 feet. During the summer of 1933 a considerable amount of surface work was done by trenching and ground-sluicing to trace the *Athabasca* vein. A new tunnel-site, giving an additional vertical depth of 200 feet, or 300 feet on the dip of the vein, was then located. At the portal of this new *Athabasca* tunnel a camp to accommodate twenty men was established and compressor-house and blacksmith-shop were erected. The compressor, of 1,000 cubic feet capacity, now being driven by a 150-horse-power motor, was moved from the old mill building to the new site and a transmission-line 2,000 feet long was built to connect with the sub-station of the West Kootenay Power and Light Company, which was formerly in use in connection with operations at the *Silver King* mine. At the time of writing (early 1934) this tunnel has been driven 300 feet toward the first objective, the downward continuation of an ore-shoot with a projected position 500 feet in from the portal.

On the *Venus* a tunnel giving an additional depth of about 300 feet measured on the flat dip of the vein has been started by hand. References to past reports on the properties are contained in the Annual Report for 1932. The combined past production of the *Athabasca* and *Venus*, according to the official records at the Bureau of Mines, Victoria, is 28,296 tons, containing 17,915 oz. gold and 427 oz. silver. These figures cover the period between 1899 and 1917, since when no production is recorded. Prior to 1899 some ore was shipped, of which there is no exact record. The *Juno* is credited with shipments of 1,925 tons, containing 911 oz. gold, in 1905. Lessees shipped 123 tons in 1932, and 29 tons in 1933 before the present company took over. P. Lincoln is president and general manager.

California. At this gold property, east of the *Athabasca*, south of Nelson, W. J. Turner and associates have started to ship ore at intervals, and 91 tons was sent to the Trail smelter during 1933. The property, formerly under lease and bond to the Hillside Mining Company, reverted to the owner, Mrs. F. Wilson. Past production is summarized in the Annual Report for 1930.

Granite-Poorman. At this property, west of Nelson, work has been continued by H. R. Smith, representing the Livingstone Mining Company, an extra-provincial company with head office at Seattle. Shipments for 1933, chiefly by lessees, amounted to 552 dry tons. At the end of the year preparations were being made by A. E. Jerome and W. Smith, lessees, to ship ore from the upper *White* tunnel on the *Granite* vein. Latterly, company activities included moving the machinery from the old mill at the foot of the mountain to a new site convenient to the location of the proposed tunnel to be driven below the *Poorman-Hardscrabble* shaft-workings.

Royal Canadian and Nevada. New activity has been initiated at this gold property, situated west of the *Granite-Poorman* holdings, by J. G. Allan, of Vancouver, and the Kootenay Nevada Mines, Limited (N.P.L.), has been incorporated. A crew of men under E. Bergstrom has been engaged in reconditioning the old workings and other preliminary work. The property is described in the Annual Report for 1928. J. F. Coats, of Vancouver, has been acting in a consulting capacity.



Golden Eagle. At this gold-silver-lead prospect, on Sandy creek east of the *Granite-Poorman* property, work was resumed late in 1933 by B. A. Pickering, of Nelson, and three associates. There are nine claims in the group held by the partnership. The deposits are reported to occur in a vein in granite near the contact with schistose rocks of the Rossland Volcanic group, and the workings include two drift-tunnels, 106 feet vertically apart, connected by raises. Since November 50 feet of underground work was done to the time of writing (early 1934). Two lots of ore have recently been shipped, values being as follows:—

Dry Weight.	Gold.	Silver.	Lead.	Zinc.
Lb.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
9,564	1.093	2.4	7.0	1.3
10,126	0.476	0.7	1.6	0.8

Shipments aggregating 6 tons made in 1925 and 1932 assayed: Gold, 0.30 to 0.71 oz. per ton; silver, from 6.3 to 7.7 oz. per ton; the lead content being of negligible importance.

Rover. At this group of claims, situated on Anderson creek east of Nelson, R. Barron and associates continued work in the lower tunnel-drift. From this working a test shipment of 1 ton, recently sent to the Trail smelter, gave the following assay and analysis: Gold, 1.82 oz. per ton; silver, 2.7 oz. per ton; lead, 2.5 per cent.; zinc, 9.5 per cent.; sulphur, 6 per cent.; silica, 65.8 per cent.; iron, 5.7 per cent.; lime, 1.1 per cent. The net value of such ore, after deducting smelting charges, is $50.71 per ton, including gold premium as at January 18th, 1934. The vein, in granite, is well defined, and in addition to the underground work done, as described in past Annual Reports under *Silver Reef* and Silver Leaf Mines, Limited, has been traced some distance along the surface. Appreciable gold values were not previously known to be present, assays from other parts of the workings having shown only silver, lead, and zinc. Systematic sampling of the vein for gold values would be of interest. Some drifting was also done in the adjacent working by H. E. Morgan and associate.

Good Hope. At this group of claims, on Bird creek, 2 miles from the road leading to the Nelson City power-station, W. E. Coles, A. Lambert, and associates discovered ore by ground-sluicing on the *Dorothea* claim. The vein occurs in schistose rocks of the Rossland Volcanic group, as described in the Annual Report for 1928. The new showing has been stripped for a length of 40 feet, the vein having the prevailing east-west strike and dipping here at 65° to the south, apparently coinciding in altitude with the foliation of the country-rocks. The showing is from a few inches to 15 inches in width, averaging 12 inches for 30 feet of the total length exposed. The quartz is honeycombed, iron-stained, and mineral-

ized with pyrite. A sample of 150 lb. shipped to the Trail smelter assayed: Gold, 1.1 oz. per ton, the silica content being 83 per cent. Ten feet north and parallel to the above showing a 6-inch streak of quartz is exposed in the floor of the rock approach to the big cut. West of this working there are two tunnels, driven by the late J. Smallwood, which develop barren-looking quartz striking parallel with the new showing in the surface cut. The new owners plan to crosscut from the old tunnels to test the extension of their ore-shoot to the west.

Iron King. At this prospect, near Beasley, on the Nelson–Castlegar highway, exploration by surface-trenching and diamond-drilling, with extensive sampling, was carried on during the summer of 1933 under the direction of C. C. Starr. Work was subsequently discontinued. The area covers the contact of intensely metamorphosed sedimentaries with granitic rocks of the Nelson batholith, this contact striking north and south. The sedimentaries are composed of more or less impure limestones, considerably garnetized in part, with quartzites and schists. Their strike is approximately north-easterly, with 45° dip to the south-east. Mineralization, quite extensive and often intense, is of the contact-metamorphic type. Trenches and prospect-shafts have been dug at intervals over a length of over 2,000 feet, exposing mineralization from a few feet to over 100 feet wide. It is generally strongest near the contact, but extends much farther in favourable beds than others. Magnetite, the most abundant mineral present, occurs in masses up to 20 feet wide and in disseminations through the rock. Pyrite occurs in irregular seams and disseminations through the rock and the magnetite, and marcasite is occasionally present in pockets and segregations. Much of the mineralization is accompanied by intense silicification. Sampling showed interesting but erratic gold values, thought to be largely associated with the pyrite.

Overlook. The claims of this group, staked by J. S. McKechnie, of Kamloops, and associates, adjoin the road along the Columbia river 6 miles north of Robson. Work was carried on for a short period during the fall, four men being employed. An old shaft and short tunnel develop a silicified fractured zone in granite, containing iron sulphides in places and considerable iron-stain in oxidized areas, as in the shaft. Extensive sampling showed no appreciable values in gold or silver. Work has been discontinued.

Perrier. At this property, adjoining the highway and Great Northern Railway 4 miles south of Nelson, work was resumed by the Perrier Gold Mines, Limited, of Nelson, in September. At the time of writing (January, 1934) two car-loads of ore have been shipped to the Trail smelter. Previous to resumption of work by the company, D. Berry, of Nelson, and associate lessees, shipped two car-loads, and before that some shipments were made by the lessees represented by J. Flagel, of Ymir. Total 1933 shipments amounted to 292 dry tons.

The following table gives the officially recorded production from the *Perrier* mine:—

Year.	Tons.	Gold.	Silver.	Lead.	Zinc.
		Oz.	Oz.	Lb.	Lb.
1913	5	10	30	.....	.....
1914	7	5	17	.....	.....
1915	30	45	210	.....	.....
1916	140	265	750	700	.....
1929	18	13	59	362	.....
1931	152	114	303	4,090	5,018
1932	858	387	802	.....	19,842
1933	292	105	219	3,838	4,094

The geology, character of the deposits, and history of the property are described in past Annual Reports, in Bulletin No. 1, 1932, and in the Geological Survey of Canada Summary Report for 1911. Drifting on the vein from the inclined shaft is now as follows: No. 1 level north, 50 feet down on the dip, 400 feet; No. 2 level north, 120 feet down, 120 feet; No. 3 level north, 200 feet down, 110 feet; No. 2 level south, 145 feet down, 150 feet; No. 3 level south, 200 feet down, 60 feet. Most of the stoping was done above Nos. 1 and 2 north drifts between 1931 and 1933. Recent work by T. H. Turner, representing the company, included the extension of No. 2 north drift, from which ore was shipped recently, and on this level a large block of stoping-ground has been partially opened up, with good showings in the northern extremities.

On the No. 2 level south, where some stoping has been done over a short length, the intersection of the shaft-vein with a vertical vein, striking N. 30° W. with the trend of the schists, was encountered. This is believed to be the vein described by O. E. LeRoy, of the Geological Survey of Canada, in the Summary Report for 1911 previously referred to. An extract from this report is as follows: "It (the vein) consists of bands of quartz, with an aggregate thickness varying from 7 to 15 inches, interbanded with the schists. The mineral content is the same as that of the main vein, but in addition minute quantities of ruby and native silver have been found in small fissures associated with calcite. It is probable that this vein is a branch of the main one, but development-work is not yet sufficiently advanced to prove it." The structural relationship of the two veins is not yet clear owing to the limited amount of work done.

The production made from the very limited workings and the showings of ore visible in various places are features encouraging the expectation that a substantial production would follow adequate development on systematic lines based on objectives indicated by surface and underground showings.

Humming Bird. At this property, situated at the head of Roaring creek, 14 miles south-easterly from Nelson, development-work was carried on by F. T. Harbour during part of 1933. This work has been discontinued pending consummation of plans for refinancing. In this connection Newton W. Emmens made a comprehensive examination for Seattle interests in July. The Humming Bird Gold Mines, Limited (N.P.L.), was incorporated to acquire and develop the properties consisting of the *Humming Bird* group of four claims owned by R. Qua and four claims owned by T. E. Levasseur. Additional claims are located in the name of the company. A description of the original *Humming Bird* prospect is contained in the Annual Report for 1921. The property is now supplied with living-quarters for twelve men, a portable 2-drill gas-driven compressor, blacksmith-shop, and general mining equipment. A branch road 2½ miles in length from Apex, 8 miles south of Nelson, leads to a pack-trail 3½ miles long, giving access to the camp. The ground covered by the claims is from 5,200 to 6,500 feet in elevation. The area is underlain by sedimentary rocks, including quartzites and siliceous schists, which are intruded by granitic rocks of the Nelson batholith. The sedimentaries were mapped by R. W. Brock and R. G. McConnell (West Kootenay Sheet, Geological Survey of Canada) as the Nisconlith series, corresponding to the Pend d'Oreille series of R. A. Daly (Memoir 38). These rocks can now be definitely allocated to the late pre-Cambrian age. The following information is extracted from the report of Newton W. Emmens: "The quartzite is a grey to greenish-grey banded rock, considerably altered near the granite intrusions. It is of granular texture, in which the quartz grains are cemented together by silica, and in which can be detected small crystals of biotite. The siliceous schists are a dark-coloured, fine-grained rock containing considerable carbonaceous matter, with some graphite developed along the joints and slips. The strike of the rocks varies from N. 30° W. to N. 30° E., with a steep easterly dip as a general rule, but just above the trail near the lower adit a well-defined wall was noted, having a strike of N. 30° E., with a dip of 50° to the north-west. Because of the badly weathered condition of the rock here exposed, it was not possible to determine whether this wall was parallel to the strike of the formation at this place or was cutting it; but the dip is in the opposite direction to the walls encountered in the underground workings. Between the granite and the quartzite on the *Humming Bird* claim, a little north of west from the portal of the lower adit, a lamprophyre dyke was noted. This dyke consists of a dark-coloured rock, closely related to the granite intrusive, and was probably formed during the last stages of granite intrusion. In the Ymir district these dykes are associated with the ore-deposits.

"The ore-deposits thus far found on the *Humming Bird* claim consist of three types—fissure veins cutting the formation at various angles; formation veins in which the ore follows closely the strike of the enclosing rocks; and contact deposits in which the ore is deposited in the brecciated and crushed quartzite close to the granite and not only forms the cementing material along the cracks and fissures in the quartzite, but in places actually replaces the rock. On the *Josephine* claim two veins have been found and traced by outcrop and surface-trenching for several hundred feet. They are of quartz, 4 to 6 feet wide, having a strike of N. 70° W., with a dip of 45° to the north, cutting the enclosing granite at almost right angles to its strike. The most southerly of these veins is well mineralized with pyrrhotite and the northerly vein with pyrite, galena, and zinc-blende. On the *Humming Bird* claim a quartz vein has been found in the quartzite having a strike of N. 23° to 40° E., with a dip of 40° to the south-east. This vein,

which is from 8 to 24 inches wide, appears to be cutting the formation at a low angle and is following a well-defined wall. It is of 'ribbon' structure and is mineralized with iron pyrite, galena, and blende, carrying good values in gold. Near the south line of the *Humming Bird* claim, close to the granite-contact, there is a belt of crushed and brecciated quartzite well mineralized with pyrite, galena, and blende, having a strike of N. 40° E., with a dip of 60° to the south-east. The width of this belt of mineralized quartzite has not yet been definitely determined, but it is exposed over a width of 5 feet without the foot-wall having been reached. From what can be seen at surface, there is a lamprophyre dyke between this quartzite and the granite, so it will probably be found that this dyke forms the foot-wall of the ore. In addition to the veins above enumerated, it is stated that there are other veins which have been found by surface prospecting, but they were not seen by the writer as the cuts are caved.

"With the exception of the vein on the *Humming Bird* claim and the belt of mineralized quartzite on the same claim, development-work has been confined to surface-trenching and shallow prospect-shafts. On the *Josephine* claim two quartz veins have been prospected by surface cuts along their outcrops for the full length of the claim, 1,500 feet, and shallow shafts have been sunk on each. The most southerly of these veins, in a shallow shaft sunk from the outcrop at an elevation of 6,050 feet, shows a well-defined quartz vein having a strike of N. 70° W., with a dip of 50° to the north. This vein is 5 feet wide and is well mineralized with pyrrhotite. At the surface it is in granite, but at the bottom of the shaft, around 20 feet, it is stated to be in quartzite. The shaft was full of water at the time of the writer's visit, so it was not possible to verify the statement. About 300 feet farther up the hill, and at an elevation of 6,200 feet, is a second vein of quartz 4 to 6 feet wide, having a strike of N. 65° to 75° W. and a dip of 45° to the north. This has been opened by a shallow shaft, now partly caved and filled with water. Upon the dump of this shaft is considerable quartz showing pyrite, galena, and blende. A sample of the better mineralized portions of this rock assayed: Gold, 0.06 oz. per ton; silver, 1.24 oz. per ton. This vein has been traced by outcrop and open-cuts for several hundred feet in either direction from this shaft, but no work of any consequence has been done thereon to locate a payable ore-shoot.

"On the *Humming Bird* claim a quartz vein was discovered in the bed of a small creek. It panned well and in places showed a few colours of gold in the quartz. The surface along the outcrop of this vein is covered quite deeply by overburden, in some places to a depth of 18 feet. In order to prospect it, therefore, ground-sluicing was resorted to, and the small stream, in the bed of which the vein was first found, was utilized for that purpose. In these trenches, 100 and 200 feet apart respectively, a high-grade streak of ore was found against the hanging-wall of the vein. This streak is highly mineralized with iron pyrite, galena, and blende, in which free gold can be seen. In the bottom of a cut, now caved, a sample taken over a width of 2 feet by B. T. O'Grady, Resident Engineer, assayed: Gold, 6.25 oz. per ton; silver, 3.9 oz. per ton. A shaft was sunk on this vein to a depth of 15 feet, showing good ore all the way down. It was stated to the writer that much of this ore showed free gold, but as the shaft was full of water this statement could not be verified. There is reason to believe, however, that this statement is correct. About 50 feet west of and 35 feet lower than the collar of the shaft a crosscut 70 feet long has been made to the vein, with drifts along the vein of 85 feet to the north and 45 feet to the south. At the point of intersection of the crosscut with the vein the latter shows 14 inches of white quartz that assays: Gold, 0.12 oz. per ton; silver, a trace per ton. Going south from this point, the vein narrows and at the face is only 4 inches wide. It is not as well mineralized as in the north drift. Going north, the vein maintains a width of 12 to 16 inches for 20 feet, beyond which it narrows down to 6 inches, then increases in width to the face, where it is 10 inches wide in the roof and 20 inches wide in the floor of the drift. Several samples were taken along this north drift, as follows:—

"Across 14 inches in the floor of the drift, 10 feet north of the crosscut, white quartz showing no mineralization, assayed: Gold, 0.08 oz. per ton; silver, a trace per ton. This sample was vertically under the shallow shaft from surface, and in the roof of the drift the ore is wider and well mineralized, indicating that the ore-shoot has a northerly rake in the vein.

"In the north end of the drift the vein is wider, of a banded structure and better mineralized than elsewhere, and is the downward extension of the ore-shoot which was prospected at surface by the shallow shaft and the trenches. In the face of the drift, 85 feet north of the crosscut, near the roof, across 10 inches of banded quartz, an average sample assayed: Gold,

0.90 oz. per ton; silver, 1.10 oz. per ton. In the face of the drift, midway between the roof and the floor, across 18 inches of banded mineralized quartz, a sample assayed: Gold, 0.72 oz. per ton; silver, 0.64 oz. per ton; lead, 1.37 per cent. In the face of drift, close to the floor, across 20 inches of banded, well-mineralized quartz, a sample assayed: Gold, 0.64 oz. per ton; silver, 0.48 oz. per ton; lead, 3.79 per cent. Along the floor of the drift, 75 feet north of the crosscut, a sample of quartz taken across 16 inches of the vein, showing less iron and zinc sulphides than the previous three samples, assayed: Gold, 0.12 oz. per ton; silver, 0.48 oz. per ton; lead, 2.09 per cent. Another sample taken across 18 inches of banded quartz in the floor of the drift, 70 feet north of the crosscut, assayed: Gold, 0.76 oz. per ton; silver, 0.72 oz. per ton; lead, 1.98 per cent. These last two samples were beneath one of the surface cuts where there is good ore, and which is supposed to be near the southern end of the ore-shoot. In another surface cut farther north some 200 feet similar ore is found. It is not worth while to drive the present drift ahead, because the slope of the ground is such that no material added depth will be gained for a long way and no stoping-ground would be made available. It is therefore advisable to sink a winze to test the vein as to width and value, also to obtain some information as to the rake of the ore-shoot, so that deeper development can be laid out intelligently to obtain the maximum results with the least expenditure. It was with this in mind that the last two samples were taken, as this appeared to be the logical place to sink.

"Near the south line of the *Humming Bird* claim, in the side of a canyon, 870 feet horizontally south-west of and 138 feet vertically below the portal of the upper adit, another adit has been started to tap the *Humming Bird* vein at a depth of 214 feet on its dip below the upper adit. Twenty feet in from the portal of this adit mineralized quartzite was cut, and a few feet farther on a well-defined wall, having a strike of N. 40° E., with a dip of 60° to the south-east, was encountered. This wall is now being followed. This quartzite is brecciated and cut by cross-fractures to its bedding-planes. Both along some of the bedding-planes, which had been opened by the movement of the rocks, and along the seams and fractures, mineralization has taken place and the sulphides of iron, lead, and zinc deposited therein. In places where the brecciation is most pronounced, part of the quartzite has been replaced by ore-minerals. The mineralized quartzite extends from the wall for the entire widths of the adit, 5 feet plus. An average sample taken across the face, 24 feet in from the portal, assayed: Gold, 0.24 oz. per ton; silver, 2.36 oz. per ton; lead, 10.27 per cent. A second sample taken across the full width of the adit, 30 feet in from the portal, assayed: Gold, 0.16 oz. per ton; silver, 1.74 oz. per ton; lead, 7.08 per cent. No assay was made for zinc.

"This quartzite is close to the granite-contact and to a lamprophyre dyke which parallels the formation, and is a long way from where the *Humming Bird* vein should be at this level, assuming that it maintains its course and dip as shown in the upper adit. A compass survey indicates that the downward continuation of the *Humming Bird* vein at the level of the lower adit lies between 120 and 220 feet to the south-east of the hanging-wall of the mineralized quartzite, depending upon the strike of the vein. If it maintains its strike of N. 40° E. the distance will be 120 feet, but if its true course is N. 32° E. (which is probable) the distance will be 220 feet."

Euphrates. At this property, on the eastern side of the Salmo river, 10 miles south of Nelson, work was resumed in August, 1933, when an option on the control of shares of the Euphrates Mining Company, Limited, was acquired by the Spokane-Idaho Copper Company, of Spokane. Information concerning this gold prospect is contained in the Annual Reports from 1926 to 1932. Work has been suspended since the Portland interests relinquished their option in the fall of 1931. Under the new management of B. N. Sharp, of Spokane, surface work has been done: repairs made to the flume, pipe-line, compressor, and buildings; and a caterpillar-tractor road, nearly 2 miles in length, on a 10-per-cent. grade, has been constructed from the camp on the Great Northern Railway to the lower tunnel, 1,000 feet above the valley. The equipment includes a Canadian Ingersoll-Rand 2-stage 16 by 9 by 16 compressor, with rated capacity of 744 cubic feet of free air per minute, driven by a Pelton wheel supplied with water under 310 feet head by a 24- by 18-inch flume 8,000 feet in length. The plant is located in the valley, across from the camp, and air is delivered to the mine by a 4-inch pipe-line 3,000 feet in length. Rock-drills include two drifters, one jack-hammer, and one stoper. A Riblet 2-bucket aerial tram, about 3,200 feet in length, connects the mine with the railway. A small sawmill, powered by a tractor-engine, and a 30-horse-power

caterpillar tractor are on the ground. The camp affords accommodation for a crew of fifteen. As the water in the flume from Clearwater creek freezes in extreme cold weather, auxiliary power has been provided through the recent installation of a 150-horse-power motor connecting with the power-line of the West Kootenay Power and Light Company.

The geology and general characteristics of the deposits were described in the Annual Report for 1929. Frederick Keffer, of Spokane, associated with the present operators as consulting engineer, sampled the various ore-exposures, and as a result of his advice, and that of B. N. Sharp, superintendent, the *Ell-Tee* lower tunnel, 1,200 feet long, is to be advanced along the vein for an estimated distance of 700 feet to the expected intersection with the *Lost Cabin* vein, which roughly parallels the *Ell-Tee* vein, but dips to the west instead of to the east (both dip at about 70°).

HALL CREEK.

Flying Dutchman, H.B., Rainbow.

These gold prospects, owned by C. Peterson, H. Erickson, and associates, have been taken under option by W. T. Hoover, of San Francisco. The owners have been prospecting their ground for several years, driving tunnels and doing surface-trenching at intervals. Due to pressure of other work these claims have not yet been visited. The gold-bearing veins occur in rocks of the Rossland Volcanic group as at the *Fern* mine, mentioned in Bulletin No. 1, 1932, which has also been optioned recently, in this case to Eastern United States interests.

Recently the Gold Fern Syndicate was formed to operate the *Fern* mine. The head office of the syndicate is 72 Queen Street West, Toronto, and the manager who sponsored the undertaking is Leonard L. Adams, of Buffalo, N.Y.

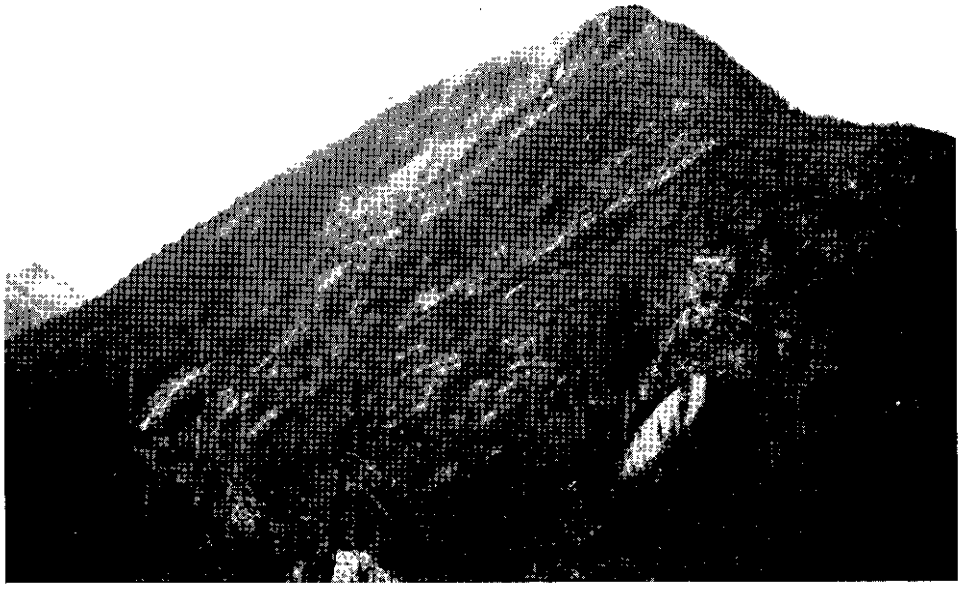
YMIR CAMP.

Yankee Girl.

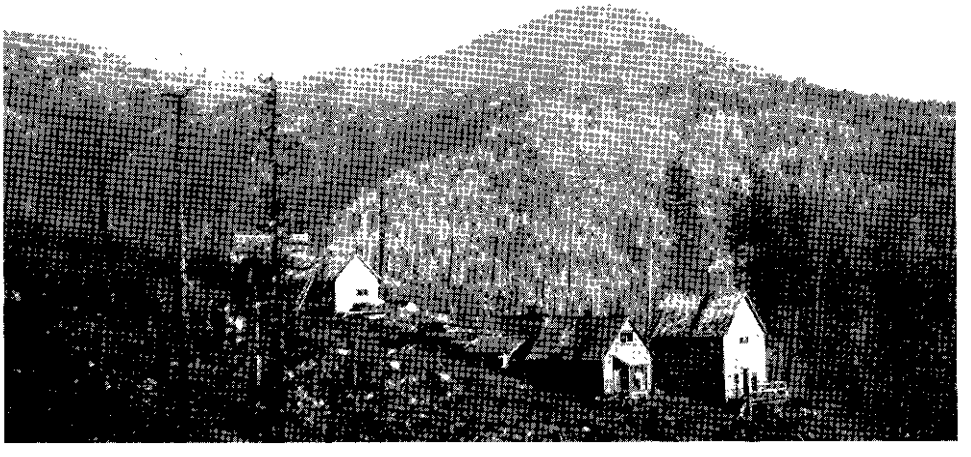
This mine on Oscar (Bear) creek, opposite Ymir, has been operated throughout 1933 by E. P. Crawford and associates on a shipping basis of over 1,100 tons a month. Stoping and development-work has continued, mainly in the known ore-zones. The 800-foot and 935-foot levels have received most attention, with smaller amounts of work on the 1,035-foot and 540-foot levels, the reason for this being to concentrate the work as much as possible on one or two levels at a time. The results of stoping and development have been most encouraging and the mine at present looks better than at any time before. A small amount of work on the 540-foot level has proven the upward extensions of ore-bodies in areas which were formerly thought to be barren, and the 800-foot level operations show much better lengths of ore than were before indicated. Large tonnage of lower-grade material will become available as ore if the increased price for gold can be depended on to continue. The tonnage mined and shipped was 13,456 tons, from which were recovered 6,792.9 oz. gold, 38,309.3 oz. silver, and 655,622 lb. lead. In the absence of E. P. Crawford on sick-leave, H. W. Seaman is in charge at the mine.

Two Star.

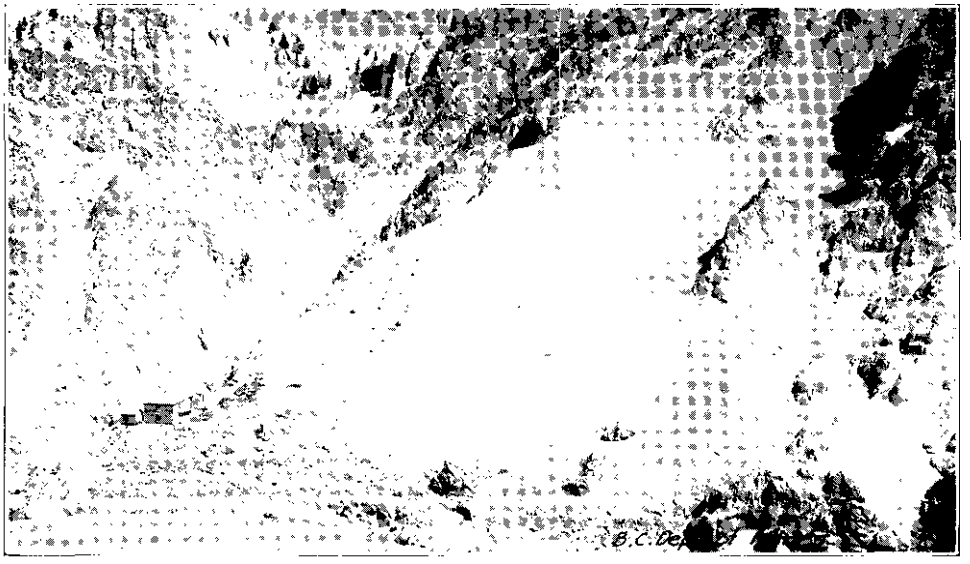
At this property, on the north side of Oscar creek opposite Ymir, active operations were initiated in August, 1933, by J. L. Parker on behalf of A. B. Trites, of Vancouver. The Oscar Creek road was extended 1⅛ miles under contract by A. H. Green Company, of Nelson, to connect with the new tunnel-site. Camp construction included a bunk-house, cook-house, office, and power-house, with a wash-room at one end and a blacksmith-shop at the other end, together with accessory buildings and dam for water-supply. The old compressor plant from the *Giant* mine was first installed and is still in use. This consists of a 25-horse-power semi-Diesel Fairbanks-Morse engine and Sullivan compressor of 189 cubic feet capacity. A new plant has been added recently, consisting of a double-cylinder 60-horse-power Petter engine and a 10 by 10 Ingersoll-Rand compressor of 250 cubic feet capacity. A 350-cubic-foot compressor, only recently available, will be substituted later on for the 10 by 10 unit. The crosscut tunnel, 374.5 feet in at the end of 1933, is planned to be driven about 3,000 feet to cut the easterly depth extensions of the *Yankee Girl* and *Dundee* vein systems. The geology of the area, by C. W. Drysdale, is shown on Map 175A accompanying Memoir 94, "Ymir Mining Camp," Geological Survey of Canada. As at the *Yankee Girl* and *Dundee* properties, the formation consists of schists of the Pend d'Oreille group intruded by granitic stocks and tongues from the Nelson batholith. The property consists of the *Morning Star*, Lot 3778, and *Evening Star*, Lot 3779, Crown-granted claims, with fourteen other contiguous mineral claims and fractions. The old outcrop-workings consist of open-cuts and a shaft 95 feet deep, which develop what is understood to be the extension of the *Lakeview* vein of the adjoining



Kootenay Belle Mine, Nelson M.D.



Clubine Comstock Mine, Nelson M.D.



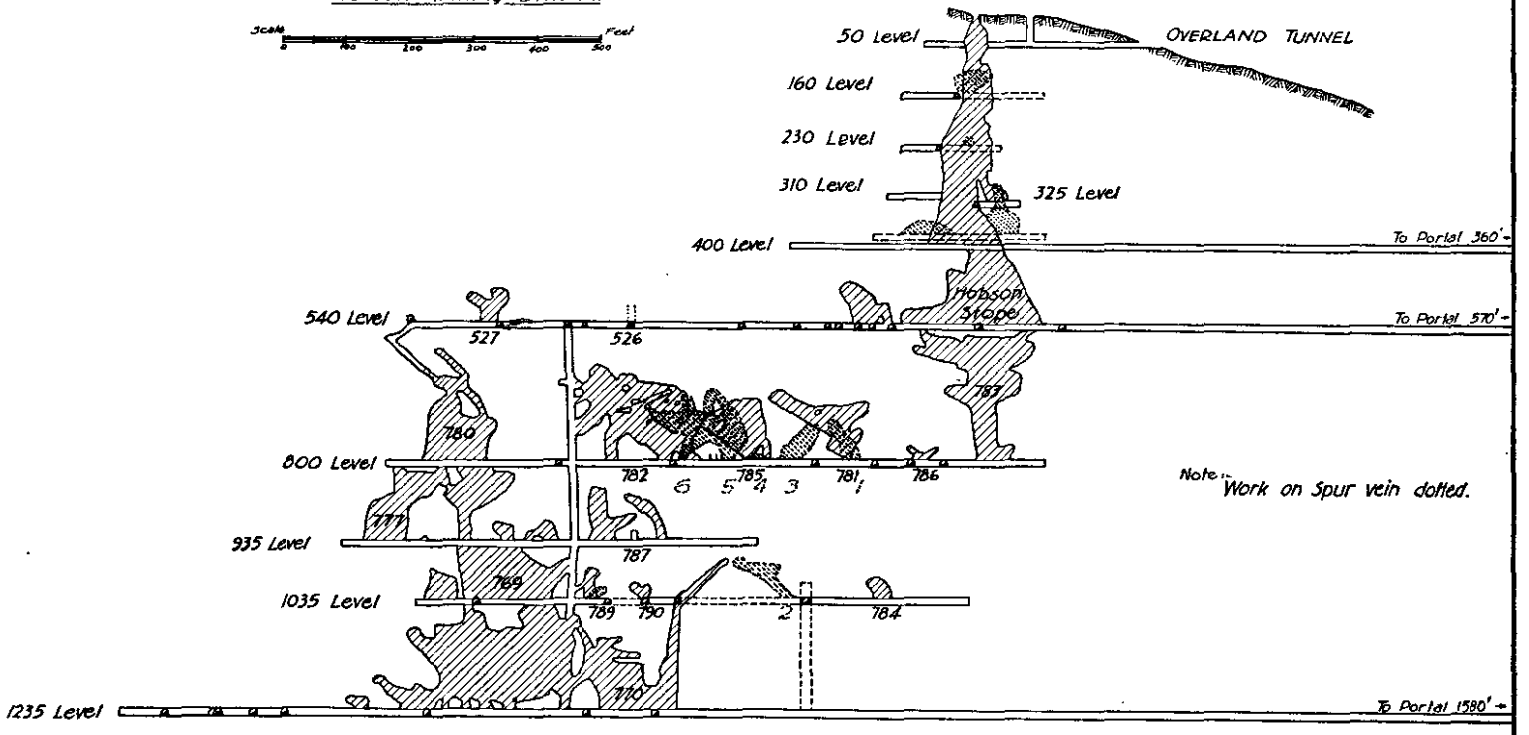
Grange Mines, Ltd. (Big Slide), Clinton M.D.

Midway Mine, Aldridge, Fort Steele M.D.

LONGITUDINAL SECTION

YANKEE GIRL MINE.

Nelson Mining Division.



Note:- Work on Spur vein dotted.

With report by D.T. O'Grady, 1933, Resident Mining Engineer, Nelson, B.C.

B.C. Department of Mines,

A.M.E.

Yankee Girl property. On the *Evening Star* the shaft, which is flooded, is reported to have been sunk on a wide vein containing iron sulphides and fine-grained galena in a siliceous gangue, the gold and silver values being about the same as in the ores of the camp. Open-cuts north-easterly from the shaft traced the continuity of the vein on to the *Morning Star* claim. The tunnel now being driven is at an elevation of 4,400 feet, or 880 feet lower than the collar of the *Evening Star* shaft. It starts on the *Mill Fraction* claim and will cross the *Black Diamond* claim into the *Evening Star* ground. The Trites Gold Mining Company, Limited, has recently been incorporated in connection with this undertaking.

Big Patch. On this prospect, at the head of Porcupine creek, a tunnel is being driven by H. Stevens, of Ymir, for Arthur Lakes, who during the open season had a large force of prospectors in the area northerly from the *Reno* mine to the headwaters of Wild Horse creek. A large number of claims were staked along the northerly extension of the Ripple formation on behalf of a Coast syndicate. These new undertakings have not yet been visited.

Wilcox. At this mine, on the north-west side of Wild Horse creek about 7 miles from Ymir, work was resumed early in May, 1933, by D. H. Norcross, J. J. Cullinane, and associates, and continued until December 10th, when snow and cold weather made it advisable to shut down for the winter season. A full description of the property is contained in Geological Survey of Canada Memoir 94, "Ymir Mining Camp," by C. W. Drysdale, and in the Report of the Minister of Mines for 1915. The writer is indebted to D. H. Norcross for details of the 1933 operations. During the year 1,700 tons of ore was milled, most of which came from No. 2 ore-shoot. Stoping was done between Nos. 1 and 2 and 2 and 3 levels. Sections of the vein mined averaged about 2 feet in width, widening to as much as 6 feet in places. Frequently portions of the wall-rock adjoining the vein were sufficiently mineralized to constitute ore. The vein-filling, varying from a hard, dense blue to white quartz, is mineralized with pyrite, sphalerite, and galena. Gold values seem to be associated with all these minerals and occasional free gold is seen in the white quartz, generally extremely finely divided. A small tonnage of lower-grade ore was extracted from No. 1 ore-shoot, which is east of the large mica-lamprophyre dyke which separates Nos. 1 and 2 ore-bodies. All ore was hand-sorted at the head of the tram at No. 3 tunnel portal before being lowered to the mill. The mine and mill were operated on a two-shift basis during the season, with the 10 stamps crushing an average of 10 tons per day. The difference in elevation between the mine and mill is about 800 feet. The ore is dumped from the tram-buckets into the mill ore-bin, from which it is fed into a 7- by 9-inch Blake crusher, thence to the ten 1,050-lb. stamps crushing to 50 mesh, and thence to lip-plate, apron-plate, blankets, and two Wilfley tables. About 60 per cent. of the bullion was recovered inside the mortars and about 5 per cent. recovered by the blankets. These were washed every four hours, the resulting concentrate being amalgamated in the clean-up barrel. The concentrate from the Wilfley tables averaged about 1.70 oz. gold per ton, 5 oz. silver per ton, 4 per cent. lead, 4 per cent. zinc, with 25 per cent. iron. About 70 per cent. of the gold was recovered as bullion and the balance in concentrates. Production for the season approximated 1,500 oz. of bullion of 475 gold and 500 silver fineness. In all 188 dry tons of concentrates was shipped to Trail. Sufficient water-power was developed to operate mine and mill together for the greater part of the season, a gasoline-engine being used as auxiliary power during the low-water period.

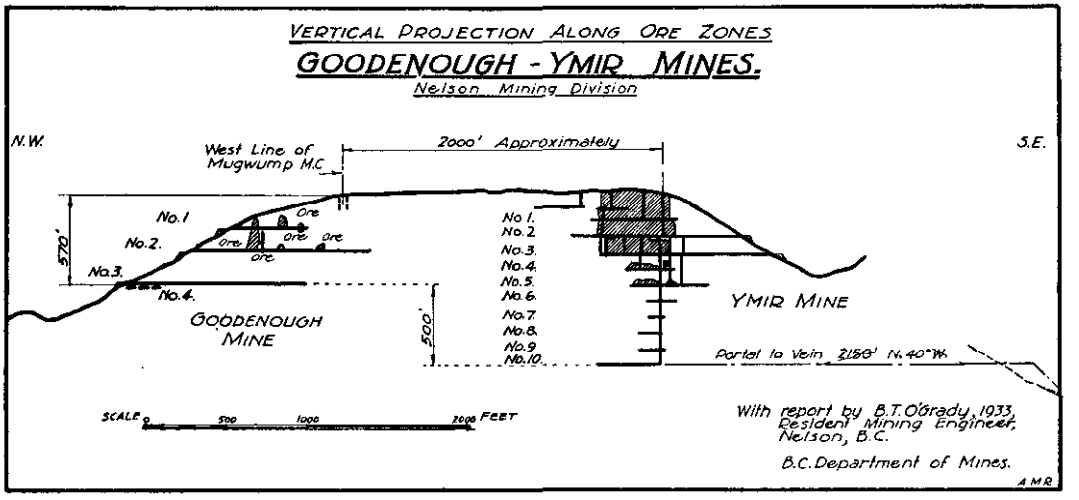
Blackcock. At this property, facing Wild Horse creek, south-west of the *Wilcox* mine, diamond-drilling was carried on in the fall of 1933 by H. S. Price, of Calgary, and associates. Two holes are reported to have been drilled to test the vein 500 feet below the outcrop. Large vein-widths are said to have been intersected, but values at these particular points were disappointing and the option was relinquished. The last two shipments, made in 1932 by R. B. Stetler, gave the following assays:—

Dry Tons.	Gold.	Silver.	Lead.	Zinc.	Silica.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
26.703	0.896	2.4	3.8	3.4	67.8
28.7	1.726	3.4	7.8	6.1	60.3

The property, described in past Annual Reports, is owned by A. McMillan, of Calgary.

Elise and Elite. At this prospect, on Huckleberry creek, the old tunnel-workings were reconditioned by A. Dunn, of Nelson, and associates. These consist of a tunnel and shaft below the old road to the *Summit* prospect. The country-rock is argillite of the Pend d'Oreille schist formation. The shaft is caved and inaccessible. It was sunk on a quartz vein, exposed for a short distance on the surface, striking N. 69° E. Below the shaft and just above the creek a crosscut tunnel cuts a quartz vein, probably the same, about 300 feet in from the portal. This vein was drifted on for 140 feet to the south-west. Here the vein, 3.5 to 4.5 feet wide, strikes N. 54° E. and dips steeply to the north-west. The strike of the formation is northerly, so that the vein cuts the rocks at a wide angle. In the drift the vein is composed of stringers and lenses of quartz in the sheared country-rock. Slight iron-stain is visible in places, but no appreciable amount of sulphides was noted. Where the crosscut intersects the vein there is more pronounced silicification and at this point a little stoping was done from a raise. On the tunnel dump, specimens of quartz with inclusions of country-rock contain pyrite, with occasional green copper-carbonate stains. As it parallels the production veins of the camp, the *Elise* vein would appear to warrant further testing to find an ore-shoot at some point along the outcrop where geological conditions might be more favourable for ore-deposition.

Goodenough. At this property, on Wild Horse creek, J. F. Coats has been carrying out exploration-work since the spring of 1933 for the Ymir Gold Mines, Limited, a private company, which also has an option to purchase the adjoining *Ymir* mine holdings. A résumé of information concerning both properties is contained in Bulletin



No. 1, 1932. On the No. 3 tunnel-level, elevation 3,945 feet or 194 feet below the No. 2 level, work done includes 660 feet of drifting and 250 feet of crosscutting. In No. 4 tunnel, at elevation 3,932 feet and 280 feet south-easterly from the portal of No. 3, 60 feet of drifting was done. Diamond-drilling footage totalled 1,030 feet, of which 600 feet was from points on No. 3 level, 360 feet on the No. 4, and 70 feet on the No. 2 level. The object of this exploration was to prove the downward continuation of the ore stoped on the No. 2 level, and in this connection a problem was encountered which will probably be solved in due course by sinking on the ore which shows up strong in the floor of the No. 2 tunnel-drift. Meanwhile preparations are well advanced to ship ore from that level, two cars of ore being broken in the No. 2 big stope. A thorough sampling of the upper levels shows good assays in gold with appreciable silver values at numerous points, and substantial shipments can be expected with possible discovery of new ore areas. One machine is in use for stoping wide areas and single-jackers are working at other points. Twelve men are employed and more will be added as required. O. D. Frith, of Vancouver, who was formerly in charge of shipping operations from the *Goodenough*, has taken over the management, and at the time of writing car-load lots of ore are being shipped to the Trail smelter at short intervals.

Tamarac.—At this property, north of Ymir, no work has been done since March. Details of the two lots shipped by A. T. Powell to the Tacoma smelter are as follows:—

Date of Shipment.	Dry Weight.	Gold.	Silver.
	Tons.	Oz. per Ton.	Oz. per Ton.
February 10, 1933	22.0955	1.515	0.27
March 20, 1933	30.2055	1.385	0.18

A summary of conditions is contained in the Annual Report for 1932. Negotiations for a deal are reported to have been opened recently. The property is owned by E. W. Widdowson, of Nelson.

BOULDER CREEK.

Clubine-Comstock Gold Mines.

At this company's *Boulder City* group, on Boulder creek, 3 miles north of Salmo, work was continued throughout 1933 with L. R. Clubine in charge. The geology and character of the mineral occurrences are described in Bulletin No. 1, 1932, and subsequent progress is recorded in the Annual Report for 1932. Two shipments of ore, aggregating 57 tons, were made early in 1933. This ore was extracted from an ore-shoot 90 feet long in No. 2 tunnel, which working was advanced to a point 300 feet in from the portal. One car-load averaged: Gold, 1.22 oz. per ton; silver, 1.9 oz. per ton; and the second averaged: Gold, 1.17 oz. per ton; silver, 1.17 oz. per ton. The No. 2 tunnel is the uppermost of the group of three tunnels where work has been proceeding during 1932 and 1933, the No. 1 being over 1,000 feet higher along the outcrop. In the No. 3 tunnel, 100 feet below the No. 2, new work has exposed a short ore-shoot, 6 to 8 inches wide, assaying 1.5 oz. gold per ton. The vein here is up to 12 feet wide, well mineralized with iron sulphides, values outside of the pay-streak being very low. No. 4 tunnel, at 50 feet lower elevation, has been extended 125 feet in ore and is now about 250 feet long. According to the management, the best values are on this level and samples across widths of 18 inches assayed from 0.86 to 2.27 oz. gold per ton. About 14 tons taken off the outcrop at the portal assayed nearly 3 oz. gold per ton. A shipment of about 37.5 tons made from the No. 4 tunnel at the end of the year (credited to 1934 production) assayed: Gold, 1.225 oz. per ton; silver, 1.9 oz. per ton. Ore is shipped as extracted without any appreciable sorting. A fair road, 1⅓ miles in length, now connects the workings with the Nelson–Salmo highway. New machinery, consisting of a Sullivan compressor and an 80-horse-power Junkers-Diesel engine, has been provided, with which development-work will be expedited. New bunk and cook houses, office, compressor-house, and accessory buildings have been erected, accommodation being provided for twenty men.

SHEEP CREEK CAMP.

Reno Gold Mines, Ltd.

Production from this company's *Reno* mine has been maintained throughout 1933 and development of ore reserves has latterly been noticeably expedited with good results. On the No. 6 level, the deepest working, the best showing in the mine has recently been developed. The 1933 development footage amounted to 2,962 feet, consisting of 2,421 feet of drifting, 400 feet of raising, and 141 feet of sinking. The No. 5 tunnel was driven to a point 2,382 feet in from the portal. Revised figures show that the easterly ore-shoot on this level has a length of 343 feet, assaying 1.18 oz. gold per ton across an average width of 1.8 feet. A small exploratory winze, started in May on No. 5 level, was sunk below No. 514 raise in the westerly ore-shoot to a depth of 100 feet. Drifting on the vein on the 600-foot level, driven from the bottom of the winze, developed ore over a length of 278 feet, assaying 1.6 oz. gold per ton over an average width of 3 feet. The quartz is heavily mineralized with sulphides, the most abundant being pyrrhotite, with sphalerite, pyrite, galena, and occasional chalcopyrite. In the 600-foot level drift the vein attained a maximum width of 6.6 feet and development-work is being pushed rapidly. At the time of writing (January, 1934) it is expected that the easterly or No. 2 ore-shoot will be reached shortly. West of the No. 1 or western ore-shoot on this 600-foot level encouraging widths and values were encountered at the close of 1933, indicating favourable possibilities for a third ore-shoot at this horizon. In the development of the primary ore-bodies there is being experi-

enced an increased hardness of the country-rocks, a favourable factor for ore-deposition in the Sheep Creek camp. Owing to the hardness of the ground the diamond-cut round, drilled from a vertical column, is used for development drifting in place of the old "bottom-swipe" or "toe-cut" type of round. Using the new system, the management has been able to advance headings at a rate considerably over 200 feet a month. Canadian Ingersoll-Rand type S-70 machines are used for all drifting and crosscutting. Following the success attained in the exploratory winze, it is proposed to sink a 3-compartment shaft, with two hoisting compartments and a manway, from the No. 5 level, and preparations for this work are well in hand. At the close of 1933 installation had just been started of a Canadian Ingersoll-Rand 36 by 24, PE 1, electric double-drum hoist, with double helical gears, friction-clutch and post-brakes. The rope-speed is 600 feet a minute and the hoist has a capacity of 2,600 feet of ¾-inch rope. This is driven by a 75-horse-power 550-volt motor, with semi-magnetic control. A Mancha storage-battery locomotive has been provided for haulage purposes.

Most of the stoping done throughout 1933 has been above No. 4 level, and a large part of the exploration of ore reserves on No. 5 level was not undertaken until the latter part of the year. The mill was operated continuously, treating a total of 21,967 tons, yielding a gross value of $338,636.70. The average tonnage milled was 60 tons per day. This was increased from a daily average of 53 tons in January to a milling rate of nearly 80 tons per day at the close of the year. There were numerous changes and additions to the mill which are complete or well under way. The crushing and sorting arrangement was moved from the mine to the mill. In the new installation crushing is done by a 10 by 20 Fraser and Chalmers jaw-crusher as primary breaker, with a 3-foot Symons cone-crusher as secondary breaker. The ball-mill classifier was discarded. The tube-mill classifier was replaced by a Dorrco 9-foot bowl classifier giving critical size-control, operating in closed circuit with the tube-mill. An 8-disk, 6-foot diameter, American filter has been ordered to replace the Merrill sluicing-presses. There were numerous minor alterations in milling practice, and the latest advice from the mine is that these changes will materially increase both tonnage and recovery. No recent statement of ore reserves has been published, but a mid-year estimate, before No. 6 level drift was started, showed an assured ore reserve of 44,900 tons containing 0.62 oz. gold per ton. During 1933 the *Nugget-Motherlode* workings were cleaned out and tunnel entrances repaired, and while no definite plans have been expressed, it is believed that work at this property will be resumed in 1934. I. M. Marshall is managing director and general superintendent, the mine captain is Charles Wilson, mill superintendent is George L. Mill, and the newly appointed electrical engineer is H. J. Styles. A crew of ninety-seven men was employed at the close of the year.

Fawn Mining Co., Ltd.

This company was incorporated in connection with the *Golden Fawn* group and the *Mastodon* silver-lead-zinc property, in the Revelstoke Mining Division. The *Golden Fawn* group, which adjoins the *Reno* property to the east, contains eight claims and is situated at an elevation of 6,300 feet. The workings are located on both sides of the ridge running north from the *Nugget* property (now included in the *Reno* mine holdings). A detailed description of the geology, by J. F. Walker, will be published shortly in a special Geological Survey of Canada report on the Sheep Creek Map-area. The writer is indebted to the author for a summary of conditions. A parallel series of veins and fissures cut the hard white quartzites of the upper part of the *Ripple* formation. These strike easterly parallel to the vein system of the camp. Most of the work has been done on two veins, the northern one having been developed by two tunnels on the *Golden Fawn* claim (on the western slope) at approximate elevations of 6,275 and 6,420 feet above sea-level, and on the *Mint* claim (on the eastern slope) by open-cuts at elevations of 6,390 and 6,360 feet, a tunnel at 6,300 feet, and an open-cut 200 feet easterly from this tunnel. This north vein, striking slightly north of east and dipping very steeply to the south, or vertical, shows some evidence of oxidation of iron sulphides and some stoping was done in former years in the upper tunnel, as detailed hereafter. The lower tunnel on the north vein, 280 feet long, encounters the fissure 50 feet in from the portal and follows it to within 5 feet of the face, where a small offset to the north is caused by a northerly-striking, easterly-dipping slip. The fissure has a greatest width of 2 feet at a short crosscut to the north 212 feet in from the portal. The country-rocks traversed are first white quartzites passing into platy quartzites, then argillaceous schistose rocks, and again quartzite for the last 70 feet of the working. In the upper tunnel on the same vein, driven 140 feet in white quartzites, underhand stoping has been done for a length of 36

feet and a depth of 12 feet in addition to stoping above the level for a length of 56 feet. The south vein has been developed by a tunnel on the *Golden Fawn* at 6,330 feet elevation and by a tunnel on the *Mint* at the same elevation. The first-mentioned working, 160 feet long, develops a fissure up to 1 foot in width, which swells locally to 2½ feet at a bend in the vein 100 feet in from the portal. At the inner end of this working there is a vertical raise believed to connect with an open stope 36 feet long on the top of the ridge. The tunnel on the south vein on the *Mint* slope of the ridge is 167 feet long, exposing a tight fissure in massive white quartzites, which are crushed near the face with vein-quartz throughout the country-rock across the width of the working. On top of the ridge parallel tight fractures are exposed 150 feet north of the north vein and about 90 feet south of the south vein. The schists and limestone of the lower *Reno* formation are just west of the *Golden Fawn* workings and the quartzites, favourable for ore-deposition, extend easterly. The proposed new work at the property is expected to be started in the spring of 1934.

Gold Belt Mining Co., Ltd.

This company's property now includes the *Golden Belle* group and comprises the area situated between the *Reno*, *Queen*, and *Kootenay Belle* holdings. The thirty-three mineral claims held by the company aggregate 1,000 acres in area and cover extensions of various veins through the *Reno*, *Nugget*, and *Motherlode* quartzites, favourable host-rocks of the gold-deposits in the Sheep Creek camp. Prospecting and development have shown the existence of a number of veins and fissures, including the *Joint*, "A" (western extension of the *Motherlode* vein), "B," "C," "D," and *Bruce* veins in the northern section of the property and veins on the *Nevada* and *Peggy* claims in the southern section. The relative position of most of these veins and fissures was detailed in the Annual Report for 1932. Two camps have been established, one for the *Golden Belle* workings and the other for the *Gold Belt* area. During the period under review 6,000 lineal feet of new road was built and 5,000 feet of caterpillar-tractor road improved for truck-haulage, connecting both sections of the property with the main road system. In the *Gold Belt* workings development-work during 1933 totalled 2,917 feet of crosscutting and drifting, of which 1,826 feet was on the 600-foot level and 1,091 feet on the 200-foot level. Diamond-drilling in this area totalled 1,750 feet.

The No. 2 crosscut, on the 200-foot level, at elevation 5,389 feet, cut the "C" vein at a depth of 220 feet below the surface at a point 541 feet in from the portal. The western section of the outcrop of this vein was resampled by the management for a length of 155 feet, giving an average assay of 1.73 oz. gold per ton. In the No. 2 crosscut the *Bruce* vein was cut 100 feet vertically below its surface outcrop and between the *Bruce* and "C" veins a new vein, called "D" vein, was encountered. An aggregate of 442 feet of drifting has been done at the time of writing on the No. 2 level, as follows: "C" vein, 220 feet; "D" vein, 52 feet; and *Bruce* vein, 170 feet. A raise has been carried 85 feet up on "C" vein and will be continued to the surface.

At the No. 6 or 600-foot level, elevation 4,943 feet, the *Bruce* vein was cut 340 feet vertically below the drift in No. 2 level. Drifting was done along this vein for 355 feet. The "C" and "D" veins have not as yet been crossed by this tunnel, as work in No. 2 level indicates that these veins dip north and lie ahead of the face of the No. 6 tunnel, where, according to the management, their positions have been indicated by diamond-drill holes. The *Gold Belt* was visited by the writer in the summer of 1933 before any drifting on the veins had been undertaken and details of results of this work done on the 200-foot level are not yet known at the time of writing.

The *Golden Belle* section was developed by hand, including 194 feet of drifting, crosscutting, and raising, with 600 lineal feet of surface-trenching done along the vein. From these workings a car-load of ore was recently shipped to the Trail smelter, which, according to the management, assayed 1.3 oz. gold per ton. The old workings in the central part of the property were reopened and sampled. In the upper tunnel an 80-foot length, averaging 20 inches in width, gave an average assay of 0.5 oz. gold per ton. The combined *Gold Belt* and *Golden Belle* operations have been conducted under the technical direction of H. Lakes, of Nelson. M. O'Donnell is mine foreman.

Queen.

In connection with this mine on Wolf creek, just above its junction with Sheep creek, 10 miles by road from Salmo, and the adjoining *Vancouver*, *Midnight*, and other claims of the Midnight Mining Syndicate, a consolidation has been effected resulting in the incorporation of the Sheep Creek Gold Mines, Limited (N.P.L.).

The *Queen* holdings, represented by C. E. Witter, of Moscow, Idaho, include fifteen Crown-granted claims, with all buildings, equipment, and the mill. The other properties involved are the *Midnight Fraction* and *Helena* Crown-granted claims and the *Vancouver*, *Marie Fraction*, and *Victoria Fraction* claims held on location. The character of the mineral occurrences, geology, and history of the *Queen* mines property are summarized by J. F. Walker in Geological Survey of Canada Summary Report, 1929, Part A. The period of greatest productive activity was between the years 1902 and 1916, when 116,076 tons was produced, yielding a recovery in gold and silver of $1,188,320. According to report this represented an approximate recovery of 65 to 70 per cent. of the values. No important production has been made since 1916, minor activity having occurred at intervals. The *Queen* location represents an important strategic base for a consolidated operation, being centrally situated, with water-power rights on Sheep and Wolf creeks totalling 1,320 cubic feet per minute and capable of developing about 800 horse-power. During the period under review the Wolf Creek flume was rebuilt. This is 4,800 feet long, the box dimensions being 24 by 40 inches. New equipment was installed in the mill, including flotation unit, ball-mill, classifier, conveyor, Pelton wheels, and sorting-tables. C. E. Witter reports that 1,250 tons was mined, of which 150 tons milled in testing yielded $1,637.73 in gold; 1,100 tons were treated with flotation and about 125 tons of concentrates made. The shaft-workings are being dewatered preparatory to resumption of development by the new company. Prior to the consolidation, exploratory work was carried on at the *Vancouver* by the Midnight Mining Syndicate, of Kamloops, under the technical direction of H. G. Nichols.

Kootenay Belle. This well-known property, in the heart of the Sheep Creek gold camp, was operated steadily during 1933, Frank Phillips being in charge at the mine. Latterly E. P. Crawford has acted as consulting engineer. On February 14th, 1933, the Kootenay Belle Gold Mines, Limited, of Vancouver, was incorporated, F. M. Black being managing director. From February to December 673.5 dry tons of siliceous ore was shipped to the Trail smelter, yielding 920.48 oz. gold and 465.28 oz. silver of an average net value of $32 per ton, including gold premium and after deducting freight and smelting charges. Development-work totalled 767 feet, plus the work necessary to opening up No. 1 level. The main work has been done on the lower or No. 2 level, toward the east on No. 1 vein, where favourable quartzite formations cross the property. A new ore-shoot was found in this working of fair average grade, and the ore is primary sulphides in quartz in contrast to the oxidized ores heretofore worked in this mine. Development is proceeding in this direction on both the No. 1 and No. 2 levels, that on the upper level having been commenced only recently. Other development was in the western parts of the mine, where the former production was made. A new Crossley 120-horse-power Diesel engine and a Canadian Ingersoll-Rand 500-cubic-foot capacity compressor were installed and much equipment added to the mine, including an oil-furnace and steel-sharpener. A new engine-house, mess-house, and office have been constructed and a pipe-line to give fire-protection was also laid. During the open season the *Yellowstone* vein was definitely located and explored with open-cuts and extensions of the main veins were similarly traced. Since midsummer the crew has averaged twenty-two men.

Bonanza. This group of five mineral claims, owned by M. C. Donaldson, E. K. Donaldson, and J. E. Read, is situated on the south-western side of Wolf creek, which is a tributary of Sheep creek from the south-east. The workings, situated on the well-wooded, steep hillside, are reached by switchback trail from the road extending up Wolf creek to the *Alexandria* workings of the *Queen* mine property. The ground covers a vertical range of about 2,000 feet above Wolf creek. The general geology of the area is shown on the sketch of the Sheep Creek Gold Camp in Bulletin No. 1, 1932. The *Bonanza* vein is a well-defined quartz-filled fissure cutting the "Nugget" and "Motherlode" quartzites. The old underground workings consist of four tunnels and aggregate between 500 and 600 lineal feet.

The three upper tunnels are drifts on the vein in the "Nugget" quartzite, which to the north contains the *Alexandria*, *Kootenay Belle*, *Nugget*, and other veins. The lowest tunnel, or No. 4, is a crosscut to the vein in the "Motherlode" quartzite, which is separated from the "Nugget" quartzite, containing the upper group of three tunnels, by a belt of schistose argillaceous rocks. Throughout all the workings the general strike of the vein is from N. 76° E. to N. 84° E. (ast.), with steep dips up to 80° to the south-east. The formation strikes northerly,

dipping from 50° to 55° to the east. The *Bonanza* vein therefore cuts the rock formation at a wide angle similar to the other productive veins of the Sheep Creek gold area.

The uppermost or No. 1 tunnel is caved at the portal and could not be inspected. The No. 2 tunnel is a drift about 180 feet long, in which the vein, from 3 to 4 feet wide, consists of iron-stained quartz and ledge-matter. Close to the portal a little stoping has been done where the vein shows more oxidation than elsewhere, indicating the presence at one time of sulphides at this point. A sample across 42 inches assayed: Gold, 0.30 oz. per ton; silver, 0.1 oz. per ton. From this ore-shoot the 19 tons shipped in 1910 (*see* page 110, Annual Report for 1910) is believed to have been extracted. Values of this shipment are not at hand, but are said by J. E. Read to have been about $27 per ton. From the vein-outcrop at the portal specimens showing visible gold were obtained by the writer, and a sample of selected oxidized material assayed: Gold, 3.24 oz. per ton; silver, 0.4 oz. per ton. This showing, extending back from the portal to the western end of the stope, about 35 feet, constitutes the best exposure seen, judging from the intensity of the oxidation present in the vein in this location.

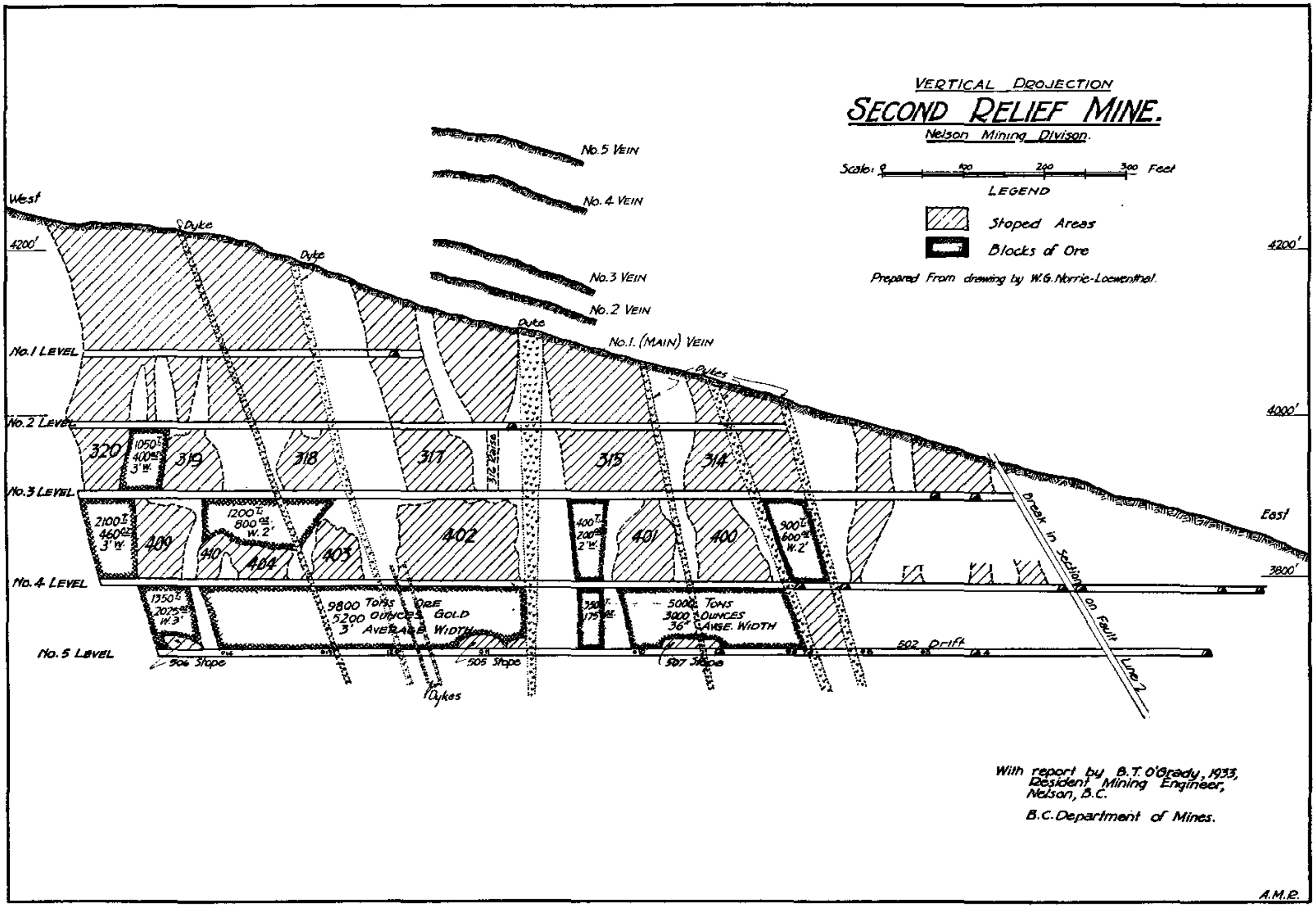
The No. 3 tunnel, a drift on the vein at about 100 feet lower elevation, is believed to be close to a point below the ore-shoot at the mouth of No. 2 tunnel. In this working the vein is up to 4 feet wide, as in the face where oxidation is tending to increase in intensity. The No. 4 tunnel crosscut, several hundred feet lower in elevation, cuts the vein at a point about 180 feet in from the portal. From this point drifting on the vein has been done in both directions for a total length of 30 feet. In these workings the vein is 12 inches wide in the eastern face, where it enters a lamprophyre dyke, and 24 inches wide in the western face.

Summarizing conditions, the downward continuation of the ore-shoot in the No. 2 tunnel can easily be tested by extending the No. 3 tunnel a short distance. Stripping and trenching along the vein in the favourable quartzite formations could be done with a view to the discovery of new ore-shoots. The *Bonanza* vein compares favourably with most of the veins in the camp, both in size and strength of the fissuring. As yet no ore-shoot of importance has been disclosed, but much of the vein-outcrop remains to be tested. Intense oxidation characterized the outcrop of the productive veins of the camp, and this condition, denoting at one time the presence of strong sulphide mineralization, should be sought for.

Aspen. At this property, situated near the head of Deer creek, exploratory work was recently resumed by P. F. Horton, representing the Salmo-Malartic Mines, Limited, of Toronto, after an interval of several years. Past references to the property are contained in the Annual Reports, those from 1926 to 1929 covering the period of chief activity. The geology and mineral occurrences in the included limestone-belt are described by J. F. Walker in Geological Survey of Canada Summary Report, 1929, Part A. The lower "A" crosscut tunnel, near the north end of the workings, has been extended and is now 333 feet in length, with its south branch 180 feet long and the north branch 220 feet long. At the inner end of the latter working, where mineralization in the limestone similar to that encountered in Nos. 3 and 4 diamond-drill holes to the north-west was cut, a drift is being run south-easterly. The "B" crosscut tunnel has been extended to 554 feet in length and its branch to the north-west is now 180 feet long. "B" shaft is being sunk to indicate where the downward continuation of the ore can be intersected in "B" tunnel-workings below. Appreciable gold with good silver values are associated with the lead and zinc in "B" shaft, as in 7 tons shipped in 1918, which assayed: Gold, 0.18 oz. per ton; silver, 61.7 oz. per ton. From the same place a sample of sorted ore, quoted in the Annual Report for 1917, assayed: Gold, 0.68 oz. per ton; silver, 123.4 oz. per ton, with 6 per cent. zinc. Ore now being taken out in sinking is being sacked for shipment. The mine is equipped with Ingersoll-Rand machinery, including two compressors, 8 by 6 and 9 by 8 respectively, drill-sharpener, hoist, three mounted jack-hammers, one plugger jack-hammer, and one stoper. The mine buildings include compressor-house, blacksmith-shop, hoist and sorting shed, and accommodation is provided by two bunk-houses, cook-house and dining-hall, office building, and barn.

ERIE SECTION.

Second Relief. This mine, situated on Erie creek, 13 miles from Erie, is owned by the Relief-Arlington Mines, Limited, the control of which was acquired in August, 1933, by the W. N. O'Neil Company, of Vancouver. Work started in June under the management of W. Norrie-Loewenthal and production commenced on July 15th. Additional


VERTICAL PROJECTION
SECOND RELIEF MINE.
Nelson Mining Divison.
Scale: 0 100 200 300 Feet
LEGEND
Stoped Areas
Blocks of Ore
Prepared From drawing by W.G. Norrie-Loewenthal.
No.5 VEIN
No.4 VEIN
No.3 VEIN
No.2 VEIN
No.1. (MAIN) VEIN
West
East
4200'
4000'
3800'
Dyke
Dykes
No.1 LEVEL
No.2 LEVEL
No.3 LEVEL
No.4 LEVEL
No.5 LEVEL
320
319
318
317
312 Raise
315
314
1050 T. 400 oz. 3' W.
2100 T. 460 oz. 3' W.
409
1200 T. 800 oz. W. 2'
410
404
403
402
400 T. 200 oz. 2' W.
401
400
900 T. 600 oz. W. 2'
1350 T. 2025 oz. W. 3'
9800 Tons Ore 5200 Ounces Gold 3' Average Width
350 T. 175 oz.
5000 Tons 3000 Ounces 36" Avge. Width
502 Drift
506 Stope
505 Stope
507 Stope
Break in Section on Fault Line 2
With report by B.T. O'Grady, 1933, Resident Mining Engineer, Nelson, B.C.
B.C. Department of Mines.
A.M.R.

camp facilities have been provided to accommodate the crew of forty men, together with quarters for the staff and accessory buildings. The mine camp, at an elevation of 3,650 feet, is reached by a road on an easy grade from Erie, on the Great Northern Railway, at 2,400 feet elevation above sea-level. Information concerning the claims included in the *Second Relief* group, the history of the property, geology, and conditions of the ore occurrence, is contained in past Annual Reports. The intermittent character of the work done during recent years was due largely to inadequate financing. Under the new auspices the major work has been the driving of the fifth level to assure ore reserves and the partial remodelling of the mill to improve recoveries and increase capacity. The water-power plant of 180 horse-power, which can be depended upon for six months in the year, is supplied by a 30- by 18-inch flume 1¾ miles long, which connects the intake with the penstock, the latter at an elevation of 195 feet above the Pelton wheels. A riveted steel pipe 16 inches in diameter and 800 feet long connects the penstock with the three Pelton wheels in the mill building. These are 66, 48, and 24 inches in diameter, developing 110, 60, and 10 horse-power, and operating respectively the old 4-drill compressor, the mill, and the electric-lighting dynamo and amalgam-barrel. The auxiliary power plant consists of two Fairbanks-Morse Diesel engines, one single-cylinder 60 horse-power and one 2-cylinder 80 horse-power. Both engines, together with the Pelton wheel driving the mill, are belt-connected to a line-shaft, equipped with a coupling and three clutches, together with necessary pulleys. This line-shaft is connected to the various mill units and to two new 12- by 10-inch Canadian Ingersoll-Rand ER-2 single-stage compressors. With this convenient installation it is possible to run the mill by Diesel engine and the old compressor by water-power, or the mill and new compressors by combined water and Diesel power, or the three Pelton wheels and two engines to operate both mill and compressors, depending on the condition of the water-supply and the amount of compressed air required in the mine. Eight machine-drills can be operated with all three compressors running. A new blacksmith-shop, equipped with steel-sharpener and oil-furnace, was built at the portal of No. 5 level, also timber-shed and ore-sorting house with grizzly, storage-bin, and chute. Additions were made to the mill building to house the new equipment provided. New equipment for the mine includes four cars and three self-rotating stopers, two of which are of Canadian Ingersoll-Rand make, the other one being a Holman machine. All mine and camp buildings are electric-lighted.

The writer is indebted to the management for the following notes covering mill practice: "A number of different processes of treatment has been used in the past by different operators. Stamp-batteries with the amalgamation-plates followed by table and vanner concentration was the process most commonly used. Cyanidation by sand-leaching was tried. Under the Oscarson operation, rubber mats were used to catch the free gold and tables were used for concentration of the sulphides. The rubber mats proving unsatisfactory were replaced with two Senn pan amalgamators, which, it is reported, were mechanically difficult to operate. However, it is stated that a recovery of 60 per cent. of the gold was made with this method of concentration in the form of bullion, but a poor total recovery was made, as no flotation-machines had been installed and there was consequently a big loss of the gold in association with sulphides. In the year 1931 a 4-cell Fahrenwald flotation-machine was added. As the records of both of the above operations were very poorly kept, it is very difficult to arrive at any estimate of recovery, but there must have been a considerable loss in the tailings, judging from the actual recoveries reported and the assays of the tailings-dumps. When the Wm. N. O'Neil Company, Limited, secured the option on the mine in June, 1933, there was not a sufficient supply of ore available in the mine to justify any large expenditure in remodelling the mill or in new mill-construction. Nevertheless, it was apparent that if the mill were to be used at all, some expenditures had to be made to at least remedy the many mechanical imperfections, such as leaky launders, imperfect lining of shafting, insecure pulleys, etc. Accordingly, it was decided to utilize the equipment available, rearranging it somewhat at as small an expense as possible. The Senn pan amalgamators were discarded and one of the Wilfley tables set in its place, otherwise the flow-sheet was not changed. This table caught most of the coarse and some of the fine gold which was amalgamated in a barrel. The tailings after classification in a Drag classifier, with regrinding of the oversize in the ball-mill, were sent to flotation. This system effected a recovery of 83.5 per cent. of the gold, treating 18 tons per 24 hours. It was possible with this operation to test the

grade of the ore uncovered during the course of development and to obtain revenue sufficient to more than offset the development expense. Most important of all, however, was the fact that it was possible, as a result of this mill operation, to work out a more or less permanent flow-sheet. When the development of the mine justified, additional equipment was ordered, more space provided, and the flow-sheet changed in detail somewhat to conform to the experience gained in milling the ores during the preliminary operation. Briefly, it was found that there is a certain amount of free gold in the ore; also a certain proportion of gold combined with sulphides. The free gold is mostly in the form of flakes and dust and is extremely likely to be carried in suspension in the water through all of the machines, even the flotation-machine, if some efforts are not made to catch it as soon as possible. The gold associated with the sulphides is not such a hard problem, the tables and the flotation-machine catching most of this, but the fine free gold is a different matter. Amalgamation would be quite successful on this gold, but would seriously interfere with flotation; hence, if this system were used, there would probably be a good recovery of bullion, but a poor recovery of concentrates, or a poor total recovery of the gold.

"The flow-sheet as finally evolved and installed and which is now in operation is as follows: The ore is trammed from the fifth level to the sorting-house, where it is passed over a grizzly with 2-inch spacing, the fines going to the bin, the coarse material being hand-sorted. In this manner about 15 per cent. of the original material is discarded as waste. From the ore-shed the material is trammed a short distance to a 25-ton capacity bin at the top of the mill building, from whence it passes over a grizzly with 1-inch spacing, the oversize being crushed in an 8- by 12-inch Blake-type crusher to 1½-inch size. The ore then goes over an automatic belt feeder to a No. 54 Marcy ball-mill for fine grinding; the product from this is elevated to a 2-foot 3-inch by 14-foot 8-inch Dorr Simplex classifier. The sands from this classifier are passed over a shaking screen 4 by 6 feet, with 16-mesh screen and 0.032 opening; the oversize is returned to the ball-mill for regrinding, the undersize passing to the first table (No. 6 Wilfley) at the top end of the mill, where a concentrate containing most of the free gold is made. The tailings from this table are classified in a Drag classifier, the slimes going to flotation, the sands being returned to the ball-mill for regrinding.

"The slimes from the Dorr classifier go to two No. 6 Deister tables, the feed being divided so that one table handles a finer product than the other. The concentrates from the two tables are mixed with those from the top table and amalgamated in an amalgam-barrel, where amalgam is produced, retorted, and cast into bricks for consignment to the Mint at Ottawa. The tailings from the two Deister tables are pumped to a Callow cone at the top of the mill building by means of a 2-inch sand-pump. This dewaters the pulp, the overflow water passing into a tank, the underflow water from which is passed over a blanket-table to the Dorr classifier for return to the circuit. The overflow water from the same tank is similarly passed over a blanket-table. The pulp from the Callow cone passes over two blanket-tables to a 4-cell Fahrenwald flotation-machine, the tails from which pass over a No. 6 Wilfley table at the bottom of the mill, which acts as a pilot, producing a small amount of concentrate. The final tailings are automatically sampled and impounded below the mill. The flotation-machine being under capacity, a concentrate is made from each cell, this concentrate being pumped by means of a 1½-inch pump to a Callow cone, where the concentrates are dewatered, sacked, and shipped to the smelter.

"Records of performance from July 15th, 1933, when the mill was first put into commission, up to the end of November, 1933, are as follows: 3,034 tons treated, the heads assaying 0.56 oz. gold per ton and the tails 0.10 oz. gold per ton. Of the 1,709.153 oz. gold contained, recoveries were 652.572 oz. in bullion, 773.581 oz. in 176.37 dry tons of concentrates, equivalent to a 38-per-cent. recovery in bullion, 45.5 per cent. in concentrates, and a tailings loss of 16.5 per cent.

"The average assay of the tailings till December 10th of the year 1933 was 0.10 oz. gold per ton. When the new flow-sheet was put into effect, the assay of tailings dropped to 0.075, indicating a recovery of 90 per cent. of the gold, which is 6½ per cent. better than had been done heretofore. However, the system has not been working long enough to judge the performance and it is hoped that the recovery will be still further improved. A new gearing was put on the ball-mill, also a complete new set of liners was installed, and with the other improvements outlined the capacity of the mill has been more than doubled and it can now handle up to 40 tons a day. Tests are being conducted with a view to determining the advisability of cyaniding the

concentrates rather than shipping them to the smelter. Also tests should later be made on the tailings to find out if cyanidation of these would be an advantage."

For the five months ended December 15th 4,856 tons of ore was mined and 3,538 tons milled; 1,606.653 oz. gold and 338.7 oz. silver were recovered, the gross value of the output being $51,120.14.

In the mine the No. 5 level drift, entered by a crosscut, has been advanced about 1,000 feet, of which 720 feet is driven in ore. Commercial ore on this level was encountered shortly after the present operators started work, and No. 503 raise (*see* vertical projection), started between the first two dykes met with, was later extended and this block of ground stoped out. Beyond this point the downward continuation of all the ore-shoots stoped on the No. 4 level were developed on the No. 5 level, with greater lengths at the latter horizon. At least twelve months' ore reserves above the No. 5 level seem assured, giving a grade to the mill of 0.58 oz., according to the systematic and comprehensive sampling computations of the management. Stoping is now proceeding on the No. 5 level, the initial production by the present operators having come from development ore and from areas above No. 4 level.

Surface exploration and some crosscutting underground was done in connection with parallel veins on *Second Relief* ground. The No. 1 or main vein, the only one worked hitherto, has been developed over a length of about 1,200 feet and a depth of 540 feet below its apex. Of the four parallel veins, very slightly explored, the No. 5, 320 feet to the south-east of the No. 1 vein, outcrops at a point 620 feet higher than the No. 5 level. At this point a large excavation, 40 feet long, exposes the vein, which is 4 feet wide and contains from 12 to 42 inches of massive sulphides, mainly pyrrhotite with some chalcopyrite, very little quartz being present. The character of the vein occurrence is very similar to that of the No. 1 vein. The hanging-wall is granodiorite and the foot-wall composed of the greenstone of the Rossland Volcanic formation. Samples 12, 39, and 42 inches wide assayed respectively 0.24, 0.39, and 0.36 oz. gold per ton. From the abundant sulphide content of the showing it was expected that the gold values should be proportionately high, but the absence of quartz at this point has similar characteristics to certain sections of the main vein, where, in some cases, massive sulphides without quartz show lower gold values than anticipated. It is inferred, therefore, that the surface showing represents a local replacement condition. The No. 4 vein, 290 feet south-east of the No. 1 vein, has been prospected by open-cuts over a length of 50 feet. In this case the hanging-wall is the greenstone and the foot-wall is diorite. The vein-filling is quartz with pyrrhotite and chalcopyrite, a sample across 22 inches assaying 0.36 oz. gold per ton. No. 3 vein, 140 feet to the south-east of the main vein, is a narrow stringer with no obvious mineralization, on which two open-cuts have been made 30 feet apart. No. 2 vein, about 30 feet to the south-east of the main vein, has diorite on the hanging-wall and greenstone on the foot-wall side. It has been exposed in surface cuts and a prospect-tunnel over a length of 60 feet, and has been crosscut at two points on the Nos. 2 and 4 levels and at one point on the No. 5 level. Where it has been cut this vein has been narrow but well mineralized in places, as in one crosscut on No. 2 level, where a sample across 12 inches assayed 0.7 oz. gold per ton; and in the No. 5 level crosscut, where a sample across the same width assayed 1 oz. gold per ton. In addition to the expectation of lateral and vertical extensions of the No. 1 vein ore-bodies, the Nos. 2, 4, and 5 veins, especially the No. 5, present interesting ore possibilities. With the exception of the apparently unimportant No. 3 vein, the parallel veins are similarly mineralized and occur under the same geological conditions. The No. 2 vein, though narrow, has been proved to extend down to No. 5 level and the Nos. 4 and 5 veins can be expected to be similarly continuous at depth. The evidences of mineralization warrant the assumption that ore-shoots will be found in all three of these veins in areas favourable for mineralization, as in the zone of dyke intersections on the main vein.

The Relief-Arlington Mines, Limited, has also a half-interest in the *Ida D.* claim, from which some ore is reported to have been shipped by the co-owner, J. E. Read, in past years. The *Ida D.* vein, exposed over a length of 200 feet by a short tunnel and shaft, is about 450 feet north-west of the intersection of the main *Second Relief* vein with the *Ida D.* boundary-line.

Arlington.

This other property of the Relief-Arlington Mines, Limited, also controlled by the W. N. O'Neil Company, Limited, of Vancouver, is being worked under lease by the Oscarson Bros., former operators of the *Second Relief*, with a crew of men. G. Birtsch, of Nelson, has a separate lease on part of the workings. The *Arlington*, on Whisky creek, near Erie, has been described in past Annual Reports and the revised geology

of the included area is to be published in the forthcoming Geological Survey of Canada Memoir on the Sheep Creek Map-area by J. F. Walker.

Keystone. At this property, adjoining the *Arlington*, N. Zell, of Spokane, and associates, have been shipping ore at intervals, the total for 1933 amounting to several hundred tons. The ore is similar to that at the *Arlington*, values being chiefly in gold, with silver, and lead. General conditions are described in Bulletin No. 1, 1932.

In the same locality work was carried on at the property of the Black Rock Syndicate, represented by D. H. Lougheed, of Vancouver. A test shipment of 2 tons was shipped from the *Second Chance* by Margerall & Peterson, of Salmo.

Shamrock. This group, including the *Antonia*, *Rustler*, *Shamrock*, and *Monday* Crown-granted claims, situated on the northern side of the railway and highway west of Erie, has been acquired by J. E. Read, of Erie. The claims formerly constituted the property of the defunct Gordon Mining and Milling Company. The old workings develop two main veins, of which only the *Shamrock* vein, which cuts granite and greenstones of the Beaver Mountain-Rossland group, was examined. From the highest point, diagonally down the slope towards the road, the workings visited included: At 3,540 feet elevation, a trench 40 feet long; at 3,500 feet, an open-cut; at about the same elevation, a vertical shaft, said to be down 40 feet, full of water; a little below this, an open-cut; at 3,480 feet elevation, a 26-foot vertical shaft; at 3,350 feet, a deep open-cut; at 3,250 feet, another open-cut; and at 3,155 feet, a drift-tunnel 70 feet long. All the above workings, in the rocks of the schistose eruptive series, develop a line of shearing which is accompanied by silicification, iron-stain, and pyrite. In places distinct bands of quartz mineralized with pyrite and occasional galena is found. The strike of the shear is from N. 15° E. to N. 25° E., the dip being about vertical. From the collar of the 26-foot shaft, below which the ground falls off steeply, a sample selected from a pile of ore assayed: Gold, 0.10 oz. per ton; silver, 1.6 oz. per ton; lead, 1 per cent.; zinc, trace. Farther down the hill a group of three workings, consisting of an inclined shaft with open rock approach at 2,900 feet elevation, a caved inclined shaft 25 feet away, and a deep open-cut at 2,890 feet elevation, develop a vein striking from N. 50° E. to N. 55° E., with 40° dip to the north-west. From the last-mentioned working, where granite is exposed in both walls, a car-load of ore is said to have been shipped in past years. Selected galena in honeycombed quartz assayed: Gold, trace; silver, 17 oz. per ton; lead, 13.5 per cent. The width of the vein at 2,900 feet elevation was 40 inches and it consisted of iron-stained rock containing disseminated pyrite.

The other vein, not visited by the writer, lies roughly parallel and to the north-west. The workings include two tunnels which are in granite. The upper tunnel is reported to be a crosscut 475 feet long, from which a 20-foot drift was run in a direction from N. 20° to 25° E. These workings will be described in detail by J. F. Walker in the forthcoming special Geological Survey of Canada report on the Sheep Creek Map-area. Some notes made available to the writer show that this vein appears to have formed in a shrinkage fracture resulting from the cooling of the granite-mass. It carries pyrite and a little molybdenite, striking at right angles to the granite-contact.

Pend d'Oreille River Area.

Red Rock. At this silver-lead-zinc prospect, across the Salmo river from the *Reeves-MacDonald* mine in the Pend d'Oreille River area, work was resumed by M. Michaely, of Trail, in the fall of 1932. Attractive showings of good-grade ore have been opened up on the surface and in a crosscut tunnel to a depth of 80 feet. The property is now controlled by the Michaely Silver Lead Mines, Limited, a private company of Trail, H. S. Gamble being president and L. A. Read secretary. The property, consisting of the *Red Rock*, *Blue Rock*, *Green Rock*, *White Rock*, *Marjorie*, and *Mary Loo* claims, is conveniently reached by a branch road connection with the Pend d'Oreille River road. The geology of the area, by R. A. Daly, is shown on Map 80A accompanying Geological Survey of Canada Memoir 38. Revision of the section included in the Salmo Map-area, by J. F. Walker, is awaiting publication. The deposits occur in Pend d'Oreille limestone adjoining greenstone-schist which forms the foot-wall country-rock of the ore-body. The local strike of the limestone is from N. 50° E. to N. 20° E., the dip varying from 55° to 70°, or steeper, to the south-east (i.e., towards the Salmo river). On the surface the ore has been stripped for a continuous length of 60 feet in a large open-cut. This exposure is from 4 to 6 feet wide, composed of massive iron-lead-zinc sulphide

mineralization with leached and stained country-rock. Typical samples of the ore in the big open-cut are as follows:—

Description.	Width.	Gold.	Silver.	Lead.	Zinc.
	Feet.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
10 feet from south-west end	2.5	0.005	18.4	41.9	20.0
Galena streak in centre (over tunnel)	2.5	Trace	22.0	40.4	14.4
Near north-east end	6.0	Trace	5.5	9.2	8.2
Centre	4.0	Trace	18.2	47.0	13.9

At the north-eastern end of the showing conditions were not clear at the time of the writer's visit in the spring, but continuity of mineralization to some extent is proved by a streak of carbonates and galena following a well-defined north-striking fracture. Beyond this to the north some sulphide mineralization with iron-stained material is exposed in open-cuts and a 10-foot shaft, over a total length of about 150 feet. No surface work had been done southerly from the big open-cut. Opposite the centre of the latter, and at 15 feet lower elevation, a 25-foot crosscut at the end of a long open rock approach, all in limestone, intersects a mineralized band of sulphides 5 feet wide, which is widening in the floor. A sample across 14 inches of galena included in this showing assayed: Gold, 0.01 oz. per ton; silver, 40.4 oz. per ton; lead, 67.5 per cent.; zinc, 2.1 per cent. A sample from 1 ton of sorted ore from this working assayed: Gold, trace; silver, 16.2 oz. per ton; lead, 29.4 per cent.; zinc, 19.9 per cent. Between this tunnel and the surface showing the ore-body dips at between 60° and 70°.

The lower tunnel, 80 feet below the big cut, is 98 feet long, exclusive of a 15-foot open rock approach. From a point 56 to 78 feet in from the portal the limestone is partially leached and contains some disseminated sulphides. The tunnel then cuts a width of 8 feet of massive lead, zinc, and iron sulphides. Having in view the possible improvement of metal prices, this prospect warrants more extensive development, and in this connection a detailed geological study of the area would seem advisable to correlate conditions in the parallel limestone-bands. At the *Reeves-MacDonald* concentrations of mineralization were found adjacent to sharp folds or faults displacing the strata to the north and similar conditions might occur on the *Red Rock*. The comparatively high silver and lead values at the last-mentioned property are of exceptional interest in view of the abundance of zinc ore with small silver and lead content found in the Pend d'Oreille River area.

Bunker Hill. This property, situated on 16-Mile creek, a tributary of the Pend d'Oreille river, has been acquired by A. H. W. Crossley, J. Brodie, H. Burns, G. K. Burns, and associates, of Nelson. The position of the *Bunker Hill* is marked on Geological Survey of Canada Map 80A, by R. A. Daly. The geology of the area has since been revised by J. F. Walker and the result will be published shortly in a special Geological Survey of Canada report on the Sheep Creek Map-area. The property was formerly equipped with a stamp-mill, elevation 2,800 feet, at the foot of a tram connecting it with the workings at an elevation 3,800 feet above sea-level. A branch road connects the mill-site, from which a trail extends to the mine, with the Pend d'Oreille River road. The old workings consist of two tunnels, the upper being temporarily inaccessible at the time of the writer's visit. At 170 feet in from the portal the lower tunnel intersects a quartz vein striking about N. 30° E. and dipping 45° to the south-east, closely approximating the attitude of the impure quartzites of the *Reno* formation, according to the revised geology by J. F. Walker. A few feet beyond the point at which the vein is first exposed it is faulted 35 feet to the north and then drifted on from that point for 80 feet. On the west side of the fault a raise goes up about 25 feet. The vein, up to 5 feet wide, consists of somewhat vitreous quartz and country-rock, the mineralization, chiefly composed of disseminated pyrite, being rather irregular in character. The upper tunnel, not inspected, about 100 feet higher in elevation, is reported to have been driven 120 feet on the vein and some stoping done. At about 4,200 feet elevation, and to the north-east, an irregular quartz vein outcrops. It strikes about N. 40° E. and dips 45° to the south-east. This is possibly the same vein as in the lower tunnel. The latter is well defined and further development would seem to be justified if sampling of the exposures gives encouraging values. At about 4,150 feet elevation, in an easterly direction from the tunnel-workings, an open-cut exposed a quartz vein

40 inches wide striking about N. 85° W. and dipping at 35° to the north. The foot-wall country-rock here is granite, the other wall not being exposed. On the hanging-wall side of the vein a streak of mineralization was in evidence, the nature of the dark mineral not having been determined. Since the writer's visit, in the spring of 1933, a trench 60 feet long was made on this vein and towards the centre of this working a shallow shaft was sunk. Samples across 27 and 39 inches both assayed 0.40 oz. gold per ton.

A long trench has also been made at a slightly lower elevation on the "Blue Quartz" vein, which strikes N. 80° W., with a dip of 42° to the south. This is reported to be from 6 to 14 inches wide, with schist walls. A shipment of 4,440 lb. sent to the Trail smelter from this working assayed: Gold, 0.511 oz. per ton. No appreciable sulphide mineralization was present in the quartz, the analysis showing only 1.5 per cent. iron and no sulphur. Other veins are stated to have been found on the property, which includes the *Bunker Hill* and *Mormon Girl* Crown-granted claims and sixteen other claims staked by the associated interests. In connection with this undertaking the Bunker Hill Gold Mines, Limited (N.P.L.), a private company, of Nelson, has been incorporated.

Kootenay Lake Area.

Lakeview. At this prospect, adjoining the highway north of Sanca creek, on the east side of Kootenay lake, and owned by E. G. Timmons, a crosscut tunnel 252 feet long was driven by F. Staples, of Creston, at a point 90 feet northerly from the 30-foot shaft and 90 feet vertically below the shaft-collar. The deposits are situated in an area of metamorphosed sediments of late pre-Cambrian age surrounded by granitic rocks. The approximate extent of these rocks is shown on Geological Survey of Canada Map No. 792, "West Kootenay Sheet," on which they are mapped as Cambrian or Cambro-Silurian. This classification was later revised by J. F. Walker. The shaft, approximately vertical, with 13-foot drift to the north at the 20-foot level, develops a northerly-striking vein-zone, dipping steeply to the east, in calcareous sediments. In the drift near the shaft lenses of massive ore about 12 inches wide, composed of mixed lead, zinc, and iron sulphides, are exposed on the foot-wall side. Going towards the hanging-wall there is 2.5 feet of waste and then from 18 to 24 inches of scattered sulphide mineralization containing streaks of massive sphalerite. The crosscut, driven S. 80° E., or nearly at right angles to the vein, first intersects siliceous sediments followed by calcareous rock towards the inner end. Well-defined mineralized fissures are encountered at 22 feet and 18 feet back from the face. The first mentioned contains up to 4 inches in width of disseminated fine-grained galena and the other one contains similar mineralization, up to 2 feet wide, with some concentration of the lead sulphide along the western cleavage. No sphalerite is in evidence in this working. Three feet back from the face, on the north side of the tunnel, there is a fracture, striking N. 30° E., mineralized with iron sulphide. Selected material from this assayed: Gold, 0.04 oz. per ton; silver, 2.6 oz. per ton. Sixty feet in from the portal the siliceous rock contains disseminated iron sulphides over a width of 30 inches. This gave a negative assay for gold and silver. Samples of selected ore from the first fissure cut by tunnel assayed: Gold, trace; silver, 15 oz. per ton; lead, 28 per cent.; zinc, trace; and selected ore from the second fissure assayed: Gold, trace; silver, 18 oz. per ton; lead, 34 per cent.; zinc, trace. At the time of writing, E. G. Timmons is reported to be drifting southerly along the lead towards a point below the shaft. Selected ore from this working assayed: 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.

Sanca Mines, Ltd. This company was registered in July, 1933, as an extra-provincial company entitled to do business in British Columbia. In connection with the operations of W. Frampton in the Sanca Creek-Ginol area since 1926 the Associated Mining and Milling Company was dissolved in December, 1931; the United Lode Mining Company, Limited, is still in existence. General conditions surrounding the deposits were described in the Annual Report for 1927. In 1928 it was decided to take over these two companies and form the Sanca Mines, Limited. Subsequently the Canada Smelters, Limited, a private company with office at Sanca, B.C., was formed for the purpose of carrying on leasing operations on part of the holdings of Sanca Mines, Limited, and, according to report, the Sanca Mines, Limited, was to get 30 per cent. of the net smelter returns of any ore shipped from the property. On this basis, it is understood, work commenced on the *Valparaiso* by P. S. Woodhall, of Calgary, and associates, and car-load lots were shipped at intervals between July

and December, 1933, the total amount being about 322 dry tons. Details of the shipments are as follows:—

Dry Tons.	Gold.	Silver.	Dry Tons.	Gold.	Silver.
	Oz. per Ton.	Oz. per Ton.		Oz. per Ton.	Oz. per Ton.
17.4615	0.484	4.2	49.9865	0.27	2.7
22.797	0.495	4.2	46.3195	0.235	2.5
34.586	0.36	3.2	26.6825	0.38	4.4
44.0015	0.327	3.2	36.8015	0.331	3.3
44.0885	0.32	3.4			

According to the management, the object in shipping the above nine car-loads was to prove the values in bulk with a view to putting in equipment to handle larger tonnage. The ore contains about 58.5 per cent. silica.

Gold King. At this prospect, between Gray Creek and Boswell, a crosscut tunnel is being driven from below the highway to test the superficial showings of gold-copper ore described under *Gold Queen* in Bulletin No. 1, 1932. The work is being done by R. J. Elliott for H. W. Robertson, of Nelson.

Bayonne. In this gold area, reached by the Cultus–Canyon Creek route on the west side of Kootenay lake, examining engineers were active. In connection with their *Spokane* gold-silver-lead property, described in past Annual Reports, the Laib Bros. made improvements to their trail connecting with the narrow-gauge road with a view to shipping ore.

Wisconsin. At this property, on Midge creek, described in Bulletin No. 1, 1932, a syndicate of Vancouver business and mining men, called the Lucky Strike Mining Syndicate, has conducted during the summer season an extended examination. Considerable surface-trenching, some shallow diamond-drilling, thorough sampling of old surface and more important underground workings, including unwatering the 60-foot winze in the No. 1 tunnel, and sampling it, were accomplished. Diamond-drilling totalled just over 1,000 feet in three holes, two from the hanging-wall side and one from the foot-wall side, and the results were considered not discouraging for the depths attained. Surface-trenching proved vein-continuity for about 1,200 feet and the widths are well maintained. Heavy oxidation and leaching and also a heavy mantle of overburden toward the south do not give much information concerning values in this section and deeper development will be necessary to obtain useful results. This property is still in the prospect stage and merits a more extended campaign of development than it has yet received. F. R. Weekes and E. P. Crawford acted as consulting engineers for the syndicate and H. W. Seaman was in charge of exploration.

Placer-mining.

The more actively prospected areas were Forty-nine and Rover creeks, west of Nelson, and the Pend d'Oreille river adjacent to the mouth of the Salmo river.

Pot-hole.—In connection with this lease on Forty-nine creek, owned by H. W. Robertson, of Nelson, work was continued throughout the greater part of 1933 by H. A. McKen, representing the Black Watch Syndicate. Recent activities were concentrated on the bench on the north-eastern side of the creek at a point about half a mile above the road leading to the Nelson City power plant on the Kootenay river. A drag-line was operated in connection with ground-sluicing and about 8,000 cubic yards of ground was moved. Up to seventeen men were employed.

Cann Mining Syndicate.—Preparations are being made by George Hyde, of Winnipeg, to sink a shaft on Rover creek, from which stream placer gold has been washed at intervals during past years. Previous to this new undertaking, work was done by him on Falls creek, on the opposite side of the Kootenay river, where a large bank of gravel was tested with disappointing results.

TRAIL CREEK MINING DIVISION.

Gold production in the Rossland camp, which during recent years has been maintained to a minor degree by small shippers in the O.K. Mountain area, received a considerable impetus in August, 1933, when shipments on a large scale were initiated from the numerous leasing operations on the well-known properties of the *Consolidated Mining and Smelting Company*. As a

consequence the gold-output of this Division is the largest recorded since 1925, when large-scale company production languished. The decision of the Consolidated Mining and Smelting Company to lease sections of its Rossland mines to miners residing locally has been very beneficial in supplying profitable employment to a large number of men during the most difficult times experienced in the Kootenays. In this connection there were thirty-one separate leasing undertakings, from which, chiefly during the period from August to December, was produced 10,833 tons containing 7,224 oz. of gold. In the following list of these shippers the name of the party representing each group or partnership is given in each case:—

Shipper.	Mine.	Dry Tons.	Gold.
			Oz.
R. Ackerman	Le Roi	45	31
Gus Beckman	Centre Star	478	410
Jas. Benson	Poorman and War Eagle	1,135	655
Evald Berg	Centre Star	22	6
A. Bridgeman	Iron Mask	239	183
O. L. Colborne	Josie Dump	14	6
J. D. Coleman	City of Spokane	18	1
J. P. Gill	Nickel Plate	18	5
O. Gowing	Le Roi	176	65
A. Grubisic	Centre Star	23	2
C. Hanson	Le Roi and Monita	159	99
N. Hatlevick	Pack Train	4	3
A. K. Heidler	Josie and Anna	129	186
G. Holms	Assay Office Dump	93	51
L. McAuley	Le Roi	209	87
Nick Michaely	Lulla Fraction and Le Roi	840	671
E. A. Mitchell	Idaho	34	10
E. A. Mitchell	Le Roi Tramway	452	182
Morley Newman	Le Roi	280	342
Mike Purcello	Centre Star	1,368	686
John Ruffner	Annie	47	44
W. J. Scorgie	Le Roi	55	22
J. Sokolic	Josie Dump	14	4
G. Sommerville	No One	158	97
Roy Stevens	War Eagle	4,064	2,828
Jas. Stevens	Centre Star and Iron Mask	198	84
C. M. Stevenson	Columbia and Kootenay	188	76
Edward Terzick	Josie	224	303
Ed. Tomich	Le Roi	25	21
Tomich and Penny	Le Roi	31	15
Arthur Turner	Iron Mask	93	49

Of the above undertakings, that of Roy Stevens was the most important, as many as thirty-five men being employed in connection with his lease on the west half of the *War Eagle* ground extending from the surface outcrop, where a large amount of the ore was extracted from below the old shaft head-gear to the flooded level at No. 4 tunnel-horizon. Most of the ore from the various lessees was hauled in 5-ton trucks by A. H. Green Company, of Nelson, to the smelter at Trail. Other activities in the Red Mountain area included: The *Evening Star*, from which C. E. Fraser and associates shipped two car-loads; and the *Cliff-Consolidated St. Elmo*, from which S. J. Hackney shipped one car-load. Active leasing undertakings at the independently owned O.K. Mountain properties included the *I.X.L.*, *Midnight*, *O.K.*, and *Gold Drip*. Of these, the *I.X.L.* was the largest and most continuous shipper with about 272 dry tons, which included fourteen small lots, ranging from 178 to 1,105 lb., of ore rich in coarse gold. These lots, totalling 4½ tons, are separately treated at the smelter under special arrangements. One such lot of 178 lb. contained 182.66 oz. gold and 40.8 oz. silver. The bulk of the ore shipped in car-load lots varied in assay value from 0.35 to 3.686 oz. gold per ton, with a good average. The silver content ranged from 0.8 to 2.8 oz. per ton. Ole Osing was in charge at the mine. Equipment includes a 220-cubic-foot Ingersoll-Rand compressor driven by a Canadian General Electric motor, power being supplied by the West Kootenay Power and Light Company. Recently the I.X.L. Lessors, Limited, has been incorporated; W. Baker, of Rossland, is secretary.

At the adjoining *O.K.* mine J. Hendrickson and associates drove a tunnel parallel to the *I.X.L.* boundary and cut a vein, believed to be the *Baker* lead. Stoping on this showing has been

proceeding and 31 tons of ore, including some small lots of rich ore similar to that at the *I.X.L.*, was shipped. The new vein section, cut in the crosscut 80 feet in from the lowest level, strikes from N. 50° E. to nearly due east.

At the *Gold Drip* M. Penney has a showing, up to 10 inches wide, of quartz containing copper and iron sulphides, with occasional streaks of material rich in coarse gold. This is in the *Virginia* tunnel, near the *I.X.L.* boundary, where the vein strikes N. 40° E., with a dip from approximately vertical to very steep to the north-west. The formation is the basic eruptive member of the Rossland volcanics, as in the case of the other productive veins of the area.

At the *Midnight*, below the *I.X.L.*, Martin Dally and associates have continued work throughout the year. The small mill installed early in the year did not prove suitable for crushing the hard ore and has not been used since the testing-period. Shipments aggregating 141 dry tons were made.

Velvet. In connection with this property, adjoining the Rossland–Cascade highway 12 miles from Rossland, a reorganization of the Velvet Gold Mining Company, Limited, is reported. An entirely new Board of Directors has been elected, Newton W. Emmens, of Seattle, being appointed vice-president and consulting engineer. It is proposed to ship representative bulk samples from the mine and dumps for metallurgical tests to work out a flow-sheet that will make a satisfactory recovery. This would be followed by necessary changes in the mill for a continuous operation. During 1933 work was carried on intermittently, mostly in connection with surface improvements. Two car-loads of sorted ore, aggregating about 80 tons, were shipped early in 1933 to the Tacoma smelter.

Douglas. This claim, located in July, 1933, by Thomas Hardie, of Trail, is situated on the western side of the Trail–Castlegar highway about half a mile south of Genelle Siding. When inspected recently the workings consisted of a shallow excavation in the rock bluff by the roadside and a partially caved tunnel driven in soil and boulders. A sample said to have been derived from the last-mentioned working was reported as assaying $564.40 in gold per ton. This high assay value was featured in a circular in which subscriptions were solicited, issued on behalf of the Douglas Syndicate under date of January 4th, 1934. A number of other samples, principally composed of feldspar, with a little quartz and occasionally some pyrite, carried no values. There was no mineralization of interest to be seen at the time of the writer's visit. The neighbouring rocks belong to a highly metamorphosed series, tentatively referred to the Crystalline Archaean by R. G. McConnell on the West Kootenay Sheet of the Geological Survey of Canada. Close by there is a contact with rocks of the Rossland Volcanic group, and loose masses of pegmatitic granite indicate the presence of intrusive rocks in the vicinity. No vein-structure was in evidence, but a band of quartz 18 inches wide is said to have been encountered at the caved inner end of the tunnel in soil.

Consolidated Mining and Smelting Company of Canada.

Smelting Operations.

During 1933 the most interesting feature to record has been the treatment of the ores derived from the extensive leasing operations on the company's properties. Since the operations of the Granby Consolidated Mining, Smelting, and Power Company, Limited, at Copper mountain were discontinued some years ago no copper ores have been smelted at Trail. With the advent of increasing tonnage from Rossland it became necessary to devise special means of treatment for these ores with high alumina content, as it would have been detrimental to add them to the lead-zinc charge on account of the deleterious action of Al_2O_3 in running slags high in zinc. The inclusion with this tonnage of lead ore would also have resulted in the dilution of the zinc charge, which would mean that the slag going to the re-treatment furnace would be lower in zinc and, as the cost of treating slag is a condition of the tonnage rather than of the zinc content, the cost of zinc-recovery in this manner would be increased. It therefore became necessary to treat the Rossland ores in a separate furnace and using just sufficient lead on charge to collect the gold. All of this ore is being crushed to ¼ inch and then sintered with a small amount of the regular lead charge, making a slag running under 2 per cent. in zinc, which is necessarily wasted, as this slag goes to the dump and will not be re-treated. In this way the ore can be treated without starting up a copper operation.

The rest of the plant has been operated as usual with very little change in processes other than minor improvements. Operations in the lead department have been at 85 per cent. of

capacity and at 50 per cent. capacity in the zinc department. This is in accordance with production ratios established by the International Cartel, which regulates output. The slag-furnace has produced on the average about 80 tons of zinc and 15 tons of lead per day which would otherwise have been wasted. The treatment of the fume from this operation and incidental problems are mentioned in the notes on the zinc process appended hereafter. Contemplated improvements include proposed experimenting with oxygen for enriching the air to both the blast and fuming furnaces. This oxygen is a by-product of the nitrogen department of the fertilizer plant.

The writer is indebted to G. E. Murray, chief metallurgist, for information concerning the progressive improvements in metallurgical technique, and in particular for the following notes on recent developments in electrolytic zinc practice at Trail: "The treatment of fumed zinc oxide from lead blast-furnace slags has introduced several new factors into the electrolytic process. A paper by W. H. Hannay and James Bryden was read at the annual Western meeting of the C.I.M.M. in Vancouver in November, 1933. It summarizes the steps that have been necessary in the preparation of the solutions from this oxide-leaching process. The difficulties have been mainly due to the presence of (*a*) antimony, tin, and germanium, and (*b*) fluorine derived originally from the electrolyte of the Betts lead-refinery process. The use of the spectroscope was of the greatest possible assistance in the discovery of tin and germanium, this part of the work having been accomplished before U. C. Tainton had published his results on the effects of germanium. The combinations of cathodic impurities having proved particularly toxic, it required the development of a special purification, which consists of elevated temperature (70 to 80° C.), together with zinc-dust and copper as sulphate to overcome the plating difficulties.

"Fluorine, which previous to the start of the fuming process had been considered unlikely to build up in the zinc-plant solutions, was discovered to be the cause of abnormally high corrosion of the aluminium cathode sheets. This has resulted in the splitting of the two circuits, sulphide and oxide, into separate flows. Means for overcoming this corrosion are being sought. Cathode protection with rubber paints and strips has been tried and it has been found that aluminium in solution inhibits corrosion. A study of the rôle of chlorine in zinc electrolysis has demonstrated the harmful action of chlorine other than chlorides, notably perchloric acid ($HClO_4$). This compound in conjunction with chlorides is highly destructive to the lead anode when present in excessive amounts. The production of $HClO_4$ is a function of the amount of chloride chlorine present and is inversely proportional to the age of the anode.

"Work with cobalt, which has universally been regarded as a highly objectionable impurity, has demonstrated that its action may be beneficial when present in suitable amounts in making zinc of a low lead content with no loss of current efficiency. The use of rubber-lined electrolytic cells is proving very satisfactory.

"Concentrate-burning in place of the ordinary hearth-roasting previously practised is proving of great value. Furnaces now operate at 100 tons per day with no fuel and a much higher content of SO_2 in the roaster gases, which is advantageous for acid-manufacture. The roasting capacity of the furnaces already in use is only limited as yet by the size of the dust-catching equipment installed. The whole operation is very flexible and affords better results than were attainable using the old method. Roaster extractions are higher and costs are very materially less, due to fewer repairs and a greater tonnage per unit. A supply of oxygen is available from the manufacture of the nitrogenous fertilizers now made by the company. Experiments with the use of oxygen-enriched air are now being carried out, although it is too early to make a definite report. As the limit of the capacity of the roasters in use has not yet been reached, it is possible that as tonnages are increased the recovery of waste heat may be advantageous. The entire operation is distinctly successful and the limits of its successful application are not yet known."

Chemical and Fertilizer Department.

Sulphuric-acid-plant operation on zinc-plant gases was on about the same scale as in 1932, the acid, apart from that marketed as such, being used for the most part in the production of ammonium sulphate. The hydrogen, nitrogen, ammonia, and ammonium-sulphate plants were run practically at capacity throughout the year. Continuing difficult Prairie conditions curtailed the company's phosphate programme to a large extent, but prospects for 1934 demand for these brands are considered very bright. At the present time the plant is operating at the rate of about 125 tons per day.

WESTERN MINERAL SURVEY DISTRICT (No. 6).

REPORT BY GEORGE A. CLOTHIER, RESIDENT MINING ENGINEER (HEADQUARTERS, WORKMEN'S COMPENSATION BUILDING, 411 DUNSMUIR STREET, VANCOUVER).

INTRODUCTION.

District No. 6, with the addition of the Lillooet Mining Division in 1932, now includes eight Mining Divisions of the Province, and covers Vancouver island and the Mainland north to Seymour inlet and east to Lillooet.

The geological, geographical, and other features essential to mining have been described in more or less detail in former Annual Reports. Geologically the all-important factor is the Coast Range batholith, which not only contains within itself immense mineralized belts, but is bordered on either side by wide belts having every condition favourable to the deposition of ore-bodies. Extensive geological literature has been compiled covering wide areas of the district, and the reader is referred to the bibliographies published in the 1928, 1931, and 1932 Annual Reports.

The entire district is covered by the geological map "Vancouver Sheet, No. 196A," issued by the Geological Survey of Canada and obtainable at its Western office, 510 Winch Building, Vancouver, B.C. Additional to the above, the Summary Report, 1932, Part A II, issued in 1933, contains information on the Zeballos River area, Vancouver island; Quadra Island radium-bearing rocks; and the Cadwallader Creek area, Bridge River district.

During 1933 the Geological Survey of Canada field-work, under the direction of J. F. Walker, included a critical and detailed study of the area west of McGillivray creek to Birkenhead river, and also east of the Pacific Great Eastern Railway and Anderson lake. This work will give much-needed information as to the extension to the south-west of the Cadwallader Creek mineral area.

ROADS AND TRAILS.

Too much emphasis cannot be given the importance of the policy of the Mines Department in giving assistance towards road and trail construction throughout the mining areas. It is a great incentive for a prospector to explore new territory knowing that it will be made accessible if anything indicating importance is found.

In 1933 assistance was granted for work on over thirty trails in the district, the expenditure amounting in all to but a few thousand dollars. The San Juan trail from Shawnigan lake makes the territory at the head of San Juan river accessible for prospecting. Operations on the Zeballos River valley necessitated improvements to the old trail. The Kains Lake trail from Port Hardy to the interior of the northerly end of Vancouver island was improved. The old trails from Alberni canal to China Creek properties were improved. Activity in the Fire Mountain section north of Harrison lake required trail-repairs. The old Cayoosh Creek road in from Lillooet was put in repair and the bridge renewed at the upper end. The old trail up the Yalakom river was made passable to the Poison Mountain area. Two small bridges were put in over Hurley creek and the old Pemberton trail cleared to enable prospectors and operators to develop properties between Bridge river and Hurley river.

A start was made on the construction of a road up Gun creek, with a branch road from the Tyaughton Lake road to the Gun Creek trail, the latter being repaired as far as the summit. The trail up Cadwallader creek to the summit was improved so as to serve as a tractor-road and continued as a trail from the summit to the Pacific Great Eastern Railway at Anderson lake, making a through trail from the railway to the *Pioneer* mine, a distance of about 25 miles. A trail for prospecting purposes was built from Birkenhead lake up Phelix creek to the summit west of Cadwallader creek. This trail branches from the old logging-road from D'Arcy, on the Pacific Great Eastern Railway. A new bridge was put in across Cadwallader creek at the *Bralorne* mine to serve the properties on the south side of Cadwallader creek and up the Hurley River valley.

Information on and sketches of all trails in this district can be obtained at this office.

That the Mines Department is alive to the mining situation and recognizes the importance and necessity of adequate transportation is evidenced in the expenditure during 1933 of $10,000 in improvements to the main Bridge River highway from Shalalth, on the Pacific Great Eastern Railway, to the *Pioneer* mine. Approximately 10,000 tons of freight were handled over this road during 1933.

PROSPECTING.

The records of the Government Mining Recording offices throughout the district show 1933 to have been a banner year for the claim-staker. Altogether some 5,675 claims were recorded in No. 6 District, the Lillooet Mining Division leading with 4,303, an increase of 3,664 over 1932. Probably less than 50 per cent. of these claims were staked by prospectors and the balance therefore may be considered as "ground," not prospects. There was, nevertheless, a great deal of good prospecting done during 1933; many old sections were thoroughly investigated and several new areas discovered.

The west coast of Vancouver island has long been known as a gold-bearing section and the season's prospecting gave some rather encouraging results in several localities. Some staking was done on new finds in the Zeballos River valley. Farther south, on Herbert arm, considerable activity was caused by the discovery of quartz veins carrying good gold values. The section of country between the head of Kennedy lake and Sproat lake shows gold-bearing quartz veins and is worth prospecting. High-grade free-gold quartz has been found on the north side of Barkley sound. South of Alberni canal, the old placer-ground in China creek would suggest probable gold-bearing quartz veins in that section, and the same applies to the headwaters of the San Juan, Sombrio, Leech, and Jordan rivers, in the south end of Vancouver island.

On the Mainland coast and islands, Loughborough inlet, the vicinity of Phillips and Frederick arms will receive more prospecting attention, due to the favourable development of the *Enid-Julie*, the reopening of the Alexandria Gold Mining Company's property; and further activity at the *Thurlow Gold*, *Douglas Pine*, *White Pine*, *Sonora*, and others in that locality. Any of the belts included in the granodiorite, as indicated on the Vancouver Sheet (Map 196A), are well worth the prospector's attention. Water transportation and the accessibility of this Coast area give a commercial value to comparatively low-grade ore.

The old Fire Mountain area north-west from the head of Harrison lake was given some attention during 1933 and considerable staking was done. Rich samples of free gold caused considerable activity in this area many years ago. Prospecting at the headwaters of the Pitt river is rumoured to have found a "lost mine," and it is understood that arrangements have been made to thoroughly investigate the matter in 1934. High-grade gold values in pyrrhotite found in places on Pierce mountain should be an incentive to the further prospecting of that section. The geological map (No. 196A) shows a large mass of diorite intrusive into the Chilliwack sedimentaries on the west and north and in contact with a granodiorite-mass on the east, which, with the indicated values found in places, makes a promising field for prospecting.

Increasing interest is being shown in the country contiguous to the Pacific Great Eastern Railway. A number of claims were staked on Ashlu creek, a west tributary of Squamish river. Promising-looking ore was found in the Brandywine River area and farther up the railway in the Tenquille Creek-Birkenhead Lake and Phelix Creek sections a great many claims were staked in 1933. The latter two sections are reached from D'Arcy. Some very fine samples of grey-copper ore carrying high silver values were brought in from the Duffey Lake country at the head of Cayoosh creek, reached by foot-trail from Mile 86. A new area is being opened up on Whitecap creek in from Seton Station. Several prospectors went into the Poison Mountain country by the Yalakom River trail from Moha.

On Bridge river and its tributaries an immense number of mineral claims have been staked. There has also been some real prospecting done. Encouraging reports are heard of the section at the headwaters of the Hurley river and discoveries on Gun creek certainly indicate that the northerly extension of the diorite-belt is exceptionally promising. Later information is to the effect that this section is being rapidly staked and it seems likely to be the most active portion of the Bridge River area in 1934. The headwaters of Eldorado creek, emptying into Gun creek, and the basins of Bonanza and Taylor creeks, tributaries of Tyaughton creek, are responding to prospecting and prospects well worth developing have been found.

The contact-belt along the eastern border of the Coast range holds unlimited possibilities and inducements to the prospector.

Esquimalt & Nanaimo Railway Belt, Vancouver Island.

The following information is given to clarify the hazy ideas prevalent about prospecting and mining in the Esquimalt & Nanaimo Railway Belt, which occupies about a quarter of Vancouver island. This area is shown on all Government maps.

All the base metals, copper, lead, and zinc, within the belt belong to the Esquimalt & Nanaimo Railway Company, leaving only the gold and silver owned by the Government. The area is, however, open for prospecting and staking of mineral claims under the regulations of the "Mineral Act," but subject to the regulations of the railway company. The locator of mineral claims on unsold areas may, for $1 paid to the railway company, procure an option for one year to purchase the surface and timber at $5 per acre (about $210 for a full claim). The timber, to be used for mining purposes and not removed from the claims, may be purchased at $1.50 per thousand feet in excess of 8,000 feet per acre. The royalties placed on the base metals are on a sliding scale and are not prohibitive. A 10-per-cent. lead ore would pay 20 cents per ton royalty; a 40-per-cent. zinc ore would pay 40 cents per ton royalty; a 50-per-cent. zinc ore would pay 60 cents per ton royalty; a 5-per-cent. copper ore would pay 10 cents per ton royalty; and over 5 per cent. copper the royalty is 3/10 cents per pound.

Prospecting in Parks.

Permission must be obtained from the Lieutenant-Governor in Council, on recommendation of the Minister of Mines, to prospect and stake mineral claims in Garibaldi Park.

Strathcona Park on Vancouver island is open for prospecting and staking. Mining operations in either park are subject to the conditions and restrictions prescribed by the Lieutenant-Governor in Council. No Crown grants can be given for claims in Strathcona Park.

Placer-mining.

Placer-mining by hand methods has very limited possibilities on Vancouver island or the Mainland coast. While it is a fact that "colours" can be obtained in many of the creeks and on some of the beaches, as a rule there is not a sufficient supply of gold present in the gravels to constitute profitable diggings. Further, the gold is so fine that only expert operators will make any recovery. Placer-mining has been attempted at many places in the past three years, such as the Leech river, mouth of the Jordan river, mouth of the Sombrio, Wreck bay, Herbert arm, Zeballos river, north coast of Vancouver island, and in the creeks along the Mainland coast, but without much success. In the Interior, in the Lillooet Mining Division, there are, of course, always placer possibilities along the Fraser river, and possibly the lower Bridge river, during the low-water period. The tributaries of the upper Bridge river, such as Marshall creek, Tyaughton creek, Hurley river, and their tributaries, have been pretty thoroughly worked over by the old-timers and therefore do not offer much encouragement for individual mining now. Cayoosh and McGillivray creeks have been worked over so much that hardly a living can be made from them now.

Development.

The year 1933 was one of exceptional activity in the exploration and development of mining properties. In addition to a great number of owners who have been working on their own properties, over fifty companies operated properties throughout the district.

It is estimated that over $1,000,000 was raised by these companies for mining-work, and in the majority of cases sufficient funds were obtained to demonstrate whether or not further work is justified. Those properties showing merit can be further financed, but inevitably a large number must go into the discard, and amongst these will probably be found those whose merits have been broadcast loudest and longest.

The Bridge River area has naturally had the bulk of development for the district during 1933, and, of necessity, everything and anything in the shape of a mineral-showing was tried out, as has been the case in every new mining camp. In the balance of the district a more careful selection is made of properties, and the results will perhaps show as great a percentage of successes as made in the popular areas.

The following tabulation is given as a résumé and index to the operating properties throughout the district and it shows at a glance the number of development activities in 1933:—

Vancouver Island.

The Leech River and Wolfe Creek placers were further developed.

New development was undertaken on the *El Capitan*, on Cottonwood creek north of Cowichan lake.

The *W.W.W.* and Vancouver Island Gold Mines, Limited, property east from Alberni canal are under development.

Work is being continued on the *Leora* group up from Kennedy lake. The *You* group on Bedwell river, Bedwell sound, was operated during the summer.

The *Big Boy* on Herbert arm shipped during 1933 and the *Mary Mquilton*, adjoining, is being developed.

The Zeballos River Mining Company and the King Midas Mining Company, Limited, are operating on Zeballos river. The *Alice Lake* group on Quatsino sound was further developed by the owners.

Mainland Coast and Islands.

The Hayden Bay Gold Mines, Limited, and Golden Gate Syndicate are opening up properties on Loughborough inlet.

The *Enid-Julie* and *Doratha Morton* properties on Phillips arm are under development and the *Alexandria* is to be reopened.

The *Douglas Pine* on Thurlow island had some work done on it in the summer of 1933, and the *Thurlow Gold* and *White Pine* are under option, as also is the *Sonora Gold* on Sonora island. The *Blue Bell* on Frederick arm has a small crew working on it.

The *Gem* property on Texada island has been dewatered and exploratory work undertaken. O. B. Bush is also continuing work on his claims.

Along the Pacific Great Eastern Railway.

The owner of the *Golden Coin* group on Ashlu creek continued development.

The *Astra*, *Brandywine*, and *Blue Jack* groups on the Brandywine river also had further work done by the owners.

Work was resumed on the old *Li-li-kel* group on Tenquille creek by Geo. Moffatt.

Extensive work has been carried out by the National Gold Mines, Limited, on McGillivray creek, and the *Gold Hill* group at the forks has had several hundred feet of work done on it during 1933.

The *Star* group at the head of McGillivray creek is also being explored. The Richstrike Gold Mines, Limited, is developing a property on Whitecap creek in from Seton Station.

The Bonanza-Cache Gold Mines, Limited, has undertaken the development of the old *Golden Cache* and *Bonanza* groups on Cayoosh creek.

W. A. Wells, of Vancouver, is hydraulicking on the *Baird Lease* across from Lillooet on the Fraser river and also on the Lillooet side.

Bridge River and Tributaries.

The Lower Bridge River Placers, Limited, continued operations on its leases on Bridge river, about 10 miles above Lillooet.

The Tyaughton Creek Gold Placers, Limited, excavated a few small pits and later moved the plant down to a more advantageous point.

The Truax Gold Mines, Limited, property was taken over by a Vancouver syndicate and work continued.

The Minto Gold Mines, Limited, acquired the *Alpha* group below Gun creek on the main road, built substantial camps, installed machinery, and is driving two tunnels.

The Congress Gold Mines, Limited, is doing some exploratory work on the *Turner* group at the mouth of Gun creek.

Bunting and Ferguson are developing their showings on the east side of Gun creek. The *Region* group, adjoining on the north, did some surface work during the 1933 summer and preliminary work was done on the *Gold Pass*, *Gold Bond*, and other groups up Gun creek.

Considerable work has been done on the mineral-showings at the headwaters of Bonanza and Taylor creeks, tributaries of upper Tyaughton creek.

The *Wayside*, between Gun lake and Bridge river, on the main road, has had extensive, successful development during 1933 and has outstanding possibilities.

The Cariboo-Bridge River Gold Properties, Limited, is developing promising quartz-showings on the north side of Gun lake.

Matt Foster has advanced his lower tunnel on the *Veritas* group on Little Gun lake.

The Reliance Gold Mines, Limited, across Bridge river from the *Wayside*, has done surface work and is now driving a tunnel.

The Bridge River Consolidated has been diamond-drilling and doing some underground work on the *Why Not* workings.

The Bridge River Exploration Company has been exploring the *California* and other veins in the lower tunnel and latterly doing some diamond-drilling.

The *Grull-Wihksne* property was diamond-drilled for structure and is now sinking a shaft to the diorite.

Taylor (Bridge River) Mines, Limited, property will be explored at depth by the continuation of the main crosscut from the *Bralorne*, now under way.

Bralorne has been made into a mine during 1933.

Pioneer has developed a new mine in its east ground and opened up wonderful ore in the lower levels of the main ore-body, west of the shaft.

The *Reward*, *Divide*, *Yorkshire Syndicate*, and *Holland*, south of the *Bralorne* and *Pioneer*, have been under exploration.

The *Native Son*, *Bridge River Ogden*, *Golden Mitt*, and a portion of the *Grull-Wihksne* ground north of the *Bralorne* are also being investigated.

East of the *Pioneer*, up Cadwallader creek, the *Pioneer Extension*, *Dan Tucker*, *Kirkwood* groups, *Red Hawk*, *Butte*, *I.X.L.*, *Bramoose*, and *Standard* have all been under development in 1933.

REFERENCES—ANNUAL REPORTS.

The reader's attention is particularly directed to the list of references, given under each Mining Division, to old mineral claims, groups, and companies, with the year of the Annual Report in which they are described. The reports on these old properties have been reproduced in later reports for the reason that the old issues are sometimes hard to procure.

VICTORIA MINING DIVISION.

This Division comprises the south end of Vancouver island. Mining activities have been confined to a little placer and hydraulic mining on Leech river and Wolfe creek; prospecting at the headwaters of the San Juan, Jordan, and Leech rivers; placer-prospecting at the mouth of the Jordan river and on the beach at the Sombrio river; and development of properties north of Cowichan lake.

References.—Alpha-Beta, 1931; *Blue Grouse*, 1931: Gabbro Copper Mines, Limited, 1931; *Kitchener*, 1931; *Margaret*, 1931; *Paint Pot*, Bulletin No. 1, 1932; *Sombrio Placers* (Kootenay Central Mining and Development Company, Limited), 1930; *Southern Cross*, 1931; Sunloch Mines, Limited, 1931; *Tyee*, 1931; *Willow Grouse*, 1931.

On Leech river E. Butterworth, of Victoria, and associates moved their hydraulicking outfit up to Martin's gulch, but so far as could be learned they did not make any production in 1933.

Wolfe Creek. This is a tributary of Sooke river, which joins the river just opposite Leech river, and 1½ miles from the Kapoor Lumber Company's mill. Two half-mile placer leases have been taken up by Kennedy, Chambers, and associates above the old Eagle Talc and Mining Company's property, about 1¼ miles from Leechtown, a flag-station on the Canadian National Railway.

It is believed that some gold was taken from the lower end of Wolfe creek in early days when Leech river was being worked. Bed-rock is the same formation as Leech river—namely, slates and schists, in which the quartz veins were the source of the placer gold. The topography shows the present stream to have cut down through the formation, leaving a series of gravel-covered benches. The present showing is about 30 feet above the creek, where an open-cut shows bed-rock to be dipping slightly into the hill, suggesting an old channel behind.

There is from 4 to 6 feet of coarse bouldery gold-bearing gravel on bed-rock, and above this in places is up to 6 feet of glacial silt with a covering of recent gravel up to 6 feet in thickness.

Two yards of gravel from a depth of 2 to 3 feet on bed-rock were sluiced, the gold weighed and assayed, giving a button worth $1.10 (gold $20.67 per ounce). The gold is well worn, fairly coarse, and runs 890 fine, which is high for placer gold. This value of 55 cents per cubic yard gives the deposit interesting possibilities, depending, of course, on the extent and volume of the gravel-deposits.

Only preliminary work has been done, and further testing, preferably by ground-sluicing, should be done to demonstrate its possibilities for hydraulicking, for which, it is stated, sufficient water is available.

El Capitan. (*See* Bulletin No. 1, 1932.) This property, consisting of the *El Capitan* and *El Capitan Nos. 2, 3,* and *4,* is owned by a syndicate under the management of E. F. Miller, Duncan. The claims are situated at the head of Cottonwood creek, which empties into the north side of Cowichan lake. They are reached from Youbou, a station on the Canadian National Railway, to which there is an auto-road from Duncan.

Considerable work has been done on the property on a quartz vein in a shearing in andesitic country-rock. The mineralization is pyrite and chalcopyrite carrying good gold values. The vein is about 20 inches wide and on the surface, where it is almost entirely oxidized, small ribs and patches of sulphides of iron and copper are found assaying up to 1.95 oz. gold per ton. Two tunnels have been driven on the east side of the apex of the hill, the lower one obtaining a depth of 150 feet below the apex. Where encountered by the crosscut from the surface the vein shows 4 inches of sulphides on the foot-wall assaying 2.70 oz. gold per ton and 3.5 oz. silver per ton; then 3 feet of oxidized material; then 6 inches partially oxidized chalcopyrite on the hanging-wall assaying 4.1 oz. gold per ton, 1.3 oz. silver per ton, and 13 per cent. copper. A crosscut at the face shows the vein to have split into three small oxidized seams. An independent sampling at the face shows 10 inches of oxides on the hanging-wall assaying 0.45 oz. gold per ton; then 6 feet 6 inches of slightly mineralized rock assaying 0.10 oz. gold per ton; then 17 inches of oxides assaying 2.25 oz. gold per ton; the whole a fair grade of milling-ore.

During 1932 it was decided to try to pick up the vein on the west or Cowichan Lake side of the summit, this side being more favourable for transportation as well as for opening up the property. A start was made in 1932 on a crosscut tunnel and I am informed that the continuation of it during 1933 picked up the vein, the width of the tunnel, and of a fair grade of ore.

Nitinat Section.

This is a copper-bearing area lying west of Cowichan lake, in the drainage area of the Big and Little Nitinat rivers, and continuing west to Alberni canal. It is traversed by the old grade of the Canadian National Railway, which, however, with the exception of about 5 miles from Cowichan lake which has been cleared, is so overgrown as to be practically impassable. There is now a foot-trail from a point on the railway-grade about 5 miles west of Cowichan lake, across country to meet the railway-grade again near Francis lake, from which point there is a good foot-trail (not the railway-grade) to Alberni canal at the old Headquarters camp. The *Southern Cross* cabin is about 4 miles from the railway-grade and the total distance from Cowichan lake to Alberni canal is about 25 miles. Discoveries have been made of promising bodies of chalcopyrite in altered limestone in contact with the volcanics of the Vancouver Island series and granitic intrusions.

ALBERNI MINING DIVISION.

This Division occupies the drainage areas of Barkley sound, Alberni canal, Sproat and Great Central lakes. Port Alberni, at the head of the canal, is the distributing-point. Boats are available on Sproat and Great Central lakes, and at Port Alberni for points down the canal. There is a mail-boat service to Ucluelet, from which point there is an auto-road to Long beach, thence by launch to Tofino. There is an excellent telephone service all along the west coast of Vancouver island. The prospector's attention is called to the foot-trail from the head of Taylor arm, Sproat lake, up Taylor river, from which there is a branch crossing Taylor river, over the divide, and down to Kennedy lake, giving access to a promising country containing gold-bearing quartz veins. Small veins of rich, free-gold quartz were found in the vicinity of Toquart harbour this season.

References.—Alberni Mines, Limited (*Three Jays*), 1928; *Big Interior*, 1931; Canadian Quicksilver Company, Limited, 1931; *Copper King*, 1928; *Dauntless*, 1931; *Edith*, 1931; *Ferguson*, 1932; *Happy John* and *Monitor*, 1916; Island Copper Company, Limited, 1931; *Klanawa*

and *Canyon*, 1931; *Morning*, Bulletin No. 1, 1932; *Rainy Day*, 1928; *Regina*, Bulletin No. 1, 1932; *Sunshine*, 1928; *Thistle*, 1927.

W.W.W.

(*See* Bulletin No. 1, 1932.) This property of four Crown-granted claims, *W.W.W. Nos. 1, 2, 3,* and *4*, situated on the Franklin river, 12 miles from Alberni canal, is owned by A. James, of Vancouver. From Port Alberni it is reached by following the logging-road of the Alberni Pacific Lumber Company for 5 miles, from which point a new trail about a mile long connects with the old Franklin Creek trail to the camp.

Reports state that there are two gold-bearing pyritized quartz veins on which two tunnels have been driven, and from these a small tonnage of high-grade ore was shipped many years ago. Some development-work was done in 1932 and again in 1933 by Vancouver interests. Results apparently were not satisfactory, for after a couple of months work ceased.

Vancouver Island Gold Mines, Ltd.

This company was organized in September of this year with a capitalization of $2,250,000, divided into 4,500,000 shares of 50 cents par value. The registered office is 810 Lumberman's Building, Vancouver. The property consists of the four old Crown-granted claims—*Alberni*, *Victoria*, *Chicago*, and *Warspite*—and sixteen recently staked claims. The Crown grants were formerly the holdings of the Alberni Consolidated Gold Mines, Limited. They were staked in 1895 and worked for two years by James Dunsmuir. In 1897 they were acquired by an English company. They built an 8-stamp mill the following year, but quit after making a few satisfactory clean-ups.

In the spring of 1933 R. W. Williams, of Vancouver, leased the reverted Crown grants from the Government, dewatered and sampled the shaft, and later turned the property over to the present company. The claims are situated on Mineral creek, a tributary of China creek, about 10 miles up the logging-railway of the Alberni-Pacific Lumber Company from Port Alberni, and about 1½ miles by trail from the railway. The showings are about 1,500 feet higher than the railway. At one time there was a good wagon-road from Alberni to the property; the portion of this from the railway to the camp will be reconditioned and utilized for present needs.

The general rock formation is andesite of the Vancouver Island series. The mineralization consists of a quartz-filled shearing in the andesitic rock, varying up to 4 feet in width, carrying gold values in iron sulphides with occasional free gold. The old work consists of a long open-cut from which a shaft was sunk 60 feet. A 100-foot crosscut was later driven to connect with the bottom of the shaft and a 200-foot drift was driven on the vein. About 300 feet west of the tunnel a shaft was sunk about 45 feet and some high-grade gold ore mined from the vein, which is here about 2 feet wide on the surface. Small stopes in the 200-foot tunnel indicate that some better-grade ore was taken out, but the average values in the tunnel are low. The vein strikes S. 15° E. and dips into the hill at about 80° W. The hanging-wall is well defined, but the mineralization grades out into the foot-wall.

The present company proposes driving a crosscut tunnel from the creek-level, a distance of about 400 feet, to intersect the vein at approximately 250 feet depth; then raising to the shaft and drifting both ways on the vein, particularly to the east to get under the old tunnel-workings. For this purpose the road is being reconditioned from the railway up to the camp and a portable compressor installed. J. Bryden, Victoria, is in charge of operations.

Della.

There have been a number of inquiries regarding this property and the following notes are therefore repeated from the 1916 Annual Report: The property consists of a number of Crown-granted claims, some of which have reverted to the Government. It is situated at Della lake, at the head of Drinkwater creek, which empties into the head of Great Central lake. There is a trail from the lake up the creek to the property.

It was staked in 1900 and the owners put in an arrastra, driven by water-power, to recover the free gold showing in the outcroppings. Iron pyrites appeared at shallow depths carrying too little free gold to be profitable by arrastra methods of milling. The showings consist of rusty iron-stained quartz mineralized with pyrite, arsenopyrite, and a little galena, in a 4-foot fissure in much-altered pyroxenite rock. It strikes north and dips at 68° to the west. Open-cuts have traced the fissures for about 400 feet, but the main showings appear to be in an open-cut 35 feet long, 5 feet wide, and 8½ feet deep. A sample taken from the dump, representing its average, assayed: Gold, 1.68 oz. per ton; silver, 2.8 oz. per ton. The report states that the sulphide content would indicate a concentrating rather than a free-milling ore.

Of the nine adjoining Crown-granted claims, the *Della*, *Bessie*, *Mamie*, *Marie*, *Della Fr.*, and *Minnie* have reverted to the Crown and are open to lease.

Toquart. This group of four claims—*Toquart Nos. 1, 2, 3,* and *4*—is situated on Toquart harbour, Barkley sound, and owned by the Hillier Bros., of Ucluelet. Only prospecting-work has been done, but some samples of quartz were brought in carrying good values in finely distributed free gold.

CLAYOQUOT MINING DIVISION.

This Division occupies the central portion of the western half of Vancouver island, from Barkley sound to Esperanza inlet. It is served by the Canadian Pacific Railway coastwise boats. Mining interest was renewed in this Division in 1933 by the discovery of quartz veins carrying substantial gold values at the head of Herbert arm. This resulted in the staking of a large number of claims in that vicinity.

References.—B.C. Wonder, 1931; *Copper King,* 1931; *Craigellachie,* 1928; *Douglas,* 1930; *Indian Chief* (Pacific Tidewater Mines, Limited), 1931; *Ormond,* 1932; *Jo Jo,* Bulletin No. 1, 1932; *Rose Marie,* Bulletin No. 1, 1932; *Shannon,* 1928; *Star of the West,* 1928.

Clayoquot Sound Section.

Leora. This claim, situated 2 miles up Kennedy river from the head of Kennedy lake, is owned by W. W. Gibson, of San Francisco, who operated the property in 1914–15, and states that over $20,000 was recovered from ore averaging about 0.45 oz. gold per ton. Two years ago Mr. Gibson started a shaft in the hanging-wall with the object of intersecting the vein at about 150 feet depth. It is stated that a crosscut was driven from that depth to the vein during the summer of 1933, exposing 2 feet of shipping-grade ore.

You. This group, consisting of the *Ex, Ten, You,* and *Eight* claims, is owned by J. B. Woodworth, of Vancouver. It is situated about 13 miles up Bedwell river from the head of Bedwell sound at an elevation of 3,000 feet. Considerable work has been done on this property, consisting of surface-stripping and a 300-foot tunnel driven on a small quartz vein, stated to be 10 inches wide, in a 3-foot shearing in volcanic rock. This is typical of the gold-bearing quartz veins of the west coast. The owner states there is sufficient ore in sight averaging 2 oz. gold per ton, amenable to cyaniding, to assure a profitable operation.

A new crusher was installed during 1933. This was expected to supply crushed ore to the small cyaniding plant, but it did not prove satisfactory and only about a month's work was done. It is extremely difficult to get supplies, particularly machinery of any kind, in to the property.

Herbert Arm Section.

Big Boy. This group consists of eight claims, the *Big Boy Nos. 1* to *8,* inclusive. Staked early in 1933 by R. P. Duncan and associates, it was later acquired by a Vancouver syndicate headed by Albert C. Wright. The property is situated at the head of Herbert arm on the west coast of Vancouver island, the claims extending inland from tide-water.

The showing, located on the beach, consists of a quartz vein, up to 4 feet in width, occupying a shear in the volcanic country-rock. The vein is sparsely mineralized with iron pyrites, galena, and zinc-blende, the latter two minerals apparently accompanied by high gold values. The average values at the discovery were about $15 gold per ton, but due to the high ratio of concentration the sulphide concentrates gave very much higher values.

The vein was stripped back from the water's edge for a distance of about 40 feet, and from there a 45-foot tunnel was driven, of which length 30 feet was in ore. In the last 15 feet of the drift the quartz pinches out to a small seam of soft, sheared material in the face. The ore-shoot is therefore about 75 feet long. Approximately 30 tons of $35 ore were sorted and shipped from the above work. Further ore could be mined and the extent of the ore-body determined by sinking in the ore-shoot near the mouth of the tunnel and developing out under the river. The vein strikes S. 70° E. into the hill and dips, at the tunnel portal, 35° E., with a more vertical dip at the face.

The shearing is strong and further drifting on it is warranted in the hope of encountering other ore-bodies. Ore can be dumped directly into a scow taken in on high tide.

The *Moy-E-Ha* group of eight claims lies on the west side of the river, opposite the *Big Boy*. No work has been done on it as yet.

Mary Mquilton.

This group of twelve claims, owned by Jas. Livesley, W. Kennedy, and Jack Gibson, is now under option to the Waverley Tangier Mines, Limited. This company is capitalized for $4,000,000, divided into 16,000,000 shares of 25 cents par value. The claims are situated a mile east of the head of Herbert arm, the upper showing being at an elevation of 2,000 feet above sea-level. A good trail was built in the fall of 1933 from the beach to the camp, built on the property, and development-work will be continued through the winter.

There are two showings on the ground, both shears in the Vancouver volcanics, similar to those at the *Big Boy*. Within the shears are parallel quartz veins mineralized with iron pyrites, with traces of galena and zinc-blende. The lower showing at 1,700 feet elevation has not been opened up. The upper showing at 2,000 feet elevation is now being developed. An open-cut here shows a sheared width of 7 feet containing several parallel veins of quartz assaying separately up to 1.5 oz. gold per ton, the whole averaging about 0.4 oz. gold per ton. Free gold has been found. The development of these showings may indicate new possibilities for gold-bearing veins on the west coast.

Mary Lou, Monarch, Rio, and Sunrise.—These adjoining groups, situated south of the *Mary Mquilton*, are under option, *en bloc*, to Vancouver interests and are being thoroughly prospected.

Nootka Sound Section.

Points on Nootka sound can be reached by launch from Nootka, a port of call for the Coast steamers.

Shannon.

This group of three claims is situated on the north side of Muchalat arm, opposite Gore island, about 14 miles from Nootka cannery. The claims extend back from the beach and the showings, reached by a good foot-trail, are about a mile back from the water. There is a showing about 150 yards along the trail from the cabin, but the main showings are at the end of the trail at 400 feet elevation.

The deposit, which has been exposed in several places by open-cuts, is a replacement in limestone along the contact of the limestone and igneous rocks. There is no defined foot-wall in the limestone and there is little evidence of metamorphism. The predominating mineral is sphalerite and in places there are important exposures of galena, while the uppermost exposure shows a predominance of chalcopyrite. The mineralization is up to 6 feet in width. The strike of the contact is S. 50° E. (mag.) and its dip about 70° under the volcanics. A sample taken to get an idea of the general values assayed: Gold, trace; silver, 6.6 oz. per ton; lead, 8 per cent.; zinc, 13 per cent. There are places showing 6-foot widths of 20 to 25 per cent. zinc. Due to the gradual slope along the deposit, drifting would not gain depth quickly, but a comparatively short crosscut would obtain considerable depth under the surface ore-exposures.

Star of the West.

There have been a number of inquiries about this property, hence the following short review: There are three claims in the group (owned by Wm. Poole, Nootka), situated at the head of Tasis canal, about 22 miles from Nootka cannery. There is a good cabin on the beach and a good foot-trail from it to the showings and cabin at 1,400 feet elevation. The geology consists of a belt, up to 100 feet wide, of limestone altered to garnetite along its contact with an intrusion of granodiorite. The contact strikes N. 60° E., cutting diagonally across the head of the canal. Extensive stripping, trenching, and open-cutting shows the garnetite in many places to be replaced by pyrrhotite, magnetite, and chalcopyrite, and the occurrence would seem to be of sufficient size, values, and frequency to warrant some systematic development. Samples from the different exposures show gold values up to 0.15 and 0.2 oz. gold per ton; silver, from 1 to 4 oz. per ton; copper, up to 12 or 15 per cent.; and zinc, from 2 to 6 per cent.

Zeballos River Section.

This section at the head of Zeballos arm is reached by launch from Ceepeecee cannery.

Zeballos River Mining Co.

This company was organized in February, 1933, with a capitalization of $1,000,000, divided into 1,000,000 shares of $1 par value. The registered office of the company is 701 Yates Street, Victoria. The company's holdings consist of the *Tagore* group of twelve claims, situated about 2½ miles up Zeballos

river from the head of Zeballos arm, and the *Jack of Spades* group of eight claims about 2 miles farther up the valley. The *Tagore* group was acquired from Malmberg, Nordstrom, and associates. The *Jack of Spades* group was staked by the company.

The vein on the *Tagore* is quartz varying in width from a seam up to about a foot and averaging probably 6 inches, carrying mainly pyrrhotite and zinc-blende, with minor amounts of galena and chalcopyrite. High values in gold have been obtained, presumably in association with the galena and blende. The vein is in a fine-grained greenish rock and where exposed it shows considerable garnetite and epidote on the surface for a length of about 40 feet. A few tons of ore have been taken out at the river's edge and from a 15-foot shaft under high water in the river. The vein strikes north-east under the river and has not been traced for any distance south-westerly. As exposed on the surface the vein is rather small and with uncertain values it does not give very much encouragement.

A tunnel with its portal under a lamprophyre dyke, below which ore was found, is being driven just above the river-level with the object of reaching a contact of volcanics with granodiorite, on which stringers of gold-bearing quartz were found on the surface. Later information from the company states that the tunnel encountered the contact at 120 feet from the portal and found the vein material of drift-width carrying substantial gold values. The face is about 100 feet below the surface. The company has two claims across the river at this point on which some interesting discoveries have been made. A bridge is being built to facilitate the development of these showings.

On the *Jack of Spades* group a good cabin was built and some surface work done on the mineral-showing. The mineral-bearing formation is a wide contact-metamorphic belt of garnetite at the contact of limestone with a large body of granodiorite. The garnetite is in places 200 feet wide. Within a width of 30 to 40 feet in the garnetite, masses of good-grade chalcopyrite have been exposed, in addition to quartz-patches carrying fair gold values. This mineralized belt strikes S. 60° to 70° W. and parallels the contact. The extent of mineralization disclosed by the small amount of work done along the belt justifies more extensive exploration both along the surface and underground by drifting.

A crew of fifteen men under the supervision of Joe Staller did a lot of work during 1933 in establishing float camps at the beach, making trail repairs and a road right-of-way across the Indian reserve, constructing camp additions, and conducting general mining-work on both the *Tagore* and *Jack of Spades* properties.

King Midas Mining Co., Ltd.

This company was organized in July, 1933, with a capitalization of $2,000,000, divided into 2,000,000 shares of $1 par value. The company's registered office is 1318, 510 Hastings Street West, Vancouver. The holdings of the company include the *Yauco* group of nine claims—*Major Nos. 1* and *2*, *Big Ben Nos. 1* to *4*, and *Gold Rock Nos. 1* to *3*, all situated about 9 miles up Zeballos river from the beach. There is a good foot-trail to the forks, where this winter a cableway was put across the Zeballos river to connect with the trail on the other side to the camp and workings. The property is under the supervision of J. S. Rear, of Vancouver.

Attention is being directed toward the development of a number of small, parallel, gold-bearing quartz veins contained in a dense, greenish volcanic rock on the west side of Zeballos river, about a mile above the forks. Considerable surface-stripping and open-cutting has been done, and this work shows the veins to be small, not very continuous, but very rich in gold where mineralized with zinc-blende, galena, arsenopyrite, chalcopyrite, and pyrite. Where the zinc-blende predominates the values are correspondingly high.

An 80-foot crosscut tunnel was driven from the river-edge and it gives a depth of about 80 feet at the face. The last 6 feet of this crosscut cut a series of five small parallel quartz veins, varying from 1 to 5 inches in width. A winze was sunk at the vein intersections and a drift 100 feet long was driven on the vein series, mainly to the south, following a seam of sulphides. This work apparently was not sufficiently encouraging to warrant further development at that point. It is estimated that in places the width of quartz in the 6 feet will aggregate 15 inches, and this width of quartz would have to average 2.5 oz. gold per ton to give an average value of 0.5 oz. gold per ton across the 6 feet to be mined.

Another crosscut tunnel was started about 200 feet farther south, down the river, and driven some 90 feet with the objective of cutting a 6-inch mineralized quartz vein that shows high gold

values on the surface and probably indicates the extension of the vein series cut in the first crosscut. It is understood this crosscut was not completed. About a quarter of a mile above the camp, on the east side of the river, a small quartz vein from 6 to 8 inches in width shows along the contact of the limestone and volcanics. This vein carries good gold values but has not been developed.

QUATSINO MINING DIVISION.

This Division includes the western half of the north end of Vancouver island, north of Esperanza inlet. It is reached either by west-coast boats from Victoria, or from Port Hardy, on the east side of the island, by a good auto-road to Coal Harbour, from which point the mail-boat calls at several places or launches are available.

This is essentially a copper-bearing area, and since present market conditions necessitated the closing-down of the Coast Copper property there has been very little mining activity, the *Alice Lake* group being about the only property on which anything is being done. That there has been some prospecting is shown by the fact of there being fifty-six mineral claims recorded in 1933, against one recorded in 1932.

References.—Alice Lake, 1932; Canada Copper Company, Limited, 1930; Coast Copper Company, Limited, 1931; Copper Cup Mines, Limited, 1930; *June*, 1931, and Summary Report, G.S.C., Part A, 1929; *Marble Creek*, 1930; *Millington*, 1927–28–29, and G.S.C. Summary Report, Part A, 1929; Quatsino Gold-Copper Mines, Limited, 1931; *Quatsino King* (Teta River Gold), 1931; *Yreka*, 1928, and G.S.C. Summary Report, Part A, 1929.

NANAIMO MINING DIVISION.

This Division includes the eastern half of Vancouver island and the west coast of the Mainland from the south end of Texada island north to Seymour inlet. The recording office is at Nanaimo. It is one of the largest Divisions in District No. 6 and, because of the diversity of its products, one of the most important in the Province. It contains all the coal-mines of Vancouver island; iron-ore bodies; many deposits of gold, silver, copper, lead, and zinc ores; and producers of many non-metallic products, such as lime, cement, brick, sand, gravel, crushed-rock materials, and building-stone.

Over 300 claims were recorded in 1933, the records showing the greatest activity on the Loughborough Inlet and Phillips Arm areas on the west coast of the Mainland, due to the favourable development, so far, of the *Enid-Julie;* and in the Tatlayoko Lake section at the headwaters of the Homathko river, which flows into the head of Bute inlet.

References (Vancouver Island).—Big G., 1916; *Caledonia*, 1927–28–29, and G.S.C. Summary Report, Part A, 1929; *H.P.H.*, 1931–32; *Jubilee*, 1930; *Kinman*, 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; *Smith Copper*, 1931.

References (Mainland).—Alexandria Gold Mines, Limited, Bulletin No. 1, 1932; B.C. Gold Mines, Limited, Bulletin No. 1, 1932; *Blue Bells*, Bulletin No. 1, 1932; Cambria Copper Company, 1928–29; Central Copper and Gold Company (Vananda), 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; *Enid-Julie*, Bulletin No. 1, 1932; *Juneau*, Bulletin No. 1, 1932; Lasqueti Mining Company, 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; Santana Copper Syndicate, 1929–30; *Solyman* and *Freya*, 1930; Sonora Gold Mines, Limited, Bulletin No. 1, 1932; *Stromberg*, 1927; Tatlayoko Lake Gold Mines, Limited, Bulletin No. 1, 1932; Thurlow Gold Mines, Limited, Bulletin No. 1, 1932; *White Pine*, Bulletin No. 1, 1932; *Wyho*, 1927.

In the northern portion of Vancouver island there was little or no mining activity in 1933. The Nahwitti Lake area, containing the *H.P.H.* group, is a favourable section for lead-zinc deposits, which occur as replacements in the limestones where it is in contact with volcanics. There is a fair foot-trail from Port Hardy to Kains lake, also to the *H.P.H.* camp and to Nahwitti lake. The Nimpkish Lake section, being essentially a copper-bearing area, is inactive.

Shoal Bay Section.

This area, reached by Coast steamships to Shoal bay on Thurlow island, in 1933 became the centre of a number of development operations. The development of the *Enid-Julie* property and the higher price of gold has attracted attention to a number of properties on which work is being started.

Enid-Julie Mines, Ltd.

This company, incorporated in August, 1933, as a specially limited company, is capitalized at $750,000, divided into 1,500,000 shares of 50 cents par value. The company's registered office is 732 Marine Building, Vancouver. The holdings consist of twenty-two mineral claims, of which six are Crown-granted, the remainder being held on locations. The old Crown grants are the *Enid*, *Julie*, *Stella*, *Jennie*, *Empress*, and *Daisy*. With the exception of four claims located on the east side of Fanny bay, the property lies west of Fanny bay and extends from tide-water to the summit. There is a good foot-trail from the beach to the camp at 2,100 feet elevation and a telephone has recently been installed from the beach to the camp. Construction of a wagon-road has been started from below the camp to connect with the old *Doratha Morton* mill-site at tide-water, a distance of about 2 miles, on a 20-per-cent. grade.

The general rock formation in the area is a belt of sedimentaries lying on the west border of a wide belt of altered sedimentaries and volcanics contained in the Coast Range granodiorite. Bedded with the sedimentary rocks and lying on the east side of a 10-foot basic dyke is a quartz vein up to 25 and 30 feet in width. This vein was discovered at an elevation of 2,900 feet, where a 15-foot shaft showed good gold values. It was traced down the hill and a tunnel was started at 2,140 feet elevation. This tunnel is about 30 feet east of the dyke and has been driven about 155 feet in mineralized quartz, without any walls showing. The mineralization consists of iron sulphides, mainly pyrrhotite, carrying values up to 0.4 oz. gold per ton, except where cross-fracturing causes enrichments. It is now proposed to crosscut both ways at the face of this lower tunnel, cutting through the dyke to prospect the ground to the west, where arsenopyrite float gave high gold values upon assaying.

During road-construction a second vein was discovered about 600 feet north-east of the main vein and a little lower down the hill. Stripping exposed this vein on the surface for a few hundred feet length and a 30-foot crosscut intersected it underground. It is reported to be 6 feet wide, of more or less banded quartz, from which encouraging assays were obtained.

About 500 feet up the hill from this discovery the No. 3 vein has been exposed. A 37-foot drift on the foot-wall was in loose material, but the face shows signs of more solid formation.

The work on the main vein indicates an important tonnage of at least milling-grade ore, with excellent chances of finding high-grade ore-shoots. The property is ideally situated for operating and transportation and altogether is an outstanding prospect. The property is being opened up under the supervision of R. Crowe-Swords, of Vancouver.

Doratha Morton (Hercules C.M.S. & P. Corp., Ltd.).

The old *Doratha Morton* property has been acquired and is being reopened by the Hercules Consolidated Mining, Smelting, and Power Corporation, Limited. This corporation was organized in 1897 with an authorized capital of 10,000,000 shares of $1 par value, of which approximately 2,300,000 shares were issued. The registered and transfer office is 618–19 Vancouver Block, Vancouver. The *Doratha Morton* property consists of ten Crown-granted mineral claims and a mill-site on the beach at Fanny bay in Phillips arm. The present company staked an additional twenty-four claims north-east of and adjoining the Crown grants. The property was operated in 1898–99, when 10,000 tons of ore was cyanided, yielding 4,434 oz. gold and 10,000 oz. silver. The present company has reconditioned the old camp, repaired the old trail, and is now putting up a large building on the beach.

The general geological formation is similar to the *Enid-Julie;* i.e., a belt of altered sedimentaries and volcanics. The old workings consist of three tunnels, and later another level, the No. 5, was started east of No. 1 level, and 120 feet vertically lower, to explore the vein east of the fault. All the ore mined was taken out above No. 1 level. No. 3 level was driven 650 feet to the vein, with only 40 feet of drifting west and 50 feet east thereon. This level was intended as the main working-tunnel. It is now proposed to drift east in No. 1 level, clean out and drift east on No. 3 level towards the *Enid-Julie* ground. No. 5 level will be continued about 15 feet to the vein and drifting done on that level east of the fault. About twenty-five men will be employed early in 1934 under the supervision of R. Crowe-Swords.

Alexandria Gold Mines, Ltd. (formerly Alexandria Mining Co., Ltd.).

(*See* Bulletin No. 1, 1932.) This company was incorporated in Ontario in 1927 with a capitalization of 5,000,000 shares of $1 each, and acquired a controlling interest in the Alexandria Mining Company. The *Alexandria* group consists of seven Crown-granted claims situated on Phillips arm and an additional seven claims were later staked west of and adjoining the original group. Extensive development-work has been done, including four adit-tunnels, a 200-foot shaft from the beach tunnel, and drifts on two levels from the shaft. The property has been idle for several years until it was recently bonded by the Premier Gold Mining Company, Limited, which will start operations early in 1934, with M. Manning in charge at the property.

Thurlow Gold Mines, Ltd.

The property of this company, situated on the north-east end of Thurlow island, near Shoal bay, has been bonded by the Federal Gold Mines, Limited. This company was incorporated in September, 1933, with a capitalization of $1,500,000, divided into 1,500,000 shares. Registered office, 716 Hall Building, Vancouver. The property is probably in the same belt in the granodiorite as the *Alexandria* and *Enid-Julie*. Development-work includes a 100-foot tunnel and a 60-foot shaft, from which some drifting was done toward the tunnel. This latter work did not reach the ore-shoot. There is a promising ore-shoot in the tunnel and the vein can be traced down the hill to the beach.

The *Douglas Pine* group, just south of Shoal bay, is under option to Vancouver interests, who did some prospecting on it this season.

Blue Bells.

This group of three Crown-granted claims, situated on Frederick arm, about 1½ miles from the beach, has had some work done on it in 1933 by Vancouver interests. There is an immense quartz-exposure on this property on which several hundred feet of underground work has been done, without apparently finding sufficient values to encourage further development at that time.

Hayden Bay Gold Mines, Ltd.

This company was incorporated in May, 1932, with a capitalization of 10,000 shares of no par value. The office is at 522 Seymour Street, Vancouver. The property consists of the two old Crown-granted claims, *Martle* and *Hayden Bay*, situated on Hayden bay, Loughborough inlet, and several claims located later by the company. The general rock formation is a dark diorite, traversed by tongues of granodiorite which extend from the main mass to the west, and which were later intruded by basic dykes. A quartz vein mineralized with pyrite and small amounts of chalcopyrite is associated with a pegmatite dyke, and subsequent work on the beach shows it to continue for 25 to 30 feet, where a later dyke has offset it to the right. It was again picked up farther inland and drifted on, producing a small tonnage of ore. The sulphides carry values up to 1.50 oz. gold per ton in the sorted ore. The tunnel at the beach has been driven nearly 200 feet, producing probably 100 tons of 1 to 1.25 oz. gold ore, now stored in a bunker ready for loading. The vein is up to 2 feet in width and if found to be continuous would make a profitable small operation.

Late in 1933 the possible continuation of the vein was found up the hill in two old open-cuts at elevations of 250 and 325 feet respectively, and in an old tunnel at 1,250 feet elevation, all on the strike of, and presumably the extension of, the beach vein. The tunnel had been driven about 40 feet and from a point 35 feet down the 50-foot winze sunk at the face a short drift was driven into the hill. The vein at the top of the winze in the back of the tunnel is about 4½ feet wide. It is composed of 12 inches of slightly pyritized watery quartz assaying a trace in gold on the foot-wall side, 14 inches of ribbon-quartz, showing pyrite on the seams, assaying 0.4 oz. gold per ton, with 26 inches of slightly mineralized grey watery quartz assaying 0.1 oz. gold per ton on the hanging-wall side. Examination of the winze was prevented by the condition of the timbering. Good depth on the vein could be gained in a short distance by extending the tunnel. The vein can be traced up the hill for some distance.

An air-line was laid from the compressor on the beach to the first open-cut and drifting started on an encouraging-looking vein here associated with pegmatite. It may be possible that the higher ground at this working will show fewer intrusions and consequently a more continuous vein-structure and ore-shoots. The property is well equipped with compressor, mining outfit, and camps on the beach. Its ideal location and the grade of ore, when found, makes it a rather attractive prospect.

Texada Island and Lasqueti Island Section.

This is an old gold-bearing area in which some interest is again being taken.

Gem Gold Mines, Ltd. (B.C. Gold Mines, Ltd.).

This company was incorporated in September, 1933, with a capitalization of $2,000,000, divided into 2,000,000 shares. The registered office is 955 Thurlow Street, Vancouver. The property consists of five Crown-granted claims and was formerly known as the *Nutcracker* group. The general rock formation is volcanics, predominantly augite porphyrite containing quartz veins mineralized with pyrite, pyrrhotite, chalcopyrite, and galena. These veins typically carry low gold values, but in places bonanza pockets of free gold have been found. Such a pocket was mined from this property about 50 feet south of the working-shaft. There are a series of veins in this formation striking north-east, north-west, and north-south; the vein on this property on which work has been done strikes N. 35° E. to N. 60° E. and dips slightly to the east. A shaft has been sunk 150 feet, from which three levels have been run at 50, 100, and 150 feet. The 50-foot level was driven south to intersect a north-south vein, but no values were found in it. The 100-foot level has been driven over 100 feet on the vein, but the short 150-foot level is not on the vein. Considerable ore was taken out of the high-grade pocket, which extends from the surface down to near the 50-foot level. The property is equipped with hoist, compressor, small mill, and camp.

It has not been operated for several years until 1933, when the underground workings were dewatered and some prospecting done on the 100-foot level. The encouraging values found in places probably warrant considerable exploration-work. The values are found in the vicinity of an open fissure filled with loose material, from the fines of which fine free gold can be panned. The vein cuts this fissure. A 35-foot drift to the east on this fissure shows the same conditions and another 10-foot drift west exposes similar material. The same fissure appears on the 50-foot level, but here the material gives smaller gold values when panned. The fault is not post-mineral, as there has been no lateral movement to displace the vein. The fine gold may therefore have been brought from the surface, as gold can be panned there in several places. Close prospecting of the surface should be done. Crosscutting should also be done on the 150-foot level to pick up the vein, after which some drifting should be done on it. No appreciable depth has been obtained on any of these gold-bearing quartz veins and later work might warrant diamond-drilling.

Bush Claims.—O. B. Bush has continued development-work on his claims, which extend inland from Davis bay on the west coast of Texada island. He states that the results have been encouraging.

Pacific Gold Mines, Ltd. (Venus Group).

This company is a reorganization of the Pacific Red Cedar Products, Limited. It is capitalized at $1,000,000, divided into 1,000,000 shares of $1 par value. Registered office, 909 Stock Exchange Building, Vancouver. The company took an option on the *Venus* group, owned by the Lasco Development Company, and the adjoining *Juneau* group, owned by Khurtzhals Bros., of False Bay. The properties are on the north end of Lasqueti island and reached from False Bay. (*See* Bulletin No. 1, 1932, Lasqueti Mining Company.) The company operated in 1932 and part of 1933, continuing the main tunnel over 500 feet, not all on the vein. The results did not meet expectations and work ceased. The company's operations were under the direction of I. Rosenthal.

Tatlayoko Lake Section.

This section, at the headwaters of the Homathko river, which empties into the head of Bute inlet, was given some attention during 1933 and several groups of claims were staked. Samples brought out from the different properties show arsenopyrite carrying promising gold values. The area is reached from Hanceville by auto-road to Chilko lake.

VANCOUVER MINING DIVISION.

This Division includes the drainage areas of Jervis and Burrard inlets and Howe sound, and extends up the Pacific Great Eastern Railway to Alta lake, on the summit of the Coast range. It therefore lies wholly within the Coast Range granodiorite batholith, which contains belts of mineral-bearing, metamorphosed sedimentaries and volcanics. The *Britannia* mine on Howe sound, one of the great copper-producing properties in Canada, exemplifies the potentialities of these belts.

Mineral claims were staked in 1933, mainly in the areas near Britain river, Halfmoon bay, McNab creek, Howe sound, and Ashlu creek, a tributary of the Squamish river.

References.—*Astra* and *Doffofy*, 1930; *Belle*, 1931; *Blue Jack*, 1927–30, and Bulletin No. 1, 1932; Bowena Copper Mines, Limited, 1929; *Brandywine*, 1927, and Bulletin No. 1, 1932; Britain River Mining Company, Limited, 1928; *Bulliondale*, 1931; *Fitzsimmons*, 1928; *Golden Coin*, 1932, and Bulletin No. 1, 1932; *London*, 1930; *McVicar, Manson, and Tocher*, 1929–30; Mount Diadem Mines, Limited, 1931; Pacific Copper Mines, Limited, 1931; Radiant Copper Company, Limited, 1928–29.

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 of $25 each. It is a subsidiary of the Howe Sound Mining Company, Limited, capitalized for 600,000 shares of no par value. The *Britannia* holdings consist of 25,000 acres of mineral claims situated on the east side of Howe sound, contiguous to Furry creek. Throughout 1933 the company has operated on a curtailed basis with the object of giving employees sufficient work to keep them and keep the organization intact as far as possible. Ore was mined almost entirely from the *East Bluff* mine, where the gold content is better and the zinc content is sufficient to warrant a zinc separation. High-grade zinc concentrates containing 54 per cent. zinc were shipped from the *Britannia* for the first time. These shipments could not be made under normal production conditions, as the general run-of-mine ore would not contain enough zinc to make the separation worth while.

Up to mid-year about 400 men were employed, at which time it was decided to increase the concentrator tonnage and other parts of the mine were put into operation, resulting in an additional 116 men being employed. These are segregated into 328 at the mine, surface and underground, 64 in the mill, and the remainder in surface shops, stores, and staff.

Underground work totalled 5,598 feet and 184 feet of diamond-drilling. There were 622,718 tons of ore milled (compared to a tonnage of 1,920,339 in 1929), from which about 8,000,000 lb. copper (including precipitates), 12,819 oz. gold, and 42,799 oz. silver were recovered. The pyrite-concentrate production amounted to 16,629 short tons and the zinc-concentrate production was 7,865 short tons of 54 per cent. zinc content.

The company in 1933 examined properties in several of the gold-bearing areas in the Province, though no major plan of development was carried out.

PACIFIC GREAT EASTERN RAILWAY SECTION.

The mining-work done in this section during 1933 was confined to the activities of individual owners working on their own claims. It is understood that further work was done on the *Golden Coin* property on Ashlu creek. A trip into the Brandywine River area in 1933 was planned, but lack of time prevented it being made. New finds were made and encouraging results reported on the older properties.

NEW WESTMINSTER MINING DIVISION.

This Division comprises the drainage area of the Fraser river to within a few miles of Hope. On the south side of the river it extends to the International boundary, and on the north side it takes in the Pitt, Stave, and Harrison Lake areas.

Prospecting throughout this Division was more active in 1933 than for many years and about 375 claims were recorded. The Fire Mountain area; around Lillooet lake, Pierce mountain; and around Harrison lake have had the most attention. It has been reported that the "Lost mine" in the Pitt River country has been discovered and preparations are being made to thoroughly investigate it early in 1934.

Interest was revived in the Boundary Bay area, where several holes have been put down in times past in an endeavour to get oil. Companies are now being financed for the purpose of drilling for natural gas. The last hole drilled showed a commercial volume of natural gas above the 2,300-foot mark, but this hole has filled with sand, water, and debris and is useless. An extensive area has been acquired and the foundations are now in for derricks and drilling will be undertaken as soon as possible. Such enterprises open up possibilities not only for the domestic use of the gas, which has much higher heating qualities than the manufactured gas, but it is well known that manufactories follow the gas-fields for cheap fuel. The field location, 8 miles from New Westminster and 20 miles from Vancouver, is surely an ideal one.

References.—*Barkoola*, 1930; *Blue Lead*, 1930; *Cox* claims, 1928; *Dandy* (*Mayflower*), 1930; *Empress*, 1931; *Faith* (Silver Chief Mining Company, Limited), 1923–30; Harrison Gold Mining and Development Company, Limited, Bulletin No. 1, 1932; *Lucky Four*, 1931; *Money Spinner*, 1930; *Mountain Goat*, Bulletin No. 1, 1932; Pitt Mining Company, 1930; Sleese Creek Mining and Development Company, 1929; *Wissota* and *Zenith*, 1929.

LILLOOET MINING DIVISION.

This Division includes the drainage areas of Lillooet lake and that portion of Lillooet river flowing into the lake; Birkenhead river; Anderson and Seton lakes; Cayoosh creek; and Bridge river. It is traversed by the Pacific Great Eastern Railway. Since 1932 it has been included in Mineral Survey District No. 6. Before 1932 it was a part of the Central Mineral Survey District No. 3.

The area has been brought into prominence during the past three years because of the outstanding development of the Bridge River area. The year 1933 has been one of intense mining activity in prospecting, development, and production. In 1932, when 640 mineral claims were recorded, it was considered a remarkable showing, but the 1933 record of 4,303 claims staked and recorded is certainly remarkable. In 1932, certificates of work (indicating the assessment-work completed and recorded) were issued on 502 properties, but this was more than doubled in 1933, when 1,193 such certificates were issued. These figures are probably records never before reached in any Mining Division in the Province. About forty companies operated in the Division during 1933, besides the hundreds of individuals who worked their own claims. Well over a thousand men were engaged in actual mining operations and at least an additional five hundred men were prospecting and staking in the hills.

References.—The following list gives the names of all the claims, groups, and companies reported in the Annual Reports since 1916, together with the date of the issue in which the report is contained: *Alpha* (now Minto Gold Mines, Limited), 1930, and Bulletin No. 1, 1932; Anderson Lake Mining and Milling Company, Limited (now National Gold Mines, Limited), Bulletin No. 1, 1932; *Arlo*, 1918; B.C. Alluvials, 1927; Cayoosh creek (Enterprise Mining Partnership), 1927; *Cinnibar King*, 1931; *Copper Bear*, 1927–28; *Copper Mount*, 1929–30; *Copper Mountain*, 1917–18; *Copper Plate*, 1918; Copper Queen Mining and Smelting Company, Limited, 1916–28; *Coronation*, 1923–25–27; *Countless*, 1923; *Crown*, 1923–25; *Eureka*, 1928; *Eva* (*Moffatt*), 1918–23–25–26; *Forty Thieves* (now Bridge River Consolidated), 1916; *Gold King*, 1923–27–30, and Bulletin No. 1, 1932; *Griswold*, 1929–30; *Index*, 1916; *Iron Ridge*, 1924; *Li-li-kel*, 1923–25–27; *Lorne* (*Bralorne*), 1916–18–23 to 31, and Bulletin No. 1, 1932; Lower Bridge River Placers, 1931; *Lucky Jem*, 1924–31, and Bulletin No. 1, 1932; *Marion*, 1927–29; *Moffatt* (*Eva*), 1923; McGillivray Gold Mines, Limited, 1929; *Native Son*, 1924–25; Nobb's placer claim, 1922; *Paymaster*, 1930; P.E. Gold Mines, Limited, 1929; *Pioneer*, 1916–18–22 to 31, and Bulletin No. 1, 1932; *Regal*, 1918; *Shulap*, 1925–26; *Silver Bell*, 1923–25–26; *Thelma Maud*, 1918; *Tyaughton*, 1927; Universal Mining and Milling Company, Limited, 1925; *Wayside*, 1927.

Pemberton Section.

Sunrise-Morris. This group of four claims—*Sunrise*, *Morris*, *Black Diamond*, and *Big Four*—is owned by Messrs. Pendergast and Maroni, of Pemberton. The claims are situated on the Pacific Great Eastern Railway about 1½ miles east of Pemberton. There are a number of more recently staked claims adjoining, but the work has been done on these four.

The general formation here is andesite or greenstone with beds of argillaceous shales (probably corresponding with the Cadwallader series of Bridge river), intruded by tongues and masses of granodiorite.

On the *Sunrise-Morris* claim, at an elevation of 2,250 feet, which is about 1,500 feet above the railway, an open-cut 15 feet in length, continued as a tunnel a further 15 feet, has been driven, following a vein of brecciated quartz and country-rock which fills a shearing in the greenstone near its contact with granodiorite. The vein strikes N. 50° W. (mag.), dips west at about 75°, and is from 5 to 10 feet in width. The quartz carries a little pyrite, but only very low values have been found so far. About 750 feet west of this, an open-cut exposed another quartz vein with about the same strike, but here there is no mineralization and no values. Just below this open-cut some stripping and an open-cut shows a strong vein striking north-south

(mag.) and dipping slightly west. About 40 to 50 feet of the vein has been exposed along the hanging-wall, and the showing of a few inches of ribbon-quartz, when sampled and assayed, returned only low gold values. The balance of the vein is a watery-looking quartz with an occasional crystal of pyrite. The hanging-wall is solid, massive greenstone. East of these showings, and also on the *Sunrise-Morris* claim, are two more veins, one striking N. 40° E. (mag.) about at right angles to the first vein described above, and another striking N. 30° W. Surface values on these veins are also low.

Eureka. This claim, owned by John K. MacKenzie, 305 Heatley Avenue, Vancouver, is situated on the Pacific Great Eastern Railway about 2 miles from Pemberton. Some open-cutting on the north side of the railway-track has exposed a quartz vein, up to a foot in width, in a highly contorted belt of argillite. The vein strikes N. 40° W. and dips east about 80°. The mineralization consists of patches of iron sulphides with some galena. The open-cuts are almost filled in, but a sample taken from three or four places where the vein is exposed gave only low values.

Birkenhead River and Lake Section.

There is an old mining area at the head of Tenquille creek, a tributary of Birkenhead river, the history of which dates back to 1916. It was for several years reached by trail from Pemberton Meadows, but now there is a fair horse-trail, 14 miles long, from the mouth of the Birkenhead river (Mile 72 on the Pacific Great Eastern Railway) to the head of the creek. For the geology of this area the reader is referred to the information given in the Geological Survey of Canada Summary Report, 1924, Part A, "Pemberton Area," by C. E. Cairnes.

During 1933 some 200 claims were staked around Birkenhead lake and tributary creeks and on Blackwater creek. This area is reached from D'Arcy, on the Pacific Great Eastern Railway, over 5 miles of logging-road which was continued as a trail to Birkenhead lake. A branch trail was built in 1933 up Phelix creek to the divide west of that promising area. Reports and ore samples indicate promising quartz veins with encouraging values. This will very probably be a busy area in 1934.

Li-li-kel. This old group of eight claims, situated at the head of Tenquille creek, had an extensive amount of underground work done on them up to 1927. The showings consist of narrow quartz veins in two series of shears within the massive greenstone country-rock. The veins in places carry high silver values, but have not shown sufficient continuity to constitute commercial ore-bodies. The property was idle from 1927 to 1933, when Geo. Moffatt, an old prospector in the area, acquired it. The trail was put in good repair and exploratory work continued.

Anderson Lake Section.

This area is reached from McGillivray Lodge, on the Pacific Great Eastern Railway, by a good horse-trail which extends up McGillivray creek to the summit, where it connects with the trail up Cadwallader creek from the *Pioneer* mine. It is about 26 miles from McGillivray Lodge to the *Pioneer* by this route over a summit of 6,000 feet elevation. To meet the development of this section will necessitate a truck-road from the railway up the valley, eventually to the summit and probably down Cadwallader creek.

National Gold Mines, Ltd. This company was incorporated in December, 1932, with a capitalization of $1,500,000, divided into 1,500,000 shares of $1 par value. Its registered office is at 901 Vancouver Block, Vancouver. The holdings of the company consist of the *National* group of six mineral claims, situated at the head of the West fork of McGillivray creek about 7 miles from the railway, and five mineral claims that include the old Anderson Lake Mining and Milling Company's property. The latter group is the one under development and it is situated 3 miles up the trail from the railway, at about 3,500 feet elevation.

The general rock formation is a dark argillaceous sedimentary situated to the south of a massive intrusion of granodiorite. The ore occurs in a strong quartz vein which occupies a shearing in the argillite. The vein varies in width up to 20 feet and will probably average 7 feet. The mineralization consists of iron pyrites, which generally carries low associated gold values, but sampling by the management has shown widths up to 6 feet assaying 5 oz. gold per ton. The sampling of the No. 3 tunnel by the management gave an average width of 6 feet assaying 0.395 oz. gold per ton over an ore-shoot length of 400 feet.

The old workings consisted of three tunnels and extensive surface-trenching. The upper or No. 1 tunnel at 3,850 feet elevation is nearly 300 feet long and from it the vein was stoped through to the surface; the No. 2 tunnel, over 600 feet long, is caved at 300 feet from the portal, and from this level the vein was stoped through in one place to No. 1 tunnel. The No. 3 level was in about 150 feet when work was resumed on the property in 1933. This level has been continued to the fault at 400 feet from the portal, and considerable work has been done beyond the fault. Several hundred feet of exploratory work was also done on veins breaking away from the main vein, but this lateral work indicates that so far the values, other than in the main vein, are too low to be profitable.

The company realizes that ample tonnage is necessary and that a large milling capacity is required to make the property a substantial producer, and to that end a 200-ton mill has been purchased.

The work has been carried out under the capable supervision of Tom Brett, one of the original owners. Good camps and first-class mining equipment for development-work has been provided, including a water-power-driven compressor, steel-sharpener, etc.

Canadian-Rand Gold Mines, Ltd.

This company was organized in November, 1933, with a capitalization of $2,000,000, divided into 4,000,000 shares. The registered office is 6th Floor, Royal Trust Building, 626 Pender Street West, Vancouver. The holdings of the company consist of the *Diorite*, *McGillivray*, and *Anderson Lake* groups on McGillivray creek. The *Diorite* group of nine claims is on the north side of McGillivray creek opposite the West fork. The showings consist of two quartz veins in a massive diorite intrusion at an elevation of 4,650 feet. The smaller vein of white quartz is about 2 feet wide and it shows little or no mineralization, striking N. 10°–15° W. (mag.). About 100 feet east of the small vein the larger vein is exposed by an open-cut which shows it to be about 14 feet in width, with a 2-foot inclusion of greenish schist. This vein also strikes N. 10°–15° W. and dips 75° W. The vein-filling is quartz, with minor amounts of calcite; it is very sparsely mineralized and shows a green stain, probably copper. The vein-walls are diorite, schisted for a width of a few feet on each wall. Two sectional samples across the vein showed only a trace of gold each. There is no information available as to work done on *McGill* groups.

Bridge Island Golds, Ltd.

This company was incorporated in May, 1933, with a capitalization of 4,000,000 shares of no par value. The registered office is at 209, 678 Howe Street, Vancouver. The company's property includes the *Coulter* group on Coulter creek, Island mountain, Cariboo, and the *Sesame* group of nine claims, *Sesame Nos. 1* to *9*, on the North fork of McGillivray creek. This latter group was acquired from the Sesame Mining Company, Limited, 678 Howe Street, Vancouver, incorporated in May, 1933, with a capitalization of $25,000, divided into 25,000 shares. There is no information available as to any work having been done on the *Sesame* group.

Gold Star Mines, Ltd.—Incorporated in July, 1933, with a capitalization of 1,000,000 shares of no par value, this company has its registered office at 470 Granville Street, Vancouver. The property includes several groups of mineral claims on the north side of the Pacific Great Eastern Railway, near D'Arcy.

Gold Hill.

This group of fifteen claims and mill-site is situated just below the South fork of McGillivray creek, on the south side of the main creek. The general formation is composed of sedimentary rocks which occur west of the diorite-mass extending across the creek from the *Diorite* group. The showing on which the work has been concentrated is on the *Winner*, the most easterly claim on the creek. At 4,660 feet elevation, where an open-cut exposed a width of 36 feet of quartz slightly mineralized with pyrite, an assay gave 0.12 oz. gold per ton. The vein strikes N. 35° W. (mag.) with the bedding of the argillite. Above this the vein apparently splits into two or three veins and these can be traced to the top of the mountain. An open-cut picked up the vein over a hundred feet down the hill, and a tunnel was started another hundred feet below this on the strike of the vein. Unfortunately the vein bends to the west and the tunnel was driven 110 feet without results. A crosscut was driven to the east for 20 feet and another crosscut was driven west 120 feet before the vein was found. Work was stopped for the winter at this point, but will be continued in 1934 as soon as snow conditions permit. Drifting on the vein should prove whether or not it has commercial possibilities. The work at the property was under the supervision of Howard Sutherland.

Star Mining Syndicate.—Noel Humphreys and associates, of Vancouver, have been developing the *Star* group, situated at the head of the North fork of McGillivray creek. No information is available as to results.

Whitecap Creek Area.

This is a new area in which a number of groups of mineral claims were staked in 1933. It is reached by trail up Whitecap creek from Seton Station on the Pacific Great Eastern Railway, a distance of about 8 miles.

Richstrike Gold Mines, Ltd.

This company was incorporated in June, 1933, with a capitalization of 2,000,000 shares of no par value. The registered office is 475 Howe Street, Vancouver. The company's holdings consist of six groups of mineral claims—*Star* group of six claims, *Geona* group of six claims, *Bonanza* group of six claims, *Peak* group of six claims, *Douglas* group of six claims, and the *Gold Diggers* group of six claims, a total of thirty-six claims—situated about 8 miles up Whitecap creek from Seton Station on the Pacific Great Eastern Railway.

The rock formation is described as a massive intrusion of diorite or greenstone into the Bridge River series, within which there is a stock of light-grey, siliceous rock, containing a series of parallel quartz veins varying in width from 1 to 4½ feet. The mineralization consists of pyrite, arsenopyrite, and stibnite. Surface values range from a trace to 0.26 oz. gold per ton. During 1933 the old trail was improved, camps were erected to accommodate twelve men, and a crosscut tunnel driven over 200 feet, toward cutting the vein exposed on the surface. The No. 3 vein, the most promising on the surface, should be intersected at 400 feet depth about 500 feet from the crosscut portal. Some surface prospecting has also been done down along the veins.

Cayoosh Creek Section.

This is an old mining area reached from Craig Lodge, at the foot of Seton lake, by a good, though narrow, auto-road 10 miles long up the creek to the old *Golden Cache* mine. Cayoosh creek was a prolific placer-gold producer in the early days, with an estimated output of about $200,000. Several later attempts to reach bed-rock above the falls were unsuccessful and individual efforts at placer-mining in the past two or three years have not been encouraging.

Bonanza-Cache Gold Mines, Ltd.

This company (formerly the Cache-Bonanza Gold Mines, Limited) has its registered office at 827 Vancouver Block, Vancouver. The company acquired the old *Golden Cache* and *Bonanza* groups, situated about 10 miles up Cayoosh creek. The Golden Cache Mines Company owned the *Golden Eagle* group of five claims. The *Bonanza* group, on the opposite or west side of the creek, contains six claims staked in 1887, the year after placer gold was discovered by the Chinese in Cayoosh creek. Prospectors looking for the source of the placer gold found a large boulder of ore on the creek-bank, which they broke up by heating and pouring water on it, and found free gold in it. The vein was found on the mountain-side above and the *Bonanza* group staked.

Arthur Noel, now interested in the Bonanza-Cache Gold Mines, Limited, was one of the original owners of the *Golden Cache* and manager of the property in 1895–96–97, when it was equipped with a stamp-mill. Spectacular gold specimens were found, but apparently the average ore was milling-grade.

During 1933 the road was repaired and at the upper end a new bridge was built across Cayoosh creek. The old *Golden Cache* camp was reconditioned and some work done on the *Bonanza* group. A 40-foot tunnel was driven on a vein and a working crosscut tunnel started at the road. This crosscut will cut a series of parallel veins in a length of about 1,000 feet and will attain a depth of about 450 feet under the main vein on the ridge. It is proposed to crosscut the vein series and drift on the main vein when it is encountered because of the great depth which can be gained in a comparatively short distance. The work was stopped for the winter, but a compressor is to be installed as soon as possible in 1934 to hasten underground development.

Fraser River Section.

The only portion of the Fraser river in this district is from Foster Bar creek, about halfway between Lytton and Lillooet, to Kelly creek, a short distance from Moran, on the Pacific Great Eastern Railway. During 1933 the usual number of individuals placer-mined along the river-banks by means of rockers, long-toms, and shovelling into sluice-boxes.

It is understood that a flume is being built to take water from Texas creek, about 9 miles below Lillooet, on the west side of the river, for hydraulicking operations on benches below.

Baird Leases. These leases, covering the benches on the east side of the Fraser river opposite Lillooet, were acquired in 1933 by a Vancouver syndicate headed by W. A. Wells, 525 Standard Bank Building, Vancouver. A plant was installed and operated under the able supervision of F. Hilton. The ground was tested by sinking pits, which showed from 2 to 4 feet of top soil, below which were varying depths of Fraser River sand and gravels, under which, along this particular portion of the Fraser, may be found old channels of Bridge River deposits deposited when the Fraser River bed was in places several hundred feet higher than at present. It is stated that the Bridge River gravels are readily distinguished from those of the Fraser river, the former giving a white milky wash when sluiced and the latter a dark muddy wash. The Fraser gravels carry from 3 to 10 cents per cubic yard and the Bridge River sands and gravels from 20 to 60 cents per cubic yard. Test-pits across the bench for a width of 500 feet gave an average of 30 cents per yard for a depth of 15 feet.

A pumping plant and sluice-boxes were installed in 1933 with a capacity of 1,000 yards in twelve hours. This capacity could be increased and the operating cost greatly lowered by increasing the size of the sluices and providing more water, so that no boulders would have to be hand-handled. A 400-horse-power gasoline-engine was installed; 100 horse-power of this is utilized for pumping 3,000 gallons per minute from the river. Only one 3-inch stream of water is needed for breaking down the gravel-bank, the balance of the water carrying the gravel to and through the sluices. The sluice-box is 20 inches wide, set on a 10-per-cent. grade. The head-boxes are riffled lengthwise with steel rails and the next ten to twelve boxes are cross-riffled with steel rail. Under each of the cross-riffled boxes is an undercurrent box with a test-box in every second undercurrent. The face of the pit showed a depth of 30 feet of gravel underlain by a bed of hard sand which was used as a bed-rock to wash to.

Present operating methods would require 10 to 12 cents per yard gravel to break even, but increased water and flume capacity would cut operating costs much lower.

Mr. Hilton has designed and erected a Wilfley table with a cast-aluminium top for the treatment of the undercurrent product. The table is fitted with an amalgamator consisting of the usual copper plate, but with 1-inch copper tubing a few inches apart on the plate and across the flow. The drop of the fine gold over the tubes and the back-eddying greatly increased the efficiency for amalgamation. By an ingenious arrangement of the springs carrying the table a variety of motions can be given as best suited to the feed. A piece of gold placed at the lower edge of the head of the table crawls up the grade to the top edge of the foot of the table.

It is understood that the 1933 operation, while only moderately productive, furnished sufficient data to justify further work in 1934 on a large scale. The plant was moved to the Lillooet side and operated the latter part of the season.

Bridge River Section.

This section, occupying the drainage area of Bridge river, has a width (east-west) of about 70 miles and a length of approximately 40 miles. It is reached by good auto-road from Shalalth, a station on the Pacific Great Eastern Railway, to the *Pioneer* mine, a distance of 55 miles. There is an excellent auto-passenger service from Shalalth or Bridge River Station, as well as aeroplane service from Vancouver to Shalalth. The Pacific Great Eastern Railway operates a gas-car from Lillooet or Craig Lodge for transportation of automobiles to Shalalth, thus making it possible to drive from Vancouver to the *Pioneer* mine. The Bridge River road, which was only a road a year ago, now has every accommodation in the way of hotels, gas-stations, restaurants, etc. Over 10,000 tons of freight were trucked over the road in 1933 and the increasing traffic necessitated extensive expenditures for improvements, funds for which were furnished by the Mines Department.

The Government Sub-mining Recorder's office, ably administered by Wm. Haylmore, is conveniently located at Haylmore, on Hurley creek. The records show that approximately 4,000 mineral claims were located during 1933, but it must be admitted that, on a high percentage of them, the outstanding features are the location-posts.

Over thirty companies were operating in 1933 and there is no doubt that the majority of companies and operators were honestly endeavouring to find and develop something worth while.

The encouragement, as mentioned, of finding commercial ore-bodies outside of the diorite is an incentive to close prospecting and opens up a wide field for investigation. The main Bridge river and its South branch, the Hurley river, rise in the Coast range, and, flowing east, traverse the wide contact-belt bordering the granodiorite range, which is one of the greatest potential mineral-belts in the Province. East of this, the now famous augite-diorite belt, containing gold-bearing quartz veins, has been traced from near the head of Cadwallader creek for about 24 miles in a north-westerly direction to and across Gun creek, north of Gun lake. Outcrops have also been found in McGillivray Creek valley and west of the lower end of Anderson lake, making these areas promising for prospecting. North of Gun lake the outlining of a large area of diorite gives this section of country outstanding possibilities. Earlier work demonstrated the occurrence of high-grade gold-bearing quartz veins in the diorite, generally associated with albitite dykes, and the development of the *Pioneer* and *Coronation* ground first brought the area into prominence. Since then the extension of the *Pioneer* vein both laterally and to depth, the remarkable development of the *Bralorne*, and the very encouraging results on the *Wayside* and *B.R.X.* properties have greatly enhanced the possibilities of the belt. It is now staked solidly and practically every property is being investigated.

On either side of the intrusive diorite, and roughly paralleling it, are belts of the older formations—the Cadwallader series, the serpentines or Shulaps volcanics, and the Bridge River series. In 1933 there was a large amount of exploratory work off the diorite and there has been much favourable speculation by the holders of bordering ground as to the extension of the veins from the diorite into adjoining formations, and also as to the dip of the diorite into their properties at depth.

So far as the vein extensions are concerned, it is a safe conclusion that where the veins extend to the serpentines and sedimentaries they (the veins) break up and disappear, but where they extend to the diorite-greenstone contact it is reasonable to expect that the fissuring, veins, and values continue in the equally compact and homogeneous greenstone, as has been demonstrated in the eastern extension of the *Pioneer* vein.

The massive greenstone intrusions in the Bridge River formation should be favourable formation for fissuring and shearing and resultant ore-bodies, as evidenced in the development on the *Minto*, and promising indications on other properties. Surface values off the belt are typically low, but small lenses of high-grade ore have been found, and it remains to be seen whether increased depth will show improvement in average values.

Properties on the Diorite as known.

Red Hawk Gold Mines, Ltd.

(*See* 1932 Annual Report.) This company was incorporated in December, 1932, with a capitalization of $1,000,000, divided into 2,000,000 shares of 50 cents par value. The registered office is at 712 Stock Exchange Building, Vancouver. The company acquired the *Red Hawk* group of nine claims—*Red Hawk Nos. 1* to *9*, inclusive—from the original owners, Malcolm McKenzie, Harry Kerr, and Joe Marron. The claims are situated about 6 miles south of the *Pioneer*, on the west side of Cadwallader creek.

Considerable work was done on the property in 1932, mainly in surface prospecting. In 1933, on engineers' advice, a crosscut tunnel was started south in the sedimentary formation to obtain depth on a shearing in the diorite-mass above. This shearing has been traced through this property and the adjoining property on the north-west. It is estimated to be 600 feet to the objective, of which over 500 feet of crosscut tunnel has now been driven. The work is in charge of Malcolm McKenzie.

Pacific Eastern Gold, Ltd. (Dan Tucker, Plutus, and Pioneer Extension Mines, Ltd.).

This company was incorporated in November, 1933, with a capitalization of 5,000,000 shares of no par value. The registered office is at 508 Pacific Building, Vancouver. The holdings of the company consist of the Dan Tucker, Limited, property of twenty-seven claims; the Plutus, Limited, property of twelve claims; and the P.E. Gold Mines, Limited, property of thirty-seven claims; all adjoining and situated east of the *Pioneer* property. Further exploratory work was done on the *Dan Tucker* on the shearing in the diorite as described in the 1932 Report. A thorough investigation was carried out on the *P.E.* ground during the summer, necessitating a considerable amount of surface work.

Pioneer Gold Mines, Ltd.

(*See* 1932 Annual Report.) This company was incorporated in March, 1928, with a capitalization of $2,500,000, divided into shares of $1 par value. The registered office is at Rogers Building, Vancouver. The holdings consist of eighteen mineral claims and fractional claims situated on Cadwallader creek. The mine is 55 miles by good truck-road from Shalalth, on the Pacific Great Eastern Railway, on Seton lake.

The property has had not only a very successful operating year, but development-work has proved exceptionally satisfactory. During 1933 100,159 tons of ore was mined and milled, producing 82,519 oz. fine gold, valued with bonus at about $2,400,000, of which approximately $1,600,000 represents profits. The mill has been steadily treating over 300 tons per day.

The development on the lower levels, below the tenth level, on the main vein at the shaft has exposed fine ore-bodies. The bottom or fourteenth level is exceptionally promising. This development the management is inclined to believe may possibly represent the top of another ore-body, as no particularly high values have been found below the eighth level on this end of the mine until the showing on the fourteenth level was opened up. The tenth level has been extended over 3,000 feet in length, showing ore throughout this length, with the exception of two short lengths where the vein pinched. The mine on the east end has been opened now from the tenth level to the fifth. It is stated that the fifth level has developed an ore-body 400 feet long, 3 feet wide, and averaging 6.25 oz. gold per ton. This east ore-body is proving a remarkable deposit. The company's unexplored ground extends half a mile farther east. It has been announced that the shaft will be sunk another 500 feet during 1933.

Bralorne Mines, Ltd.

(*See* 1932 Annual Report.) This company, incorporated in April, 1931, has a capitalization of 1,000,000 shares of no par value. The registered office is at 555 Burrard Street, Vancouver. The company's holdings consist of fifty-nine claims situated on Cadwallader creek, a tributary of Hurley river (the South fork of Bridge river). Early in January, 1934, the property was divided, twenty-six of the claims being transferred to the Bradian Mines, Limited, the balance being retained by the Bralorne Mines, Limited. The *Bradian* was incorporated with a capitalization of $2,000,000, divided into 2,000,000 shares, of which the *Bralorne* owns 1,200,000 shares outright. Four hundred thousand shares have been offered to the shareholders of *Bralorne*, each shareholder being entitled to two shares of *Bradian* at $1 per share for every five shares held in the *Bralorne*. This gives an available fund of $400,000 for the development of the *Bradian* property.

The year 1933 was an exceedingly favourable and important one for the Bralorne Company, for the reason that the mine was made. A year ago it looked doubtful as to whether the mill could be kept running, because the ore-bodies in the *King* vein east of the fault were being depleted and other ore-shoots in other parts of the mine were not very encouraging. West of the No. 1 fault some fine ore-bodies of milling-ore up to 50 feet in width have been developed on four levels and three or four years' ore reserves created for the present milling capacity of approximately 225 tons per day. Some 6,000 feet of development-work was done in 1933 on Nos. 6, 7, 8, and 10 levels west of the No. 1 fault, mainly developing the *King* vein. The "turntable" or "C" vein showing on the old No. 4 level has been developed, with remarkable results on No. 6 and No. 8 levels. This development shows bonanza ore in places and will supply substantial tonnage of good milling-grade ore in steady production.

The *King* vein has been picked up west of the No. 2 fault, but to date has not been developed to any extent. Between No. 1 and No. 2 faults from the tenth level up has been proved a wonderful ore-carrying section. West of No. 2 fault the vein may be expected to be equally good. As depth is obtained between the faults the ore-shoots should lengthen, and work at depth in this section has exceptional possibilities.

Under an agreement with the Taylor (Bridge River) Mines, Limited, the *Bralorne* is driving a 700-foot crosscut on its eighth level to get into *Taylor* (Bridge River) ground at a depth of over 1,000 feet below the surface.

Taylor (Bridge River Mines, Ltd.).

This company was incorporated in June, 1933, with a capitalization of 3,000,000 shares of no par value. The registered office is at 1500 Royal Bank Building, Vancouver. The company's holdings comprise twenty-two claims and fractions north-east of and adjoining the west claims of the *Bralorne*. The ground covers an extensive outcropping of diorite, on which extensive

surface work, trenching, and stripping has disclosed similar conditions to the *Bralorne*. Quartz veins have been found, associated with albitite dykes, carrying low gold values on the surface.

The company has made an arrangement with the Bralorne Mines, Limited, under which *Bralorne* extends the crosscut on its No. 8 or working-level to the *Taylor* ground. It will require about 700 feet of crosscut to enter the *Taylor* ground at a depth of over 1,000 feet. Altogether it is an excellent arrangement as it provides for deep exploration of the *Taylor* ground at a minimum of cost. Up to the end of 1933 about 500 feet of crosscut had been driven. The property-line was crossed early in February, 1934, and it is expected that the "C" vein (north-south) of the *Bralorne* will be intersected in a few hundred feet.

Grull-Wihksne Gold Mines, Ltd.

This company was incorporated in June, 1933, with a capitalization of $2,500,000, divided into 2,500,000 shares of $1 par value. The registered office is at 1007 Royal Bank Building, Vancouver. The company's holdings consist of the *Grull* group of ten claims; the *Wihksne* group of five claims; the *Don* group of five claims; the *Golden Ribbon* and *Golden Queen Fractions;* the *Broatch* group of six claims, and the *Andy* and *Turret Fractions*. The property, with the exception of the *Brootch* group, is situated west of and adjoining the property of the Bralorne Mines, Limited. The claims have all been surveyed and application made for certificates of improvements.

Operations were started early in 1933, and under the supervision of E. J. Conway, M.E., much work has been done. A two-story, 24- by 40-foot cook and mess house, and a bunk-house with "dry," 20 by 60 feet, were erected. The camp is supplied with water through 650 feet of 2-inch pipe under a head of 65 feet. Mining equipment consists of blacksmith-shop; power-house, housing a 45-horse-power Petter-Diesel engine and a 220-cubic-foot belt-driven Gardiner-Denver compressor; steel-sharpener, etc.

Underground work was undertaken in the *Grull* tunnel and the *Alma* tunnel on the south side of Cadwallader creek. In the *Grull* tunnel the grade was lowered by taking up the floor of the tunnel for 155 feet from the portal, from which point the drift was advanced 110 feet on the vein, which varies from 1 to 3 feet in width. At this point the bearing of the tunnel was changed to a south-easterly direction to cut some quartz veins outcropping on the *Mother Lode Fraction*. At the end of 1933 this tunnel was in 650 feet from the portal.

The *Alma* tunnel was advanced from 30 feet to 120 feet on a quartz vein varying from 1 to 3 feet in width in diorite formation. A long trench below the dump exposes a width of 500 feet of diorite. Small quartz veins in the diorite make it worth future exploration. The *Alma* vein strikes north-south (mag.) and dips 73° E.

In order to establish the westward extension of the diorite-belt through the *Don* group from the *Taylor* (Bridge River) ground, diamond-drilling was utilized because of the heavy overburden. Four holes were put down, two of which reached diorite bed-rock, one at 103 feet depth and the other at 27 feet depth. At the site of the 27-foot hole a 2-compartment 80-foot shaft has been sunk into the diorite, from the bottom of which diamond-drilling will be conducted to prospect the width of the diorite. It is also proposed to diamond-drill from the *Grull* tunnel as well as on the *Alma* and *Millbank* claims on the opposite side of the river.

B.R.X. Gold Mines, Ltd.

(*See* 1932 Annual Report.) This company, organized in March, 1933, has a capitalization of $1,250,000, divided into 2,500,000 shares of 50 cents par value. The registered office is at 640 Pender Street West, Vancouver. It is a reorganization of the Bridge River Exploration Company, Limited, a private company incorporated in June, 1931. The company did a lot of development-work in 1933 in the No. 3 tunnel. A crosscut was driven over 900 feet to cut the *California* vein, on which several hundred feet of drifting was done. Quartz veins encountered in this work were also explored. The work on the *California* vein, while showing some improvement in values, was not particularly encouraging. It was therefore decided to put down a diamond-drill hole from a point about 900 feet from the portal of the tunnel on the hanging-wall side of the vein. This hole at 413 feet depth struck the vein hanging-wall and was in vein-matter to 423 feet. This distance across the vein on its dip of 50° to 55° N.E. gives a true vein-width of about 7 feet.

The vein-matter as shown in the diamond-drill core recovered is a siliceous rock with some quartz, showing free gold in places, the whole averaging about 0.80 oz. gold per ton. This is a very encouraging indication of commercial ore-bodies at that depth. It has been recommended that a vertical shaft be sunk from a point in the No. 3 crosscut tunnel to intersect the vein at a

depth of about 500 feet. From this point of vein intersection drifting both ways on the vein in *B.R.X.* ground will be started.

Bridge River Consolidated Mines, Ltd.

(*See* 1932 Annual Report.) This company was organized in September, 1928, with a capitalization of $3,000,000, divided into 3,000,000 shares of $1 par value. The registered office is at 410 Seymour Street, Vancouver. The property consists of the four Crown-granted claims—*Ural*, *Elephant*, *Forty Thieves*, and *Why Not*—and a number of adjoining claims, all situated along Hurley river and west of and adjoining the *B.R.X.* ground. Extensive underground work has been done mainly on the *Forty Thieves* and *Wayside* claims, by the company and the B.R.X. Company, who had an option on the property in 1932, but did not exercise it.

During 1933 the Consolidated Mining and Smelting Company bonded the property and they are now carrying out a comprehensive programme of diamond-drilling and underground work on the *Why Not* tunnel-level. About thirty men are employed, with C. A. Seaton in charge of the work.

Wayside Consolidated Gold Mines, Ltd.

(*See* 1932 Annual Report.) This company was organized in 1928 with a capitalization of $2,000,000, divided into 4,000,000 shares of 50 cents par value. The company's office is at 725 Howe Street, Vancouver. The company's holdings consist of twenty Crown-granted mineral claims situated on the west side of Bridge river, about 2½ miles below the South fork on the main Bridge River highway. The general rock formation is a massive outcropping of the Cadwallader Creek augite-diorite belt, in which are found the gold-bearing quartz veins as developed in the *Pioneer* and *Bralorne*. On the *Wayside* property there is a zone of parallel fractures filled with gold-bearing quartz veins. On the eastern border or hanging-wall of this zone is a pronounced shearing varying in width up to 40 feet, in which substantial bodies of low-grade milling-ore are being developed.

Previous to 1933 six tunnels had been driven on the west fissure-veins, with one tunnel nearly 1,000 feet long on the shearing. The short tunnels demonstrated the existence of ore-shoots in the west veins up to 70 feet in length and 2 feet in width carrying gold values up to 1.25 oz. gold per ton. The "shear" tunnel showed generally low values, with one place showing 6 feet wide of 0.3 oz. gold ore, indicating possibilities of bodies of workable low-grade ore.

In 1933 work was started in No. 2 and No. 3 tunnels. In No. 2 tunnel the vein split and the east fork led the tunnel to the shear-zone. A 280-foot drift on the foot-wall was driven and from it crosscuts were driven east across the shear at 50-foot intervals. In No. 3 tunnel about 450 feet of drifting was done, from which nine crosscuts were driven at 50-foot intervals to cut the shear-zone. In No. 4 tunnel east, crosscuts were also driven to expose the width of the shearing. No. 1-B tunnel was driven 250 feet and 245 feet of crosscutting done from it. No. 5 tunnel, started just above the road, was driven over 700 feet and over 400 feet of crosscutting done from it to and across the shearing. In crosscutting east from the No. 5 tunnel for a diamond-drill station another vein was cut about 180 feet east of the shear, indicating interesting possibilities.

Altogether over 4,000 feet of development-work was done, exposing the shear on five levels through a vertical distance of about 500 feet and along a horizontal distance of approximately 1,000 feet. This work and its results have satisfied the management that a concentrator of 200 to 300 tons daily capacity is justified.

A great deal of surface work was done in 1933 by way of construction, such as dining-room, office, warehouse, blacksmith-shop, power-house, etc. A hydro-electric plant generating 460 horse-power was installed across the river on Sucker creek, and it is estimated that this power can easily be doubled by tapping a lake some 400 feet above. A crew of about sixty men has been employed under the able supervision of Geo. Bancroft, M.E.

Mogul Mining Co., Ltd.

This company, incorporated in January, 1929, has a capitalization of $1,500,000, divided into 3,000,000 shares of 50 cents par value. The registered office is 509 Union Building, Victoria. The company's Bridge River holdings consist of several groups of mineral claims. One group is situated on the west side of Bridge river a short distance above the Hurley river, and another group on the west side of the Hurley river opposite the Bridge River Consolidated ground. The first group is on the general strike of the diorite, though no diorite is indicated on the property on the Geological Survey of Canada map.

Frances Gold Mines, Ltd. This company was incorporated in 1933 with a capitalization of 2,000,000 shares of no par value. The registered office is at 211 Pemberton Building, Victoria. The company's Bridge River holdings consist of nineteen claims, extending east from the south end of Gun lake to Bridge river, about a mile above the Hurley river. There is a tongue of diorite shown on the geological map (issued by the Geological Survey of Canada) on the south side of Gun lake and this may extend into this property. The area between Bridge river and Gun lake probably holds considerable possibilities.

Veritas. (*See* 1932 Annual Report.) This group consists of ten mineral claims, of which eight are Crown-granted. They are situated at Little Gun lake. The road from the main Bridge River road at the Hurley river to B. Smith's summer home on Little Gun lake gives accessibility to this property. The owner, Mat Foster, has lived here for twenty-five years, during which time he has driven three tunnels, totalling over 1,000 feet of underground work, in developing a small quartz vein in augite-diorite formation. High gold values are found in spots on the surface, but the vein where exposed underground has shown only low-grade ore.

During 1933 the lowest tunnel, just above the lake, was continued to 340 feet from the portal, the last 20 feet of it being in a shearing in which are two small quartz veins about 3 inches wide carrying only small gold values.

Cariboo-Bridge River Gold Properties, Ltd. This company was incorporated in March, 1933, with a capitalization of $250,000, divided into 10,000 shares of $25 par value. The registered office is at 425 Howe Street, Vancouver. The company's holdings consist of five groups of mineral claims aggregating thirty-five claims in the Bridge River area in the vicinity of Gun lake, and a group of seven claims on Slough creek, Cariboo. The *Ypres* group of fifteen claims, on which the work is being concentrated, is situated on the north side of Gun lake. This group is staked three claims wide on the lake-front and extends five claims back. They cover a wide belt of diorite in which three or four quartz veins have been exposed by ground-sluicing along the lake-shore.

During 1933 good camps were erected, a compressor plant driven by water-power was installed, and considerable underground work was done under the supervision of E. J. Marshall. The water for the wheel is brought in from a creek with a 10-inch wooden pipe, the Pelton wheel generating about 70 horse-power. Further power can easily be obtained.

Prospecting north of Gun lake on the *Gold Pass*, *Gold Bond*, and other groups above the *Ypres* group has shown the extension of the diorite-belt to nearly the mouth of Eldorado creek and considerable staking has been done beyond that up Gun creek. There is an excellent horse-trail through to the summit, making the country very accessible. The large indicated area of diorite and the favourable bordering formations make this area a very attractive one for prospecting. The high gold values found by Stewart and McLellan on their group enhances the prospects. This group, it is understood, was bonded by the Bralorne Company.

Gold Bond. This group of about twenty claims, owned by J. M. Taylor and associates, has been acquired by the Taylor (Bridge River) Mines, Limited. The claims are situated on both sides of Gun creek, a short distance south of the mouth of Eldorado creek. A little surface work has been done, showing favourable geological conditions.

Eldorado Basin. This basin, at the head of Eldorado creek, a tributary of Gun creek, is reached by horse-trail either from Tyaughton lake or from the Gun Creek trail. This trail follows up Pearson creek to its head, where it branches to the west to Eldorado basin and continues over the divide to the Taylor Creek and Bonanza Creek basins, a distance of about 18 miles from Tyaughton lake.

In this basin is situated the *Lucky Jem* group of five mineral claims that have been held by Grant White, of Bridge River, for a number of years. The feature of this area is the fact that on the southern slope of Eldorado mountain, in an area 1,000 feet long by 600 feet high, free gold can be panned practically everywhere from the decomposed material covering the surface. These values doubtless are the result of the oxidation of many small veins of arsenopyrite which can be seen striking in every direction in a wide zone of fracturing. Some work has been done on these arsenopyrite veins and good gold values up to 2 oz. per ton have been obtained, but apparently a sufficient number of them have not been found in any place to constitute a commercial ore-body.

Taylor and Bonanza Basins. These basins, at the heads of their respective creeks, which flow into Tyaughton creek, have the characteristics mentioned for deposits found in the Eldorado basin. Taylor basin was staked by Herb Taylor, who has done a lot of prospecting and development-work in it during the past several years. His ground has been optioned to Toronto interests, who plan extensive work in 1934. Several veins of arsenopyrite have been exposed in open-cut work by H. Taylor around the rim of the basin at an elevation of from 7,500 to 8,400 feet. These veins occur in the sedimentaries and altered greenstones of the underlying Bridge River formation and the overlying slates of the Eldorado formation. Two trenches, each over 100 feet long, down in the valley, have been dug by ground-sluicing to a depth in places of 15 feet to expose bed-rock, but they do not expose any veins. The values in the veins at the higher elevations show from a trace to 0.65 oz. gold per ton.

In Bonanza basin, reached by the continuation of the trail over a 7,500-foot divide between Bonanza and Taylor basins, Cooper Drabble, of Bridge River and Vancouver, and associates hold about thirty claims. A reconnaissance has been made for a trail down Bonanza creek to Tyaughton creek to Tyaughton lake, which would eliminate the two summits of over 7,000 feet on the present trail. The general formation of this area is given by Drysdale and McCann as the Eldorado series, which here consist mainly of sandstones and slates, intruded by extensive belts or masses of quartz diorite. In the Bonanza basin there is a feldspathic belt probably over 1,000 feet wide, which cuts diagonally through the quartz diorite, intrusions, and sedimentaries.

During 1933 C. Drabble established a camp and with a small crew of men did extensive ground-sluicing on the upper or south end of the dyke, and also along Hughes creek on the north end. On the upper end the dyke is exposed along its strike for several hundred feet up a tributary creek, showing small seams and veins of arsenopyrite carrying distributed gold values. To date, on this end, no vein has been found large enough to be workable, nor are they numerous enough in any one place to constitute a commercial width of ore. On the north end, where the dyke is crossed by Hughes creek, a wider section has been exposed showing the same characteristics as above. One vein exposed by this work shows a width of 34 inches, of which 5 inches of arsenopyrite on the hanging-wall assayed: Gold, 2.40 oz. per ton; silver, 20.9 oz. per ton. Next to this there is 29 inches of decomposed vein-matter assaying: Gold, 0.12 oz. per ton; silver, 0.14 oz. per ton; and adjoining this 12 inches on the foot-wall of broken-up rock assaying 0.02 oz. gold per ton. About 15 feet up along the vein the hanging-wall portion is 10 inches wide, assaying 2.39 oz. gold per ton and 16.8 oz. silver per ton. The vein dips flatly about 40° west and strikes N. 10° E., which is about the general strike of the dyke. The creek-bed is steep and the vein can be exposed higher up by ground-sluicing. Numerous open-cuts have been put in and stripping done south of Hughes creek along the dyke shows several of these small veins. They are so widely distributed that it is rather difficult to know just what is the best method of exploration.

Lucky Strike. *Lucky Strike Nos. 2, 3, 4,* and *5* are owned by Jack McPhail, of Tyaughton Lake. The claims are situated in Taylor basin near the summit close to where the trail crosses. Taylor creek is a tributary of Tyaughton creek. Very little work has been done on the property, but the mineralization appears to be about 15 feet wide and associated with a coarse porphyry dyke. A sample taken across 3½ feet assayed: Gold, 0.14 oz. per ton; zinc, 6.8 per cent. A grab-sample of the heavy sulphides of iron and zinc assayed: Gold, 0.30 oz. per ton; silver, 5.7 oz. per ton; zinc, 9.6 per cent. Good depth could be obtained on the vein with a short crosscut tunnel. The property is well worth a little work.

Off the Main Diorite-belt (so far as known).

Dominion Gold Fields, Ltd. This company was incorporated in November, 1933, with a capitalization of 5,000,000 shares of no par value. The registered office is at 101 Royal Trust Building, 626 Pender Street West, Vancouver. The company's holdings consist of several groups of mineral claims to the west of Gun creek and situated west of the *Gold Bond* group, but with a group intervening; and also several groups of claims east of Gun creek at its mouth and east of and adjoining the property of the Congress Gold Mines, Limited. The *Golden* group included in the property, situated east of the mouth of Gun creek, has had some work done on it by its owner, H. E. Rines. Here the general formation is the greenstones and argillites of the Bridge River series. The outcrop showings, about 400 feet above the main road, are oxidized across a width of 30 to 40 feet. The sulphide ribs in this

zone assay up to 0.3 oz. gold per ton. It is understood that a crosscut tunnel has been started to get some depth under the croppings.

Region Mines, Ltd.

This company was formed in June, 1933, with a capitalization of $3,600,000, divided into 3,600,000 shares of $1 par value. The registered office is at 716 Hall Building, Vancouver. This company controls the Region Gold Mines, Limited, incorporated in May, 1933, for only $250,000, divided into 500,000 shares. The company's Bridge River holdings consist of three groups of mineral claims under option—the *Dolly Madison Nos. 1* to *10*, the *La June Nos. 1* to *10*, and the *Trossic Nos. 1* to *12*—situated mainly on the north side of Gun creek, from just below Cinnabar creek and extending 3 miles along the Gun Creek trail. During 1933 a camp was constructed on Cinnabar creek a short distance north of the main trail and some surface prospecting was done. A 2½-mile road was also built branching from the Tyaughton Lake road to Cinnabar creek. This road can be extended up Gun creek as development warrants, and present indications are that it will be required very soon.

Bunting-Ferguson.

This group, consisting of eight claims situated north of Gun creek, adjoining a portion of the Region Mines, Limited, ground, is owned by Wm. Bunting and Jas. Ferguson, two old-time northern prospectors. The camp is at 3,700 feet elevation and 1,800 feet above the Gun Creek trail. There is a fair horse-trail to the camp. The trail branches from the main trail on the north bank of Lick creek about 1½ miles beyond Cinnabar or Pearson creek.

When the Resident Engineer was on the property in August, 1933, the owners were away and he therefore did not have an opportunity to see everything. The showing in a small creek below the cabin is in a belt of highly altered and silicified volcanic rock. Here there is a width of about 10 feet mainly composed of quartz, beyond which are small stringers of quartz running in all directions. The silicified zone is spotted with a light-green stain, probably nickel, as there are similar zones to the east near Tyaughton lake carrying up to 0.35 per cent. nickel. The quartz is very sparsely mineralized on the surface and probably carries only low gold values.

The zone was traced by open-cuts for a few hundred feet at that time. It is understood the owners put up a fine camp and are working throughout the winter, but with what results is not known. About 300 feet south of this an outcrop showed a considerable width of quartz in the quartzites of the Bridge River formation. There probably will be found in the locality intrusions of greenstone and tongues of diorite which will add to the possibilities of mineralization and values.

Congress Gold Mines, Ltd.

This company was incorporated in August, 1933, with a capitalization of $2,000,000, divided into 2,000,000 shares. The registered office is at 302, 744 Hastings Street West, Vancouver. The property consists of twenty-one mineral claims situated on both sides of Gun creek and extending five claims up-stream from the mouth of the creek at Bridge river.

The formation is made up of the cherty sedimentaries of the Bridge River formation. On the east side of Gun creek there are some interbedded seams of mineral showing pyrite and stibnite with associated small gold values. These occurrences are small and irregular. On the other side of the creek some old work, including open-cuts and an 85-foot tunnel, shows similar mineralization, with gold values up to 0.3 oz. per ton. The property is located on the main highway.

Minto Gold Mines, Ltd.

This company was incorporated in June, 1933, with a capitalization of 3,000,000 shares of no par value. The registered office is at 102–6 Pacific Building, Vancouver. The property consists of the *Alpha* group of mineral claims, which are situated about a mile below the junction of Gun creek with Bridge river, and on the main Bridge River highway.

The general rock formation is the Bridge River series. Some surface work, a 400-foot drift-tunnel from the edge of Bridge river, and two tunnels, about 200 and 300 feet respectively above the road, had been done before this company acquired the property. Since acquirement a first-class camp has been constructed, the buildings including a bunk-house, another building containing dining-room and kitchen, office, store-rooms, and blacksmith-shop. A Diesel-engine power plant was also installed. The two upper tunnels, the Hagmo, 200 feet above the camp, and the Warren, 300 feet above the camp, were continued on a pronounced shearing in massive greenstone. The Hagmo tunnel consists of a 75-foot crosscut from the surface to the shearing,

where a small quartz vein was found. This vein was drifted on for over 100 feet, at which point it started to widen. Up to the end of 1933 the tunnel had been extended to over 400 feet from the portal, showing an ore-shoot nearly 200 feet long, averaging 5½ feet wide, and with a reported average of 0.40 oz. gold per ton. One section from 195 to 217 feet showed high gold values. A crosscut at 390 feet from the portal showed a width of 20 feet of shearing of lower-grade ore. The mineralization consists of pyrite, arsenopyrite, with lesser amounts of galena and zinc-blende.

The Warren tunnel, 100 feet vertically higher than the Hagmo, was driven 253 feet in 1933. At 232 feet a 13-foot crosscut showed a 19-foot width of shearing. At the collar of this tunnel the vein-width was 5 feet, of which about 50 per cent. was quartz. Within a short distance the vein-filling was all quartz and has continued so throughout. A sample across the face at 35 feet in assayed 0.40 oz. gold per ton, and an average assay of 5½ feet for the total distance is reported by the management to be 0.3 oz. gold per ton.

Another tunnel at the road has been driven 100 feet in favourable ground.

Truax Creek. The Truax Mining Company did a considerable amount of work in the winter of 1932 by way of open-cuts and short tunnels in trying to pick up the extension of the No. 2 vein on the east side of the creek. This vein was drifted on the west side of the creek for about 100 feet in greenstone, but showed only a small width of quartz, from a seam up to a foot in width, carrying iron sulphides and a little stibnite, but never assaying more than 0.15 oz. gold per ton.

Further work was done down the creek on the east side, where a sample across 7 feet assayed 0.9 oz. gold per ton. A depth of about 12 feet was obtained at this point by blasting out the creek-bank. At this depth the mineralized quartz and 2 feet width of magnetic iron disappeared, leaving only a seam on each wall, with a little scattered slightly mineralized quartz between them. Short tunnels up the creek cut the same seams in the greenstone formation without results, and a tunnel about 100 feet long failed to find anything worth while. Surface prospecting farther up the creek was also disappointing.

Reliance Gold Mines, Ltd. This company was incorporated in Washington State and registered in British Columbia in 1933. It has a paid-up capitalization of $20,000. The registered office is at 514 Stock Exchange Building, Vancouver. The property consists of twenty-one mineral claims situated on the south side of Bridge river opposite Gun creek. The Resident Engineer did not examine this property during 1933, but the company reports encouraging development results.

Goldside Mines, Ltd. This company is a reorganization of the Babine Development Company, Limited, capitalized at $3,000,000, divided into 3,000,000 shares of $1 par value. The head office is at 302 Bay Street, Toronto. The company's holdings consist of the *Simons* group of mineral claims on MacDonald lake east of and adjoining the B.R.X. ground; and Herb Taylor's ground at the head of Taylor creek, a tributary of Tyaughton creek, already described under Taylor basin.

The *Simons* group is on the Bridge River formation and has several shearings of low-grade quartz on the surface. Work will be started on both properties as soon as weather conditions permit, under the direction of S. H. Davis.

B.C. Cariboo Goldfields, Ltd. This is a reorganization of the Williams Creek Consolidated Gold Placers and was incorporated in 1933 with a capitalization of $2,500,000, divided into 2,500,000 shares. The registered office is in the Stock Exchange Building, Vancouver. The company's Bridge River holdings consist of the *Success* and *Comstock* groups of mineral claims. The *Success* lies between the *Bralorne, Taylor (Bridge River)*, and *Grull-Wihksne*, and the *Comstock* group adjoins the *Taylor (Bridge River)* on the east and the *Bralorne* on the north. These groups are under option to purchase. In addition to these there are six or seven groups staked in the company's name.

During 1933 work was done on the *Success* and *Comstock*, particularly the latter, under the supervision of Fred Bradley. Surface prospecting uncovered a vein close to the end line of the *Edna May* of the *Taylor (Bridge River)* property, striking east-west (mag.) and dipping north about 60°. The westerly extension of this vein would therefore be in the *Taylor (Bridge River)* ground. The surface exposure consists of a vein about 4 feet in width, with 6 inches of quartz adjacent to each wall, with a calcareous filling between. It is in a greenstone-belt of the Bridge River series and probably near its north border, because the vein extends into the argillites in

a few hundred feet to the east. Should this greenstone-belt prove of considerable width south toward the *Bralorne* ground and extend west to contact with the *Taylor (Bridge River)* diorite-mass, there would be a probability of the extension into this ground of quartz veins found in the diorite. A caterpillar shovel of ¾-yard capacity was used to expose the bed-rock by trenching across the greenstone toward the *Bralorne*.

Holland Gold Mines, Ltd. Incorporated in May, 1933, with a capitalization of $500,000, divided into 1,000,000 shares, this company has its registered office at 612 Standard Bank Building, Vancouver. The property consists of the *Holland* group of six claims and the *Nomad* group of seven claims, situated north of and adjoining the *Pioneer* and *Pioneer Extension* ground and east of and adjoining the property of the B.C. Cariboo Goldfields, Limited. This ground is all in Bridge River formation. The company did considerable work in 1933 in exploring the vein on the *Holland* and the Riel vein on the *Nomad*, as well as extensive surface prospecting. The *Holland* vein is about 1,100 feet above the *Pioneer* camp, strikes east-west (mag.), and dips north with the siliceous argillites in which it occurs. Surface values are low, but the vein as exposed on the surface is fairly regular. Open-cutting and a crosscut tunnel in the gulch where the best surface exposures were found did not give much encouragement. Surface work east on the *Nomad* group likewise did not find anything sufficiently attractive to develop.

Yorkshire Mining Co., Ltd. This company was incorporated in June, 1933, with a capitalization of 1,000,000 shares of no par value. The registered office is in the Stock Exchange Building, Vancouver. The company acquired the *Caesaro* group of thirteen mineral claims situated on the upper slope of Fergusson mountain, above *Pioneer*. There is a steep but fairly good horse-trail to the camp at 7,200 feet elevation, 3,200 feet higher than the *Pioneer* camp. The rock formation consists of quartzites and porphyries of the Bridge River series, here enclosing a number of small belts of black argillite. A considerable amount of work was done in the summer of 1933 by open-cutting along the side-hill, and a few small stringers of mineralized quartz carrying fair gold values were found, but nothing big enough to indicate commercial ore-bodies.

Divide. This group of eight claims, situated west of the *Caesaro* group, owned by the Yorkshire Mining Company, Limited, was acquired by the Waterloo Gold Mines, Limited. This company also owns a property of that name in the Lightning Peak area, on the Edgewood–Vernon highway.

The *Divide* group also covers an area of Bridge River formation. A crosscut was being driven at the time of examination to cut small veins of quartz which occur in a mass of basaltic volcanics. It is almost impossible to make any headway by hand-work in this rock.

Mix Gold Mines, Ltd. This company was incorporated in August, 1933, with a capitalization of $1,000,000, divided into 2,000,000 shares. The registered office is at 415, 789 Pender Street West, Vancouver. The company acquired the *Mix* group of eight claims, *Mix Nos. 1* to *8*, inclusive, from the original staker, Howard Cameron. The claims are situated on Cadwallader creek, at Hawthorn and Twin creeks north of and adjoining the east claims of the *Pioneer Extension* ground. Work was started on this group late in 1933.

Bramoose Gold Mines, Ltd. This is a private company incorporated in May, 1933, with a capitalization of $50,000, divided into 50,000 shares. The registered office is at 626 Pender Street West, Vancouver. The company acquired the *Moose* group of eight mineral claims, *Moose Nos. 1* to *8*, inclusive, situated on the north side of Cadwallader creek, just west of Piebiter creek and about 6 miles by good tractor-road from *Pioneer*. The original staker and owner was Hans Pedersen. The claims lie in the Bridge River formation.

At 4,800 feet elevation a drift-tunnel has been driven 28 feet. It is timbered to within 6 feet of the face, where there is a width of about 3 feet of finely laminated brownish argillite which strikes N. 80° W. and dips N. 75°, conforming with the strike and dip of the enclosing argillite. In the width of 3 feet are fine seams of calcite and quartz in the bedding of the argillite slightly mineralized with pyrrhotite. This belt is also exposed in an open-cut above on the surface. A sample taken across 18 inches of hard, glassy quartz showing a little pyrrhotite assayed only a trace of gold. About 400 feet south-east of the tunnel a few good-sized open-cuts have been made and they show a belt of crystalline limestone in contact with a

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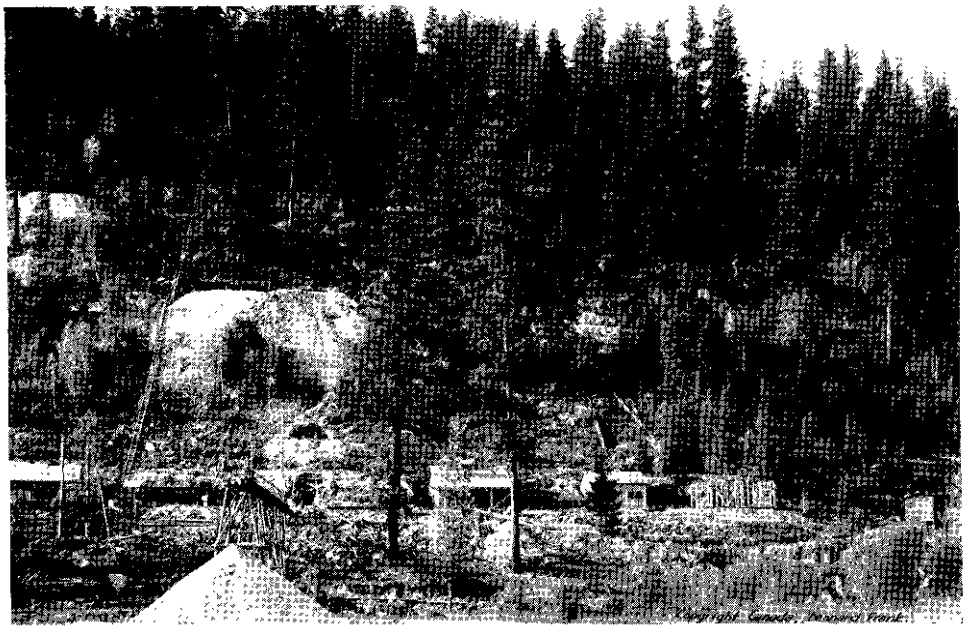
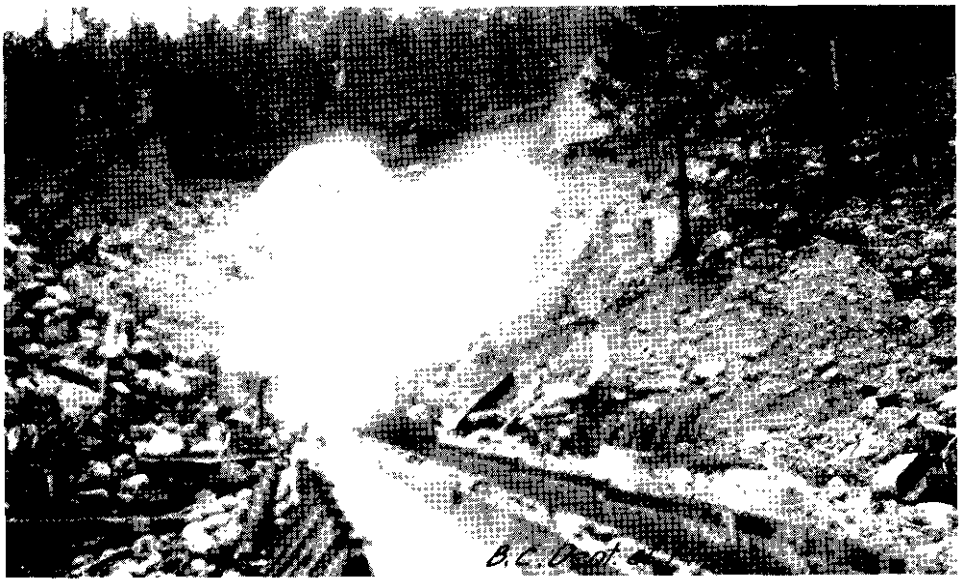
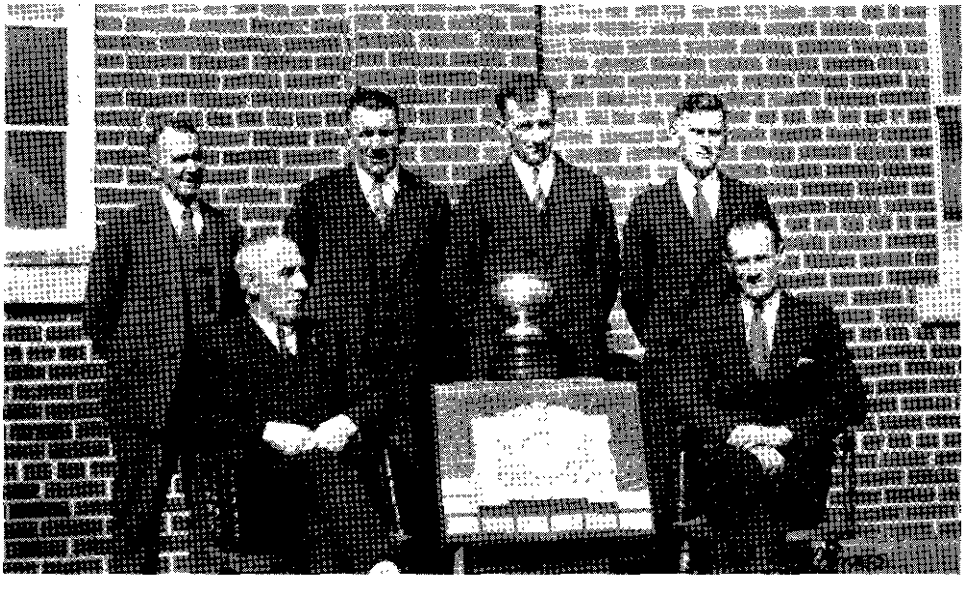
Pioneer Gold Mines of B.C., Ltd., Lillooet M.D.



Wayside Consolidated Gold Mines, Ltd., Lillooet M.D.



Lower Bridge River Placers, Ltd., Lillooet M.D.



Sullivan Mine First-aid Team, Winners of Dept. of Mines Cup and Rotary Shield, 1933.

tongue of granodiorite or quartz diorite. On the contact the limestone has been altered and contains typical contact-metamorphic minerals, epidote and traces of garnetite, and mineralization of chalcopyrite and pyrrhotite. Below the open-cuts a tunnel was driven 48 feet to strike the tip of the quartz diorite and the face is all in that rock. Some work on this contact is warranted.

Cadwallader Gold Mines, Ltd.—(*See* 1932 Annual Report.) No work was done on this property, situated east of Piebiter creek, during 1933.

Standard Gold Mines, Ltd.

This company was incorporated as a private company in September, 1932, with a capitalization of $100,000, divided into 100,000 shares. This was later increased to $500,000, divided into 500,000 shares. The registered office is at 716 Hall Building, Vancouver. The Standard Consolidated Gold Mines was incorporated in June, 1933, with a capitalization of $3,000,000, divided into 3,000,000 shares, to take over and develop the holdings of the original company. The company's holdings consist of forty-eight surveyed mineral claims situated at the head of Cadwallader creek and about 10 miles south of *Pioneer*.

Operations were started early in the summer of 1933, when snow conditions on the higher ground were anything but favourable. The horse-trail up Cadwallader creek was utilized to a point about 2 miles from the property. This portion of the trail was shovelled out of 5 feet of snow and a trail built to get material and supplies through for the construction of a camp. Later the trail from the property to the *Pioneer* was improved into a wagon-road by the company. Some assistance in road-construction was given by the *Butte-I.X.L.*, who are also served by this road. A 20-ton tractor makes the trip from the *Pioneer* in about three hours. Equipment, consisting of two Diesel engines, a 300-cubic-foot compressor, drill-sharpener, mine equipment, generator, electric hoist, sawmill, etc., were taken in and installed.

As soon as camp accommodations were completed work was started in the creek-bed to strip No. 1 vein. This work showed a width of about 40 feet of feldspathic rock, showing some mariposite, and containing small veinlets of quartz sparsely mineralized with pyrite, the whole averaging low in values. Two or three other cuts were made on the west bank of the creek. Surface work on the east side showed three other zones similar to that stripped in the creek. A crosscut tunnel was therefore started farther down the creek with the objective of cutting the four zones. No. 1 zone is apparently below the portal of the tunnel and therefore was not encountered. This crosscut has been driven 400 feet and intersects the second belt at 214 feet at a depth of 150 feet. This belt is about 70 feet wide on this level and similar to the surface exposures, in that it contains mineralized siliceous widths carrying gold values. The company reports that the whole width will average about 0.125 oz. gold per ton from the channel-sampling.

The crosscut tunnel will be driven ahead to about 600 feet to cross the Nos. 3 and 4 zones at depths of about 200 feet and 300 feet respectively. It is then proposed to sink a shaft 250 feet to cut the No. 1 belt and explore the other belts at that depth from the shaft.

Butte I.X.L. Gold Mines, Ltd.

This company was incorporated in June, 1933, with a capitalization of $1,000,000, divided into 2,000,000 shares. The registered office is at 520 Stock Exchange Building, Vancouver. The company's holdings consist of twenty-two mineral claims situated mainly on the west side of Cadwallader creek, adjoining the *Red Hawk* on the south and about 7 miles from *Pioneer*. A branch road from the Standard Gold Mines, Limited, road up Cadwallader creek makes this property easily accessible.

The general rock formation is Bridge River series. There are two veins exposed on the ground—one a short distance above Cadwallader creek, just above the camp, which is in a belt of black argillites; and another vein in a belt of greenstone farther up the hill and about 200 feet west of the No. 1 vein. No work other than a little surface-stripping, showing low values, had been done on the veins prior to their acquirement by the company. Since starting operations in June, 1933, a substantial camp suitable for twenty-five to thirty men has been built. A branch tractor-road to the Cadwallader Creek road was also built.

A dam was constructed on Copp creek and a 3,500-foot flume of 12-inch pipe-line laid, giving a water-head of 550 feet at the compressor-site. This installation developes 260 horse-power, with a minimum of 150 horse-power at low water. A sawmill, a 500-cubic-foot Ingersoll-Rand compressor and hoist were installed, as well as drill-sharpener and mining equipment. The company's plans call for the sinking of a shaft 200 feet or more on No. 1 vein, at which level

No. 1 and No. 2 veins will be developed. At the end of 1933 the shaft was down about 90 feet and had cut No. 1 vein. The vein showed no change from the surface showing.

Native Son Mines, Ltd.

This company was incorporated in May, 1933, with a capitalization of $1,000,000, divided into 2,000,000 shares. The registered office is at 902 Hastings Street West, Vancouver. The property consists of the *Native Son* group of nine mineral claims and the *Native Son Extension* group of six claims, all adjoining and situated south of and adjoining the *Bralorne* holdings. As the *Bralorne* ground extends approximately a full claim-width of 1,500 feet on the south side of Cadwallader creek, and is all in argillite, the *Native Son* ground is that distance from the *Pioneer-Bralorne* diorite-mass and in the Bridge River formation.

Work in 1933 consisted of the construction of a 1-mile road branching from the "Pioneer Dam" road; the construction of a camp; the installation of a compressor plant and mining equipment. A little surface work was done on some surface quartz-showings until the compressor plant was put in operation. A tunnel was then started with the objective of getting a section across the general strike of the bedded argillite, greenstone, etc., of the Bridge River formation. It is understood that this tunnel was driven approximately 600 feet without encountering anything sufficiently encouraging in size and values to encourage development. The property is now under the supervision of Captain N. Evans-Atkinson, who proposes making a thorough surface investigation as soon as snow conditions permit, upon the result of which will depend further development-work.

Bridge River Ogden Mines, Ltd.

This company was incorporated in June, 1933, with a capitalization of 2,000,000 shares of no par value. The registered office is at 912 Hall Building, Vancouver. The company's Bridge River holdings comprise the *Ogden Fractional* mineral claim and *Ogden Fractional Nos. 2, 3,* and *4* mineral claims (restaking of the *Roxy* and *Chesterfield* groups), and the *Short O' Bacon* group of eight claims, all adjoining and situated adjoining the *Bralorne* on the south and the *Native Son* on the west. The camp at 4,100 feet elevation on the *Short O' Bacon No. 4* claim is reached by a branch trail from the "Pioneer Dam" road.

The general formation is Bridge River series. A short distance above the camp a quartz vein has been opened up by open-cut, giving a 15-foot face and showing a shearing in the greenstone about 3 feet wide, of which 1 foot is quartz-filled. This is in contact with argillite on the east side. The vein and contact strike S. 15° E. (mag.) and are about perpendicular. The quartz vein shows some mariposite and iron sulphides, but carries no values. This and several other veins in the Bridge River camp, notably on the *Standard*, carry mariposite and show that it is absolutely no indicator of gold values, although the bonanza values in the *Bralorne* and *Pioneer* are associated with mariposite.

About 700 feet west of this open-cut and about 100 feet lower on the same claim, another vein has been found in greenstone, the vein striking S. 40° E. (mag.) and dipping west about 80°. It is about 4 feet wide and composed of watery-looking quartz typical of this formation, with seams of sericite and chlorite and sparingly mineralized with iron sulphides, carrying low gold values on the surface. This vein has been traced down the hill and at 4,000 feet elevation a tunnel is being driven through the overburden to pick up the vein.

On the *Ogden* claim (Crown-granted) a short tunnel driven in on the west bank of Cadwallader creek shows a width of 7 to 8 feet in argillite, in which are a number of small quartz veins striking south toward the *Millbank* claim and which carry some sulphides. Only low gold values were obtained.

Jack Pine and Sarah.—These two groups of ten claims are owned by R. Fletcher, Bridge River, and are situated about 4 miles up Hurley river on the east side. The owner states that he has found three veins in greenstone formation up to 9 feet wide carrying surface values of about 0.10 oz. gold per ton.

Golden Mitt Mining Co., Ltd.

This company was incorporated in June, 1933, with a capitalization of 2,000,000 shares of no par value. The registered office is at 515 Bower Building, Vancouver. The property consists of the *Taff*, *Bonanza*, and *Star* groups, situated on the north side of Hurley river above the Pioneer dam. The company is applying for change of name to Bridge River Pacific Mines, Limited.

The general formation covered by this property is the Cadwallader formation, consisting of greenstones or andesites and sediments, here cut by an intrusion of quartz diorite as indicated

on the geological map. Near the west border of the quartz diorite, open-cuts have exposed a small quartz vein for a distance of about 1,000 feet, striking in a N. 40° W. direction and probably dipping slightly to the north. The south end of this vein on the *Bonanza* group shows a width on the surface of about 2 feet of oxidized material and quartz carrying only low gold values. Farther north the vein has been exposed in the granite to a width of 2 feet, carrying some gold where mineralized with iron sulphides. More work to get some depth at most favourable showings will be necessary to form any opinion as to possibilities. On the *Taff No. 8* claim a few trenches were dug to bed-rock, exposing from 18 inches to 2 feet of quartz in the sedimentaries. A camp was established at Lake Gwyneth and some further work done which the Resident Engineer was unable to examine.

PLACER-MINING.

Tyaughton Creek Gold Placers, Ltd.

This company was organized in December, 1933, with a capitalization of $125,000, divided into 125,000 shares. The registered office is at 118 Vancouver Block, Vancouver. The company owns three leases on Tyaughton creek, about 6 miles by good trail from the Bridge River highway at Bert William's ranch. During 1932 an hydraulicking plant was almost completed. Water is taken from a dam constructed on Liza creek by 3,700 feet of ditch-line to penstock No. 1, then by 22-inch pipe-line to a lower ditch-line to penstock No. 3, and from there to the gravel-bank on the river.

In 1933, under the supervision of Chris. Beaton, an old-time Atlin hydraulic operator, two pits were piped out at the upper end of the top lease. The first pit produced about 7,000 yards of gravel, but a clean-up showed that the "pay" was too poor, running around 4 cents per yard. Another pit was started below this and proved better ground, although evidences of old drift-working were found. Lower water in Tyaughton creek failed to take away the tailings, and after trying out several schemes for tailings-disposal it was decided to move to the lower end of the lease, about a quarter of a mile down-stream, where the tailings could be easily disposed of in the rapids of Tyaughton creek. The second pit averaged about 10 cents per yard, which would just about pay. The pipe-line down the hill from the end of the lower ditch was removed and over 600 feet of 18-inch to 16-inch steel pipe laid to the lower pit, preparatory to the 1934 operations. Some preliminary testing on bed-rock at the lower end of the property gave encouraging results. With more water and no tailing-disposal troubles, 1934 should be a profitable season.

Lower Bridge River Placers, Ltd.

This company was incorporated with a capitalization of $1,000,000, divided into 2,000,000 shares, and has its registered office at 708 Yorkshire Building, Vancouver. The company's property comprises sixteen river leases and six bench leases on lower Bridge river. The plant and operations are at 7-Mile creek, about 12 miles from Lillooet. No work other than some drilling has been done on the river leases, as this operation will depend on the diversion of Bridge river for power purposes by the British Columbia Electric Company.

In 1932, under the efficient supervision of Major Hartley, a well-planned, substantial hydraulicking plant was installed and everything put in readiness for the resumption of operations in 1933. A portion of the ditch which had caved during the winter had to be cleared this spring, but piping was started early in the season. The sluice was started on bed-rock at the edge of the river and extended back to the foot of the bank. The plan of operation was to sluice off the top gravel to as great depth as possible on a good clearing grade to the sluice-head, and later clean up the bed-rock. Two to three hundred thousand yards of top gravel were disposed of, the excavtion having a bank-face of about 80 feet at the back. A pit was then started at the head of the sluice to go ahead to bed-rock on a sluicing-grade. This ground was taken out for 50 to 60 feet back from the sluice-head without encountering bed-rock, and it was thought advisable to sink to find it. A pit was sunk to a depth of over 40 feet below the sluice-box head, or to a depth of 10 to 20 feet below bed-rock at the edge of the river, without reaching bed-rock.

This unforeseen condition made the 1933 operation practically useless. There would be little object in making a clean-up, for any gold in the top gravel would be lost in the loose gravel floor of the pit in washing the material over it into the sluice-box. Drilling will probably have to be done to locate bed-rock before future operations can be planned.

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, 1933.

STAFF PERSONNEL.

INSPECTORS.

James Dickson	Chief Inspector, Victoria.
James Strang	Inspector, Victoria.
Robert Strachan	Senior Inspector, Nelson.
John MacDonald	Inspector, Fernie.
H. E. Miard	Inspector, Fernie.
Geo. O'Brien	Inspector, Nanaimo.
Thomas R. Jackson	Inspector, Nanaimo.
John G. Biggs	Inspector, Princeton.
Charles Graham	Inspector, Prince Rupert.

INSTRUCTORS, MINE-RESCUE STATIONS.

J. D. Stewart	Nanaimo Station.
John Thomson	Cumberland 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 in District.
Vancouver Island	Victoria, Alberni, Clayoquot, Quatsino, and that portion of the Nanaimo Division situated on Vancouver Island.
Southern Coast	Vancouver, New Westminster, and that portion of Nanaimo Division situated on the Mainland.
Northern	Atlin, Liard, Stikine, Portland Canal, Nass River, Omineca, Peace River, Skeena, Bella Coola, and Queen Charlotte Islands.
Nicola-Princeton	Cariboo, Quesnel, Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, Similkameen, and Osoyoos.
West Kootenay and Boundary	Revelstoke, Lardeau, 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, 1933, was 1,264,746 tons, being a decrease of 270,229 tons or 17.6 per cent. below the production of 1932.

The Coast District, which includes Vancouver Island, Nicolá-Princeton District, and Northern District, produced 787,069 tons, a decrease of 160,031 tons or 16.8 per cent. from 1932. Vancouver Island collieries produced 613,203 tons during 1933, a decrease of 135,803 tons or 18.1 per cent. from 1932. The Northern District produced 3,403 tons. The Nicola-Princeton District produced 170,463 tons, a decrease of 24,849 tons or 12.7 per cent. from 1932. The East Kootenay District produced 477,677 tons, a decrease of 110,198 tons or 18.7 per cent. under 1932.

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	261,674	165	971	1.63	269	660	2.40	396
No. 5 mine, South Wellington	158,356	207	305	2.50	519	255	3.00	621
Comox Colliery	180,970	217	486	1.71	372	365	2.28	496
Lantzville Colliery	5,327	238	24	0.93	222	19	1.17	280
Fiddick mine	1,231	276	12	0.36	102	9	0.49	136
Richardson mine (Ida Clara Colliery)	3,516	319	7	1.57	502	4	2.75	879
Jingle Pot mine	182	56	6	0.53	30	6	0.53	30
Biggs' mine	1,854	137	9	1.43	206	5	2.70	370
Old Adit mine	51	20	3	0.85	17	3	0.85	17
Chambers' mine (Old Extension No. 1)	43	11	4	1.00	11	3	1.27	14
Middlesboro Colliery	25,736	171	108	1.39	238	75	2.00	343
Coalmont Colliery	77,093	152	192	2.60	401	121	4.12	637
Tulameen Coal Mines, Ltd.	48,261	287	143	1.42	337	109	1.86	442
Pleasant Valley Colliery	8,466	248	34	1.00	249	20	1.70	423
Blue Flame Colliery	9,398	118	40	2.00	235	24	3.31	391
Bromley Vale Colliery	1,062	67	12	1.31	88	8	1.97	132
Red Triangle Coal Co., Ltd.	90	31	6	0.48	15	5	0.58	18
Sunblaze Colliery	75	.....	9	.....	8	6	.....	12
Normandale Colliery	150	.....	3	.....	50	3	.....	50
North Thompson Colliery	34	6	7	0.83	5	6	1.00	6
White Lake mine	98	.....	5	.....	19	5	.....	19
Bulkley Valley Colliery	3,403	238	10	1.42	340	8	1.78	425
Coal Creek Colliery	53,874	90	143	4.17	376	111	5.38	485
Michel Colliery	206,591	202	302	3.38	684	222	4.60	930
Corbin Colliery	217,212	189	253	4.54	858	189	6.07	1,149

Collieries of Vancouver Island Inspection District.

The output of Vancouver Island collieries was 613,203 tons; added to this was 24,863 tons taken from stock, making a total of 638,066 tons handled during the year. Of this amount, 31,903 tons or 4.9 per cent. was lost in preparation for the market, 70,572 tons or 11 per cent. was consumed by producing companies as fuel, and 535,591 tons or 83.9 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 515,905 tons or 96.3 per cent. was sold in Canada and 19,686 tons or 3.6 per cent. was sold in the United States.

Collieries of Nicola-Princeton Inspection District.

Of the gross output of 170,463 tons produced by the collieries of the Nicola-Princeton District, 22,898 tons or 13.4 per cent. was consumed by the producing companies as fuel and 147,397 tons or 86.5 per cent. was sold in the competitive markets, of which 147,326 tons was sold in Canada and 71 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 477,677 tons; added to this was 1,247 tons taken from stock, making a total of 478,924 tons handled during the year. Of this amount, 29,163 tons or 6 per cent. was lost in preparation for the market, 13,501 tons or 2.8 per cent. was consumed as fuel, 8,435 tons or 1.7 per cent. was made into coke, and 427,825 tons or 89.3 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 409,237 tons or 95.7 per cent. was sold in Canada and 18,588 tons or 4.3 per cent. was sold in the United States.

The following table shows the output and *per capita* production of the various districts for the past five years. Similar figures for the years prior to 1929 are shown 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.
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
1932	East Kootenay District..	587,875	1,001	587	752	781
	Coast District.....	947,100	2,607	363	1,876	504
	Whole Province.....	1,534,975	3,608	425	2,628	584
1933	East Kootenay District..	477,677	698	684	522	915
	Coast District.....	787,069	2,396	328	1,719	457
	Whole Province.....	1,264,746	3,094	408	2,241	564

The following table shows the production and distribution of coal by the various collieries and districts, compiled from returns furnished by the owners:—

Collieries of British Columbia—Production, 1933.

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 1933.
Vancouver Island District.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Canadian Collieries (D.), Ltd.—													
South Wellington, No. 5 mine	119,181	5,409	.....	124,590	24,320	.....	8,265	32,785	8,607	9,588	981	.....	158,356
Comox Colliery	172,224	2,931	.....	175,155	739	.....	5,126	5,865	6,148	6,098	.....	50	180,970
Western Fuel Corporation of Canada, Ltd.—													
No. 1 mine	214,313	11,346	.....	225,659	6,644	.....	56,272	62,916	40,738	13,836	.....	26,902	261,673
Lantzville Colliery	4,464	.....	.....	4,464	.....	.....	863	863	.....	.....	.....	.....	5,327
Fiddick mine	1,231	.....	.....	1,231	.....	.....	.....	.....	.....	.....	.....	.....	1,231
Richardson mine (Ida Clara Colliery)	3,170	.....	.....	3,170	.....	.....	46	46	.....	300	300	.....	3,516
Jingle Pot mine	74	.....	.....	74	.....	.....	.....	.....	.....	108	108	.....	182
Biggs' mine	1,154	.....	.....	1,154	.....	.....	.....	.....	.....	700	700	.....	1,854
Old Adit mine	51	.....	.....	51	.....	.....	.....	.....	.....	.....	.....	.....	51
Chambers' mine (Old Extension No. 1)	43	.....	.....	43	.....	.....	.....	.....	.....	.....	.....	.....	43
Totals, Vancouver Island District	515,905	19,686	.....	535,591	31,903	.....	70,572	102,475	55,493	30,630	2,089	26,952	613,203
Nicola-Princeton District.													
Middlesboro Collieries, Ltd.	23,025	.....	.....	23,025	.....	.....	2,693	2,693	294	312	18	.....	25,736
Coalmont Collieries, Ltd.	65,606	.....	.....	65,606	.....	.....	11,487	11,487	.....	.....	.....	.....	77,093
Tulameen Coal Mines, Ltd.	42,373	32	.....	42,405	.....	.....	5,856	5,856	.....	.....	.....	.....	48,261
Pleasant Valley Coal Mines, Ltd.	6,731	.....	.....	6,731	.....	.....	1,735	1,735	.....	.....	.....	.....	8,466
Blue Flame Colliery	8,115	39	.....	8,154	.....	.....	1,094	1,094	.....	150	150	.....	9,398
Bromley Vale Colliery	1,062	.....	.....	1,062	.....	.....	.....	.....	.....	.....	.....	.....	1,062
Red Triangle Coal Co., Ltd.	90	.....	.....	90	.....	.....	.....	.....	.....	.....	.....	.....	90
Sunblaze Colliery	50	.....	.....	50	.....	.....	25	25	.....	.....	.....	.....	75
Normandale Colliery	150	.....	.....	150	.....	.....	.....	.....	.....	.....	.....	.....	150
North Thompson Colliery	26	.....	.....	26	.....	.....	8	8	.....	.....	.....	.....	34
White Lake Mine	98	.....	.....	98	.....	.....	.....	.....	.....	.....	.....	.....	98
Totals, Nicola-Princeton District	147,326	71	.....	147,397	.....	.....	22,898	22,898	294	462	168	.....	170,463
Northern District.													
Bulkley Valley Colliery	3,403	.....	.....	3,403	.....	.....	.....	.....	.....	.....	.....	.....	3,403
Totals, Northern District	3,403	.....	.....	3,403	.....	.....	.....	.....	.....	.....	.....	.....	3,403
Grand totals, Coast District	666,634	19,757	.....	686,391	31,903	.....	93,470	125,373	55,787	31,092	2,257	26,952	787,069
East Kootenay District.													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek Colliery	46,300	4,366	.....	50,666	.....	.....	3,186	3,186	.....	22	22	.....	53,874
Michel Colliery	192,627	131	.....	192,758	.....	8,435	5,432	13,867	503	469	.....	34	206,591
Corbin Collieries, Ltd.	170,310	14,091	.....	184,401	29,163	.....	4,883	34,046	23,450	22,215	.....	1,235	217,212
Totals, East Kootenay District	409,237	18,588	.....	427,825	29,163	8,435	13,501	51,099	23,953	22,706	22	1,269	477,677
Coal.													
Grand totals for Province	1,075,871	38,345	.....	1,114,216	61,066	8,435	106,971	176,472	79,740	53,798	2,279	28,221	1,264,746
Coke.													
Crow's Nest Pass Coal Co., Ltd.—													
Michel Colliery	451	4,455	.....	5,906	.....	.....	.....	.....	674	212	.....	462	5,444
Total coke for Province	451	4,455	.....	5,906	.....	.....	.....	.....	674	212	.....	462	5,444

Collieries of British Columbia—Men employed, 1933.

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.					
Vancouver Island District.	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.
Canadian Collieries (D.), Ltd.—																																	
South Wellington, No. 5 mine	9	2	11	166		166				67	28	95	13	9	22		11	11													225	50	305
Comox Colliery	19	10	29	42		42	62		62	94	34	128	118	46	164	16	13	29							12		12	2	18	20	365	121	486
Western Fuel Corp. of Canada, Ltd.—																																	
No. 1 mine	34	30	64	201		201				257	109	366	119	69	188	49	31	80											72	72	660	311	971
Lantzville Colliery	3		3	14		14	2		2		1	1		3	3													1	1	19	5	24
Fiddick mine				5		5	4		4								3	3													9	3	12
Richardson mine (Ida Clara Colliery)				4		4					1	1																	2	2	4	3	7
Jingle Pot mine				4		4								2	2																6		6
Biggs' mine				3		3	2		2		1	1					3	3													5	4	9
Old Adit mine				2		2	1		1																						3		3
Chambers' mine (Old Extension No. 1)	1		1	2		2					1	1																			3	1	4
Totals, Vancouver Island District	66	42	108	443		443	71		71	418	175	593	252	127	379	65	61	126							12		12	2	93	95	1329	498	1827
Nicola-Princeton District.																																	
Middlesboro Collieries, Ltd.	5	1	6	40		40	12		12	18	9	27		13	13		10	10													75	33	108
Coalmont Collieries, Ltd.	10	11	21	71		71				31	24	55	6	34	40	3	1	4											1	1	121	71	192
Tulameen Coal Mines, Ltd.	8	5	13	37		37	38		38		11	11	9	11	20	17	7	24													109	34	143
Pleasant Valley Coal Mines, Ltd.	3	2	5	12		12	3		3	2	5	7		5	5		2	2													20	14	34
Blue Flame Colliery	3	2	5	9		9	8		8	1	7	8	3	5	8		2	2													24	16	40
Bromley Vale Colliery		1	1	5		5	3		3		2	2		1	1																8	4	12
Red Triangle Coal Co., Ltd.	1	1	2	2		2	2		2																						5	1	6
Sunblaze Colliery	1		1	2		2	2		2	1	1	2		2	2															6	3	9
Normandale Colliery				1		1	1		1	1		1																			3		3
North Thompson Colliery	1		1	2		2	2		2	1		1		1	1															6	1	7
White Lake Mine	1		1	3		3	1		1																						5		5
Totals, Nicola-Princeton District	33	23	56	184		184	72		72	55	59	114	18	72	90	20	22	42											1	1	382	177	559
Northern District.																																	
Bulkley Valley Colliery	1	1	2	3		3	3		3	1		1		1	1																8	2	10
Totals, Northern District	1	1	2	3		3	3		3	1		1		1	1																8	2	10
Grand totals, Coast District	100	66	166	630		630	146		146	474	234	708	270	200	470	85	83	168							12		12	2	94	96	1719	677	2396
East Kootenay District.																																	
Crow's Nest Pass Coal Co., Ltd.—																																	
Coal Creek Colliery	5	2	7	68		68				6	6	12	30	23	53	2	1	3													111	32	143
Michel Colliery	11	6	17	114		114				43	22	65	54	50	104		2	2													222	80	302
Corbin Collieries, Ltd.	12	12	24	110		110	22		22	33	21	54	9	27	36	3	4	7													189	64	253
Totals, East Kootenay District	28	20	48	292		292	22		22	82	49	131	93	100	193	5	7	12													522	176	698
Grand totals for Province	128	86	214	922		922	168		168	556	283	839	363	300	663	90	90	180							12		12	2	94	96	2241	853	3094

NOTE.—U=Underground; A=Above ground; T=Total.

LABOUR AND EMPLOYMENT.

During 1933, 3,094 persons were employed in and about the coal-mines of the Province, a decrease of about 14.2 per cent. compared with 1932.

Taking the average of all the mines in Vancouver Island District, about 30 per cent. of the working-days were lost through lack of trade. In the Nicola-Princeton District the different collieries worked from 39 to 80 per cent. of the working-days, averaging for the district about 60 per cent. of the working-days. In the East Kootenay the mines worked from 30 to 67 per cent. of the working-days during the year, and worked, on an average for the whole district, about 53 per cent. of the time.

The table on page 280 shows the number of persons ordinarily employed in and about the mines, distinguishing the persons and different classes employed underground and above ground. These figures are compiled from returns furnished by the owners.

FUEL-OIL COMPETITION.

The following table shows the amount of fuel-oil imported and an estimate of the amount produced in British Columbia:—

Year.	Imported Fuel-oil subject to ½ Cent Gallon Duty. Gallons.	Fuel-oil produced in B.C. from Duty-free Crude Oil. 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
1932	24,964,000	100,000,000
1933	21,379,075	100,000,000

The fuel-oil ex-warehoused, duty-free, in British Columbia ports for shipping during the year totalled 23,866,818 gallons, as compared with 26,289,000 gallons in 1932, while the dutiable fuel-oil imported for use in the Province totalled 21,379,075 gallons. There was imported for refining in British Columbia, in 1933, 141,846,473 gallons of crude oil, duty-free, and it is estimated that 100,000,000 gallons of this reached the market as fuel-oil, making a total of over 145,000,000 gallons of fuel-oil which displaced approximately 1,000,000 tons of British Columbia coal.

COMPETITION OF COAL PRODUCED OUTSIDE BRITISH COLUMBIA.

During 1933 the imports of coal from United States into British Columbia consisted of 2 tons of anthracite, 2,098 tons of lignite, and 7,220 tons of bituminous coal, or a total of 9,320 tons, as compared with 5,204 tons in 1932.

Imports of coal from Great Britain into British Columbia during 1933 consisted of 3,647 tons of anthracite, 18,850 tons of bituminous coal, and 730 tons of coke, or a total of 23,227 tons.

From Alberta mines 64,128 tons of lignite, 35,175 tons of sub-bituminous, and 19,723 tons of bituminous coal was sold in British Columbia, a total of 119,026 tons.

The following table shows the amount of Alberta coal sold in British Columbia during past years:—

Year.	Short Tons.	Year.	Short Tons.
1924	114,186	1929	247,060
1925	117,037	1930	227,385
1926	127,858	1931	193,060
1927	187,028	1932	136,188
1928	262,198	1933	119,026

The total tonnage of coal brought into British Columbia during 1933 was 151,573 tons, as compared with 149,867 tons in 1932.

HYDRO-ELECTRIC DEVELOPMENT.

At the end of 1933 the hydro-electric horse-power in use amounted to 717,602 horse-power. The steadily increasing development of hydro-installations in British Columbia is shown in the following table:—

Year.	Water-power developed. Horse-power.	Year.	Water-power developed. Horse-power.
1900	9,366	1925	414,702
1905	29,334	1926	460,562
1910	64,474	1927	473,142
1915	254,065	1928	523,902
1920	309,185	1929	559,792
1921	309,762	1930	630,792
1922	329,057	1931	655,992
1923	355,718	1932	713,792
1924	355,718	1933	717,602

For the purposes of comparison it may be stated that one developed horse-power per year is equivalent to the power value of 6 tons of coal.

ACCIDENTS IN AND AROUND COAL-MINES.

During 1933, 3,094 persons were employed in and around the coal-mines. Three fatal accidents occurred during the year, as compared with eight for 1932.

The ratio of fatal accidents per 1,000 persons employed was 0.97, as compared with 2.21 in in 1932. In 1931 the ratio was 1.22; in 1930, 11.62; in 1929, 2.38; in 1928, 2.64; in 1927, 2.10; in 1926, 1.88; in 1925, 1.10; in 1924, 1.66; the average for the ten-year period being 2.79.

The number of fatal accidents per 1,000,000 tons produced during 1933 was 2.37; during 1932 the figure was 5.21; in 1931, 2.81; in 1930, 28.64; in 1929, 5.33; in 1928, 5.54; in 1927, 4.48; in 1926, 4.3; in 1925, 2.45; in 1924, 4.52; the average for the ten-year period being 6.42 per 1,000,000 tons of coal mined.

The following table shows the collieries at which the fatal accidents occurred during 1933 and comparative figures for 1932:—

Name of Company.	Name of Colliery.	1933.	1932.
Western Fuel Corporation, Ltd.	No. 1 mine	....	1
Canadian Collieries (D.), Ltd.	Comox	....	1
Tulameen Coal Mines, Ltd.	No. 2 mine	1	1
Coalmont Collieries, Ltd.	No. 3 mine	....	1
Coalmont Collieries, Ltd.	No. 4 mine	1	....
Crow's Nest Pass Coal Co., Ltd.	Coal Creek	....	2
Crow's Nest Pass Coal Co., Ltd.	Michel	1	....
Corbin Collieries, Ltd.	No. 6 mine	....	1
Corbin Collieries, Ltd.	No. 4 mine	....	1
Totals		3	8

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for 1932:—

Cause.	1933.		1932.	
	No.	Per Cent.	No.	Per Cent.
By falls of roof and coal	2	66.70	5	62.50
By mine-cars and haulage	1	33.30	3	37.50
Totals	3	100.00	8	100.00

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the years 1933 and 1932:—

Cause.	1933.		1932.	
	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	632,373	5	306,995
By mine-cars and haulage	1	1,264,746	3	511,658
Totals	3	421,582	8	191,871

The number of tons mined per fatal accident during 1933 was 421,582 tons, compared with 191,871 tons for 1932. The average for the ten-year period was 154,455 tons.

The following table shows the fatalities from various causes in coal-mines during the year 1933, compared with 1932, according to Inspection Districts:—

District.	Number of Deaths from Accidents.		Total.		Accident Death-rate.			
	Falls of Roof and Coal.	Mine-cars and Haulage.	1933.	1932.	Per 1,000 Persons employed.		Per 1,000,000 Tons of Coal mined.	
					1933.	1932.	1933.	1932.
Vancouver Island	....	....	....	2	.....	0.99	.....	2.67
Nicola-Princeton	1	1	2	2	3.57	3.50	11.73	10.24
East Kootenay	1	....	1	4	1.43	3.99	2.09	6.80
Northern	....	....	....	....	.....	.....	.....	.....
Province (1933)	2	1	3	....	0.97	.....	2.37	.....
Province (1932)	....	....	....	8	.....	2.21	.....	5.21

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, 1933:—

District.	No. of Fatalities.	Accident Death-rate.	
		Per 1,000 Employees.	Per 1,000,000 Tons of Coal mined.
Coast	105	3.05	7.64
East Kootenay	27	2.10	3.75
For Province	132	2.79	6.42

The details regarding the occurrences of the fatal accidents in coal-mines during 1933 are as follows:—

The fatal accident which occurred to Joseph Rossi, miner's helper, No. 2 mine, Tulameen Coal Mines, Limited, on March 17th was due to a runaway car. Deceased was at work at the face of a short slope when a trip of empty cars was being lowered from the top landing and, due to an error, one of the car-couplings had been omitted, permitting the first car to run free and strike the deceased.

The fatal accident which occurred to Paul Szenyesi, miner, No. 4 mine, Coalmont Collieries, Limited, on November 8th was due to a cave of coal and timbers. Szenyesi was working alone at the immediate time of the accident, and it is presumed that some coal fell from the face and displaced two sets of timber, which collapsed on deceased.

The fatal accident which occurred to Andrew Chala, machine-helper, No. 1 mine, Michel Colliery, on December 23rd was due to a fall of rock on a machine-cut long-wall face. Deceased was engaged at the time in repairing the air-hose in the presence of the manager of the mine, who was slightly injured by the fall, which came from an undetected slip in the roof. This place was inspected by the miners' safety inspection committee only two hours before the accident and was found in good condition.

EXPLOSIVES.

The following table shows the quantity of explosives used in coal-mines during 1933, together with the number of shots 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	62,226	261,673	120,185	4.20	0.51
No. 5 mine, South Wellington	66,525	158,356	68,216	2.38	0.97
Comox Colliery	33,724	180,970	46,670	5.36	0.72
Lantzville Colliery	5,100	5,327	7,050	1.04	0.72
Fiddick mine	2,200	1,231	2,900	0.56	0.75
Richardson (Ida Clara) mine	1,600	3,516	1,690	2.19	0.94
Jingle Pot mine	.....	182	.....	.....	.....
Biggs' mine	800	1,854	1,000	2.31	0.80
Old Adit mine	.....	51	.....	.....	.....
Chambers' mine	50	43	75	0.86	0.66
Totals for district	172,225	613,203	247,786	3.56	0.69

Nicola-Princeton District.

Middlesboro Collieries	6,050	25,736	9,975	4.25	0.60
Coalmont Collieries, Ltd.	16,992	77,093	23,000	4.53	0.73
Tulameen Coal Mines, Ltd.	11,150	48,261	20,150	4.32	0.55
Pleasant Valley Colliery	4,000	8,466	8,400	2.11	0.47
Blue Flame Colliery	2,500	9,398	5,087	3.75	0.49
Bromley Vale Colliery	250	1,062	750	4.24	0.33
Red Triangle Coal Co.	50	90	100	1.80	0.50
Sunblaze Colliery	100	75	125	0.75	0.80
Normandale Colliery	.....	150	.....	.....	.....
North Thompson Colliery	.....	34	.....	.....	.....
White Lake mine	200	98	375	4.90	0.53
Totals for district	41,292	170,463	67,962	4.12	0.60

Northern District.

Bulkley Valley Colliery	1,800	3,403	3,000	1.89	0.60
Totals for district	1,800	3,403	3,000	1.89	0.60

East Kootenay District.

Coal Creek Colliery	29	53,874	51	1857.72	0.57
Michel Colliery	17,673	206,591	27,445	11.69	0.64
Corbin Colliery	10,025	217,212	13,776	21.66	0.72
Totals for district	27,727	477,677	41,272	17.22	0.67
Totals for Province	243,044	1,264,746	360,020	5.20	0.67

QUANTITIES OF DIFFERENT EXPLOSIVES USED.

	Lb.
Monobel of different grades	183,462
Permissible rock-powder	59,582
Total	243,044

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 Monobel No. 14.
Polar CXL-ite No. 2.

MACHINE-MINED COAL.

During 1933 mining-machines produced approximately 509,490 tons of coal, or 40.2 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.	Anderson Boyes.	Little Hardy.	Siskol.	Sullivan.	Ingersoll-Rand.
Vancouver Island	1	33	9	5	....	16	4	....
Nicola-Princeton.	....	23	....	....	....	11	....	12
East Kootenay.....	....	15	1	2	8	2	....	2
Northern.....	....	....	....	....	....	....	....	....
Totals...	1	71	10	7	8	29	4	14

SAFETY-LAMPS.

There were 2,805 safety-lamps in use in the coal-mines of the Province. Of this number, 219 were flame safety-lamps of the Wolf type and 2,586 were electric lamps of various makes, as follows: Edison, 2,433; Wheat, 84; and Wolf electric, 69.

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	35	633	35	633
No. 5, South Wellington	12	228	12	228
Comox Colliery	35	375	35	375
Lantzville Colliery	3	25	3	25
Fiddick mine	3	10	3	10
Richardson mine	3	7	3	7
Jingle Pot mine	2	.....	2	.....
Biggs' mine	2	9	2	9
Old Adit mine	3	.....	3	.....
Chambers' mine	1	6	1	6
Totals for district	99	1,293	99	1,293

NICOLA-PRINCETON DISTRICT.

Colliery and Mine.	Method of Locking Lamp.		Illuminant used.	
	Magnetic Lock.	Screw or Automatic Clip.	Naphtha Gasoline.	Electricity.
Middleshoro Colliery	7	70	7	70
Coalmont Colliery	11	120	11	120
Tulameen Coal Mines, Ltd.	7	130	7	130
Pleasant Valley Coal Mines	5	70	5	70
Blue Flame Colliery	3	14	3	14
Bromley Vale Colliery	1	10	1	10
Red Triangle Coal Co.	1	6	1	6
Sunblaze Colliery	1	6	1	6
Normandale Colliery	3	.....	3	.....
North Thompson Colliery	3	.....	3	.....
White Lake mine	1	4	1	4
Totals for district	43	430	43	430

NORTHERN DISTRICT.

Bulkley Valley Colliery	10	.....	10	.....
Totals for district	10	.....	10	.....

EAST KOOTENAY DISTRICT.

Coal Creek Colliery	7	120	7	120
Michel Colliery	38	574	38	574
Corbin Colliery	22	169	22	169
Totals for district	67	863	67	863
Totals for Province	219	2,586	219	2,586

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 nine mines and underground at six 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	1,247
Ventilation	1,440
Haulage	335
Coal-washing	1,034
Miscellaneous	2,326
Total horse-power	6,382
Underground—	
Haulage	1,930
Pumping	2,030
Coal-cutting	300
Miscellaneous	520
Total horse-power	4,780
Total horse-power above and under ground	11,162

Of the above amount, approximately 1,861 horse-power was operated as direct current and 9,301 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 1933 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 1933 and 235 samples were collected in the various coal-mines of the Province; of this number, twenty-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 and No. 5 mine, Comox Colliery, where the gas-inflow is much higher than in other mining districts of the Province. In the Vancouver Island and also the Crowsnest Pass Districts a large number of samples were taken in old workings and near the origin of fires. Analyses of mine-air samples

taken throughout the coal-mines of the Province during 1933 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 their courtesy the Chief Inspector of Mines' office is furnished with copies of all tests made. During the year 890 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 re-treated.

DANGEROUS OCCURRENCES.

During the year the following dangerous occurrences were reported from the different coal-mines under the requirements of section 71, subsections (*d*), (*e*), and (*h*), as follows:—

On February 1st spontaneous heating was discovered in No. 1 Incline section, No. 5 mine, South Wellington; this occurred in a caved roadway, but the area was reached and the heated matter loaded out; no damage was done.

On February 12th a slight explosion occurred in the New Diagonal slope, No. 5 mine, Comox Colliery, and five men were slightly burned.

On February 28th an ignition of gas, following a shot, occurred at the face of the New Diagonal slope, No. 5 mine, Comox Colliery; the ignition was extinguished without any damage.

On June 14th spontaneous combustion was discovered in the Blue Flame mine, Princeton; the area affected was sealed off without any serious trouble.

On June 27th two trucks collided on a steep hillside at the open-cut mine of the Mammoth Collieries, Corbin; one truck was forced some 40 feet from the road, but no one was injured.

On September 14th a truck used in the open-cut mine of the Mammoth Colliery, Corbin, rolled down the hillside when part of the roadway failed; the driver sustained broken ribs and other injuries.

On September 23rd an ignition of gas, following a shot, occurred on No. 2 machine-cut wall, No. 5 mine, Comox Colliery: this was extinguished by the use of lime-rock dust and water and by the digging-out of the cut coal; no one was injured.

On October 23rd a heavy "bump" occurred in Nos. 18 and 19 East slope area, No. 1 East mine, Coal Creek Colliery; considerable damage was done, but no one was injured.

On November 2nd a fairly heavy "bump" occurred in No. 19 East slope, No. 1 East mine, Coal Creek Colliery, and damaged a roadway for 100 feet; no one was injured.

On November 9th spontaneous heating developed in No. 1 incline, No. 5 mine, South Wellington; this is the same area where heating occurred on February 1st, but as the source of this second outbreak could not be reached the whole area was sealed off.

On November 15th a serious fire occurred in the boiler-room at Michel Colliery and did considerable damage to boiler plant; no one was injured.

On December 19th an "overwind" occurred at the No. 1 shaft of the Western Fuel Corporation of Canada, Limited, Nanaimo, through an error on the part of the hoisting engineer; the automatic safety detaching device worked perfectly in this emergency and left the cage safely suspended from the safety-block. The descending cage was not damaged, but the rope, where attached to the cage, was kinked and had to be recovered; no persons were riding in the cages at the time and no one was injured by this occurrence.

THE COAL CREEK SEISMOGRAPH.

Owing to the intermittent operation of No. 1 East mine, during the year the seismograph was not in operation.

The mines worked less than two eight-hour shifts per week, and as the chief value of the seismograph lies in the correlation of the indications given by the seismograph with the observed occurrences underground it was decided to suspend this work until the mine resumes more regular operations.

PROSECUTIONS.

During 1933 there were nine prosecutions made for infractions of the "Coal-mines Regulation Act" and special rules, all of which resulted in convictions.

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

Date.	Colliery.	Occupation of Defendant.	Offence charged.	Judgment.
	Canadian Collieries (D.), Ltd.—			
Jan. 6	Comox Colliery	Fireboss	Proceeding to fire a shot where a "gas-cap" was visible (General Rule No. 12)	$10 and costs.
Feb. 12	Comox Colliery	Miner	Drilling holes in coal with percussive drills (General Rule No. 14)	$10 and costs.
			Using inflammable substance in coal-holes (General Rule No. 15)	$10 and costs.
" 12	Comox Colliery	Fireboss	Using delay detonators in coal (General Rule No. 12)	$20 and costs.
			Using non-permitted explosives in holes (General Rule No. 12)	$10 and costs.
" 12	Comox Colliery	Manager	Allowing non-permitted explosives to be used (General Rule No. 12)	$100 and costs.
" 12	Comox Colliery	Overman	Allowing non-permitted explosives to be used (General Rule No. 12)	$20 and costs.
Oct. 3	Corbin Collieries, Ltd.	Surveyor's helper	Found with matches in his possession underground (General Rule No. 9)	$5 and costs.
Nov. 21	Corbin Collieries, Ltd.	Fireboss	Having loaded more than one shot-hole at a time (General Rule No. 12)	$20 and costs.

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 1933 many requests were received from medical men for oxygen and the inhalators for use in emergencies; 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.

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. They must be under 34 years of age.

In addition to the regular teams in training during the year, fourteen new men took the full training and were granted certificates of competency:—

Cert. No.	Name.	Where trained.	Cert. No.	Name.	Where trained.
777	Solomon Angstadt	Blakeburn.	784	Robert Murray	Blakeburn.
778	Thomas Bryden	Blakeburn.	785	George E. Pollock	Blakeburn.
779	Robert Barrass	Blakeburn.	786	Thomas Rallison	Blakeburn.
780	Stanley Cunningham	Blakeburn.	787	Thomas A. Slee	Blakeburn.
781	William E. Hughes	Blakeburn.	788	Thomas Smith	Blakeburn.
782	William Hunter	Blakeburn.	789	Leonard C. Stewart	Blakeburn.
783	Robert B. W. Muir	Blakeburn.	790	Harry Vaton	Blakeburn.

SAFETY, WELFARE, AND FIRST-AID WORK.

Much work has been done by the Inspection Branch of the Department of Mines in organizing and fostering safety and first-aid committees in the different mining areas of the Province, with the result that there are now active units working towards the safety and welfare of the miners in all the larger mining towns and mines in British Columbia. The Department of Mines has provided considerable financial support to this work in the form of grants to the different safety associations in the Province.

In the older mining towns of Nanaimo, Cumberland, Princeton, and Fernie this work has been carried on for many years, and more recently the larger metalliferous mines have gone seriously into the matter of having all employees perform their work in the safest possible way.

Many safety features and devices are in use, but it is realized by all interested in safety-work that the best safety device is a careful man, and the main field of endeavour before the different safety organizations is to reach and convince the individual of the need of working safely.

However, the matter of convincing many of the miners that greater care is necessary is more difficult than it may seem. While in the face of a recognized danger or abnormal condition the average miner will observe suitable precautions, but he is prone to overlook the possible dangers that may arise from apparently normal conditions, and most of the accidents in mines occur in places where apparently conditions were normal and no danger was apprehended.

It may be pointed out that compensation to the extent of over $250,000 is paid annually to men who are injured in the mines, and this sum is only partial compensation for wages lost due to injuries and does not in any way compensate for the suffering resulting from injuries. The financial loss to the injured men will almost equal the above sum, while the employer also suffers a financial loss due to disruption of operations when an accident occurs, and the further possible loss entailed in training new men to take the place of the injured men.

Many accidents also involve property damage, so that it may reasonably be said that the toll of accidents, directly and indirectly, cost the miners and mining industry of British Columbia almost $1,000,000 annually. Therefore, entirely apart from the greater humanitarian view-point, accident-prevention is a worth-while work on the part of all connected with mining.

In the great majority of accidents, some act, however innocently performed, of commission or omission can be pointed to as one of the chief contributing factors, and when the other factors synchronize the accident occurs.

Practically all the Government safety regulations and company safety rules originated in accidents in which lives were lost, and the safety rules are designed to prevent the recurrence of such accidents.

There are some men who have the feeling that all safety rules, governmental or local, are so much red tape and have no practical application; there are other men, and many of them, who appear to feel that safety rules are good in general, but that they, personally, are capable of attending to their own safety and will many times follow their own ideas, which may be at wide variance with the safety rules.

The fact that practices which are potentially dangerous can sometimes be followed for a considerable time without a resulting accident give rise to a false sense of safety, and when an accident does occur it is usually simply charged to the so-called inherent risk of mining.

The nature of mining makes it impossible to maintain the same immediate supervision over the individual employees that obtains in other industries; the men usually work in pairs, and often singly, and it is seldom that in travelling around a mine more than three or four men are in view at one time. This partial isolation makes it imperative that all underground workers should fully understand and obey the safety regulations not only as a mere matter of compliance, but also from an understanding of the potential dangers resulting when any of the regulations are disregarded.

At all the larger mines the safety committees are active not only in devising safety rules, but in the more difficult and important matter of obtaining the individual co-operation of all the employees. In order to bring as many men as possible into direct contact with safety-work the personnel of the various safety committees undergoes a constant change, as every month or so some of the older members are replaced by new members.

These different committees not only discuss the cause of accidents with a view to suggesting how similar accidents may be prevented, but do much constructive work in suggesting the safest means of carrying on the ordinary every-day work of the mine. In some instances the safety committees have been of much assistance to different managements in introducing and later making compulsory the use of protective hats, proper working-gloves and safety-shoes.

For a number of years past first-aid and safety-first demonstrations have been held at Kimberley, Fernie, Princeton, Trail, Nanaimo, and Britannia, and serve the double purpose of showing the value of first-aid training and attracting new recruits to the safety movement. In many instances men who have taken part in the first-aid and safety training at the larger mines later go to work at some of the smaller operations, where the number of employees is too small to make it feasible to organize a class; these men seldom forget their training and are usually found to do useful pioneer safety-work wherever they may be.

In the matter of transportation of the injured the innovation of an electrically heated ambulance car centrally stationed underground in the *Sullivan* mine and the introduction of a specially designed stretcher carrier for use on the aerial tram by the Premier Gold Mining Company may be mentioned; the latter is designed for use in winter, when snow and ice conditions may render impossible ordinary means of transportation.

In many cases the smaller mines are situated some considerable distance from the nearest doctor, and in all such cases the Inspector of Mines has made a point of seeing that some qualified first-aid men were among the employees; it is not uncommon to find that the nearest doctor resides from 20 to 50 miles from the mine, and in winter this may mean several days before medical assistance could be secured in an emergency, and in such instances the first-aid man is invaluable.

In the newer lode-mining areas of Bridge River and Cariboo the Department of Mines was instrumental in securing the services of centrally located doctors. Small emergency hospitals and first-aid classes are now being organized in these new districts.

At the *Sullivan* mine of the Consolidated Mining and Smelting Company of Canada and at the *Cariboo* mine of the Cariboo Gold Quartz Mining Company all underground employees, and those exposed to dust in the surface, were examined by the X-ray to determine their condition in regard to silicosis; the diagnosis of the *Sullivan* men is not yet available, but the report of the Cariboo Gold Quartz Mining Company's employees showed that a number of men were affected. This mine has been in operation a comparatively short time and the crew is comprised of miners who formerly worked in other mining areas where their silicosis, which is the accumulated result of years of exposure to dust, was contracted.

The men affected were given work on the surface.

The interest shown by the above companies in the matter of silicosis will no doubt be followed by others.

Among the more recent safety regulations under the "Metalliferous Mines Regulation Act" are the prohibition of the use of ordinary dynamite underground and the control of dust produced by drilling. Ordinary dynamite may, under certain conditions, produce a high percentage of poisonous gases, and in the past a number of lives were lost due to this cause. In addition to above prohibition the Department of Mines took up the matter with the manufacturers of explosives, and as a result all cases of ordinary dynamite sold in British Columbia carry a warning that this explosive must not be used underground. A recent amendment to the "Metalliferous Mines Regulation Act" provides that: "Every drill, used in any mine where

the character of the ground is such that dust is caused by the drilling, shall be equipped with a water jet or spray or other appliance equally efficient to prevent the escape of dust, and of a type approved by the Inspector of Mines."

While not specifically dealt with in the "Metalliferous Mines Regulation Act," the matter of hoisting-ropes, where men are hoisted or lowered in shafts, has been taken up with the different mines, and as a result the working-life of such hoisting-ropes has been limited to two years; there are no practical means of testing the remaining strength in ropes in use and it is felt that the above is a reasonable precaution.

At the *Sullivan* mine of the Consolidated Mining and Smelting Company of Canada the mine accident-prevention committee meets once each month, and the meetings are attended by the superintendent, foremen, and shiftbosses. Ways and means of preventing accidents are fully discussed at these meetings; this ensures that all the shiftbosses, who are in daily contact with the working force of the mine, are fully informed and able to impart the safety knowledge gained at the meetings to the men directly in their charge.

A second committee comprising the superintendent, the chairman and secretary of the accident-prevention committee, and twelve employees meets each two weeks for safety discussion; two members of this committee retire each month, so that a complete change in the personnel is made twice a year, and ultimately all employees will have been brought into personal contact with safety-work.

Many of the safety measures introduced at the *Sullivan* mine have been directly due to the discussions and recommendations of these safety committees. Among these safety measures may be mentioned the compulsory use of protective hats by all men underground; the use of properly designed work-gloves, which is almost 100 per cent., while over 50 per cent. of the men now use shoes with protective toes, and goggles and dust-masks are supplied by the company to any employees requiring their use.

In the stopes special electric lamps are provided for the men engaged in "barring-down" and in specific work where lighting is an important safety factor. These lamps are made up from six Edison No. 2100 cells, and by the use of a special reflector these lamps give a beam equal to 200,000 candle-power; forty-four of these lamps are in daily use.

"Speedlight" head-lights are used on all underground locomotives and provide excellent vision for the motorman for 300 feet ahead. All trains are provided with electric tail-lights; this eliminates the possibility of tail-lights being put out from the concussion due to any necessary secondary blasting.

During the shift Duro aluminium pinch-bars are used for all barring-down done in stopes. The light weight of this metal is an important advantage where barring has to be done from ladders or other places where the use of the heavier steel bars would be potentially dangerous in causing a man to overbalance and fall.

First-aid classes are held during the winter months for new men as well as for those qualified first-aid men who desire to take further training, and 482 men, or 87 per cent. of the mine employees, now hold a St. John Ambulance certificate, while twenty-one men hold certificates of competency in mine-rescue training, issued by the Department of Mines. One team of mine-rescue men is kept in constant training for any emergency that may require their service.

The rescue-station at the *Sullivan* mine is equipped with twelve sets of the latest McCaa two-hour oxygen rescue apparatus; eighteen sets of the Burrell all-service gas-masks, with adequate supplies to maintain the equipment in service.

Teams of first-aid and mine-rescue men from the *Sullivan* mine have demonstrated their efficiency by gaining the first awards for such work in open competition at Fernie, where they had to compete with teams which had many years of experience in this work.

All employees are insured, on a non-contributory basis, by the company, so that with three years' service each employee has a policy value of $1,500, which he can increase at his discretion.

An X-ray examination of underground employees, and those exposed to dust on the surface, was carried out by the company without any cost to the men for the purpose of determining whether any were affected by silicosis.

Medical service and hospitalization is provided under contract between the employees and the local medical men on a very equitable basis, which provides satisfactory service without excessive individual cost.

The housing and living conditions at Kimberley are probably better than in any other mining town in the Province, and the town itself presents a pleasing appearance that is all too seldom found in mining areas.

At the mines of the Britannia Mining and Smelting Company an active safety-first and first-aid organization carries on accident-prevention work throughout the year, and in addition to the ordinary general meetings on the surface a safety meeting is held every two weeks on one or other of the mine levels when the men meet for lunch; these meetings are so arranged that men who work on changing shifts can attend as often as possible.

A safety engineer devotes his whole time to the inspection of the mines and the study of how to carry on the different mining operations with the maximum of safety.

A large number of the employees are qualified first-aid men, and forty new men gained the St. John Ambulance certificate during 1933.

In addition to the general committee, two men from each section of the mine are appointed to examine their own section once each week and make a report and recommendations on the safety conditions found; these men are changed each three months, so that ultimately all men are directly brought into contact with the safety-work.

Many of the recommendations made by the safety committee have been put into practice and are welcomed by the men generally. Among the safety features now in force at *Britannia* as a result of safety-work of the management and the committee may be mentioned the compulsory use of protective hats by all persons underground, the use of proper work-gloves, and, where suitable, protective shoes.

Safety-ropes are provided at all places where men may have to work on steep or sloping ground and all men are required to read the safety rules and return a receipt stating that they have done so and will obey them.

Carbide flood-lights are used for the examination of the back in the larger stopes, although with the present method of breaking ore by large blasts the use of the flood-lights is not required as much as formerly.

All new men must pass a physical examination before being employed, and if employed must agree to take a course of first-aid training; all hoistmen, motormen, and breakmen must undergo a rigid medical examination every six months to determine their physical and mental fitness to continue at such responsible work.

All employees are insured, under a non-contributory system, by the Britannia Company on entering the service, and the insurance increases until with three years' work each employee is insured for $1,500; this is entirely apart from compensation.

The housing and living conditions are as favourable as the physical limitations of the area permit, as the townsite is situated on the steep sides of Britannia creek; tennis-courts, reading and recreation room, moving-picture theatre, and dance-hall have been provided for the residents, while the large general stores on the property are operated on a co-operative basis to the entire satisfaction of the community.

At the *Hidden Creek* mine of the Granby Consolidated Mining, Smelting, and Power Company, Limited, at Anyox, a safety-first and first-aid organization was formed and considerable work has been done along this line. A safety engineer devotes his full time to this work in an endeavour to make all employees conscious of the value of obeying the safety rules, and towards the end of 1933 teams were organized in mine-rescue training with the Gibbs oxygen apparatus. The use of protective hats is standard at the different mines of this company and have proved their value in a number of cases. Following a labour dispute in the early part of the year, a large number of men with little previous experience in underground work were employed; these new men were mostly Canadians and responded quickly to the intensive safety precautions and training provided in this emergency.

SUPERVISION OF COAL-MINES.

During the year twenty-seven coal companies operated twenty-nine collieries, with forty mines, employing 2,241 men underground. In the supervision of underground employees there were twenty-two managers, one safety engineer, twenty-four overmen, sixty-five firebosses and shotlighters, a total of 111, or one official for every twenty persons employed underground.

"COAL SALES ACT."

This Act has been in force since 1931 and is designed to standardize the sale of coal and ensure that the consumer receives the particular kind and grade of coal ordered.

All coals produced in British Columbia are registered under a name selected by the company mining the coal and approved by the Chief Inspector of Mines; all invoices regarding the coal in its transfer from the producing company to wholesale or retail dealers and to the ultimate consumer must carry the registered name of the coal. In the case of coal produced elsewhere and sold in British Columbia, all invoices regarding such coal must show the name of the country, State, or Province, and the name of the mine and district where the coal was produced.

The Inspectors of Mines are charged with much of the work of enforcing the provisions of the "Coal Sales Act," and during the short time the Act has been in force they have done valuable work in reducing the substitution of one coal for another; a practice that was formerly prevalent, particularly with the smaller dealers or "peddlers," who take up the sale of coal as a side-line in the winter months.

During the winter months there are over 300 of these peddlers in the coal business in Vancouver; practically all of them were visited and their invoices regarding the purchase and sale of coal examined.

While the situation so far as the "Coal Sales Act" has been looked into throughout the Province generally, the greatest supervision is required in Vancouver; in the smaller towns the coal business is usually handled by firms that are long established and do business throughout the year and are not faced with the seasonal competition that exists in Vancouver during the winter months.

All the coal-dealers are now fully acquainted with the requirements of the "Coal Sales Act," and while closer observance of these requirements were ordered in a number of cases, in only one instance was it considered necessary to prosecute.

In addition to seeing that the different provisions of the "Coal Sales Act" were observed, every opportunity was taken to advise dealers and consumers of the advantages, direct and indirect, of using British Columbia coal, and in many instances advice was given where it was found that coal was being used inefficiently. In many cases it was found that defective furnaces or flues did not permit proper combustion, and usually such defects were charged against the fuel.

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.	Colliery and District.	Producing Company.
Comox	Nos. 4 and 5 mines, Comox Colliery, Cumberland	Canadian Collieries (D.), Ltd.
Old Wellington	No. 9 mine (Wellington)	Canadian Collieries (D.), Ltd.
Ladysmith-Wellington	No. 5 mine (South Wellington)	Canadian Collieries (D.), Ltd.
Ladysmith-Extension	No. 8 mine (Extension)	Canadian Collieries (D.), Ltd.
Hi-carbon	Mixture of Canadian Collieries' coal and B.C. Electric coke	Canadian Collieries (D.), Ltd.
Nanaimo-Douglas	No. 1 mine, Upper seam (Nanaimo)	Western Fuel Corporation of Canada, Ltd.
Nanaimo	No. 1 mine, Lower seam (Nanaimo)	Ditto.
Nanaimo Reserve	Reserve mine (Nanaimo)	"
Nanaimo-Wellington	Blend of No. 1 mine, Nanaimo, and No. 5 mine, South Wellington	"
Wellington South, Ida Clara	Ida Clara No. 1 (South Wellington)	Richardson Bros., Ltd.
Cassidy-Wellington	Cassidy Colliery (Cassidy)	Granby Consolidated M.S. & P. Co., Ltd.
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-Wellington.
Jingle Pot	Jingle Pot Colliery (East Wellington)	Jingle Pot Colliery, Ltd.
Old Adit, Wellington	Old Adit (Wellington)	Old Adit Colliery (C. Stronach).
Chambers-Extension	Chambers (Extension)	R. H. Chambers.
Bromley Vale, Princeton	Bromley Vale (Princeton)	Bromley Vale Colliery, Ltd.

LIST OF REGISTERED NAMES OF BRITISH COLUMBIA COALS—*Continued.*

Registered Name.	Colliery and District.	Producing Company.
Middlesboro	Middlesboro (Merritt)	Middlesboro Collieries, Ltd.
Nicola Sunshine	Sunshine (Merritt)	Sunshine Coal Co., Ltd.
Coalmont	Coalmont (Coalmont)	Coalmont Collieries, Ltd.
Princeton Blue Flame	Blue Flame (Princeton)	W. R. Wilson Mining & Investment Co.
Tulameen Coal, Princeton	Tulameen (Princeton)	Tulameen Coal Mines, Ltd.
Diamond, Princeton District, B.C.	Diamond (Princeton)	Pleasant Valley Mining Co., Ltd.
Sunrise, Princeton District, B.C.	Sunrise (Princeton)	Pleasant Valley Mining Co., Ltd.
Pleasant Valley, Princeton District, B.C.	Diamond and Sunrise Blended (Princeton)	Pleasant Valley Mining Co., Ltd.
North Thompson Gem	North Thompson (North Thompson)	North Thompson Colliery, Ltd.
Red Triangle, Princeton Quality	Red Triangle (Princeton)	Red Triangle Coal Co., Ltd.
Princeton-King	King (Princeton)	King Colliery, Ltd.
Hat Creek	Hat Creek (Lillooet)	Canada Coal & Development Co., Ltd.
Bulkley Valley	Bulkley Valley (Telkwa)	Bulkley Valley Colliery, Ltd.
Crow's Nest, Coal Creek	Coal Creek (Coal Creek)	Crow's Nest Pass Coal Co., Ltd.
Crow's Nest, Michel	Michel (Michel)	Crow's Nest Pass Coal Co., Ltd.
Corbin Washed	Corbin (Corbin)	Corbin Collieries, Ltd.

DESCRIPTION OF THE NEW DRY-CLEANING AND PREPARATION PLANT AT MICHEL COLLIERY, CROW'S NEST PASS COAL CO., LTD.

During the summer of 1932 the Crow's Nest Pass Coal Company, having in mind the desirability of producing a coal of uniform quality at all times, decided on the erection of a dry-cleaning plant at the above colliery. This was completed and a trial run made in December of 1932. As this plant has now been in operation for a full year, a brief description of the equipment in use and method of operation might be of interest.

Equipment in Use.—No. 1 unit: This consists of one type R.B. separating-table with a coarse-mesh deck, 17 feet 6 inches in length by 8 feet in width, and driven by a 10-horse-power motor. The fan supplying the air required for this table has a capacity of 65,000 cubic feet of air a minute and is driven by a 75-horse-power motor. Capacity of this unit is 150 to 180 tons per hour.

No. 2 unit: This table has the same dimensions as the one described above, but is fitted with a fine-mesh deck for the purpose of cleaning the fines, the motive power being provided by a 10-horse-power motor. The fan supplying the air for this table has a capacity of 30,000 cubic feet of air a minute and is driven by a 30-horse-power motor.

Two Plat-O vibrating screens fitted with interchangeable screens. At the present time ¼-inch screens are used and these can be changed in approximately twenty minutes. The power to drive these screens is provided by two 3-horse-power motors.

One 36-inch belt-conveyor to transfer the raw coal from the tipple to the cleaning plant; this is driven by a 10-horse-power motor, has a capacity of 200 tons per hour, and delivers the coal into No. 1 surge-bin.

One flight-conveyor used for loading alongside the plant; this is driven by a 20-horse-power motor and has a capacity of 160 tons per hour. Any product can be loaded by this conveyor; i.e., 1½-inch to ¼-inch or ¼-inch to 0-inch, or both mixed.

One 18-inch belt-conveyor to collect the ¼-inch product from the No. 1 unit and transfer it to the elevator for recleaning by the No. 2 unit; this is driven by a 5-horse-power motor.

One belt-elevator to raise the coal to the surge-bin over No. 2 table; this is driven by a 15-horse-power motor and has a capacity of 120 tons per hour.

One chain-elevator to elevate refuse into refuse-bin, while a belt-conveyor driven from the same motor conveys the refuse from the No. 2 table to join with that travelling from the No. 1 unit; these are driven by a 15-horse-power motor. The refuse-bin has a capacity of 100 tons.

Description of an R.B. Type Cleaning-table.—This consists of a perforated deck having both a lateral and longitudinal slope on which are fastened a number of stationary riffles extending longitudinally on its surface, having their maximum height at the feed end of the deck and tapering to nothing at the refuse end. A reciprocating motion is imparted by means of eccentrics connected to the table by short rods and driven by a 10-horse-power variable-speed motor through a silent chain-drive. The table is equipped with three chutes on each side, a clean-coal chute, a refuse-chute, and a middlings-return chute (anti-gravity). The middlings-return chutes are driven from a countershaft and are given a reciprocating motion also by means of eccentrics, causing the middlings product to have an anti-gravity flow, this being returned to the deck of the table at the point where the raw coal is being fed, then passed over the table a second time, the cleaner particles travelling with the clean coal, while the foreign material passes into the refuse-chute. Immediately under the deck are the "louvre controls," which are a series of small dampers for the purpose of regulating the flow of air passing to the various sections of the deck. These controls are operated by rods terminating at each end of the table and fitted with thumb-screws, by which it is possible to secure each control independently in its desired working position. It is necessary to utilize varying amounts of air in the different sections of the deck, as it is essential that an even bed of coal be maintained. The air required is supplied by a fan situated underneath the table and connected to it by a sheet-iron chamber, a narrow band of canvas being utilized to form a flexible coupling between the reciprocating deck and the fan, the latter being stationary. The raw coal is deposited longitudinally along the centre of the deck for approximately half its length, and the flow of air is so regulated by the "louvre controls" that the clean coal is kept in free flotation, the rock remaining on the deck, with the middlings stratified in between. The reciprocating motion of the table causes the entire bed of stratified material to move forward from the feed end, the clean coal travelling by gravity (owing to the lateral slope of the deck) across the riffles and is discharged into the clean-coal chutes at each side. The rock, etc., is carried at the base of the riffles and discharged into the refuse-chutes, the middlings being returned to the deck by means of the anti-gravity chutes for recleaning.

It is possible to make a division between the clean coal and middlings and the rock and middlings at any desired point; by this means the grade of cleanliness can be regulated, while the speed of the table and flow of air through the deck are also used to regulate the grade required.

Samples of the coal are taken at frequent intervals and tested to check results. These vary according to the class of coal treated, but in general a reduction of 4 per cent. in the ash content of the coal treated is maintained.

Operation.—The coal is delivered into the No. 1 surge-bin by a belt-conveyor from the tipple; it then passes over No. 1 table, where the rock is removed from the larger sizes, some rock also being separated from the fines at this stage. The cleaned coal passes down chutes at each side of the table to the Plat-O screens, the coarse sizes passing over the screens into either the main elevator to the bins or to the flight-conveyor for loading alongside the cleaning plant; the fines passing through the screens are transferred by the small belt-conveyor to the small elevator, which discharges into No. 2 surge-bin for recleaning on No. 2 table. After passing over this table the fines are discharged into chutes at each side and pass to either the main elevator or flight-conveyor. The fines and coarse coal can be loaded separately, one going to the main elevator (and thence either to the bins or returned to the tipple for loading there or remixing with the larger sizes), the other being loaded by the flight-conveyor into cars alongside the plant, or the two products can be mixed and loaded together by elevator or conveyor. The refuse from No. 1 table is conducted by chutes to the refuse-elevator, that from No. 2 table being taken by a belt-conveyor to the elevator, which then raises all the refuse into a steel refuse-bin, from which it is loaded into trucks and hauled to the dump. The cost of cleaning the coal in this plant averages from 3 to 5 cents per ton.

The building itself is a two-story, reinforced-concrete structure and equipped throughout with steel sash. Buckets of dry sand are provided handy to the motors, while fire-extinguishers are placed at convenient stations.

Calcium-chloride Plant for treating the Coal prior to Shipment.—The coal at this colliery being of a dusty nature, which was formerly the cause of much inconvenience in shipping and subsequent handling, the company decided during the year to install the above plant to treat all coal before it left the tipple. This consists of a 3-crank plunger-pump driven by a 15-horse-

power motor and a storage-tank having a capacity of 1,600 gallons. A high-pressure pipe-line makes a complete circuit of the tipple and cleaning plant, with spray-jets at each loading-point. This equipment is a product of the Hardie Manufacturing Company. The solution used for spraying is mixed in the storage-tank, which is located alongside the pump in the basement of the power-house; a strength of 1.2 specific gravity and a freezing-point of a few degrees below zero is maintained, as this mixture has been found to be the most suitable for prevailing temperatures in this district. The pressure in the pipe-line is kept up to between 300 and 350 lb. per square inch. When in use the solution has a constant flow through the line and back to the tank. This prevents any settling of solid material in the line, and when the plant is not being used the pipes are cleared of all solution by means of compressed air. With all loading-points equipped with sprays, any or all classes of coal can be treated.

METALLIFEROUS MINES.

The output from the metalliferous mines for 1933 was 4,030,778 tons, a decrease of 309,380 tons from the tonnage of 1932. This tonnage was produced from 109 mines, of which forty-seven shipped 100 tons or more.

Fatal Accidents in Metalliferous Mines (including Underground Placer Mines).

There were ten fatal accidents in and about the metalliferous mines in 1933, being a decrease of one from the figures for 1932. There were 3,121 persons employed under and above ground in the metalliferous lode mines in 1933. The ratio of fatal accidents was 3.20, compared with 4.83 in 1932. The ratio for the last ten-year period was 2.68. The tonnage mined per fatal accident was 480,979 tons for the last ten-year period.

The following table shows the mines at which fatal accidents occurred during 1933 and comparative figures for 1932:—

Mining Division.	Mine.	No. of Accidents.	
		1933.	1932.
Vancouver	Britannia	....	5
Fort Steele	Sullivan	1	2
Nelson	Yankee Girl	1	....
Nicola	Quilchena	1	....
Cariboo	Cariboo Gold Quartz	1	....
Atlin (Northern)	Otter Creek	1	....
Atlin (Northern)	Matthew	1	....
Nass River (Northern)	Hidden Creek	3	2
Nass River (Northern)	Bonanza	....	1
Portland Canal (Northern)	Premier	1	1
Totals		10	11

The following table shows the cause and the percentage to the whole of the fatal accidents, with comparative figures for 1932:—

Causes.	1933.		1932.	
	No.	Percentage.	No.	Percentage.
By gases from blasting	1	10.00	2	18.19
By blasting	2	20.00	....	.....
By falling down chutes, raises, etc.	3	30.00	1	9.09
Haulage	....	.....	1	9.09
By falls of ground	4	40.00	4	36.36
Miscellaneous	....	.....	3	27.27
Totals	10	100.00	11	100.00

N.B.—In addition to the above, one man was fatally injured by explosives in the crushing-house at Anyox. This was not included as a mine accident.

The fatal accident which occurred to Edward Lutz, mucker, *Cariboo Gold Quartz* mine, on May 1st was caused by a rock falling from the roof of a drift; two previous attempts had been made to bar down this rock in the preceding day and Lutz and his partner had just brought their tools in to make a further attempt when the rock fell on him.

The fatal accident which occurred to Joseph Biala, mucker, *Premier* mine, on May 22nd was caused while he was engaged in moving ore down a stope and was caught by some cribbing which the moving muck displaced; he was carried down the stope for some 75 feet; he died from his injuries three days later.

The fatal accident which occurred to John Stalzer, nipper, *Hidden Creek* mine, on June 7th was caused by some rocks striking the staging on which he was at work; the impact threw deceased down a stope, with resulting fatal injuries.

The fatal accident which occurred to Basil A. McIsaacs, mucker, *Yankee Girl* mine, on June 22nd was due to fall of ground while engaged in moving ore down a stope.

The fatal accident which occurred to Mike Ceganoff, pluggerman, *Hidden Creek* mine, on August 23rd was due to his being carried down a chute by moving muck; he and his partner had fired some bulldoze shots in this chute, and deceased, against the advice of his partner, decided to enter the chute to see the results of the shots. Both men were aware that muck was being drawn from this chute at the time.

The fatal accident which occurred to Albert E. Westnedge, miner, *Sullivan* mine, on November 6th was due to a fall of ground; the men on the preceding shift had tried to bar down this ground and told deceased and his partner of this condition; deceased and partner examined this ground and decided to keep away from the area until the end of the shift, at which time they proposed to blast the loose ground.

The fatal accident which occurred to Hugo Lindstrom, *Matthews* mine, Spruce Creek, Atlin, on July 31st was due to blasting. Deceased and his partner were driving a drift, and on this day they had a round of shots to fire and had arranged with the men driving another drift 125 feet away that both parties would spit their shots at the same time. Deceased and his partner had spit seven of their holes when the shots in the other drift started to go off and the concussion put out their lights; owing to the prevailing wet condition they could not relight their lamps and at once left the face to make their way out in the dark, and after going out some distance had lost the proper direction and turned back towards the face, which they reached just as the shots started to go off. Deceased had apparently been directly over one of the shots and died shortly afterwards; the other man was slightly injured.

The fatal accident which occurred to Oban Olson, Quilchena Gold Mines, Nicola, on August 12th was due to his being "gassed" after blasting. Deceased and three other men were engaged in sinking a small prospect-shaft, which had reached a depth of 22 feet from the surface. A round of seven shots had been fired at the end of the shift, and after dinner Olson had apparently gone down the shaft to see the result of the shots and had been overcome by the gases; the other men were not aware that Olson had gone to the shaft and when discovered next morning he was dead. Straight dynamite, which is prohibited for use underground, had been used.

The fatal accident which occurred to John E. Moran, manager, Compaigne Francaise des Mines d'Or du Canada, on October 30th was due to a fall of ground and timber; a shot had been fired and had displaced one of the posts next to the face of the drift, and while deceased and his son, D. M. Moran, were replacing this post a cave occurred, displacing two sets of timber and burying both men. The younger Moran was not seriously injured, but was unable to release himself until men working some distance away were notified of the accident and hurried to the scene. This drift was only some 30 feet in from the portal and the method of timbering was not suited to the nature of the ground.

The fatal accident which occurred to Mike Zaga, pluggerman, *Hidden Creek* mine, on November 11th was due to blasting; he had been in the act of placing a number of bulldoze charges and had apparently placed four charges when one went off, killing him instantly. When found he had two capped fuses in his hand, so that apparently he had intended to place further charges before blasting; it is presumed that a rock had fallen on one of the prepared charges and caused it to go off. None of the other prepared charges had been disturbed.

Of the above ten fatalities, three occurred in small prospecting operations where only a few men were employed, and in several cases normal care on the part of the deceased would have averted the accident.

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.

Most of the quarrying operations during 1933 were of an intermittent nature or else carried on with reduced crews; the safety provisions under the "Quarries Regulation Act" were generally well observed; there was one fatal accident in the quarries during the year.

Particular attention was given during inspections to the better fencing of machinery and approaches to quarry-holes and to dealing with steep or overhanging ground at quarry-faces, and in this work the members of the Inspection Department were generally able to secure the co-operation of those in charge of the different operations.

CONCLUSION.

I desire to express my appreciation of the faithful co-operation and assistance afforded during 1933 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 continuance of the same during the coming year. It is only by the closest and efficient co-operation of all parties concerned that the number of accidents can be kept down and so 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, particularly in the gold and silver areas, have resumed operations after several years of shut-down, and many others, while not being fully operated, are being reconditioned.

NORTHERN INSPECTION DISTRICT.

REPORT BY CHARLES GRAHAM, INSPECTOR.

Conditions in general at the various operations in the district were satisfactory and in compliance with the provisions of the "Metalliferous Mines Regulation Act." Several new operations were started in the district, as at the *United Empire* at Stewart and the *Haida Gold* and *Gold Harbour* on Moresby island. Several properties, including the *Big Missouri* and the *Dunwell* at Stewart, *Surf Point* on Porcher island, Princess Royal Gold at Surf inlet, Princess Royal island, and the *Columario* at Usk, resumed operations. Prospects for considerable renewed activity, particularly in the Stewart district, are very bright.

ATLIN MINING DIVISION.

The *Engineer* and the *Atlin Ruffner*, the only two lode mines in the district, did not operate during 1933. (NOTE.—R. Brook continued leasing operations at the *Engineer*.)

Placer operations on Spruce, Ruby, Boulder, Otter, Gold Run, Pine, and McKee creeks and on O'Donnel river were visited. Conditions in general were found to be fairly good. Underground operations were well timbered and the work was being done in a competent manner; in several cases advice was given regarding methods of improving ventilation, and in one instance, at the *Beaton* mine, the largest underground operation in the district, a second exit was ordered with a view to improving both the ventilation and general safety. Attention was also given to improving the living accommodation of the employees at the different camps.

There was considerable activity in prospecting on some of the outlying creeks during the summer months. Approximately 129 men were employed at the different placer-workings in the district.

Drilling with a Keystone drill was done on Pine creek; on one claim on the lower end of Spruce creek; and on upper Otter creek.

TAKU RIVER SECTION.

Whitewater Group.—Under option to the Alaska Juneau Gold Mining Company, Limited; L. H. Metzgar, general superintendent. In June a prospect-tunnel was started; 233 feet of drifting and 450 feet of crosscutting was driven. Operations for 1933 ceased at the end of October. It is expected that further development-work will be done on their property next season. It was found that the provisions of the "Metalliferous Mines Regulation Act" were well adhered to.

SKEENA MINING DIVISION.

PORCHER ISLAND SECTION.

Surf Point.—Owned and operated by N. A. Timmins Corporation, Limited; R. E. Legg, superintendent. This property, situated on Porcher island, about 25 miles south of Prince Rupert, was brought into production during 1933. At present there are twenty-two men employed. General conditions were found to be satisfactory throughout 1933.

Considerable prospecting has been done on other claims on Porcher island adjoining Surf point.

PRINCESS ROYAL ISLAND SECTION.

Surf Inlet.—Owned and operated by Princess Royal Gold Mines, Limited; J. B. Woodworth, managing director. This property was reopened during 1933 after the old *Belmont-Surf Inlet* property and the *Wells* group adjoining were acquired by the new company. Most of the work to date has consisted of repairing the wharf and putting the old plant in shape. Some underground work has been done.

KHUTZE INLET SECTION.

Hunter and Heather.—Three men were engaged in prospecting during the summer of 1933 and about 3 tons of ore mined from the surface was shipped.

NASS RIVER MINING DIVISION.

Anyox Section.

Hidden Creek.—Owned and operated by the Granby Consolidated Mining, Smelting, and Power Company, Limited; C. Bocking, general manager; W. R. Lindsay, general superintendent; W. B. Maxwell, assistant general superintendent; R. L. Healy, general mine superintendent; F. S. McNickolas, mine superintendent. Operations were continuous throughout 1933; except for an interruption of about three weeks during the month of February during a srike of the employees. The mine worked 336 days, producing 1,406,076 tons of ore, and there were used 1,908,600 lb. of explosives, 2,452,500 feet of fuse, 488,200 detonators, and 22,075 electric detonators. There were 3,311 missed shots reported. Quite a number of meetings of employees have been held during the year, at which the safety regulations were explained and the necessity for their strict observance emphasized. During 1933 421 men were employed.

During the year thirty-two multiple blasts were fired in this mine, the blasts being combinations of long machine-holes and coyote-holes.

Number of multiple blasts	32
Total number of long holes	14,966
Total explosives in long holes (lb.)	215,550
Total lineal footage, coyote-holes	2,065
Total number of charges, coyote-holes	107
Total amount of explosives in coyote-holes (lb.)	108,850
Total tonnage broken	1,268,000
Pounds of powder per ton of ore broken	0.25

The largest blast was in No. 2 ore-body sill, 385 level, and No. 7-A and 103 chutes, No. 3 ore-body. In this charge, which broke 500,000 tons of ore, the following data are of interest:—

Number of long machine-holes	2,805
Number of coyote-holes	25
Total lineal footage, coyote-holes	849
Number of powder charges in coyote-holes	42
Total amount explosives used (lb.)	93,800

The largest blast broke approximately 500,000 tons of ore and the smallest approximately 5,000 tons.

These blasts are fired electrically and all preparations for firing, after loading, is done by the mine electricians. Each detonator is tested, then connected in series of not more than fifty detonators, and these in turn are connected in parallel to main leads out of the stope. Each series is then tested and the main leads are also tested before being connected up. Blasting is done when all men are out of the mine. These big rounds have been developed for the mining of pillars, sills, and braces between the various stopes and levels, as they afford a rapid and safe method of mining. The broken ore resulting from such blasts, however, requires more secondary blasting at the bulldoze chambers and chutes. During my inspections conditions were found to be satisfactory and in accordance with the provisions of the "Metalliferous Mines Regulation Act."

Bonanza.—Owned and operated by the Granby Consolidated Mining, Smelting, and Power Company, Limited; W. R. Lindsay, general superintendent; H. E. Doelle, mine superintendent. This mine worked 335 days, producing 128,124 tons of ore, and there were used 119,300 lb. of explosives, 33,320 detonators, 5,190 electric detonators, and 244,400 feet of fuse. There were thirty-nine missed shots reported. During the year fifty men were employed; some additional development-work was done by drifting and raising. Conditions were found to be satisfactory and in accordance with the provisions of the "Metalliferous Mines Regulation Act."

Granby Point.—Owned by the Granby Consolidated Mining, Smelting, and Power Company, Limited: W. R. Lindsay, general superintendent; J. C. Wallis, mine superintendent. This property, which had been idle for some years, was reopened in May, 1933, and has worked continuously for 225 days, producing 5,987 tons of ore. Altogether 11,000 lb. of explosives, 4,200 detonators, and 27,200 feet of fuse were used. Operations here have been confined principally to the extraction of pillars left during the previous operation. Only one shift is employed and the men are transported from Anyox daily. During the year fifteen men were employed.

Conditions were found to be satisfactory and the provisions of the "Metalliferous Mines Regulation Act" were well adhered to.

Alice Arm Section.

Only prospecting and assessment work was done in this section during 1933.

PORTLAND CANAL MINING DIVISION.

Salmon River Section.

Premier.—Owned and operated by the Premier Gold Mining Company, Limited; D. L. Pitt, general manager; Bert Smith, assistant general manager; G. Rudolf, mine superintendent. This mine worked 365 days with an average employment of 200 men. Operations included the driving of 4,168 feet of raises, drifts, and crosscuts and 6,045 feet of diamond-drilling. During the year 185,421 tons of ore were produced and 229,525 lb. of explosives, 92,801 detonators, 491,586 feet of fuse, and 165 electric detonators were used; 124 missed shots being reported. At my different inspections provisions of the "Metalliferous Mines Regulation Act" were found to be fully observed.

Big Missouri.—Owned by the Buena Vista Mining Company, Limited, and operated by the Consolidated Mining and Smelting Company, Limited; D. S. Campbell, superintendent; T. Thomas, mine foreman. Operations at this mine were resumed about the middle of October, 1933, the mine working sixty-nine days with an average employment of twenty-six men. Work here is being confined to 306 drift north, which was advanced 258.5 feet; 360 drift south, which was advanced 410 feet; and 343 crosscut, which was driven 63 feet; total footage being 731.5. For this work 11,900 lb. of explosives, 33,800 feet of fuse, and 3,100 detonators were used, with twenty-one missed shots being reported. Ventilation at this mine is by exhaust-fan and 10-inch diameter air-pipe. "Booster" fans are located on the line to assist the ventilation. General conditions were found to be satisfactory and in accordance with the "Metalliferous Mines Regulation Act."

Northern Light.—Owned by the Premier Border Gold Mining Company, Limited; J. A. McKenzie, superintendent. During the summer some diamond-drilling was done in the mine, but no other work was undertaken.

Salmon Gold.—Owned by the Salmon Gold Mines, Limited. During the summer season some surface trenching and prospecting was done here, but operations ceased when winter set in, as the property was not equipped for winter operation. It is expected that considerable exploration-work will be done during 1934.

Unicorn.—Owned by the Unicorn Mines, Limited; John Hovland, manager. Two men were engaged in development-work on the lower tunnel and on surface-trenching during the summer.

Pioneer Syndicate.—Operated by the Pioneer Syndicate, Limited, Tide lake; J. W. Jancowski, manager. During the summer considerable prospecting was done on the property, consisting of surface-trenching, tunnelling, and crosscutting. Operations commenced in June and ceased when winter set in.

Spider.—O. McFadden, lessee. Four men were engaged in leasing operations on this property and 3½ tons of ore was packed out and shipped. Supplies were taken in before the snow came and operations are being continued during the winter months. Conditions were found to be satisfactory.

Bear River Section.

United Empire.—Operated by the United Empire Gold and Silver Mining Company, Limited; Wm. Dann, general manager; Thos. Williams, foreman. Operations commenced in August, 1933, and have been carried on continuously, with considerable work being done. The upper half of the old Bayview trail was abandoned and a new trail built. An armoured-cable power-line was installed from the Bear River road. The cable was laid on the ground. Transformer equipment and an air-compressor were installed at the mine. A crosscut tunnel 1,600 feet long has been projected to strike the ore-body so as to bring the ore to a suitable point for a tram-head. Work for the winter is being concentrated on this tunnel, which is now 150 feet in. About thirty men have been continuously employed and a cook-house and sleeping accommodations have been provided for them. Most of the supplies were got up early in the season, as the snowfall is heavy

in this section. General conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

Dunwell.—Owned by the Dunwell Mines, Limited; H. D. Rochford, lessee. The *Dunwell*, *Ben Ali*, and *Sunbeam* claims have been operated under lease, which expired at the end of 1933. The Dunwell Mines, Limited, is now taking over the operation of the property on its own. During the year about 500 tons of ore was shipped from the *Dunwell* and 102 tons from the *Ben Ali*. The provisions of the "Metalliferous Mines Regulation Act" were fully observed.

Argentine.—Some prospecting was done on this claim during the summer.

Georgia River Section.

Georgia River.—Owned by the Helena Gold Mines, Limited; J. C. McCutcheon, mine superintendent. Operations, which were resumed in July with an average employment of seventeen men, closed down for the season at the end of October. During this time considerable drifting was done on the south-west vein of No. 2 level and No. 3 tunnel was extended. During 1933 some 3,050 feet of diamond-drilling was done.

OMINECA MINING DIVISION.

Usk Section.

Columario.—Owned and operated by the Columario Consolidated Gold Mining Company, Limited; John Willman, superintendent; Alex. Martin, foreman. This property resumed operations on October 5th, 1933. A new tunnel has been projected to consolidate the operations and bring the ore to a common point on the surface suitable for a tram-head. Crosscuts and raises will be driven from this tunnel to the Nos. 4 and 5 veins. A crew of fifteen men was employed and general conditions were found to be satisfactory.

Lucky Luke.—Some assessment-work was done on these claims during the summer.

Smithers Section.

Jessie.—Owned by the Jessie Gold Mines, Limited; L. S. McGill, general manager; Alex. Zobnic, foreman. Some further work was done during the summer extending the tunnel through the vein system.

Glacier Gulch.—This property was operated by the owners, Campbell, Loveless, and Banta. The work was confined to open-cutting. The owners are still working on the claims.

Telkwa Section.

Free Gold.—Owned and operated by the Babine Gold Mines, Limited; R. W. Wilson, general manager. Development-work was continued steadily throughout the year, considerable crosscutting and drifting being done on the principal zone. Also during the summer months considerable work was done on the road to the camp.

Houston Section.

Gold Brick.—Owned by the Houston Gold Mines, Limited; operated by H. C. Stratford, A. J. McPherson, and associates. During 1933 a small pilot-mill was installed, but no ore was mined. There was also installed a gas-producer plant to furnish gas to run a 175-horse-power engine. This was constructed on the ground by Mr. Stratford and is a very interesting installation. Sawdust is the fuel used, and it is claimed that it is possible on 100 lb. of sawdust to develop the full 175 horse-power of the engine. Conditions were found to be satisfactory and in accordance with the regulations of the "Metalliferous Mines Regulation Act."

Babine Section.

Radio Gold.—Operated by the Radio Gold Mines, Limited. This company installed a portable compressor on their property at Babine lake and did some development-work.

Manson Section.

Developing and prospecting by the Consolidated Mining and Smelting Company and other concerns was actively carried out in the Manson and Vital Creek areas on placer-ground only.

QUEEN CHARLOTTE MINING DIVISION.

Graham Island Section.

Skidegate-Sunrise.—Owned and operated by the Kitsault Eagle Mining Company, Limited; W. G. McMorris, superintendent. Some drifting and crosscutting was done on the 100-foot level with the object of intersecting the vein showing in the open-cut on the surface and in the 50-foot level. Operations ceased in May and have not been resumed.

Moresby Island Section.

Haida.—Owned and operated by the Haida Gold Mining Company, Limited. During 1933 some underground drifting and crosscutting was done, also some surface stripping and trenching. No. 1 tunnel, which is in about 280 feet, is being worked by hand. Eight men were employed and adequate camp accommodation was provided for them. General conditions were found to be satisfactory and in compliance with the provisions of the "Metalliferous Mines Regulation Act."

Early Bird—Owned by the Gold Harbour Gold Mining Company, Limited. During 1933 some underground and surface exploration-work was carried out on this group. A plant consisting of a 50-horse-power Diesel and air-compressor was installed; also a 40-ton amalgamating-mill. About twelve men were employed and general conditions were found to be good, and the provisions of the "Metalliferous Mines Regulation Act" were well observed.

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; C. G. Dobson and J. P. Lee, assistant superintendents; F. Ebbutt, geologist; N. D. Bothwell, safety engineer; Geo. C. Lipsey, Mike J. Curran, and Tom C. Curnow, mine foremen. During the early part of 1933 operations were confined to the production of about 50,000 tons of ore per month, this being enough to keep all married men and 150 single men employed. In July the economic situation having brightened slightly, it was decided to increase production, and consequently new men were hired in the succeeding months as quickly as they could be profitably absorbed underground. At the close of the year 343 persons were on the pay-roll.

Mining was centred in the *East Bluff* mine, 85 per cent. of the production being obtained from that section of the property. The tonnage drawn from the *East Bluff*, *West Bluff*, *Fairview*, and *Victoria* mines amounted to 659,440 tons, total tons broken amounting to 579,078. The Britannia method of large-scale powder-pocket blasting was almost exclusively used to break ore, and has proved efficient and economical in ground similar to that now mined in the *Bluff* mine. Square set and rill stoping methods were used in mining the *Victoria* ore-body, the stopes being filled with waste drawn from glory-holes as soon as possible after the broken ore had been removed. Development-work during 1933 totalled 5,598 feet, or 1.05 miles, made up as follows: Drifts, 1,775 feet; crosscuts, 1,116 feet; raises, 2,070 feet; winzes, 637 feet. Most of this development was done in the *East Bluff* mine.

First-aid training resulted in forty-one persons, including men, women, and children, passing a proficiency test under the auspices of St. John Ambulance Association. Safety posters of the National Safety Council were posted on bulletin-boards on the surface; illuminated cases underground were used to display posters carrying safety information, and safety meetings were held during the lunch period underground once every two weeks for each level and once during the same period for each of the surface departments. The miners' self-rescue apparatus is maintained at several readily accessible places underground, and they are demonstrated from time to time at the safety meetings. When a raise is up 100 feet above the level the safety regulations required two of these to be placed adjacent to the collar of the raise; there they are kept as long as the raise is being advanced.

All men hired during 1933 have been required to equip themselves with a "hard-boiled" safety-hat, and each new man is given a copy of the company's safety rules. The last page in the rule-book is detachable and contains a pledge, stating that the employee will obey the rules and endeavour to promote safety to himself and his fellow-employees; this is signed, detached, and handed to the shiftboss within ten days from the date he starts to work.

To promote the safe transportation of shifts on jitney cars in and out of a mine a signal-bell on the motor and push-butttons on the cars have been provided. A shiftboss is in charge of each car, and the shiftboss on the end car farthest from the motor presses the button to signal the motorman to start the train. Should it be necessary to stop the train quickly en route for any reason, the signal can be given from any of the cars; all passenger-trams are protected by block-lights.

When powder-pockets are being loaded where open lights cannot be used, special electric-battery lights are provided; these can be carried as a lantern or worn on the hat. This is much more serviceable than the old flashlight method.

The safety campaign for 1933 was one of education, the effort being to establish safe standards of practice for doing work, and to create a safety-consciousness in the minds of all the workmen, making certain that each individual knew the ordinary hazards of his job.

The whole supervision and management of the housing, feeding, washing, and sanitation in the various camps is under the charge of Mr. Henderson, who resides at the 2,200-foot level camp, and who very ably sees that his working staff carries out its duties in a satisfactory manner.

For recreation there is a gymnasium, reading-room, library, tennis-court, swimming-pool, dance and recreation hall.

The company also maintains two hospitals, one at the Beach and one at the Tunnel camp; one doctor with nursing staff supervising both.

During my visits of inspection general conditions in the main camp at the 2,200-foot level were found to be good. At present the *Barbara*, *Victoria*, and *Empress* camps are closed. The underground workings were found to be in good condition; ventilation generally good, though a little smoky at times at the bulldoze chambers on the 1,200-foot level. The timbering was in good order and the use of caps and powder well handled, although one accident from explosives occurred during 1933, in which the person suffered from an injured ear-drum brought about by the concussion from the blast.

Hoisting-ropes on skips and cages are kept in good condition and replaced as soon as wear or a few broken wires are reported by the ropeman. 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 data giving its exact location.

No fatal accidents occurred during 1933, and during my different inspections the provisions of the "Metalliferous Mines Regulation Act" were found to be consistently observed.

REPORT BY JAMES STRANG, INSPECTOR.

Clayburn Co., Ltd.—Head office, Vancouver; J. M. Ball, manager; Edward Wilkinson, mine manager. The company's factory and pits are situated at Kilgard, about 50 miles east of Vancouver. The mines operating are Nos. 4 and 5 B North, No. 9, and Kilgard Fireclay. A shale-quarry at the top of the hill is operated when necessary. At Kilgard mine, during the summer, one of the roadways was driven through to the surface, making it possible to have the mine ventilated by natural means and doing away with the small electric fan that formerly ventilated the mine. A good air-current is maintained at all working-faces. Due to the poor demand for brick, tile, etc., the output and number of working-days dropped considerably, the total tonnage for 1933 being 5,828 tons. The number of men employed was ten.

CLAYQUOT MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Leora.—This mine is situated about 1 mile up from the head of Kennedy lake and is owned and operated by W. W. Gibson, of San Francisco. A small compressor plant operated by water-power was installed. At the time of my visit a shaft was being sunk to the vein, which it was expected would be reached at a depth of 150 feet. Several changes were recommended as to

location of powder-house, method of placing ladder-ways in the shaft, and type of hoisting-engine. These changes were being made by the management. Seven men were employed.

NANAIMO MINING DIVISION.

Alexandria Mining Co.—The *Alexandria* mine, situated on Phillips arm, was closed down during 1933 with only a watchman in attendance, but it is expected it will be opened early in 1934 by the Premier Mining Company.

Enid Julie.—Operated by the Enid Julie Mines, Limited. This mine is situated between the *Alexandria* and the *Doratha Morton* properties at an elevation of about 2,200 feet above sea-level. A great deal of surface work has been done and some tunnelling. The tunnel at present worked is in about 120 feet.

A blasting accident occurred on June 30th through the blaster returning to the face of the tunnel too soon after a supposed miss-shot, causing serious injury to himself. His blasting certificate was suspended for six months. All material has to be transported by packers from the beach to the mine camp and, considering these difficulties, camp conditions are very good. A new bunk-house and blacksmith-shop have been built recently; thirteen men are employed at the mine. Every effort is made by the management to see that the regulations of the "Metalliferous Mines Regulation Act" are observed.

Hayden Bay.—Operated by the Hayden Bay Gold Mines, Limited. This mine is situated at Hayden bay, Loughborough inlet. It is close to the beach and a good camp has been erected. Some surface work and tunnelling has been done and a fair tonnage of ore taken from the vein between the tunnel-level and the outcropping. General conditions at the mine were found to be good and twelve men were employed.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS AND THOMAS R. JACKSON, INSPECTORS.

REPORT BY JOHN G. BIGGS, INSPECTOR.

The low price of base metals prevailing during 1933 offered little attraction to this class of mining, and as a result none of these mines operated in this district during the year. There has been, however, much prospecting and development work done in the gold-bearing areas of this district, and particularly in the Hedley area and at the *Vidette*, north of Savona.

Nickel Plate.—Owned by the Hedley Gold Mining Company; B. W. Knowles, superintendent. This mine is situated in the Hedley district and is the oldest operating gold-mine in this section of the Province. Operations were suspended in 1930, following which the company reorganized and resumed operations late in 1932. During 1933 this company carried on an intensive programme of diamond-drilling, followed by drifting and crosscutting. Twenty-four men were employed and general conditions were found to be satisfactory and in accordance with the provisions of the "Metalliferous Mines Regulation Act."

Stemwinder.—John Frazer, superintendent. This mine is situated to the east of Hedley. During 1933 a considerable amount of work was done on this property. A suitable camp was established and some drifting was done before the end of the year. General conditions were found to be very good and the provisions of the "Metalliferous Mines Regulation Act" were well adhered to.

Maple Leaf.—Operated by the Gold Mountain Mines, Limited; John McConville, superintendent. This mine is situated on the west side of the Similkameen river near Hedley. A very aggressive policy of development has been in force during 1933; a road suitable for the transportation of material was built from the Similkameen river near Henry creek to the camp, a distance of almost 2 miles. A new camp was erected during 1933 and a considerable amount of drifting done; a gas-driven air-compressor was also installed and power-drills are in use underground. During 1933 a fairly large number of men was employed, chiefly on construction-work, and the provisions of the "Metalliferous Mines Regulation Act" were fully observed.

Sterling Creek.—Operated by the Canada Lode Gold Mines, Limited; Dan McKinnon, superintendent. This mine is situated on Sterling creek. Work has been of an exploratory nature, most of which has consisted of drifting in the altered limestones: the power-installation consists of a 2-drill capacity compressor and eight men were employed at the end of 1933. The provisions of the "Metalliferous Mines Regulation Act" were well observed.

Morning Star.—Operated by the Morning Star (Fairview) Gold Mines, Limited; R. L. Clothier, superintendent. This is an old mine and during 1933 it was reopened with an aggressive policy of development-work in force. The old inclined shaft, sunk down to the 350-foot level on the ore-body, was dewatered and a bulkhead was built below the 200-foot level; a new ladder-way, with platforms and partition, was built in this shaft. A new Rushton Diesel-engine power plant was installed for operating a 3-drill air-compressor, and a Diesel-driven geared hoist. Twenty-two men were employed and general conditions were found to be very good and in accordance with the provisions of the "Metalliferous Mines Regulation Act."

Twin Lake.—Ed. Farquharson, superintendent. This is a small gold-mine situated 24 miles south-west of Penticton and at an elevation of 4,300 feet. During 1933 this mine has been the scene of active work; a new bunk-house, drying- and bath-room, and dining-hall were built. During my last visit a 100-horse-power Petter Diesel engine and a Denver-Gardner air-compressor were being installed. Thirty-five men were employed on this work and general conditions in and around the mine were satisfactory.

Dawson.—Operated by the Dawson Consolidated Gold Mines, Limited; A. Ward, superintendent. This mine is situated near Verona, a flag-station on the Kettle Valley Railway. During 1933 there was a fair amount of drifting and sinking in the Nos. 3 and 4 tunnels of this property and some work was done on the surface. A new water system was laid down the side of the mountain from the creek to the mill, while a new compressed-air line was laid from the mill up the side of the mountain to the No. 4 tunnel; an air-compressor driven by a Diesel engine was also installed. A small crew of men was employed at this mine during 1933. Conditions were found to be satisfactory and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

Home Gold.—Operated by the Home Gold Mining Company; J. J. Fagan, superintendent. This is a small mine situated 5 miles from Jessica, at an elevation of 3,800 feet, and is accessible by a fairly good road. It consists of four adit-levels driven into the side of the mountain on the ore, and these are known as the Nos. 1, 2, 3, and 4 tunnels; the latter has been driven a distance of some 500 feet from the portal, with a fair amount of crosscutting done. The power plant consists of a dam installed in the creek, 300 feet in elevation above the entrance to the No. 4 tunnel, with a wood-stave pipe-line laid down the side of the mountain to the power-house; this water is used for operating a Pelton wheel, which is connected by a belt drive to a small Denver-Gardner air-compressor. Eight men were employed and general conditions were found to be fairly good and in compliance with the provisions of the "Metalliferous Mines Regulation Act."

Nicola.—Charles Shaw, superintendent. This mine is situated near the Merritt–Kamloops highway and is about 30 miles from Merritt. Work commenced on this property during May, and since that time a most aggressive policy of development has been in force. The 250-horse-power Petter Diesel engine was overhauled and a 200-kw. electric generator was installed in the power-house, with the necessary switchboard and transformers; also a power-line was run to the *Joshua* shaft, situated 2,300 feet away. At this shaft an electric hoist has been installed and a new head-frame erected; the shaft was dewatered by an electric pump and at 550 feet depth further sinking was started. One of the main developments at this property during the present year was the continuation of the adit-level, which intersected the *Enterprise* vein 800 feet from the portal; this was continued for a further distance of 1,400 feet to make a connection with the *Joshua* shaft; this level constitutes the main haulage system of the mine and cuts the *Joshua* vein at 450 feet below the surface. During my last visit there were forty-seven men employed, twenty underground and twenty-seven at the surface. General conditions of the mining operations were good and the provisions of the "Metalliferous Mines Regulation Act" were well adhered to.

Windpass.—Byron Wilson, superintendent. This mine is situated in the North Thompson district, 6 miles north of Chu Chua, at an elevation of 5,400 feet, and is accessible by a pack-trail. A considerable amount of work was done at this mine in former years by way of drifting, raising, and sinking in the ore, but very little was done from 1925 until the mine was reopened in 1933.

During 1933 there has been a considerable amount of work done and a large crew of men was employed with a view to bringing this mine into production. A large mill and camp-site was cleared near the north end of Dunn lake and an aerial tram-line of 2½ miles was built

connecting the mine and mill site; the carrying-cable is 1 inch in diameter and the tractor-cable ⅝ inch in diameter; eighteen buckets are in use on this tramway and the difference in elevation between the lower and the upper terminals is 3,512 feet. The aerial tram has a capacity of 250 tons per day. A new power plant has been installed at the mill-site, consisting of two Petter Diesel engines, one 60 horse-power and the other 187 horse-power, used for operating a 50- and a 105-kw. alternator respectively, with the necessary transformers and power-line to carry power at 2,000 volts to the mine, where it is reduced to 400 volts.

During my last visit to the mine a mill was in the course of construction. There were twenty men employed at the lower camp and eighteen at the mine. General conditions at the mine and camp were found to be very good and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

LILLOOET MINING DIVISION.

REPORT BY THOS. R. JACKSON, INSPECTOR.

BRIDGE RIVER SECTION.

Pioneer.—Operated by the Pioneer Gold Mines of B.C., Limited; David Sloan, managing director; Harry L. Cain, general superintendent; Dr. Howard T. James, mine superintendent; Ed. Emmons, mine foreman. This operation is situated on the banks of the Cadwallader creek; it is reached by the Bridge River–Pioneer highway at about 53 miles from Shalalth, on the Pacific Great Eastern Railway. The mine is at about 4,000 feet elevation. This is the largest gold-producer in the district, employing 160 men underground and 85 on the surface, with an average daily output of over 300 tons of ore. During 1933 there was installed an additional 1,000-horse-power electrical generating unit on the Hurley river. Water is taken from the original dam on the Hurley river through a wood-stave pipe 8,000 feet long to this new unit, which is at a point about 1,800 feet below power-house No. 1.

The *Pioneer* mine has been developed through three shafts. The original or No. 1 shaft is an incline from the surface to No. 5 level. At the present time it is used only as a manway and pumping-shaft. The No. 2 shaft is a vertical shaft from the adit-tunnel to No. 9 level; the section between the tunnel and No. 5 level being a 2-compartment size, with three compartments between Nos. 5 and 9 levels; since the completion of No. 3 shaft, No. 2 shaft is used entirely as a service shaft. At present it is equipped with a single-drum air-hoist, but will be equipped in the near future with a double-drum electric hoist. At present this shaft is being sunk to No. 14 level, and when the new hoist is installed it is intended to continue this shaft to 500 feet below No. 14 level. No. 1 shaft is vertical from the surface to No. 14 level; this was completed about the middle of 1932 and from it development of the new lower levels has been done. It is equipped with a double-drum Ingersoll-Rand electric hoist driven by a 225-horse-power motor, giving a rope-speed of 1,000 feet a minute. Loading-pockets have been cut on all the levels from No. 9 level down and fitted with loading-flasks for speedy handling of ore. The No. 9 level pocket is connected by transfer raises to the upper levels to No. 5, which is the uppermost level connecting with the old workings.

The main pump in the mine is on No. 5 level, at the foot of No. 1 shaft, where two 125-gallon-per-minute-capacity triplex pumps, with electric drive, are stationed, one of these being a stand-by. Most of the water in the mine comes in above No. 5 level, but some is also made on the next two lower levels. To take care of this water a sump has been cut on No. 9 level, off No. 2 shaft, and fitted with a 75-gallon-per-minute-capacity duplex pump. On No. 14 level there is a heavy-duty triplex pump which can be moved down another 500 feet. The lower levels have been dry except for water from the machines.

During 1933 over 16,000 feet of development-work was done: of this amount nearly 13,000 feet was drifting, over 2,000 feet was crosscutting, and about 1,500 feet was raising. In addition, 400 feet of No. 2 shaft was raised from Nos. 11 and 14 levels and 28 feet of the shaft was sunk below No. 14 level.

The production of ore during the year amounted to about 100,000 tons, and in addition 3,600 tons of tailings were recovered. Toward the end of the year about 10,000 tons of ore per month was being delivered to the mill.

A two-story recreation-hall, 80 by 50 feet, has been erected. In this building there is a restaurant, barber-shop, pool-room, library, two dressing-rooms, dance-floor on the upper story

the full size of building, and a gallery with projection-room for moving pictures. There is also a new 3-room school and thirteen 4- and 6-room cottages for employees, also a new bunk-house with modern accommodation for fifty-six men.

The first-aid room is furnished with a bed, stretchers, splints, bandages, and all other necessary supplies for first aid to the injured. There are several qualified first-aid men on the property, who are available at any time should an accident occur underground or on the surface. It is to be hoped that the employees will get together in 1934 and have some good first-aid classes going; this camp is large enough for such humanitarian work.

During my visits of inspection conditions underground, generally speaking, were found to be fairly satisfactory and the camp accommodation received proper attention. Safety-first precautionary measures were given efficient consideration and the "hard-boiled" hat was used much more than in the past; there were only two slight accidents during the year. The management have remedied, as quickly as possible, any defect when drawn to their attention. In general the provisions of the "Metalliferous Mines Regulation Act" were well adhered to.

B.R.X. Gold Mines, Ltd.—Ernest Shepherd, superintendent. This company, formerly Bridge River Exploration, Limited (N.P.L.), was incorporated as a public company in March, 1933. The property of the B.R.X. Gold Mines, Limited, consists of forty claims and fractions, covering 1,100 acres. From the junction of the Bridge and Hurley rivers it extends southerly a distance of 3 miles on the eastern bank of Hurley river; it also lies three-quarters of a mile to the south of the Wayside Consolidated Gold Mines, Limited, property, 1¼ miles to the north of the Bralorne Mines, Limited, and adjoins, on its western boundaries, the Bridge River Consolidated Mines, Limited, holdings.

Work was continuous throughout 1933, with an average monthly pay-roll of twenty-one men. Mining activity was centred largely on the development of the *California* No. 3 tunnel, where 2,339 feet of tunnelling (1,211 feet of crosscut and 1,128 feet of drift) was driven. The *California* No. 3 adit crosscuts to and drifts on the *California* and associated veins at an elevation of 200 feet below the *California* tunnel No. 2. During 1932 this vein was drifted a distance of 485 feet.

Mining operations have also been conducted at the *Gloria Kitty* tunnel with portable compressor and one drifter; during the latter part of 1933 about 300 feet of drift and crosscut was driven at this working.

The *Arizona* No. 2 tunnel, near the north end of the property, has been advanced, by hand-work, to 250 feet. In the spring of 1934 it is proposed to install a portable compressor and power-drill at this operation; a ¾-mile road is now being built to facilitate transportation of machinery and supplies from the main Bridge River road. This road will also service the *Golden Gate* and *Berta* claims, where considerable hand-work and open-cutting has been done.

At the *California* No. 3 adit a motor-driven 350-cubic-foot air-compressor was installed to supply air for two drifters. At the camp-site a 120-horse-power Diesel engine and a 75-kw. electric generator were installed to supply power for the air-compressor at the mine and electric light and power for the camp. In the early part of 1933 a kitchen and cook-house was built; this was followed by a 13-room bunk-house to accommodate twenty-five men; the camp buildings now consisting of four dwelling-houses, office, assay-room, store-rooms, garage, bunk-house, and cook-house. During 1933 a short auto-road was built from the Bridge River road to the *California* No. 3 adit. During my different inspections general conditions were found to be satisfactory and in accordance with the "Metalliferous Mines Regulation Act."

Bralorne.—Operated by the Bralorne Mines, Limited, Bralorne; Richard Bosustow, general manager; Fred Grey, mill superintendent; Ted Chenoweth, mine manager. This mine is situated on the Bridge River highway at an elevation of 3,600 feet. The water-power required to operate the property is derived from Cadwallader creek. Further details as to power plant, etc., can be obtained from previous Annual Reports.

This is the second largest gold-producer in the district, and with the gradually increasing underground development-work it has been necessary from time to time, during 1933, to employ more workmen underground as well as on the surface; consequently various additions and improvements to the property have been made.

During 1933 a total of 6,200 feet of exploration and development work was driven in the *Bralorne* mine. At the present time an incline shaft is being sunk below the No. 10 level, a new air-hoist installed on the No. 8 level or main haulage-level, and the old hoist is being moved to

the No. 6 level for handling material. A new crushing plant was also installed, the mill capacity being increased to approximately 250 tons per day; 54,283 tons of ore were mined and milled. The capacity and efficiency of the power plant was increased by the installation of a new water-driven generator.

Camp accommodations were found to be good. The new dry-room was enlarged and improved, more rooms were added to the bunk-house, and a new heating plant was installed. A community hall was built which provides moving pictures, a good dance-floor, and a reading-room. Also the school-children have been provided with a well-lighted and comfortable school-room. In addition to this a new office was built, which makes things more efficient and comfortable for the office staff.

The company maintains a two-bed hospital for temporary purposes only. It is equipped with stretchers, splints, bandages, and other supplies necessary for first-aid work. Several qualified and experienced men are on hand to render first-aid treatment to any one who may be unfortunate enough to suffer injury either underground or on the surface, and the management have been active in starting first-aid classes for mine employees in the district.

During my visits of inspection throughout 1933 underground conditions were found to be, generally speaking, in fairly satisfactory order; the general ventilation was satisfactory, with the exception of the *Taylor* tunnel and the 700 and 800 level development; auxiliary blowers are recommended until such time as connections are made. There are ninety men employed underground and forty-one on the surface. General conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

Minto.—Operated by the Minto Gold Mines, Limited; Warren A. Davidson, mine superintendent. This mine is situated near the Bridge River highway, within 4 miles of the *Wayside* mine at an elevation of 2,300 feet. Work was carried on here throughout 1933 and during the last four months between thirty and forty men have been employed. Two tunnels, the *Hagmo* and the *Warren*, are being developed and were driven by hand steel until late in November, when a compressor unit was installed and air-drills put into use. The power unit consists of a Vivian 4-cycle 120-horse-power Diesel engine, a Bellis-Morcomb compressor, and a 12-horse-power Diesel engine for driving the lighting-generator. On December 5th the *Hagmo* tunnel was advanced over 200 feet and the *Warren* scarcely that amount, both tunnels being worked two shifts daily.

Suitable camp accommodation was built during the fall and a water-line laid from the river to a concrete reservoir, which gives a head of 30 feet above the highest building. During my different inspections general conditions were found to be satisfactory and in accordance with the provisions of the "Metalliferous Mines Regulation Act."

Wayside.—Operated by the Wayside Consolidated Gold Mines, Limited; P. E. Ritchie, managing director; G. R. Bancroft, general superintendent; Chas. R. Cox, engineer; D. H. Rae, mine foreman. This mine is situated on the Bridge River–Pioneer highway and is about 4 miles beyond the *Minto* gold-mine. General development-work started on May 1st, 1933, 3,260 feet of underground work being accomplished; this consisted of drifting and crosscutting on five levels. No. 5 level is the main haulage-level; here 750 feet of drifting and 400 feet of crosscutting was done by the end of 1933. The company has its own hydro-electric plant, which is at present developing 400 horse-power; this is located 1 mile from the mine. The mine is electrically lighted and all power units are electrically driven, the compressor being a 1,000-foot unit. Water for domestic purposes is brought to the mine in a 3-inch water-main, 4,500 feet long, under 150 lb. pressure; this water is supplied by a spring on the mountain-side.

New camp buildings are being added, and already a large dining-room, 73 by 30 feet, with kitchen, and capable of accommodating sixty men, has been built. Three sleep camps and a "dry," equipped with hot and cold water, are in use; the water-supply, with hydrants, is well placed for fire-protection.

Foundations for a mill of from 100 to 300 tons capacity were under construction at the end of 1933. Towards the end of 1933 work was being concentrated on No. 5 tunnel, and as it was being operated continuously throughout the twenty-four hours I requested that the ventilation be augmented, and immediate steps were taken by the management in the matter.

During my inspections there were thirty-three men employed and general conditions were found to be satisfactory and in compliance with the "Metalliferous Mines Regulation Act."

Grull-Wihksne Gold Mines, Ltd.—Edmund J. Conway, mine superintendent; John Broatch, foreman. This property, situated within 2 miles of the *Bralorne* mine and easily reached by an auto from the main highway, is at an elevation of 3,200 feet. Over 2,000 feet of tunnelling had been done on this property before the present company took charge, and since July a further 600 feet of tunnelling has been done and a shaft started; this was down 65 feet at the end of 1933; some 500 feet of diamond-drilling was also done and 500 feet of surface open-cuts. The power unit consists of a Diesel-driven compressor which supplies air for the drills and steel-sharpener. While the ventilation was fairly good, I requested that a fan be installed to augment the natural ventilation; the management agreed to install this at once.

A modern and well-equipped bunk-house, dining-hall, and kitchen were built during 1933 and a water-supply piped from a creek 600 feet away; there were twenty-three men employed. During my different inspections general conditions were found to be satisfactory and the provisions of the "Metalliferous Mines Regulation Act" well observed.

Native Son Mines, Ltd.—John W. Warwick, mine superintendent. This mine is situated on the opposite bank of Cadwallader creek, about 3,000 feet south-west from the *Bralorne* mine and at an elevation of 4,000 feet. Work commenced on the tunnel crosscut in June, and at the end of 1933 was in about 700 feet, at which point it was 300 feet below the surface. A ventilating-fan was ordered at the end of 1933 to augment the ventilation. Camp accommodation of a satisfactory nature was built during the fall for the twelve men employed. During my different inspections general conditions were found to be satisfactory and in accordance with the "Metalliferous Mines Regulation Act."

National Gold Mines, Ltd.—Thomas Brett, general manager. This mine is reached at present by means of a horse-trail and is about 3 miles up the mountain from Anderson lake at an elevation of 3,500 feet. During 1933 a big improvement was made in the living accommodation. The buildings now consist of a good bunk-house, dining-hall, and cook-house, with separate residences for the engineers. There were sixteen men employed and about 2,000 feet of cross-cutting and drifting was done in the tunnel now operated. General conditions were found to be satisfactory, although, due to the amount of work being done, I recommended the installation of a fan to augment the ventilation; this will be done early in 1934.

Bridge River Consolidated Mining Co., Ltd.—Chas. A. Seaton, mine superintendent. This mine is on the Bridge River highway near the *B.R.X.* operation and at an elevation of 3,200 feet. At the time of my visit in December the underground work in the *Whynot* tunnel had been discontinued. A diamond-drill is being operated on the property and is kept running day and night. Seven men cover the three shifts. On the surface there are a few other men doing general labouring-work. The camp accommodation is of a temporary nature, but sufficient for the present work.

Truax Gold Mines, Ltd.—Montgomery Howe, mine superintendent. This mine is reached by pack-trail from the Bridge River highway after crossing the river by ferry; the camp is reached by a 5-mile trail and is at an elevation of 5,700 feet. The several underground prospects, none of which are many yards in from the portal, are located near to Truax creek. Hand steel is used on this property and the ventilation in each opening is natural. The camp buildings, consisting of a bunk-house, office, and cook-house, are chiefly constructed of barked logs. During my inspection the general conditions of the camp were good; at the beginning of 1933 seven men were employed, but since the above visit the number of men on the property has been decreased. General conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

Pavilion Section.

Grange Mines, Ltd.—William Tompkins, mine superintendent (formerly called the Big Slide Mining and Development Company). This company's property is situated on the left bank of the Fraser river at an elevation of about 750 feet, and it is about 6 miles from Kelly Lake depot on the Pacific Great Eastern Railway. The machinery on this property consists of an Ingersoll air-compressor, capacity 520 cubic feet of air per minute, driven by a Pelton water-wheel; this compressor furnishes air to drive a 1-ton Sullivan hoist, two Sullivan drifter-machines, and two Ingersoll rotary stopers. A 30-ton mill is operated by a generator furnishing 250 horse-power, same being driven by a 500-horse-power turbine water-wheel; 250 horse-power is developed from water taken from Kelly creek at 530 feet head by means of 1,500 feet of 12-inch Canadian wood-stave pipe. There is satisfactory camp accommodation for the twenty-five men employed

and the provisions of the "Metalliferous Mines Regulation Act" are being carried out satisfactorily.

Pavilion Gold Mines, Ltd.—John Anderson, agent, Vancouver. This company's mine is situated on the bank of the Fraser river, about 3 miles from Moran, at an elevation of about 750 feet. A shaft has been sunk and is down a little over 100 feet. At the 70-foot point in the shaft a drift has been driven on the vein for about 50 feet. The general use, care, and handling of explosives were quite satisfactory, 40 to 60 per cent. Polar Forcite gelatine being used; shot-firing in the drift and in the shaft was done by means of cable and shot-firing battery. In the sinking of the shaft several rules of the "Metalliferous Mines Regulation Act" were ignored; I ordered shaft operations stopped until these defects were remedied. With the above exception, general conditions were found to be satisfactory.

CARIBOO MINING DIVISION.

REPORT BY THOMAS R. JACKSON, INSPECTOR.

Cariboo Gold Quartz Co., Ltd.—Fred Wells, general superintendent; G. Burnett, surface superintendent; N. H. Atkinson, mine superintendent; L. Walker, mine foreman. This property is situated near Lowhee creek, about 5 miles from the town of Barkerville, at an elevation of 4,000 feet. A townsite, with a post-office, has been laid out about 1 mile from the mine and named Wells, after Fred Wells, who pioneered depth lode-mining in the Barkerville area. It is expected a small hospital will be built here to serve the surrounding area.

The camp accommodation ranks with the best in the Province and does much to make the men contented during the long winter. During my last visit of inspection in December there was a total of sixty-five men working underground and ninety-four on the surface, but as many of the surface men were engaged on construction-work, which is nearing completion, the number of surface employees will be considerably reduced at an early date.

The 1,500-foot level is the main transportation level of the mine, with the 1,400-, 1,300-, 1,200-, and 1,100-foot levels at approximately 100-foot intervals above, with the new 1,000-foot level below. At the end of the year the 1,500-foot level was in 2,941 feet from the portal; the shaft to the 1,600-foot level is situated on the 1,500-foot level at 200 feet from the portal. Mancha storage-battery locomotives are used on the 1,500-foot level.

The Emco-Findlay loader is being used to good advantage in the main development-places and under normal conditions can load out a round of muck very quickly. This loader can be used efficiently in drifts 6 feet wide and 7.5 feet high. There is a 10-horse-power Buffalo fan at present providing the ventilation, but this will shortly be augmented by air-driven fans. The power plant consists of one 220-horse-power Rushton-Hornsby horizontal 4-cycle engine (this drives a 150-kw. generator which provides power for the motor units in the mill and underground); one 14-horse-power 4-cycle Rushton-Hornsby Diesel engine; one 165-horse-power 3-cycle Fairbanks-Morse Diesel engine; one 94-horse-power Rushton-Hornsby Diesel engine; one 105-horse-power Ingersoll-Rand Diesel engine; and one 350-horse-power Fairbanks-Morse Diesel engine; giving a total of 884 developed horse-power, most of which is used in the driving of the different compressor units.

A number of employees are qualified first-aid men and a resident doctor started practice at the mine in October, and he intends to organize a first-aid class at the mines. There is a small emergency hospital at the mine. One fatal accident occurred during the year when a man was struck by a falling rock which he and a miner went to bar down from the roof.

During my different inspections general conditions were found to be very satisfactory and the provisions of the "Metalliferous Mines Regulation Act" fully observed.

BARKERVILLE SECTION.

Proserpine Syndicate, Ltd.—Charles M. Campbell, mine superintendent. This organization is exploring a compact block of claims located on Proserpine mountain, about 4¼ miles from Barkerville, at an elevation of about 6,500 feet. The work was started in July and continued throughout the remainder of 1933, with twelve men employed. A large amount of surface-trenching was done while the weather was favourable; tunnels, driven by former operators, were opened up and additional work done in some of them. *Warspite* adit was extended 125 feet in the direction of the *Warspite* shaft, while drifting and crosscutting in the *Bell* adit totalled 170 feet; 100 feet of additional work was done on the *Newbury* adit and shaft; No. 1 was deepened 23 feet to a depth of 41 feet.

The camp accommodation was of the pioneer type—rough, but clean and wholesome. There was lots of good food and good water. General conditions were found to be satisfactory at this operation and in compliance with the "Metalliferous Mines Regulation Act."

Shamrock Gold Mines, Ltd.—A. S. McCulloch, director; James Doody, mine superintendent. This mine is close to Barkerville and at the end of 1933 the tunnel was in a distance of 1,066 feet. It is timbered practically all the way for the first 700 feet, the remainder being timbered in places to ensure safe working conditions. The power plant consists of a Diesel-driven Sullivan compressor, 310 cubic feet capacity, which supplies air to drills and steel-sharpener. At the time of my visit sixteen men were employed. I found the ventilation likely to be defective before the objective of this tunnel was reached, so ordered a fan to be provided; the management at once agreed to do this. General conditions otherwise were found to be satisfactory and the provisions of the "Metalliferous Mines Regulation Act" fully observed.

Island Mountain Mines Co., Ltd.—P. Kraft, director; J. McDonald, mine superintendent; J. Swanson, foreman. This mine is situated on the Barkerville highway at an elevation of 4,000 feet. Surface prospecting and underground exploration-work was done by this company on several properties in this district during the year. The most extensive work was done on the Island property mine; at the old tunnel-site, about 80 feet above the shore-line of Jack of Clubs lake, a small compressor plant was installed in March, consisting of a 250-cubic-foot capacity Holman compressor, driven by a 57-horse-power Gardner Diesel engine.

At first some difficulty was experienced in driving through faulted ground, but from June 1st to the end of 1933 3,360 feet of crosscuts and drifts were driven. One Gardner-Denver rock-drill, Model 107, was operated up to July 3rd; since then two such machines have been in constant operation. One to five hand-drill miners were employed on subsidiary drifts and it was necessary to timber 425 feet of this work. At an elevation of 250 feet above this main level several hundred feet of drifting has been done under contract, and a crosscut is now being driven to which it is anticipated a raise will be made from the lower level. In October it was decided to improve the living accommodations, also to enlarge the power plant; consequently a 500-cubic-foot capacity Bellis and Morcom compressor and a Rushton-Hornsby vertical-type Diesel engine were ordered.

A new power-plant building was erected near the main highway. It is provided with two 5,000-gallon fuel-oil storage-tanks, and a 6-inch air-line was installed to the portal of the main tunnel. Provisions were made to transfer the small power plant to the new site, where it will be used as an auxiliary and for running the electric-light plant. A new two-story combination bunk-house and cook-house, 26 by 27 feet, was built and equipped with modern conveniences; plumbing was also installed in the old bunk-house. These new quarters will provide accommodation for sixty men. A water-supply was provided by bringing water from a creek 2,000 feet away through wood-stave pipes to a 10,000-gallon storage-tank, which gives a 125-foot head at the point of use. Warehouses and other necessary buildings were already provided. A first-aid man, who is provided with all the necessary first-aid equipment and supplies, is employed. Skull guard-caps are carried in the commissary and the men encouraged to use them. A timberman is employed on each shift, part of his duty being to go through all workings each day and bar down all loose ground.

During my visits of inspection twenty-six men were employed underground and twelve on the surface, and general conditions were found to be in accordance with the provisions of the "Metalliferous Mines Regulation Act."

Consolidated Gold Alluvials of B.C., Ltd.—C. H. Unverzagt, managing director; Charles T. Docherty, mine superintendent; Robert Blair, mine foreman. This operation is situated on the Quesnel–Barkerville highway, about 35 miles from Quesnel. During 1933 a very considerable amount of construction-work for the housing of employees and operating purposes was done; also a new shaft-house was constructed at the No. 1 shaft. About 3,500 feet of tunnel-work, some for development and some for mining purposes, was driven from the No. 2 shaft, in a deposit of gravels not apparently shown by the drilling of this ground. At the No. 1 shaft a 26-inch diameter bore-hole was put down, in which a Layne-Bowler turbine-pump will be installed to dewater this area preparatory to resuming mining.

The upper camp is situated on the main highway; its buildings include a large office-house, store, post-office, carpenter-shop, assay office, machine-shop, etc. There is now good accommodation at the upper camp, with a good bunk-house, flush toilet system, recreation-room, hot and

cold water, bath and shower system, dry-room, also a good-sized dining-hall and cook-house; general sanitary arrangements are quite satisfactory. The lower camp is located near No. 2 shaft, with good accommodation, being steam-heated throughout. Ventilation is produced by a blower-fan located on the pit-head; 10-, 8-, and 6-inch galvanized pipes are used to carry the air-current to the faces. The mine is fairly well ventilated and, as practically no explosives are used, the defects from smoke are of a negligible quantity. Due to the extent of the workings depending on No. 2 shaft, the management was notified that a second exit would be necessary at an early date. During my visit in December this mine was being worked on three shifts, a total of forty men being employed underground. The whole of the mine is illuminated by means of electric lights. Conditions in general were found to be satisfactory and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

Britannia Mining and Smelting Co.—Hayward F. Eastman, mine superintendent; *Wintrip*, *Westport*, and *Blackjack* properties. Considerable surface and exploratory work was done during 1933 and underground work was done by means of hand steel. Some diamond-drilling was also done. During my last visit of inspection sixteen men were employed; ten of these were employed underground and the other six were engaged on the surface. In general the requirements of the "Metalliferous Mines Regulation Act" were being well observed.

Richfield Cariboo Gold Mines, Ltd.—H. G. Randlesome, mine superintendent. This mine is situated about 4 miles from the town of Barkerville at an elevation of about 5,200 feet above sea-level. The main tunnel has been driven about 800 feet towards the meshwork of veins that is exposed on the surface about 1,000 feet above the level of the tunnel. The compressor-house and blacksmith-shop is of framework with a corrugated-iron roof. The camp accommodation consists of trimmed-log buildings, well constructed and comfortable, with room enough to house thirty men. One of the buildings is used for a dining-hall and cook-house; another for a "dry" wash and change-house. No fatal accidents were reported during 1933.

During my last visit of inspection eleven men were employed underground and five on the surface. General conditions of the camp were good. Ventilation of the mine is natural, but will shortly be improved by fan ventilation. In general the requirements of the "Metalliferous Mines Regulation Act" were well observed.

Burns Mountain Gold Quartz, Ltd.—W. M. Halliday, president; D. S. Tait, secretary; Angus McLeod, mine superintendent. This company's property is located on Burns mountain, about 4 miles from Stanley, at an elevation of 4,700 feet. There are two tunnels, upper and lower; at the upper level is the camp accommodation, consisting of sleeping-quarters and cook-house. A prospect located near the camp has been driven in several hundred feet, but during my last visit it was not being worked. At the lower tunnel, which has been driven over 1,400 feet, there is a small Diesel-driven compressor which supplies air to the drills and to the ventilation-fan. Twelve men were employed and general conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

Cariboo Placer Operations.

Barkerville Gold Mines, Ltd.—C. W. Moore, manager; James E. Kew, foreman. This mine is hydraulically operated and is about 5 miles from Barkerville at an elevation of 5,150 feet. Six men were employed and general conditions were found to be satisfactory and in compliance with the "Metalliferous Mines Regulation Act."

Lowhee Mining Co., Ltd.—Alfred F. Eastman, managing director; T. A. Harman, mine superintendent. This hydraulic operation is situated on Lowhee creek, about 5 miles from Barkerville, at an elevation of 4,300 feet. General conditions were found to be satisfactory and there were thirteen men employed.

Bullion Placers, Ltd.—Ray Sharpe, manager; W. E. Leveridge, foreman. This company's mine is situated near Likely and is one of the largest in operation. It has inclined walls rising steeply between 450 and 500 feet, with a width at the top of about 700 feet. It has also a 1,650-foot underground passage-way of large sectional area, on the floor of which a specially built, wide and deep, wooden flume has been constructed, through which the gravel is carried out to the Quesnel river; the inside end of the tunnel and flume connects with the formation at the face of the mine, where water is applied by monitors at 175 lb. pressure. A shaft about 400 feet deep has been sunk to this tunnel and is provided with a good ladder-way from top to bottom. Flood-lights are employed in the pit and the underground workings are also provided with

electric lighting. General conditions were found to be satisfactory at this operation; eight men were employed.

Dry Gulch Placer.—O'Brien, Slade, Nicoulin Company, Stanley; W. C. Slade, mine superintendent. This hydraulic operation is close to the town of Stanley and general conditions were found to be satisfactory, except for some overhanging ground which was ordered removed.

Poquette Placer Mine Co.—B. Boe, mine superintendent. This hydraulic operation is on Poquette creek, and during my visit of inspection the face and sides of the mine were found to be in fairly good condition, but requested improvements on the trail to the working-face, and also daily inspections to be made of the water-level at the dam were ordered as a safety precaution for the men working at the lower level; this was agreed to by the management. Eight men were employed.

Slade-Cariboo Gold Placer, Ltd.—W. C. Slade, mine superintendent. This company's operation is situated on the left bank of Lightning creek, in the vicinity of Wingdam, and is hydraulically operated. During my visit of inspection general conditions were found to be satisfactory and new accommodations for the twelve men employed were under construction.

Joyce Gold Placers.—F. M. Joyce, manager. Two properties, Nos. 1 and 2 placers, are situated near the Slade mine. An adequate dam had been built to carry a small head of water and four men were employed on the property. During my visit of inspection general conditions of both properties were found to be reasonably safe, but rough-looking in places, due to overhanging ground, which the management agreed to have attended to as quickly as possible.

Swan-Ackerblade Placer.—B. W. Yateman, mine superintendent; S. Ackerblade, foreman. This placer operation is near "Lover's Leap" on the Quesnel–Barkerville highway. A dam had been built to carry efficiently the small head of water available. Four men were employed on the property. During my visit of inspection general conditions of the mine were found to be good and the care, use, and handling of explosives to be satisfactory.

EAST KOOTENAY, WEST KOOTENAY, AND BOUNDARY INSPECTION DISTRICTS.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

While little, if any, greater activity over the two preceding years was noticed in the silver-lead-zinc districts during 1933, a considerable increase in the number and importance of gold-mining operations marked the past twelve months. This increased activity was particularly noticeable in parts of the Nelson and Trail Creek Mining Divisions. In the Slocan, Slocan City, and Ainsworth Mining Divisions, leasers continued to work on several properties, but the aggregate number of men engaged in these operations remained small. Owing to the greater activity manifested in the gold section, the Inspector's office at Nelson, closed several years ago, was reopened and I have made it my headquarters since April 1st, 1933.

Under the provisions of the "Metalliferous Mines Regulation Act," nine powder-magazines were approved; and the maintenance of underground storages, to contain not more than a 24-hour supply of explosives, was authorized on the fifth level of the *Reno* and the 800, 935, and 1,035 levels of the *Yankee Girl*. In the course of inspections seventy-eight certificates of competency as blaster were granted under the Act and four certificates of the same class were issued under the "Quarries Act" from the Nelson office.

The only explosive used underground in the metalliferous mines of this section of the Province is Polar Forcite gelatine; the 40-per-cent. and 60-per cent. grades finding favour. At the *Sally* a small supply of 50-per-cent. is kept on hand, but is used sparingly. Fuse is the almost exclusive method employed in firing shots.

Three fatal accidents were reported from the metalliferous mines of this section during 1933. Two of these took place at the *Sullivan* and are discussed in detail in Inspector Miard's report on this operation. The third fatality occurred at the *Yankee Girl* and is described in the section of this report dealing with the Ymir district.

The three inspection districts covered by this report present all variations imaginable in the matter of medical attendance and first aid. We find excellent conditions prevailing at the *Sullivan*, where more than 90 per cent. of the working-force is trained in first aid and a doctor can be summoned in a few minutes in case of need, directly in contrast with those existing in

the Ymir-Salmo-Erie district, where the nearest physician is at Nelson, and few, if any, properly trained first-aid men are to be found. A determined effort is being made to remedy this unfavourable state of affairs where it is found to exist, and the willing co-operation of the mine operators is assured towards this end.

GOLDEN MINING DIVISION.

The only important mine at present operated in this Division is the *Monarch*, at Field, reopened in July by the Base Metals Mining Corporation, with Thos. Oxley as superintendent. At the end of 1933 ninety men were employed, the underground crew numbering fifty-four. At the time of the last inspection the underground self-acting incline-haulage was being extended to simplify the delivery of the ore at the upper terminal of the aerial tramway. This, combined with the use of drag-line scrapers in stopes, will greatly facilitate production. The mine is very well kept and the conditions found to prevail underground and on the surface were satisfactory in all respects.

FORT STEELE MINING DIVISION.

The most important operation in the interior of British Columbia is, of course, the *Sullivan* mine, the average daily output of which amounted to 5,450 tons throughout 1933. The Consolidated Mining and Smelting Company of Canada also operated the *Crow* phosphate-mine at Crowsnest for some time during the summer, with the object of securing a sufficient quantity of the mineral for further working-tests at the Trail fertilizer plant. Towards the end of 1933 the B.C. Cariboo Gold Fields, Limited, began operations at *Midway* (the former *Finley-Leask* property) near Aldridge. All these operations are covered in a detailed report by Inspector H. E. Miard.

A short distance above Lumberton the Palmer Bar Mining Company employed five men for some time on ground leased from Geo. Ness, the method of working followed being open-cutting with drag-line scraper. This operation, as well as the tunnel driven by G. Ness himself on the part of the ground that he had retained, were inspected under the provisions of the "Quarries Act."

LARDEAU MINING DIVISION.

The *Meridian*, at Camborne, was operated by the Meridian Mining Company, Limited, with a force of twenty-three men, fifteen of them undeground. J. A. Lade was superintendent. The work done consisted almost entirely of drifting; two levels driven at different elevations being advanced a considerable distance and connected by a raise during 1933. Ventilation was assured by force-fans. Power for the drills is supplied by a water-driven compressor. The conditions found to prevail in and around the mine were good, but the attention of the management was drawn to an infraction of General Rule 16, in the form of irregularly kept reports of daily inspections.

At Trout Lake, J. M. Robertson, of Nelson, employed six men on the *Lucky Boy*, and a group of leasers, headed by Jos. Flagel, worked on the *Gold Bug* at Ferguson.

AINSWORTH, SLOCAN, AND SLOCAN CITY MINING DIVISIONS.

There was no increased activity in these three Mining Divisions during 1933. Leasers worked at the *Whitewater* and the *Wellington* at Retallack; the *Grey Copper* and *Ruth* and *Victor* at Sandon; the *Bosun*, *Mammoth*, and *Standard* at Silverton; while small forces of men were employed for some time at the *Chapleau*, in the vicinity of Slocan City, and at the *Molly Hughes* at New Denver.

NELSON MINING DIVISION.

At the *Lakeview* and at Sanca, both on Kootenay lake, small forces of men were employed by Timmons and Staples, and the Canada Smelters, Limited, respectively. At the *Lakeview* property a compressor driven by an internal-combustion engine was installed to facilitate the driving of a small tunnel directed to strike the bottom of a shallow shaft sunk some years ago near the main highway. At the Sanca property living accommodation was built and a tramway 3,000 feet in length was erected. A crew of nine men was working at Sanca at the time of the last inspection. Operations were discontinued at the *Lakeview* towards the end of 1933.

In the Nelson district small forces of men were employed at the *Perrier* by the Perrier Gold Mines, Limited; at the *Royal Canadian*, operated on lease by J. G. Allen and associates; and at

the *California*, where operations were carried on by a group of leasers headed by W. J. Turner. The Noble Five Mines, Limited, had twenty men at work on the *Venus-Juno* and the *Athabasca* properties, under the direction of Paul Lincoln.

On Eagle creek, at Taghum, the Livingstone Mining Company employed thirty men on the *Granite-Poorman*, with Howard R. Smith as superintendent. When inspected, the mine was worked almost entirely on a system of sub-leases to miners, an arrangement presenting some conspicuous drawbacks. Some ladder-ways were found to be in unsatisfactory condition. The removal of explosives, stored underground on No. 4 level, was ordered.

Considerable activity was shown in the southern section of the Nelson Mining Division. At Apex fifteen men were employed on the *Humming Bird* property by the Humming Bird Mines, Limited, but operations were discontinued towards the end of 1933; and a small force was at work on the *Euphrates*, under the direction of B. N. Sharpe, representing the Spokane-Idaho Copper Company.

In the Ymir district the *Yankee Girl* on Oscar creek was operated with a crew of thirty men throughout 1933, with E. P. Crawford (who was being temporarily replaced by W. Seaman towards the end of 1933) as superintendent. A fatal accident occurred on the 800-foot level of this mine on June 22nd. The victim, Basil Athol McIsaac, was "mucking" in a shrinkage stope, then being drawn, when a comparatively thin slab of rock came off the hanging-wall and struck him on the head.

The Wilcox Mining Syndicate had a small force of men at work on the *Ymir-Wilcox* property on Ymir creek under the direction of J. J. Cullinane. The Ymir Gold Mines, Limited, drove a tunnel at depth on the *Goodenough;* installed a small power plant consisting of a compressor driven by an internal-combustion engine; added a drill-sharpener to the blacksmith-shop equipment; erected a fan; and employed twelve men, with J. F. Coats as superintendent.

At the *Two Stars* the Trites Gold Mining Company commenced operations with a dozen men under the direction of J. L. Parker. Operations there will be limited for some time to the driving of a tunnel, 5½ by 7 feet in the clear, the ultimate length of which is expected to be 3,070 feet. The portal is situated at an altitude of 4,400 feet. A power plant, consisting of a 25-horse-power semi-Diesel Fairbanks-Morse engine and a 60-horse-power double-cylinder Petter engine, driving a 189-cubic-foot Sullivan and a 10 by 12 Ingersoll-Rand compressor respectively, has been erected.

In the Salmo district the most important operation, as in preceding years, was the *Reno*, on Fawn creek. Under the direction of I. M. Marshall, superintendent, and Chas. Wilson, mine foreman, the Reno Gold Mines, Limited, employed sixty-two men in and around the mine; at the time of the last inspection the total working-force, including the mill crew, numbering about ninety. The conditions encountered on No. 6 level have led to the planning of an important scheme of development, involving the sinking of a 3-compartment shaft from No. 5 level and the introduction of a storage-battery locomotive haulage on the same roadway, which will thus retain its present status of main artery for the mine. This in turn implies the installation of a 75-horse-power electric hoist, a motor-generator set and transformers underground, the primary voltage used being 6,600. The project in question had already been reduced to well-defined plans at the end of 1933 and part of the preliminary excavating-work had then been completed. Shrinkage stoping is the method of mining followed. The present power plant at the mine consists of an electrically driven Sullivan compressor of 1,400-cubic-foot capacity and another compressor driven by a Diesel engine which is reserved for use in case of emergency. The blacksmith-shop is equipped with an oil-furnace and a drill-sharpener.

On Sheep creek the *Golden Belle* and the *Gold Belt*, operated by the Gold Belt Mining Company, Limited, with H. Lakes as superintendent, employed six and twenty-seven men respectively. The operations were limited principally to drifting, and the mechanical equipment consists of an electrically driven compressor and a fan, the power used being supplied by the hydro-electric plant of the Reno Gold Mines, Limited. The general conditions prevailing in and around the mines were good.

The *Kootenay Belle*, operated by the Kootenay Belle Gold Mining Company, employed sixteen men, with Frank Phillips as superintendent. The method of exploitation is shrinkage stoping, as generally adopted in the district. A new 250-cubic-foot compound 2-stage air-compressor, driven by a 110-horse-power Crossley-compressorless-Diesel oil-engine, was added to the mechanical equipment during 1933.

The Sheep Creek Gold Mines, Limited, holding the *Queen*, *Yellowstone*, *Alexander*, and *Vancouver*, employed a number of men, varying from fifteen to forty, with C. E. Witter as superintendent and Andrew McIntyre as mine foreman. The operations consisted chiefly in repair-work, and at the beginning of winter were concentrated on the unwatering, cleaning, and retimbering of the blind shaft, over 400 feet in depth, sunk from the No. 3 West level of the *Queen*, and the levels turned off it. The latter extend mostly eastward and pass under the bed of Wolf creek. The conditions prevailing underground were satisfactory, considering the nature of the operations.

At the *Emerald*, on the divide between Sheep and Lost creeks, the Iron Mountain, Limited, employed a few men under the direction of J. Kubiski. This is an old mine, with fairly extensive workings, having been operated constantly on a small scale from 1907 to 1925, since when it has been practically abandoned. The small crew maintained on the property in 1933 was chiefly engaged in repair and maintenance work. Instructions were issued for the destruction of about thirty cases of explosives, dating from 1925, found in the magazine.

Towards the end of 1933 the Salmo-Malartic Mines, Limited, commenced operations at the *Aspen* mine, under the supervision of P. F. Horton. A crew of ten men, eight of them underground, were engaged in development-work, power being supplied by two portable gasoline-driven Ingersoll-Rand compressors, 9 by 8 inches and 8 by 6 inches respectively. The blacksmith-shop is equipped with a drill-sharpener.

At the *Clubine-Comstock*, on Boulder creek, six men were employed in exploratory and development work by the Clubine-Comstock Gold Mines, Limited, with L. R. Clubine as superintendent.

In the Erie district the Relief Arlington Mines, Limited (controlled by W. N. O'Neil Company, of Vancouver), employed thirty-nine men in and around the *Second Relief*, eighteen of them underground, with W. G. Norrie-Loewenthal as superintendent and Walter Tattrie as mine foreman. The conditions prevailing there were satisfactory in all respects. The housing accommodation is old, but the buildings available are well finished inside and they were put in a good state of repair for the winter. Hydraulic power is generally used, but this is supplemented by two Fairbanks-Morse Diesel engines rated at 60 horse-power and 80 horse-power respectively.

At the *Keystone*, on Whiskey creek, ten men were employed in drifting and stoping operations by the Keystone Syndicate, under the direction of Frank I. Zell. Towards the end of 1933 the property was worked by a group of leasers.

At the *Arlington* small-scale operations were carried on, under two separate leases, by the Oscarson Bros. and Godfrey Birtsch, respectively.

In addition to the above, two operations classed as quarries were inspected during 1933 in the Nelson Division. The rock-work forming part of the power-development project at Erickson was completed at the end of March, the general conditions prevailing having been very good throughout. A limestone-quarry operated by the Consolidated Mining and Smelting Company of Canada 2 miles east of Procter employed four men, who were engaged in the driving of a tunnel at the time of inspection. The work there was also conducted in a satisfactory manner.

TRAIL CREEK MINING DIVISION.

Considerable activity took place on the properties of the Consolidated Mining and Smelting Company of Canada around Rossland, no less than twenty-eight different groups of leasers being at work during 1933. The total number of men so employed was about 100, which was the exact figure for the month of December, the size of individual groups varying from two to as many as twenty. Many of these leases cover ground in which very little, if any, mining has been done in former years, while the Stevens lease includes the surface around the old *Centre Star* shaft and the pillars down to No. 1 level. Some other leases consist of surface work only. The properties thus operated were the *Le Roi*, *Centre Star*, *Poorman*, *War Eagle*, *Iron Mask*, *Josie*, *Nickel Plate*, *Lulla Fraction*, *Idaho*, *Columbia*, and *Kootenay*. Other operations were conducted at the *O.K.*, *I.X.L.*, *Evening Star*, *Golden Drip*, and *Golden Butterfly*.

At the *Velvet* a crew of six men was at work for some time, but operations were temporarily suspended towards the end of 1933. A dam built in the spring and intended to provide a water-supply gave way owing to some defect of construction, which made it impossible to operate the concentrator.

GREENWOOD MINING DIVISION.

The *Jewel*, situated at an altitude of 4,200 feet, on Jewel lake, near Eholt, is operated by the Dentonia Mines, Limited, with a crew of fifteen men, nine of them underground, under the direct supervision of A. W. Davis, with Charles R. Hanna as mine foreman. The moderately extensive workings of the old shaft have not yet been unwatered, and development has so far been limited to the driving of a level following the ore-body, good ventilation being assured by the driving of raises meeting shallow prospect-shafts sunk some years ago on the outcrop of the gold-bearing quartz vein. The country-rock is a siliceous schist, presenting almost the appearance of a quartzite at some points, and requires little artificial support. The newly installed power plant consists of a 315-cubic-foot 2-stage cross-compound Ingersoll-Rand compressor, driven by a 65-horse-power Crossley Diesel engine. The blacksmith-shop is equipped with a drill-sharpener. A new mill was under construction at the end of 1933, under the direction of an expert borrowed from the Consolidated Mining and Smelting Company of Canada. The general conditions prevailing were satisfactory in all respects.

At Franklin camp, 46 miles from Grand Forks, the operations carried on continuously at the *Union* for a number of years were discontinued in July. Until then the mine had employed sixty men, thirty-seven of whom were working underground, with Byron Wilson as superintendent. The living accommodation and the general conditions prevailing in and around the mine had always been found very good.

A few leasers were working at the *Homestake*.

All the operations on Wallace mountain, at Beaverdell, consist in the mining of repeatedly displaced and faulted small veins carrying high silver and lead values. These, with the single exception provided by a part of the *Highland Lass* property, are found in quartz-bearing diorite requiring little, if any, artificial support, except in the immediate vicinity of fractures.

The *Tiger* was operated on lease by John L. Nordman and two associates. They drove a small drift and did a little stoping. Natural ventilation was sufficient, although a communication with an upper level will become necessary if the work is to be continued much farther.

At the *Beaver-Silver* seven men were employed by the Beaver Mines, Limited, under the direction of Major A. W. Davis, with M. Thompson as mine foreman. The work was limited for some time to the extension of an exploratory drift started 50 feet below the collar of a steep inclined shaft sunk some years ago to a depth of 200 feet. The resumption of operations on the west side is contemplated. A single-stage Ingersoll-Rand compressor driven by a Rushton-Hornsby semi-Diesel engine, a small hoist and a fan, both equipped with independent internal-combustion engines, constitute the power plant.

The *Bell*, operated by the Bell Mines, Limited, with M. Matson as superintendent, employed nineteen men, of whom fourteen were working underground. The method of mining followed is overhand stoping with partial filling. The power plant consists of two Ingersoll-Rand single-stage compressors driven by Rushton-Hornsby Diesel engines. Satisfactory conditions were found to prevail in and around the mine at all inspections. A movement of the hanging-wall followed the extraction of the ore-body at one point in the vicinity of one of the major fractures, but this had apparently been effectively checked at the end of 1933. A new office building was erected.

At the *Highland Lass* nine men were employed underground with two on the surface. The property is operated by the Highland Lass, Limited, under the same management as the *Bell*. In both mines the ore has been followed below the lower level by inclined winzes, and a new adit started late in 1933 at the *Highland Lass* will permit joint development of any ore-bodies thus proved on the two adjoining properties. The workings of the *Highland Lass* present considerable similarity to those of the *Bell* and the general conditions prevailing were good. Compressed air is supplied by the *Bell* power plant.

At the *Sally*, operated by the Sally Mines, Limited, a crew of thirteen men, eleven of whom were employed underground, did a considerable amount of exploratory work, besides producing some ore for shipment, under the direction of John C. Hanna. A small compressed-air-driven diamond-drill was in use. The immediate development of the part of the property adjoining the *Wellington* is contemplated. The new power plant consists of a 90-horse-power Petter atomic Diesel engine driving a 14 and 9 by 10 Gardner 2-stage cross-compound compressor. The underground operations were well conducted and the conditions prevailing on the surface were satisfactory.

The workings of the *Wellington* are at present concentrated on a sub-level, turned off a steep inclined winze sunk from No. 4 adit-crosscut, and were found to be in a very good condition in all respects. The ore and waste are hoisted in buckets drawn on a skidway, which is the method generally followed in the district, except at the *Bell* and the *Highland Lass* mines, in which most of dip-workings are regular slopes, and the material extracted is loaded directly in mine-cars. The power plant consists of two Diesel engines driving compressors having respective capacities of 300 and 178 cubic feet per minute. The property is operated by the Beaverdell-Wellington Syndicate, with A. J. Morrison as superintendent.

The Canadian-American Mines, Limited, succeeding the Carmi Syndicate, employed a number of men, ranging between fourteen and seventeen during 1933, at the *Carmi*, with G. E. Miller as superintendent. The operations towards the end of 1933 were confined to the *Butcher Boy* claim; operations in the lower shaft, near the river, having been discontinued at the time of the last inspection. The attention of the management was drawn on one occasion to the need of some improvement to ladder-ways, in order to comply with the requirements of the "Metalliferous Mines Regulation Act," but the conditions prevailing were satisfactory in all other respects. There is no living accommodation at the mine, all employees residing in Carmi.

FORT STEELE MINING DIVISION.

REPORT BY H. E. MIARD, INSPECTOR.

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, J. R. Giegerich; assistant safety engineer, J. M. Wolverton. The total number of employees varies within certain limits at different periods of the year, and at the end of June it amounted to 850, including a small force then working at the *Crow* phosphate-mine. This, of course, exceeds the total daily attendance by a certain margin, for all are never present at the same time. The mine personnel, including the staff, numbers 530, while, on the same basis, the concentrator accounts for 278. It is quite evident that a really earnest and successful effort has been made to retain as many men on the pay-roll as circumstances would permit. There was a total of 139,679 man-shifts worked on day wage at the mine during the year, 77,117 of them underground. For statistical purposes the contract miners are considered as day-wage men, but the time of salaried employees and members of the staff is not included.

The working-force is principally English-speaking and of British origin; men born within the Empire constituting 72.52 per cent. of the employees. Canadians represent 30.74 per cent., Americans 6 per cent., and Scandinavians 7.87 per cent. of the total. These details, with many others presenting considerable interest, but for which space could not be found here, were kindly supplied by E. S. Shannon, superintendent of employment at Kimberley.

Mining and Development Work.—Future requirements have not been overlooked and the development-work done during 1933 included 2,321.5 feet of raising, 455 feet of sinking, and 1,800 feet of crosscutting and drifting, a total of 4,576.5 feet, slightly exceeding the aggregate length of the same work done during 1932.

The 3,901 winze had reached a depth of 1,000 feet (measured on the slope) at the end of 1933, and the concreting had been completed to within 150 feet of the face. A station was being cut then, and, once this work has been completed, the shaft will be advanced another 40 feet and the concrete walls carrying the guides will be extended down to the last station. An electrically driven 3-throw pump has been installed permanently and an auxiliary fan, working in tandem with that at present in use, is to be added to the equipment in the near future, thus assuring efficient ventilation until the intended depth has been reached. The face is lighted by a 400-watt lamp, with a suitable reflector, a valuable feature from the standpoint of safety, as the minutest details of the back or ribs are distinctly visible.

At the end of December, the raise started in 1932 from S-11 stope in the north-side workings had very nearly reached the foot of a shaft sunk to bed-rock, through 72 feet of overburden. A close study of the surface drift, with the object of ascertaining its suitability as filling material for stopes, has been made by F. Fortier and G. Henderson. Only broken stone and gravel are considered as being satisfactory for the purpose, as it is feared that a large proportion of soil or clay among the stowing might create conditions favourable to the accumulation

of water. A more immediate object will be attained as soon as the raise has broken through, and that is an appreciable improvement of the ventilation in the north end.

Further study of the manner in which the exposed hanging-wall in the Upper mine may be most efficaciously supported has led to the conclusion that the slight movement permitted by the creosoted-timber wedging surmounting the concrete pillars already erected would defeat the purpose underlying the choice of this method to a certain extent. In consequence it was decided to remove the layer of wood in question and to bring the concrete walls in immediate contact with the back. Considerable progress has been made with this work at the end of 1933.

The method of working followed is well known, having been described at length in previous reports and in various technical publications, but, as behoves any operation conducted on really progressive lines, matters of detail are the object of constant attention and slight modifications of the well-established routine are introduced whenever local circumstances render such a course advisable.

Practically all actual mining is done on contract. The daily output averages 5,450 tons and the mine shipped 1,401,061 tons of ore during 1933.

Additions to Plant and Equipment.—Few additions other than those already mentioned were made during 1933 to the mechanical equipment, which, as one may judge from previous reports, is already sufficiently complete to meet all demands ordinarily made upon it. A new type of mine-car, embodying several features usually restricted to railway rolling-stock and constructed at the mine shops, is being gradually introduced. It has a carrying capacity of about 10 tons, is very easily handled, considering its size, and seems to promise long service as well as a reduction in haulage and repair costs.

The underground lighting system, which extends to every roadway in which mechanical haulage is in use, is now an entirely separate 110-volt a.c. circuit. Two distinct advantages result from the separation of this from the haulage circuit to which it was formerly linked, for the fluctuations in voltage inseparable from the latter arrangement having been eliminated, greater lighting efficiency is obtained and the lamps themselves last longer.

Explosives.—Underground 35 and 60 per cent. Polar Forcite gelatine is used exclusively, while lead azide detonators and fuse are the means of firing generally adopted. Very little trouble arises from miss-fires. In the 3,901 winze and important raises, electric firing, with delays, is very successfully applied, the necessary current being derived from the a.c lighting circuit. The handling and distribution of explosives is the object of strict supervision on the part of the underground officials.

Ventilation.—The ventilation was generally good at all times, but throughout 1933 smoke displayed a tendency to linger in some of the north-end stopes, this being due to their location on the return side of a large district and to the configuration of the workings. The effect of this was more or less impaired visibility, a condition that even the powerful portable search-lights used in the stopes did not entirely remedy. However, the quality of the air remained satisfactory, as shown by the analyses of samples taken between R-8 and R-9 stopes, the point at which the densest smoke was met at that time, the average percentage of the various gases present being as follows: Carbon dioxide, 0.095 per cent.; hydrogen, *nil;* carbon monoxide, *nil;* oxygen, 20.655 per cent.; nitrogen, 79.25 per cent. This shows a slight and easily explained depletion in oxygen (0.33 per cent. of the original contents), but the lack of any perceptible trace of carbon monoxide is a tribute to the general efficiency of the ventilation and the quality of the explosives used.

The aforementioned state of affairs was the subject of close attention and the stopes affected remained idle when smoke interfered seriously with visibility. By means of doors and stoppings erected at appropriate points, a considerable part of the air-current was deflected into the area in question. However, the new raise is expected to reach the surface very shortly and one or two auxiliary fans to be installed underground will undoubtedly afford an effective remedy.

Model of Workings.—This continues to be of invaluable assistance in planning future work and solving operating difficulties arising from time to time. An indigenous product has been found capable of replacing advantageously the Australian redwood formerly used in the model construction.

Safety and First-aid Work.—Safety-work continued to claim the attention of the staff during the year. A further reduction in the numbers of shifts lost owing to accidents, per thousand

worked, was shown by the comparative statistics compiled for the semi-annual Safety Bulletin published at the mine. In the tabulation of causes, covering a period of five years, it is shown that, out of twenty-four accidents pertaining to the class designated as "More Serious," twelve, or exactly one-half, occurred in the course of barring down or inspecting dangerous ground, while rock falling from the back or rolling down on benches accounted for three more. A very enlightening feature of the issue published at the end of June was the division of all accidents in two classes—those which could probably not have been prevented by the use of ordinary care on the part of the person injured, and those which could have been avoided through the display of a little more caution. The last section greatly exceeded the first, both in numbers and ramifications. The brief, clear, and sometimes incisive comments accompanying the tables published in these bulletins make interesting and instructive reading for those to whom they are addressed.

The safety committees remained very active and each meeting held saw some new point brought up and discussed with beneficial results. It is to this painstaking and tireless search for improvements that the gratifying decrease in number and gravity of the accidents recorded during the last few years is largely due.

The campaign instituted a few years ago has resulted in the highly creditable fact that 89.5 per cent. of the day-wage men, and all officials, are now holders of St. John first-aid certificates. Classes in first aid were held during 1933, with an attendance of 155, of which 129 successfully passed the final examination.

It might be noted here that, at the First-aid Contest held at Fernie under the auspices of the East Kootenay Mine Safety Association on July 15th, the Kimberley teams gave such an excellent account of themselves that they carried off all the prizes offered for the events in which they participated, including the Rotary Club trophy, which was awarded to McLay's team.

In the case of all serious accidents having occurred at the *Sullivan* mine within recent years, subsequent investigation always proved that those in the immediate vicinity had followed the proper course unerringly, and that medical assistance had been secured in an almost incredibly short time. Two of the accidents had fatal results—one instantaneously and the other three weeks later.

The examination of all employees for traces of incipient silicosis was completed early in 1933. The dust problem has received earnest consideration, and the use of water pluggers in stopes and on grizzlies and sprays on loading-chutes has considerably increased. Masks for use on particularly dusty work are kept on hand.

Living Accommodation and Welfare-work.—Attention has already been drawn in previous Annual Reports to the excellent living accommodation provided, in attractive surroundings, at the two company townsites, and little more needs to be said, beyond pointing out the fact that, despite the generally unfavourable economic conditions which prevailed during the last few years, none of the progress already made has been lost. More than 75 per cent. of the men employed are married and live with their families at Kimberley.

Conclusions.—That an operation of such outstanding importance could have been brought through the economic depression from which the world is now slowly emerging, without having suffered in any essential detail from the curtailment of expenditure which necessity forced upon all industries, with a very moderate decrease of output, its staff practically intact and its crew reduced only in a measure justified by improved methods of operation, constitutes in itself a most convincing proof of more than ordinary ability in all departments. Difficulties arising from time to time have been recognized, and met with skill and determination; a guarantee that further developments may be awaited with confidence, for those who have brought the operations to their present state of all-round efficiency may be relied upon to display the same degree of skill when confronted with other and perhaps different problems. The meticulous study of all matters even remotely concerned with safety, seconded by the sincere co-operation of the working-force in this respect, justify the hope that we may look forward to results still more gratifying than those already achieved. General conditions were found to be very satisfactory at my different inspections throughout the year, with the provisions of the "Metalliferous Mines Regulation Act" fully observed.

Phosphate Properties.—From the middle of June until the end of July the Consolidated Mining and Smelting Company employed twelve men at the *Crow* mine, with L. Telfer as superintendent and C. White as engineer in charge. The raise driven through to the surface

in 1931 assures efficient ventilation. The production was limited to 2,025 tons, shipped to the fertilizer plant at Trail for experimental purposes. It is hoped that further study of the possibilities presented by this local product may result in the discovery of a form of treatment permitting its use on an economic basis. The general conditions prevailing were entirely satisfactory, both underground and at the camp. Power was supplied by two portable Ingersoll-Rand gasoline-driven compressors.

B.C. Cariboo Gold Fields, Ltd.—Towards the end of 1933 this company began operations on the property known as the *Midway*, or the *Finley-Leask* prospect, 5 miles south of Aldridge and in close proximity to the Trans-Provincial highway. Very comfortable living accommodation was erected, and the power plant installed included a portable Ingersoll-Rand gasoline-driven compressor, a Delco electric generator (for lighting purposes), a Sullivan drill-sharpener, and a Sheldon No. 3 fan driven by a 3-horse-power gasoline-engine. When inspected during the month of December eighteen men were employed, thirteen of them underground, with Clifford S. Lord as superintendent, and the operations consisted in the driving of an exploratory drift and diamond-drilling. The quartzite country-rock in the immediate vicinity of the vein requires some attention, and careful timbering was necessary at some points. The general conditions prevailing were satisfactory in all respects. The water-supply was obtained from a well and, although it was apparently perfectly good and chances of contamination appeared few, the superintendent was advised to send a sample of it to Victoria for analysis.

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.

The tables showing coal production and men employed in collieries are shown on pages 279 and 280.

VANCOUVER ISLAND INSPECTION DISTRICT.

GEO. O'BRIEN AND THOS. R. JACKSON, INSPECTORS.

The Canadian Collieries (Dunsmuir), Limited, operated Nos. 4 and 5 mines, Comox Colliery, and No. 5 and Alexandra mines, South Wellington.

The Western Fuel Corporation of Canada, Limited, operated its No. 1 mine, Nanaimo Colliery.

Lantzville Colliery Company operated its No. 1 mine at Nanoose.

Chambers' mine was operated at Extension.

Fiddick mine was operated at South Wellington.

Ida Clara Colliery (formerly Richardson mine) was operated at South Wellington.

Cowie's Prospect was operated at South Wellington.

Biggs' mine was operated at Wellington.

Jingle Pot mine was operated at Wellington.

Old Adit mine was operated at Wellington.

NORTHERN INSPECTION DISTRICT.

CHARLES GRAHAM, INSPECTOR.

Bulkley Valley Colliery, Limited, operated the Bulkley Valley mine at Telkwa.

Lake Kathlyn Anthracite Coal Company operated at Smithers.

NICOLA-PRINCETON INSPECTION DISTRICT.

JOHN G. BIGGS, INSPECTOR, PRINCETON, AND THOMAS R. JACKSON, INSPECTOR, NANAIMO.

The Middlesboro Collieries, Limited, operated Nos. 3 North and 2 South mines, Middlesboro Colliery, Merritt.

The Coalmont Collieries, Limited, operated Nos. 3, 4, and 5 mines, Coalmont Colliery, Blakeburn.

The Tulameen Valley Coal Mines, Limited, operated at Princeton.

The W. R. Wilson Investment and Development Company (formerly Blue Flame Colliery) operated at Princeton.

The Pleasant Valley Coal Mining Company operated Nos. 1 and 2 mines, Princeton.

Bromley Vale Colliery (formerly King Colliery) operated No. 1 mine, Princeton.

Red Triangle Coal Company, Limited, operated at Princeton.

Sunblaze Coal Company, Limited, operated at Princeton.

Normandale Coal Company, Limited, operated at Nicola.

North Thompson Coal Company, Limited, operated at Chu Chua.

White Lake Coal Company operated at Penticton.

Canada Coal and Development Company operated the Hat Creek mine at Pavilion.

EAST KOOTENAY INSPECTION DISTRICT.

ROBT. STRACHAN, SENIOR INSPECTOR OF MINES (HEADQUARTERS, NELSON), AND JOHN MACDONALD AND H. E. MIARD, INSPECTORS (HEADQUARTERS, FERNIE).

The Crow's Nest Pass Coal Company, Limited, operated No. 1 East and No. 3 mines, Coal Creek Collieries, and No. 3, Nos. 1 and 3 East, and No. 8 mines, Michel Colliery.

The Corbin Coals, Limited, operated Nos. 4 and 6 mines, Corbin Colliery.

The Mammoth Collieries, Limited, operated No. 3 mine, Corbin Colliery (a subsidiary of Corbin Collieries, Limited).

VANCOUVER ISLAND INSPECTION DISTRICT.

REPORT BY GEO. O'BRIEN, INSPECTOR.

Western Fuel Corporation of Canada, Ltd.

Head Office—Nanaimo, B.C.

F. Perry, President, Montreal, Que.; Lieut.-Col. C. W. Villiers, Vice-President, Nanaimo, B.C.; P. S. Fagan, Secretary-Treasurer, Nanaimo, B.C.; John Hunt, General Manager, Nanaimo, B.C.

The only producing mine operated by this company during 1933 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.

This mine is situated at the south end of the Esplanade in the City of Nanaimo and adjacent to the shore of the strait of Georgia. It is the oldest working coal-mine on Vancouver island and has a large submarine area. The mine has four openings, as follows: No. 1 and No. 2 shafts on the Esplanade, Protection shaft on Protection island, and the Newcastle shaft on Newcastle island. The two shafts in daily operation are the No. 1 shaft and Protection shaft. The two other shafts are used for air-shafts.

A detailed description of the power-installation, washery plant, and other equipment has been given in previous Annual Reports. No additions were made during 1933.

No. 1 mine was in full operation 165 days during 1933 and the average daily output was 1,550 tons. This output is produced from the North and South sides of the mine, with the production of coal from each about evenly divided. The total output is hoisted from No. 1 shaft. The average number of men of all classes employed underground daily is 625 for the twenty-four-hour period. On the surface there are approximately 300 men employed daily, which includes pit-head, power plants, washery, wharves, machine-shops, colliery railway, office staff, engineering department, etc.

The sizes of coal as prepared for the market are lump, nut, pea, and slack, and very often mixtures of these grades are required by customers.

Both the Douglas and Newcastle seams are operated in both sides of the mine. Practically the whole of the workings are submarine; the average cover being about 450 feet. In the Newcastle seam the entire operations on both sides of the mine are worked on the long-wall system, with faces averaging 300 feet long. These faces are equipped with pan-conveyors driven by compressed air and are very efficient. All undercutting is done by compressed-air-driven coal-cutting machines, the average depth of cut being 6 feet.

The Douglas seam operations are confined chiefly to the extraction of pillars, though there are a few sections in the South side of the mine where there is sufficient solid work to permit long-wall operations. Pan-conveyors and machine-undercutting is standard practice in these sections. Most of the undercutting is done in the rock-bands in the seam or in the under-clays directly below the seam. The refuse made by the undercutting is packed in the gob and fills up the waste spaces. A part of the refuse is finely ground by the action of the machine-picks and this dust is carried along the face-line by air-currents and has the effect of rock-dusting, nullifying to a large extent the danger from coal-dust where explosives are used. Very light charges of explosives are used in blasting the coal as practically all the coal is undercut. A high percentage of lump coal is produced.

Ventilation of the extensive underground workings is achieved by two fans, one situated at Protection shaft on Protection island operating as a "blower" fan, and the other at No. 2 shaft operating as an exhaust-fan. There is a third fan at No. 2 shaft held ready for immediate use in case of emergency.

The haulage system underground is very extensive and is divided into two parts, animal and mechanical. Steam, compressed air, and electricity is used on the mechanical haulage system, the animals being used for gathering from the faces.

The large pumping system uses all three forms of power.

No. 2 SOUTH MINE.

James Fairfoull, Overman.

The entrance to this mine, the most important operation of the Middlesboro Collieries, is situated about 1,000 feet south of the entrance to the No. 3 North mine. The coal-seam has an average thickness of about 8 feet and lies at a high angle of inclination. It has been developed from the surface by an adit-level following the strike of the seam for a distance of some 3,000 feet. The measures are found to be lying in the form of a basin, which causes this main adit to turn from north to about 45° south-west; headings have been driven from this main adit to the surface outcrop, which is reached at a distance of about 350 feet, while the area to the dip of the main adit-tunnel has been developed by slopes for a distance of 800 feet. The usual pillar-and-stall method of mining is followed.

During my last visit of inspection ventilation measurements showed 14,000 cubic feet of air per minute passing into this mine for the use of forty-two men; the air was well conducted around the working-faces and the mine was free from any trace of 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, being naturally damp, were free from dangerous coal-dust. The power used in these mines consists of compressed air and all coal is mined by machines of the post-puncher type; Wolf electric head-lamps are in use by the employees underground and safety-lamps of the Wolf type are used by the officials for inspection purposes. Samples of material have been taken from the roads of these mines each month during 1933 and in all cases they have conformed with the requirements of the Coal-dust Regulations. The employees underground have availed themselves of the provisions of General Rule 37 and have made an inspection of these mines each month, and in all cases the reports have been very satisfactory. Copies of the "Coal-mines Regulation Act" and special rules are well posted at these mines.

No serious accidents were reported at this colliery during 1933.

Tulameen Coal Mines, Ltd.

R. Dixon, Managing Director, Vancouver, B.C.; A. B. Barclay, Secretary, Vancouver, B.C.; Thomas M. Wilson, Superintendent, Princeton, B.C.

No. 2 MINE.

William Strang, Overman.

This mine is situated 2 miles west of Princeton and for some years past has been the largest producing mine in the Princeton area; the seam averages about 6 feet thick, with an easterly dip of 20°. The workings are on the pillar-and-stall system and all coal is mined by percussive air-machines. The machinery and plant have been described in previous Annual Reports.

During my last visit of inspection ventilation measurements showed that 17,000 cubic feet of air per minute was passing into the mine for the use of forty-two men; the brattice and stoppings were in fair 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 fairly good condition, and, being naturally wet, were free from dangerous coal-dust. The mine was free from any trace of gas. Approved Edison electric head-lamps are used by all the employees underground and flame safety-lamps of the Wolf type are used by the officials for inspection purposes.

Pleasant Valley Mining Co., Ltd.

W. R. Wilson, President, Vancouver, B.C.; R. R. Wilson, Vice-President, Vancouver, B.C.; Miss M. Duncan, Secretary-Treasurer, Vancouver, B.C.; Thos. Cunliffe, Acting-Superintendent, Princeton, B.C.

This colliery is situated 2 miles west of Princeton and on the south side of the Tulameen river. The surface plant is located on the river-flats, which provide ample room for the mine-yard, tipple, the power plant, and other surface units necessary for the operation of a large colliery. Connections are made with the main line of the Kettle Valley Railway by means of a

No. 5 mine and the Alexandra mine are connected. They are ventilated by the same fan and supervised by the same officials. This colliery was in actual operation 203 days during 1933 and the average daily output was 765 tons. The average number of men employed daily was 225. There are eleven certificated mine officials underground, or one mine official for every twenty men and for every 70 tons of coal produced.

The seam operated is the well-known Douglas seam, which is all hand-mined, most of the work being pillar-extraction. The coal is very friable and requires careful handling, especially where explosives are used.

During 1933 the ventilation was kept up to a high standard and explosive gas or gas-caps were rarely found. Both mines are very damp, haulage-roads especially, and there are no accumulations of dangerous coal-dust.

There were two outbreaks of spontaneous combustion during 1933 in the same area as the outbreak in December, 1932. The outbreaks were successfully handled without accident, and the area is now entirely sealed off and no further sign of combustion has been noted since the seals were put in.

Approximately 3,000 lineal feet of rock-tunnelling was done in the Alexandra mine during 1933 in an effort to locate the extension of the Douglas seam in this area. The rock-tunnelling is now temporarily abandoned and diamond-drilling operations have been started on the surface for the purpose of determining the position of the seam.

It is very pleasing to be able to report that there were no fatal accidents at this colliery during 1933. This is the second year in succession without a fatal accident, which is a very good record. There was one serious accident reported, however, caused by a fall of rock.

Regular inspections were made monthly by the workmen's "gas committee" as provided for in General Rule 37, and this committee very kindly furnished me with a copy of their reports of inspection. At no time during the year did this committee report dangerous conditions, or apprehended danger, from any cause.

Regularly monthly sampling of mine-dust and mine-air was made and the analyses of same showed the different samples to be well within the requirements of the "Coal-mines Regulation Act."

Report-books as required by the "Coal-mines Regulation Act" are kept at the mine and were regularly examined and found to conform to the regulations of the Act.

On the whole, general conditions with regard to safety at this colliery were satisfactory during 1933.

Lantzville Collieries, Ltd.

No. 1 MINE, LANTZVILLE.

Arthur Challoner, Overman.

This mine is situated on Nanoose bay, about 9 miles north of Nanaimo. The mine is entered by a slope about 270 feet long, which dips at an angle of 30°. The seam operated is the well-known Wellington seam and is of excellent quality. The mine is operated on the long-wall system, the coal being hand-mined and hand-loaded. Gateways are driven at about 40-foot intervals and the brushing is done in the floor to give the required height. The mine worked fairly steady during 1933, a total of 238 days being worked. Only a small daily tonnage is produced, the total tonnage mined in 1933 being about 5,300 tons.

The ventilation of the mine was kept up to a fairly high standard during 1933. The analyses of mine-air samples taken in the main return airway showed an average of seven-tenths of 1 per cent. methane. Roadways and working-places were well timbered and maintained in a safe condition at all times. The mine is very damp and there are no accumulations of dangerous coal-dust. The general and special rules of the "Coal-mines Regulation Act" are well complied with and every effort appears to be made to keep the accident-rate down to the minimum.

It is very pleasing to report that this is the fourth year in succession in which no accidents of any kind were reported from this mine. This is an excellent record and the efforts of workmen and officials to maintain this remarkable record is very commendable.

BIGGS' MINE, WELLINGTON.

James Biggs, Operator.

This mine is situated about 1 mile from the town of Wellington, on the site formerly operated by the Dunsmuir interests many years ago. The seam operated is the well-known Wellington seam and is of very good quality. The present operation consists of recovering pillars left by the former operators. The coal is hand-mined and hand-loaded. This mine did not operate steadily during 1933. The daily output is small, the total for the year being 1,854 tons. The coal is sold locally.

The ventilation, partly mechanical and partly natural, was kept up to a high standard during 1933. No explosive gas or gas-caps were found during any of the inspections. Roadways and working-places were well timbered and maintained in a safe condition at all times. The mine is very damp and there were no accumulations of dangerous coal-dust. Considerable trouble is experienced in operating this mine during the rainy season, as large quantities of surface water finds its way into the mine through surface fractures caused by pillar-drawing, and the small pumping equipment in use is inadequate to handle the extra water.

It is pleasing to report that no accidents of any kind were reported from this mine during the period of operation.

OLD ADIT MINE, WELLINGTON.

Charles Stronach, Operator.

This mine is situated about 1½ miles from Wellington, on the site of the former operations by the Dunsmuir interests many years ago. The seam is the well-known Wellington seam and the present operations consist of recovering the outcrop pillars left by the former operators. The location of the mine is near the portal of the Old Adit mine and it is reached by a good road. The output, which is small, is shipped by truck and sold locally. Operations were commenced in November and a small output was produced in December. Up to the present time the mine is practically an open-cut as there is very little cover on the coal. No accidents were reported from this mine during the period of operation.

JINGLE POT MINE, EAST WELLINGTON.

A. McLachlan and Associates, Operators; Alex. McLachlan, Overman.

This mine is situated on the original Jingle Pot mining property at East Wellington, about 3 miles from Nanaimo. The mine was idle from January to September, when it was acquired by the present owners and reopened. A small daily output is now being produced. The seam is the well-known Wellington seam and the present operations consist of recovering the outcrop pillars left by the former operators. The ventilation is by natural means and fairly good. No explosive gas or gas-caps were found during my inspections. Roadways and working-places are well timbered and maintained in a safe condition. The mine is very damp and there were no accumulations of dangerous coal-dust. No accidents were reported from this mine during the period of operation.

FIDDICK MINE, SOUTH WELLINGTON.

Richard Fiddick, Operator; Wm. Roper, Overman.

This mine is situated on the site formerly operated by the Pacific Coast Coal Company, near South Wellington. The seam is the well-known Douglas seam and the present operation consists of recovering pillars left by the former operators. The coal is of very good quality. The daily output of the mine is small, the total for the year being 1,231 tons. It is sold locally.

The ventilation is by natural means and quite ample for this small operation. No explosive gas or gas-caps were found during my inspections. Roadways and working-places were well timbered and maintained in a safe condition. The mine is very damp and there were no accumulations of dangerous coal-dust. No accidents of any kind were reported from this mine during 1933.

RICHARDSON BROS.' MINE, SOUTH WELLINGTON.

IDA CLARA NO. 1 MINE.

Hugh M. Davidson, Overman.

This mine is situated on the site formerly operated by the Pacific Coast Coal Company near South Wellington. The seam is the well-known Douglas seam and the present operation consists of recovering pillars left by former operators. This mine worked very steadily during 1933, there being quite a demand for this class of coal. The daily output, however, is small, the total for 1933 being 3,516 tons. Some of it was sold locally and the remainder was shipped to Vancouver and Victoria.

The ventilation is by natural means and quite ample for this small operation. No explosive gas or gas-caps were found during my inspection at any time during 1933. Roadways and working-places are well timbered and maintained in a safe condition. The mine is very damp and there were no accumulations of dangerous coal-dust. During 1933 a new slope was driven and connected to the workings. A small tipple was also constructed and put into service, and it is a great improvement over the old method of handling the output. No accidents of any kind were reported from this mine during 1933.

OLD No. 1 MINE, EXTENSION (CHAMBERS' MINE).

Ralph H. Chambers, Operator.

This mine is on the site of the original No. 1 mine, Extension, which was the first operation of the Dunsmuir interests in the Extension district many years ago.

Access to this mine is gained by the Nanaimo Lakes road, the location of the mine being about 7 miles from Nanaimo. The seam is the Wellington seam and the present operation consists of recovering pillars left by the former operators. Operations were commenced in November and a small output was produced in December. A short slope has been driven down to the coal and it is expected that a fairly good output will be produced in 1934. The ventilation is by natural means at the present time and ample for this small operation. No explosive gas or gas-caps were found during my inspections. No accidents were reported from this mine during the period of operation.

COWIE'S PROSPECT, SOUTH WELLINGTON.

A. Cowie and Associates, Operators.

Prospecting for the Douglas and Wellington seams was done by A. Cowie and associates during 1933 in the area between Extension and South Wellington in the Cranberry district. Several small shafts and test-holes were put down and considerable trenching was done in an effort to locate the seams, but up to the present time the efforts have been unsuccessful. Active prospecting was discontinued in November due to weather conditions, but it will be continued in the early spring.

CHILTON'S PROSPECT, SOUTH WELLINGTON.

Geo. Chilton and Associates, Operators.

Nothing was done at this prospect during 1933. The slope is full of water and temporarily abandoned.

This covers in a general way the active operations in this Inspection District during 1933. I made regular inspections of all report-books kept at the various mines in my inspectorate during the year and found that the "Coal-mines Regulation Act" and special rules were very well complied with generally. Copies of the general and special rules are posted at all the larger mines and every effort appears to be made to see that they are carried out.

All workmen underground in this Inspection District are supplied with electric cap-lamps of the Edison and Wheat types; very few of the Wheat type are now in use. All mine officials are supplied with Wolf flame safety-lamps for gas-testing. All blasting operations are done under the supervision of certificated mine officials, electric shot-firing batteries and cable being

used for this purpose. Permitted explosives only are used. Regular sampling of mine-air and mine-dust was done during 1933, and analyses of the same proved that they were well within the requirements of the "Coal-mines Regulation Act."

I am pleased to report that there were no fatal accidents in my district during 1933, which speaks volumes for the workmen and officials in the campaign for accident-prevention, and I wish to express my appreciation for the valuable assistance rendered by them in this work. It is the full co-operation of all that will keep the accident-rate down to the minimum. Let us hope that we will be as successful in the years to follow as in 1933.

REPORT BY THOMAS R. JACKSON, INSPECTOR.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

F. Perry, President, Montreal, Que.; Lieut.-Col. Chas. W. Villiers, Vice-President, Nanaimo, B.C.; H. S. Adlington, Secretary-Treasurer, Montreal, Que.; P. S. Fagan, Assistant Secretary, Nanaimo, B.C.; John Hunt, General Superintendent, Nanaimo, B.C.; Thos. W. Scott, Assistant General Superintendent, Cumberland, B.C.

This division of the Canadian Collieries (Dunsmuir), Limited, comprises the Comox Colliery and Nos. 4 and 5 mines, situated in the vicinity of Cumberland.

COMOX COLLIERIES.

The hydro-electric plant of this company has been in constant operation. Sufficient electricity is generated 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.

Thos. W. Scott, Superintendent; John Williams, Manager; A. W. Watson, Overman.

For description of power plant, ventilating apparatus, haulage-engine, etc., *see* previous Annual Reports. This mine was closed down during the months of June, July, August, September, and half of October.

The present operations consist largely of pillar-extraction in Nos. 1 and 2 slopes, with some development-work to the east of No. 2 slope. In the seven and a half months the mine operated there were 140 working-days; approximately 4½ days per week. Gas committee reports covering conditions in Nos. 1 and 2 slopes have been received at this office and found to be satisfactory; analysis of coal-dust samples complied favourably with the provisions of the "Coal-mines Regulation Act," and mine-air samples taken show by analysis that the methane content is less than 0.05 per cent. in main return airway near the fan, which passes 100,000 cubic feet of air per minute.

No. 5 MINE.

Thos. Scott, Superintendent; Robert Laird, Manager; Samuel Jones, Overman.

For a description of electrical hoists, engines, ventilating apparatus, etc., *see* former Annual Reports.

The workings of this mine are reached by a shaft 280 feet deep to No. 1 seam, from which slopes have been driven down through the measures to No. 2 seam, 115 feet vertically below No. 1 seam. In this seam the slopes have been driven down a distance of about 5,000 feet, with the long-wall faces to the right and left of the main slopes: the walls average 300 feet in length and are undercut to a depth of 6 feet by air-driven machines and the broken coal is moved to the haulage-roads by jig conveyors.

The seam contains a band of rock of varying thickness, and with the present system of mining this rock-band is used as the floor and the bottom part of the seam is left in place except where roadways are brushed to make the required height. The top part of the seam has an average thickness of 4 feet. The underground haulage is handled by five motor units, at 440 volts, 3-phase, on the main and secondary slopes. Three motor-driven compressors are located underground, about 5,000 feet from the shaft; these supply the compressed air for driving the

coal-cutting and drilling machines and several small hoists. The maximum daily output of coal was 800 tons. This has been decreased now to 650 tons.

The pan-wall conveyor method of working the long-wall face-line gives the best results owing to its mobility and the simplicity of its construction. The conveyor is not easily deranged and repairs can be quickly executed. Anderson-Boyes coal-cutters are chiefly used and these are powered by compressed air. The use of electrically driven apparatus at or near the face-line workings has been totally abandoned.

The amount of gas produced from this seam has presented a serious problem in the matter of ventilation and has compelled the management to provide more separate ventilating districts than is usually necessary for a mine of this size; on some of the face-lines it is necessary to have from 15,000 to 20,000 cubic feet of air passing per minute in order to keep the methane content about 1 per cent., so that possible dangers due to a high velocity of the air-current on the face-line had to be considered. The gas-outflow is closely related to the speed of face advance and immediately related to undercutting of the coal; an immediate increase in the methane content of the air on the return side of the cutting-machines can be observed when the machines are in operation, with a corresponding decline when the cutting is completed. Eighty air samples were taken during the year, and those taken in the main return, with 125,000 cubic feet of air passing per minute, showed an average of 1.1 per cent. methane, or nearly 2,000,000 cubic feet of gas per twenty-four hours; a slight explosion, following blasting, occurred on February 17th, whereby five men were slightly burned, and two slight ignitions, also following blasting, occurred; no damage was done by these ignitions.

The cutting-machines are equipped with water-sprays to dampen the cuttings and as far as possible the cutting is done in the underlying rock; the use of explosives has been reduced to the minimum and, where used, rock-dust is previously applied to the vicinity.

A new opening to the surface by means of a rock-slope 750 feet long, on a pitch of 50°, is near completion; this will greatly increase the amount of air entering the mine and will permit the addition of other separate ventilating districts.

The Burrel methane-detector was used extensively during the year with satisfactory results.

During 1933 fairly extensive tests were made with the Cardox method of breaking down machine-cut coal, but the disadvantages of the size of shot-hole required, excessive weight of the cylinders containing the charge, and the fact that coal dislodged was brought down in abnormally large blocks prevented the general adoption of this method.

The inspection committee appointed by the miners functioned throughout 1933 and submitted reports of conditions found to this office.

An electric-heating arrangement was installed over No. 5 shaft to heat the intake air sufficiently to prevent the formation of ice in the shaft during the winter months. This gave satisfactory results.

With the above conditions in view, the conditions in No. 5 mine were fairly satisfactory at the end of 1933.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS, INSPECTOR.

The following were the coal companies operating in this district during 1933: Coalmont Collieries, Limited; Middlesboro Collieries, Limited; Tulameen Coal Mines, Limited; Pleasant Valley Mining Company, Limited; Blue Flame Collieries, Limited; Bromley Vale Collieries, Limited; Red Triangle Coal Company; North Thompson Coal Company; Normandale Coal Company; White Lake Coal Company; and Sunblaze Coal Company, Limited.

The most important operations are those of the Coalmont Collieries, Middlesboro Collieries, Tulameen Coal Mines, Limited, the Blue Flame Collieries, and the Pleasant Valley Mining Company; the balance are very small operations and are more or less in the development and prospective stage, with a consequently small production. Two new operations were commenced during 1933. The Blue Flame Collieries, Limited, got into financial difficulties during 1933 and as a result this property was taken over by the W. R. Wilson Mining and Development Company, of Vancouver. The Coalmont Collieries and the Middlesboro Collieries largely depend on railway business, and the decrease at these two operations can be chiefly attributed to the use of fuel-oil and the reduced freight movements on the railways; the other mines in the district are, in the

main, producing domestic coal, although a considerable amount is used satisfactorily for industrial use.

The free-burning qualities of this domestic coal are making it a growing favourite for use in the different sizes of automatic stokers for heating homes and public buildings; these stokers use the smaller sizes of coal which formerly were hard to market.

Inspection on behalf of the workmen has been well attended to by the employees of the larger operations in this district during 1933.

Coalmont Collieries, Ltd.

W. J. Blake-Wilson, President, Vancouver, B.C.; General J. W. Stewart, Vice-President, Vancouver, B.C.; A. H. Douglas, Secretary, Vancouver, B.C.; D. McLeod, Treasurer, Vancouver, B.C.; Geo. Murray, Superintendent, Blakeburn, B.C.

This, the largest and the most important coal-mining operation in the Princeton District, is situated on the main line of the Kettle Valley Railway, 170 miles east of Vancouver and 12 miles west of Princeton; the machinery and plant have been fully described in former Annual Reports.

There are three mines operating at the present time, known as Nos. 3, 4, and 5 mines. The Nos. 3 and 4 mines are old operations, from which pillars are being extracted, while the No. 5 mine is a new operation.

No. 3 MINE.

The entrance to this mine is situated on the same elevation as, and 1,500 feet north of, the upper terminal of the overhead tram, and the coal has been developed by a well-maintained adit-level following the strike of the seam into this section of the basin; it is the oldest operation of the Coalmont Collieries and commenced during the year 1920. All work at present consists of the extraction of pillars in close proximity to the main adit-level on the outside of the No. 1 slope section of the mine, and as a result the workable area and the life of this mine is very limited.

The seam of coal in this section of the mine averages from 8 to 12 feet in thickness; the measures are of a friable nature, and as a result not only the roads but the working-faces are very heavily timbered. Ventilation is produced by a 5-foot "booster fan" situated near the entrance to the counter-level, and during my last visit of inspection ventilation measured showed 12,000 cubic feet of air per minute passing into this mine for the use of thirteen men. The air was well conducted around the working-faces, the brattice and stoppings being in good order. The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners; also the roads were well timbered, in fairly good condition, and analysis of material taken from the same show them to be in compliance with the requirements of the Coal-dust Regulations. During 1933 there has been no trace of methane reported in this mine.

No. 4 MINE.

Harry Hopkins, Overman.

This is the largest and the most important operation of the Coalmont Collieries. It is situated 5,400 feet north of the entrance to the No. 3 mine. It is accessible by a light railway running along the side of the mountain. The mine has been developed by a well-maintained cross-measure drift that intersects the seam at the old No. 6 West level. The Main slope was continued from this point and follows the pitch of the seam to the No. 15 West level, which was used as a main haulage-level, with further slope developments below.

The measures have a general pitch north of 25° and the mine is developed on a modification of the "panel system": faulted and broken areas being used as the barriers. During November, 1932, serious spontaneous heating was found to have developed in a pillar section between Nos. 12 and 15 West levels, and after considerable work in trying to overcome the heating it was found necessary to withdraw all material from the lower section of this mine and seal off this area.

This was followed by the development of an area of coal in the lower section of the seam, in No. 8 level, and later by dewatering to the No. 12 West level, with further development in the Lower seam from the No. 11 West level. These developments are small and most of the work at the present time consists of extracting pillars.

During my last visit of inspection ventilation measurements showed 20,000 cubic feet of air per minute passing into this mine for the use of thirty-two men. The air was well conducted around the working-faces. The mine was free of any trace of methane, 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. An analysis of material taken from the same showed them to be in compliance with the requirements of the Coal-dust Regulations.

Edison head-lamps are in use by all the employees underground at the Coalmont Collieries, while safety-lamps of the Wolf type are in use by the officials for inspection purposes. The coal is all mined by hand and, being generally of a friable nature, only a limited number of shots are required; all shots are fired by officials appointed for that purpose.

No. 5 MINE.

The portal of this mine is situated 2,800 feet north of and at an elevation of 252 feet above the portal of the No. 4 mine. The seam has been developed from the surface croppings by a 20° Main slope, with Counter slope following the pitch of the seam into a section of the Coalmont basin. These slopes have reached a distance of 1,600 feet from the portal, and it is the policy of the management to confine operations to the driving of the Main and the Counter levels as far as possible before developing for production.

The measures are of the usual friable nature, with the result that these slopes are very heavily timbered. Ventilation was found to be fair and the mine free from any trace of methane; six men were employed underground.

Middlesboro Collieries, Ltd.

E. W. Hamber, President, Vancouver, B.C.; Thos. Sanderson, Secretary, Vancouver, B.C.; Robert Fairfoull, Superintendent, Merritt, B.C.

This colliery is situated about 1 mile south of Merritt and for many years has been the most important coal-mining operation in the Nicola valley. It comprises a large surface plant, consisting of mine-yards, large screening plant with bunkers, steam-power plant, machine-shops, and a number of employees' residences, and is in general well equipped to handle a large tonnage. The mining operations are conducted in the hillside above, where the seams of coal are generally found lying at a high angle of inclination and outcropping to the surface.

There have been no new underground developments at this colliery during 1933. However, it may be of interest to note that this company acquired a franchise from the city of Merritt for the supply of electrical power that resulted in the installation of a steam-driven 250-k.v.a. electric generator, transformers, and switchboard at this power plant to supplement a 75-k.v.a. plant that was in use: the power is transmitted over a new power-line from the mine plant to the sub-station of the city, where it is distributed for lighting, power, and pumping purposes.

No. 3 NORTH MINE.

Alex. McDiarmid Allen, Overman.

This mine is situated at an elevation of 300 feet above and 2,000 feet south of the mine-yard. The coal is transported over a surface incline in six-car trips. This mine, which is the oldest in operation at the present time, was developed from the surface croppings at the side of the hill by adit-level following the strike of the seam and the coal area below by a dip-slope. This seam of coal is steeply inclined, averages 6 feet in thickness, and is worked on the pillar-and-stall system; all work at present being the extraction of pillars.

During my last visit of inspection ten men were employed underground. The ventilation was found to be good and the mine free from any trace of gas. The working-places were well timbered and a sufficient supply of suitable timber is provided for the use of the miners; the roads were also well timbered and in fairly good condition; an analysis of material taken from same showed it to be in compliance with the requirements of the Coal-dust Regulations.

No. 2 SOUTH MINE.

James Fairfoull, Overman.

The entrance to this mine, the most important operation of the Middlesboro Collieries, is situated about 1,000 feet south of the entrance to the No. 3 North mine. The coal-seam has an average thickness of about 8 feet and lies at a high angle of inclination. It has been developed from the surface by an adit-level following the strike of the seam for a distance of some 3,000 feet. The measures are found to be lying in the form of a basin, which causes this main adit to turn from north to about 45° south-west; headings have been driven from this main adit to the surface outcrop, which is reached at a distance of about 350 feet, while the area to the dip of the main adit-tunnel has been developed by slopes for a distance of 800 feet. The usual pillar-and-stall method of mining is followed.

During my last visit of inspection ventilation measurements showed 14,000 cubic feet of air per minute passing into this mine for the use of forty-two men; the air was well conducted around the working-faces and the mine was free from any trace of 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, being naturally damp, were free from dangerous coal-dust. The power used in these mines consists of compressed air and all coal is mined by machines of the post-puncher type; Wolf electric head-lamps are in use by the employees underground and safety-lamps of the Wolf type are used by the officials for inspection purposes. Samples of material have been taken from the roads of these mines each month during 1933 and in all cases they have conformed with the requirements of the Coal-dust Regulations. The employees underground have availed themselves of the provisions of General Rule 37 and have made an inspection of these mines each month, and in all cases the reports have been very satisfactory. Copies of the "Coal-mines Regulation Act" and special rules are well posted at these mines.

No serious accidents were reported at this colliery during 1933.

Tulameen Coal Mines, Ltd.

R. Dixon, Managing Director, Vancouver, B.C.; A. B. Barclay, Secretary, Vancouver, B.C.; Thomas M. Wilson, Superintendent, Princeton, B.C.

No. 2 MINE.

William Strang, Overman.

This mine is situated 2 miles west of Princeton and for some years past has been the largest producing mine in the Princeton area; the seam averages about 6 feet thick, with an easterly dip of 20°. The workings are on the pillar-and-stall system and all coal is mined by percussive air-machines. The machinery and plant have been described in previous Annual Reports.

During my last visit of inspection ventilation measurements showed that 17,000 cubic feet of air per minute was passing into the mine for the use of forty-two men; the brattice and stoppings were in fair 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 fairly good condition, and, being naturally wet, were free from dangerous coal-dust. The mine was free from any trace of gas. Approved Edison electric head-lamps are used by all the employees underground and flame safety-lamps of the Wolf type are used by the officials for inspection purposes.

Pleasant Valley Mining Co., Ltd.

W. R. Wilson, President, Vancouver, B.C.; R. R. Wilson, Vice-President, Vancouver, B.C.; Miss M. Duncan, Secretary-Treasurer, Vancouver, B.C.; Thos. Cunliffe, Acting-Superintendent, Princeton, B.C.

This colliery is situated 2 miles west of Princeton and on the south side of the Tulameen river. The surface plant is located on the river-flats, which provide ample room for the mine-yard, tipple, the power plant, and other surface units necessary for the operation of a large colliery. Connections are made with the main line of the Kettle Valley Railway by means of a

bridge across the Tulameen river. This modern and well-equipped surface plant has been described in previous Annual Reports.

Only maintenance-work was carried on in No. 1 mine during 1933.

No. 2 MINE.

The portal of this mine is situated at the same elevation and 1,700 feet west of the mine-tipple. The Main level has now been developed for a distance of 2,000 feet, in which distance some local faulting of the seam has been exposed. The Main level at this point is about 800 feet from the outcrop, on a 15° pitch, to which roadways are driven for ventilation purposes.

The mine is developed on the usual pillar-and-stall system and, owing to the low inclination of the seam, air-driven conveyors are installed in the headings for transporting the coal from the working-faces to the mine-cars on the Main level. Ventilation is natural and fairly good, the mine being free from any trace of gas. The working-places were well timbered and a sufficient supply of suitable timber provided for the use of the miners; the roads were in good condition, well timbered, and analysis of material taken from the same show them to be in compliance with the requirements of the Coal-dust Regulations. The coal is mined with machines of the post-puncher type and Edison electric head-lamps are used by the employees underground, while safety-lamps of the Wolf type are used by the officials for the purpose of inspection. There were fifteen men employed in this mine.

Blue Flame Collieries, Ltd.

W. R. Wilson, President, Vancouver, B.C.; Miss M. Duncan, Secretary-Treasurer, Vancouver, B.C.; Robert Alstead, Superintendent.

No. 1 MINE.

This mine is situated 10 miles west of Princeton, near the Hope–Princeton highway, and has been developed from a coal-exposure situated on the right bank of Lamont creek; the transportation is by a good wagon-road, upon which large motor-trucks having a capacity of 10 tons are used for hauling the coal from the mine-bunkers to coal-chutes situated on a spur off the Kettle Valley Railway near the eastern portal of the railway-tunnel.

These operations were commenced during 1927 by the Linden Coal Company, which company was succeeded by the Blue Flame Collieries, Limited, who found themselves in financial difficulties during 1933. Negotiations resulted in the whole of this property being taken over by the Wilson Mining and Development Company, of Vancouver, and they made considerable improvements to the surface plant by the installation of a travelling picking-belt and larger bunkers, with improvements to the screens with a view to putting a better grade of coal on the market.

The part of the seam worked is about 8 feet thick and is free from any rock; the coal is all mined by percussive air-driven machines. The pillars in the older area of the mine are being split and preparation made for extraction, while operations conducted in the No. 1 Heading section, where levels are being driven, are for the future development of the mine.

The seam is lying at a low angle of inclination and is developed by the usual pillar-and-stall system. The mine is ventilated by a 4-foot direct-driven enclosed-type fan situated near the entrance to the counter-slope. During my last visit of inspection ventilation measurements showed 7,000 cubic feet of air per minute passing into this mine for the use of thirteen men. The brattice and stoppings were in fairly good condition, the air being well conducted around the working-faces and free from any trace of 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; analysis of material taken from the same showed them to be in compliance with the requirements of the Coal-dust Regulations.

The coal is mined by machines of the post-puncher type. 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. There has been no change made in the power plant or the housing accommodations at this camp during 1933; during my last visit there were thirty-five men employed.

Bromley Vale Collieries, Ltd.

Randolph Haigh, President, Princeton, B.C.; P. W. Gregory, Secretary, Princeton, B.C.; John Gillespie, Superintendent, Princeton, B.C.

This mine is situated on the north bank of Bromley creek, about 5 miles west of Princeton. It is reached by a fairly good wagon-road, on which the coal is hauled by motor-trucks to the Kettle Valley Railway near Princeton.

The mine was opened by three prospectors during the year 1932, who after doing considerable work were successful in discovering a seam of coal having an average thickness of 6 feet and lying at an angle of 35°.

A fair amount of development-work has been done in this mine; a small boiler and a 250-cubic-foot single-stage compressor have been installed.

During my last visit of inspection the ventilation was found to be fair, the mine free from any trace of explosive gas, the working-places 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 wet, were free from dangerous coal-dust.

The coal is mined by machines of the post-puncher type; Edison electric head-lamps are used by the employees underground, while flame safety-lamps of the Wolf type are used for inspection purposes; eight men were employed underground.

North Thompson Coal Co.

This property is situated near Chu Chua, on the Canadian National Railway, 55 miles north of Kamloops, the mine being about three-quarters of a mile from the railway. Mining was suspended in February and not resumed during 1933.

Red Triangle Coal Co.

J. T. Maage, President, Tonasket, Wash.; J. L. Lewis, Vice-President, Princeton, B.C.; M. H. Schweikert, Secretary-Treasurer, Tonasket, Wash.; W. R. Foster, Superintendent, Princeton, B.C.

This mine, situated about 4 miles east of Princeton, was formerly known as the "United Empire" and is held under lease. The measures are steeply inclined, the coal-seam being about 4 feet thick and very friable. During 1932 a crosscut tunnel was driven 825 feet to reach the pillars left by the former operators, but after reaching this area and extracting a small amount of coal the operations were suspended in February and were not resumed during the year.

Normandale Coal Co.

Walter Leek, President, Vancouver, B.C.; General Duff Stewart, Vice-President, Vancouver, B.C.; Francis Glover, Superintendent, Nicola, B.C.

This mine is situated about 2 miles east of Nicola and consists mainly of an adit-level which was driven some 400 feet during 1933. The seam was found to be steeply inclined and somewhat irregular in thickness. The mine was found to be well timbered and the general conditions very good, also the provisions of the "Coal-mines Regulation Act" adhered to; four men were employed.

White Lake Coal Co.

Antoni Ambrosi, Superintendent.

During 1933 a small party of Princeton miners obtained a lease on the White Lake mine, at which some work was done some years ago, and in addition to the extraction of some pillars did some development-work. The general equipment consists of a small gasoline-driven hoist

situated near the portal of the mine which is used for hauling the full cars from the slope, a small bar-screen, and bunkers. During my last inspection the mine was found to be in good working condition and in compliance with the provisions of the "Coal-mines Regulation Act."

Sunblaze Coal Co., Ltd.

James Simm, Fireboss.

During 1933 this company obtained a lease on an area of land situated east of the abandoned No. 1 mine of the Princeton Colliery and used one of the abandoned slopes as a means of access to the coal-seam. This slope was reconditioned for some 250 feet and an exploratory level started at this point. A small tonnage was produced from this work in the latter part of the year. The plant consists of a loco-type steam-boiler, slope-hoist, mine-pump, and a small screening plant.

During my last inspection there were three men employed underground; Edison electric head-lamps are used by the miners and safety-lamps of the Wolf type are used for the purpose of inspection. General conditions of the mine were found to be fairly good and in compliance with the provisions of the "Coal-mines Regulation Act."

Report by Thos. R. Jackson, Inspector.

Canada Coal Development Co., Ltd.

A. Murchie, Managing Director; D. L. Leonard, Mine Superintendent.

During 1933 the Canada Coal Development Company commenced work at the Hat Creek mine, located near Pavilion, and mined some trial shipments of coal; ten men were employed until snow conditions prevented the transportation of coal by motor-trucks. The part of the mine operated was in fairly good condition when it is considered that this mine has been idle for a number of years.

NORTHERN INSPECTION DISTRICT.

Report by Chas. Graham, Inspector.

Bulkley Valley Colliery.

F. M. Dockrill, Operator, Telkwa, B.C.; Edward E. Hughes, Overman.

This mine is located on Goat creek, 7 miles from Telkwa, and the coal is hauled by truck to the railway at Telkwa. It was operated practically continuously in 1933 with a small crew varying from six to twelve men. The market for this coal is chiefly domestic, along the line of the Canadian National Railway between Prince George and Prince Rupert.

A small vertical boiler and a small hoist for haulage on the slope were installed during 1933. All operations are on the No. 1 South level, which turns off the slope about 225 feet down. Ventilation is natural and frequent openings driven through to the surface provide an adequate circulation of air. No explosive or inflammable gas has been found and the mine is free from coal-dust.

Lake Kathlyn Anthracite Coal Co., Ltd.

Thos. Campbell, Superintendent, Smithers, B.C.

A crosscut tunnel was commenced at the foot of the mountain with the object of crosscutting the various seams outcropping farther up; this tunnel has been driven about 450 feet, but is not yet in far enough to crosscut the coal-seams. Operations were suspended about the middle of December.

EAST KOOTENAY INSPECTION DISTRICT.

REPORT BY JOHN MACDONALD, INSPECTOR.

Three collieries, consisting of nine separate mines, were operated during 1933—namely, Coal Creek and Michel, owned and operated by the Crow's Nest Pass Coal Company, Limited, with head office in Fernie; Corbin Colliery, owned and operated by Corbin Collieries, Limited, with head office in Vancouver; and the Mammoth Collieries, Limited, also with head office located in Vancouver. G. W. Evans is president and owner of this company, which operated the No. 3 mine of the Corbin Collieries under a lease obtained in the early part of 1933, all coal produced being sold to Corbin Collieries, Limited, and treated in the cleaning plant at Corbin.

The continued slackness in trade generally is again reflected in a further decrease in the production of coal in this district, the output being 20 per cent. less than that of 1932. The production for Corbin Colliery (this includes the output from the Mammoth Colliery) shows a decrease of 23 per cent.; the output from Michel Colliery decreased 5 per cent., while a decrease in production of 42 per cent. is recorded for Coal Creek Colliery; it might be stated here that all operations at Coal Creek are closed with the exception of No. 1 East mine. Coke production decreased 82 per cent., the only colliery now making coke being Michel, as the Fernie ovens have remained closed since September, 1932. Coal Creek worked 90 days during 1933; Michel, 202 days; Corbin Collieries, 148 days; and Mammoth Collieries (surface-stripping), 116 days.

No labour trouble of a serious nature developed during 1933 and the good relations that have existed for the past few years between employers and employees have been continued.

ACCIDENTS.

Six serious accidents, one of which was fatal, were reported and investigated. The fatal accident recorded occurred at Michel Colliery on December 23rd. No accidents of a serious nature were reported from Corbin Colliery during 1933, which is very satisfactory indeed and reflects great credit on the part of both workmen and officials. By occupations the accidents occurred to: Miners, 2; timbermen, 2; coal-cutter's helper, 1 (fatal); and truck-driver, 1.

DANGEROUS OCCURRENCES.

Five notices were received under this heading in accordance with section 71, subsection (*h*), of the "Coal-mines Regulation Act," two of which were in connection with "bumps" that occurred in October and November respectively in No. 1 East mine, Coal Creek Colliery; one dealt with a fire that occurred in the boiler-room at Michel Colliery, while two had relation to mishaps that happened to trucks on the haulage-roadway between the "Big Showing" and the loading-chute at Corbin Colliery. All of the above were investigated and reported on in detail.

While fairly good progress has been made with the cleaning and repairing of the heated area in No. 4 mine, Corbin Colliery, it is essential this work should be prosecuted as vigorously as possible until every sign of heating has been definitely removed. Conditions have been generally good in the various fire areas in the No. 6 mine of the above colliery, a close watch being maintained on these districts at all times.

VENTILATION.

The general conditions with respect to ventilation have been good throughout 1933 and are dealt with in greater detail at a later stage of this report. Forty-nine samples of mine-air were sent to the Department of Mines at Ottawa for analysis, eight being from Coal Creek Colliery, eighteen from Michel, and twenty-three from Corbin. For the most part these were taken in the vicinity of heated areas as a check on the possibility of carbon monoxide being given off rather than methane, as the latter has seldom exceeded 1 per cent. in the regular air-currents. The carbon-monoxide contents of several samples varied from a trace to 0.29 per cent., with one exception; this registered 0.74 per cent. and was taken close to a sealing which was leaking freely.

REGULATIONS FOR PRECAUTIONS AGAINST COAL-DUST.

Except in a few cases, which were attended to immediately the attention of the management was directed thereto, conditions in general with respect to this danger have been kept fairly

good. Crushed limestone-dust is the medium used to combat the dust hazard. This has also been used to advantage on many occasions in dealing with active fire underground and is plentifully distributed around all heated areas and old workings adjacent thereto.

Inspection on behalf of the Workmen.

This inspection has been made regularly at all mines in the district, and the interest shown on all occasions by the various committees in assisting with the work of maintaining safe conditions in and around the mines is greatly appreciated. No complaint or unsatisfactory reports were received from any inspection committee.

Searches for matches or other articles prohibited by General Rule 9 were made frequently, and on one occasion a workman was found with matches in his possession underground. He was convicted and fined for this offence.

Explosives.

At Michel and Corbin explosives are used in some parts of the mine to bring down the undermined coal; no explosives are used for this purpose at Coal Creek Colliery. The regulations in regard to blasting have been fairly well attended to, except in one instance, where a breach of General Rule 12 resulted in a conviction and fine for the offender.

Coal-cutting Machinery.

During 1933 two Anderson-Boyes A.B. 15 and one Mavor & Coulson Samson-type coal-cutting machines were installed and operated on the long-wall faces in the "B" seam district of No. 1 mine, Michel Colliery, and are giving satisfactory service. Additional machines of the percussive type have also been installed in the No. 3 mine of the above colliery. Full particulars regarding the tonnage produced are given in detail in the annual returns. All of these machines are operated by means of compressed air.

Mine-rescue and First Aid.

The only colliery where first-aid classes were held during 1933 was Michel, none being held at Coal Creek or Corbin; it is presumed the uncertainty prevailing regarding continuation of operation at these collieries had a bearing on this matter. It is important that interest in this subject be revived and maintained not only for the purpose of training new men, but also for the benefit of the older students.

The number and type of mine-rescue apparatus on hand at the Mine-rescue Station in Fernie and the various colliery stations is similar to last year and has been kept in good condition at all times.

Conclusion.

At all mines in this district the lamp used by the workmen is the Edison electric cap safety-lamp, while Wolf safety-lamps are used by the officials and bratticemen for testing purposes, all lamps being cleaned and repaired in well-equipped lamp-rooms located in a central position at each colliery; Burrell gas-detectors are also provided at all the mines and readings taken regularly with this instrument in the return air-currents. Copies of the "Coal-mines Regulation Act" and special rules are posted up at all mines, while regular examinations have been made of all report-books kept at each mine.

A total of 668 samples of dust were taken in the district in accordance with the Coal-dust Regulations, fifteen of which failed to reach the standard set by Regulation No. 4. In all cases where samples are under the standard, additional treatment with crushed limestone-dust is given and further samples taken. All accidents reported to our office were immediately investigated and reported on. In the case of the fatal accident that occurred, I wish to express my indebtedness to the Coroner for the privilege of questioning the witnesses at the inquest held in connection with the above.

I also wish to take this opportunity of expressing my sincere appreciation of the efforts put forth by all officials and workmen generally regarding the prevention of accidents in what we recognize as a hazardous occupation.

Crow's Nest Pass Coal Co., Ltd.

Head Office—Fernie, B.C.

W. R. Wilson, President, Fernie, B.C.; A. H. MacNeill, Vice-President, Vancouver, B.C.; J. S. Irvine, Secretary, Fernie, B.C.; A. A. Klauer, Treasurer, Fernie, B.C.; Robt. Bonar, Superintendent, Michel Colliery, Michel, B.C.; B. Caufield, Superintendent, Coal Creek Colliery, Coal Creek, B.C.; H. P. Wilson, Manager, Fernie, B.C.

The above company operated, during 1933, 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, about 24 miles in a north-easterly direction from Fernie.

COAL CREEK COLLIERY.

B. Caufield, Manager.

This colliery is situated at 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. Owing to the continued depression in trade and lack of markets for Coal Creek coal, it was decided at the close of 1932 to practically abandon operations at this colliery. All material was then recovered from Nos. 2 and 1 South mines and permanent seals erected in the early part of January, 1933.

During 1933 two mines only have been operated; No. 3 mine producing coal until the end of March, when the company decided to close this operation also; all material was then brought out and the mine sealed off in June. With the exception of a six-week suspension in the early part of 1933, No. 1 East mine has operated on a limited scale during the whole of the year and is now the only mine producing coal at Coal Creek Colliery.

A general description of the method of working, system of haulage in and around the mines, and surface plant has appeared in previous Annual Reports. As an additional protection from stormy weather, 400 feet of snowshed was erected over the double tracks of the surface haulage to No. 1 East mine.

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., produced an average quantity of 170,850 cubic feet of air a minute, under a water-gauge of 3.4 inches. Ventilation is divided into two splits at present; the quantities passing in each at the last inspection measured as follows:—

No. 1 Split.—40,000 cubic feet of air a minute for the use of forty men and six horses. Burrell gas-detector, 0.7 per cent. methane.

No. 2 Split.—36,000 cubic feet of air a minute for the use of forty-eight men and seven horses. Burrell gas-detector, 0.8 per cent. methane.

North Return.—90,000 cubic feet of air a minute for the use of fifty-one men and eight horses. Safety-lamp indicated 0.8 per cent. methane.

West side of fan-shaft, 120,700 cubic feet of air a minute; east side of fan-shaft, 59,200 cubic feet of air a minute; total return air, 179,900 cubic feet of air a minute.

Explosive gas was found a few times in the course of inspection, mostly in cavities in the roof above the timbers. Burrell readings taken regularly in the return air-currents have varied from 0.6 per cent. in the North Return to 1.7 per cent. methane in the No. 3 split. Considering the fact that this mine has been operated since the beginning of July with what one might term a skeleton crew, roadways and timbering have been kept in good shape and conditions in general are good all over the mine. All roadways and working-places are treated regularly with crushed limestone-dust. Two hundred and seventeen samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were well above the standard required by the above regulation.

No. 3 Mine.

J. Worthington, Overman.

This mine produced coal only during the first three months of 1933 and was ventilated by an electrically driven 16- by 8-foot Wilson fan, which, running at a speed of 168 r.p.m., produced an average quantity of 60,000 cubic feet of air a minute, under a water-gauge of 4.8 inches. Burrell readings taken in the return air-currents varied from 0.6 per cent. in the No. 1 split to 1.1 per cent. methane in the main return airway.

During the short period this mine was in operation, a total of thirteen days, roadways and timbering were kept in good shape and well treated for coal-dust. Coal production was definitely suspended at the end of March, when the recovery of equipment was begun, this being completed and permanent stoppings erected in the early part of June. Seventy-two samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were above the standard set by the above regulation.

MICHEL COLLIERY.

Robt. Bonar, Manager; J. Henney, Safety Inspector.

This colliery is situated on Michel creek, 24 miles north-east of Fernie, on 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. A change in the method of work in two districts in the mines of this colliery has been introduced during 1933.

In the "B" seam district of No. 1 mine, where a modified system of long-wall was formerly in operation, coal-cutting machines have been installed and operated on a long-wall face 800 feet in length. The coal is undercut for a width of 6 feet, then loaded into face conveyors of the Meco-shaker type, which deliver to a main travelling-belt; this in turn discharges into a central loading-chute which connects the No. 1 incline with the main haulage-roadway, where the coal is loaded into mine-cars and transported direct to the tipple by compressed-air locomotives. In this district the mine-cars never leave the main haulage-tunnel, as the face conveyors, travelling-belt, and loading-chute mentioned above have replaced the former haulage system. The other change in the method of working has been introduced in the new districts through the "fault" in the West level of No. 3 mine. In this part of the mine wide rooms are now driven up the pitch, the coal undermined by means of percussive coal-cutting machines of the Hardy, Siskoll, and Ingersoll-Rand types, then shot down and loaded into face-chutes which deliver it to Meco conveyors of the shaker type, which in turn discharge into central loading-chutes, where the mine-cars are loaded for transportation to the tipple by compressed-air locomotives.

Another unit has been added to the cleaning plant at this colliery; this consists of an 8- by 17½-foot air coal-cleaning table to remove the impurities from all sizes of coal under ⅜ inch, while an elevator and belt-conveyor having a capacity of 100 tons per hour has also been installed to feed the above unit.

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 114,000 cubic feet of air a minute, under a water-gauge of 3 inches. Ventilation is divided into three splits; the quantities passing in each at the last inspection measuring as follows:—

No. 2 Split.—14,850 cubic feet of air a minute for the use of fifty men and ten horses. Safety-lamp indicated 0.4 per cent. methane.

No. 3 Split.—10,000 cubic feet of air a minute for the use of thirty-eight men and two horses. Safety-lamp indicated a slight trace of methane.

No. 4 Split.—6,000 cubic feet of air a minute for the use of three men. Safety-lamp, *nil.*

Main Return, Nos. 1 and 3 Mines.—140,000 cubic feet of air a minute for the use of 130 men and fifteen horses. Safety-lamp indicated a trace of methane.

No explosive gas has been found in this mine in the course of inspection and the methane content in the return air-currents has always been under 0.5 per cent. Roadways and timbering have been kept in good shape and fairly well treated for coal-dust. All roadways and working-

places, where required, are treated regularly with crushed limestone-dust. One hundred and twenty samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but four of which were above the standard set by the above regulations.

No. 1 Mine.

Robt. McFegan and D. James, Overmen.

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; Nos. 1, "A," and "B" only being operated. Until November, 1933, this mine was ventilated by No. 3 East fan, particulars of which may be found in the report dealing with the latter mine. Ventilation is divided into two splits; the quantities passing in each at the last inspection measured as follows:—

No. 1 Seam, Intake.—14,000 cubic feet of air a minute for the use of three men and one horse.

"B" Seam, Return.—22,000 cubic feet of air a minute for the use of thirty-eight men and two horses. Burrell gas-detector, 0.3 per cent. methane.

Explosive gas was found only on one occasion during the course of inspection, and the methane content in the return air-current has always been under 0.5 per cent. Roadways and timbering have been kept in fairly good shape and fairly well treated for coal-dust. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. Ninety-two samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but four of these being above the standard set by the above regulation.

No. 8 Mine.

Robt. Taylor, Overman.

Active production of coal from this mine was suspended in September, 1932. From then until May, 1933, a small force of men was steadily engaged in repairing main roadways and recovering material. This was completed and the various openings permanently sealed off in the early part of June.

No. 3 East Mine.

S. Lazaruk, Fireboss.

This mine 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 95,000 cubic feet of air a minute, under a water-gauge of 2.1 inches. This fan provides the ventilation for Nos. 1 and 3 East mines; the quantities passing at the last inspection measured as follows:—

No. 1 Mine, Main Return.—60,000 cubic feet of air a minute for the use of forty-one men and three horses. Safety-lamp indicated a trace of methane.

No. 3 East Mine, Main Return.—91,200 cubic feet of air a minute for the use of fifty men and four horses. Safety-lamp indicated a slight trace of methane.

As in recent years, operations have been confined to repairing main roads and attending to the heated area in the vicinity of the main return airway. Conditions in this district are good.

Corbin Collieries, Ltd.

Austin Corbin, President, Spokane, Wash.; E. J. Roberts and J. M. Fitzpatrick, Vice-Presidents, Spokane, Wash.; A. M. Allen, Secretary-Treasurer, 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. This colliery consists of four mines—Nos. 3, 4, 5, and 6. All of these were on the producing list with the exception of No. 5; this mine remaining closed during 1933.

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. During the summer months underground work was confined chiefly to repairs, as the Corbin Collieries, Limited, had entered into

a contract with the Mammoth Collieries to supply a certain tonnage from the No. 3 mine or "Big Showing." Due to a falling-off in trade, the output produced at this mine was sufficient to supply the market requirements during July, August, and September.

No. 4 Mine.

W. Almond, Overman.

This mine is operated on the No. 4 seam and is ventilated by an electrically driven fan of the Guibal type, which, running at a speed of 180 r.p.m., produced an average quantity of 20,000 cubic feet of air a minute, under a water-gauge of 1.5 inches. The ventilation is all on one split; the quantity passing at the last inspection measured as follows:—

Main Intake.—31,500 cubic feet of air a minute for the use of twenty men and three horses.

Explosive gas has been found on several occasions in the course of inspection, mostly at the edge of the caving in the vicinity of the barricades. Burrell readings taken in the return air-currents have varied from 0.7 per cent. to 1.5 per cent. methane. Roadways and timbering have been kept in fairly good shape, except for portions of the main intake airway, where the formation of ice somewhat restricts the area when sub-zero temperatures prevail. The work of repairing and enlarging this roadway requires to be steadily continued, as a plentiful supply of air is an absolute necessity in this mine, where the pillars are extracted by means of the caving system. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. Seventy-seven samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, three of which were under the standard set by the above regulation.

No. 6 Mine.

J. Taylor, Overman.

This mine is operated on the No. 6 seam and is ventilated by an electrically driven fan, which, running at a speed of 280 r.p.m., produced an average quantity of 49,800 cubic feet of air a minute, under a water-gauge of 0.5 inch. With the exception of the fire areas in A and 1 levels, the ventilation is all on one split; the quantity passing at the last inspection measured as follows:—

Main Intake.—40,000 cubic feet of air a minute for the use of forty men and two horses.

Explosive gas was found on one occasion during the course of inspection, while the methane content in the return air-currents has always been kept under 0.5 per cent. Roadways and timbering have been kept in good shape generally and fairly well treated for coal-dust. Ninety sample of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, four of these being under the standard set by the above regulation.

Mammoth Collieries, Ltd.

G. W. Evans, President; D. Waddington, Overman.

This company operated the No. 3 mine ("Big Showing") under lease from the Corbin Collieries, Limited, the whole of the output being sold under contract to the latter company. This is an open-cut mine, the method of working being to remove the overburden from the seam, which is then mined in a series of benches. The coal is loaded direct into trucks by gasoline-shovel. Where blasting was necessary, all shots were prepared and fired under the direct supervision of a certificated official.

At the last inspection in November a small crew of men was engaged in removing the shovel and other equipment from the pit preparatory to closing down for the winter, as it is a physical impossibility to keep the haulage-road open during this season. Conditions in general were good at all inspections and the haulage-roadway down the mountain was kept in good shape.

REPORTS OF INSPECTORS OF QUARRIES.

REPORT BY JAMES STRANG, INSPECTOR.

VANCOUVER MINING DIVISION.

Coast Quarries, Ltd.—The property of this company is situated at Granite Falls, Burrard inlet, about 18 miles from Vancouver. Granite is crushed and screened to various sizes for use in general construction-work. Work has been very irregular during 1933, the number of men varying from twelve downwards. The regulations are generally well observed and no accidents of a serious nature occurred during 1933.

Kilgard Red-shale Quarry.—This quarry is the property of the Clayburn Company, Limited, and is worked in conjunction with their clay-mines, the men being drawn from the mine when required at the quarry.

NEW WESTMINSTER MINING DIVISION.

Gilley Bros.' Quarry.—This property is situated at Silver Valley, on the Pitt river. At both the screening and loading plant and at the quarry operations are conducted in a safe and satisfactory manner. About fifteen men are employed, but work has been very irregular during 1933.

Maryhill Sand and Gravel Pit.—This plant is situated on the Fraser river below the junction of the Pitt and Fraser rivers. The screening and loading equipment are operated electrically, as are the power-shovel and conveyor at the gravel-pit. Conditions are good and operations conducted in a safe and careful manner. An average of twelve men are employed.

VICTORIA MINING DIVISION.

B.C. Cement Co., Ltd.—A large limestone-quarry is operated at Bamberton, where an up-to-date plant for the manufacture of cement is owned by this company. The Bamberton quarry has been closed down for a good part of 1933, due to lack of orders for cement. This company takes a keen interest in safety measures and insists at all times in the strict observance of the regulations. About thirteen men are employed in the quarries.

Pioneer Sand and Gravel Co., Ltd.—This company operates a sand and gravel pit at Songhees Reserve, but work has been irregular during 1933.

Producers Sand and Gravel Co.—Situated at Royal bay. This company operates a gravel-pit, but, like the Pioneer Sand and Gravel Company, has only worked intermittently during 1933.

NANAIMO MINING DIVISION.

Pacific Lime Co.—A large limestone-quarry is owned and operated by this company at Blubber bay, Texada island. About 127 men are employed at the quarry, lime-kilns, and sawmill. Conditions at the quarry and plant were generally found to be good.

B.C. Cement Co., Ltd.—On the opposite shore of Blubber bay from the Pacific Lime Company, a quarry is operated by the B.C. Cement Company. The rock is crushed and shipped by scow to Bamberton, where the cement plant of the company is located. Five men are working at this quarry and every effort is made to operate this plant in a safe manner.

Marble Bay Quarry.—This quarry is operated by F. J. Beale, who supplies the pulp and paper companies with limestone. Two to four men are employed. Conditions were found to be good.

Vananda Quarry.—This quarry is operated by F. J. Beale and was opened in 1933; twenty-three men were employed here. The loading-wharf is under construction at present. Conditions were found to be very satisfactory.

Vancouver Granite Co.—This company operates a dimension-stone quarry at Nelson island, but very little work was done in 1933.

It is very satisfactory to record that no fatal or serious accident occurred at any of the quarries in the Coast District during 1933.

VANCOUVER MINING DIVISION.

REPORT BY THOS. R. JACKSON, INSPECTOR.

Deeks Sand and Gravel Pit.—North Vancouver; Thomas O. Burgess, superintendent. This quarry is about 3 miles above Second Narrows bridge on Burrard inlet. This is an hydraulic operation; electrical power is used for the mechanical operation of the plant, which has a production capacity of 100 tons per hour. The condition of machinery, equipment, and fencing was good and no accidents were recorded.

Cascade Sand and Gravel Quarry.—North Vancouver; Alfred Ellis, superintendent. This operation recovers sand and gravel from the bed of Seymour creek by means of a large power-shovel. The condition of machinery, equipment, and fencing was good. One slight accident was reported.

Builders' Supply Sand and Gravel Quarry.—North Vancouver; C. F. Robinson, superintendent. This operation did very little throughout 1933. The machinery, equipment, and fencing were in good condition.

B.C. Sand and Gravel Quarry.—North Vancouver; William Monks, foreman. This operation produced very little throughout 1933. The machinery, equipment, and fencing were in good condition.

Hillside Sand and Gravel Quarry.—West Howe sound; John Campbell, superintendent. This plant is situated on the beach. A quarry-face 70 feet high and 100 yards wide is used, and the quarry is operated by a gasoline-driven shovel which delivers into a large truck; this transports the gravel to the hopper, from there it is conveyed by belt to the screens and washery plant. The camp accommodation, which consists of living-quarters, cook-house, and dining-room, was in fairly good condition. Owing to the depression in trade the number of days worked and the number of men employed during 1933 has been considerably reduced. The machinery, equipment, and fencing were all in good condition and no accidents of any kind were reported.

Britannia Sand and Gravel Quarry.—Britannia Beach; J. Bissett, superintendent. Only a few scow-loads of sand and gravel were taken out during 1933. The machinery, equipment, and fencing were all found to be in good condition.

NANAIMO AND ALBERNI MINING DIVISIONS.

REPORT BY GEORGE O'BRIEN, INSPECTOR.

McDonald Cut-stone Operators.—The operations of this company, which were formerly on Newcastle island, are now carried on at the north end of Gabriola island. The entire equipment has been transferred from Newcastle island to Gabriola island and work was done for a short period during 1933. The work consisted of getting out cylindrically cut stone for pulp-grinding mills.

Gabriola Shale Products, Ltd.—This operation is situated near the southerly end of Gabriola island, in the strait of Georgia, and consists of a shale-quarry and brick-making plant. Owing to market conditions no work was done at the quarry or plant during 1933.

KAMLOOPS MINING DIVISION.

REPORT BY JOHN G. BIGGS, INSPECTOR.

Falkland Quarries.—Operated by the Canadian Gypsum and Alabastine Company, Limited, at Falkland; William J. Innes, superintendent. These mines are situated 30 miles west of Vernon and about 2 miles north of the Vernon–Kamloops highway. The operations are conducted in a large gypsum-deposit on steeply rising ground and the quarrying operations are carried on at three different elevations. During 1933 work has been confined to the upper or No. 3 quarry. The rock after being blasted is loaded into cars having a capacity of 1 ton, trammed by hand to a small bunker, where it is loaded into skips running on a surface incline; then lowered to large bunkers at the top terminal of an overhead tramway, where it is transferred into the buckets and lowered to chutes situated at the lower terminal, which is situated on a spur off the Canadian National Railway.

The production of these quarries during 1933 was very limited and intermittent; ten men were employed. General conditions of the quarries were found to be fairly good and the provisions of the "Quarries Regulation Act" adhered to.

BELLA COOLA MINING DIVISION.

REPORT BY CHARLES GRAHAM, INSPECTOR.

Cunningham Island Quarry.—Thos. Coulter, foreman. This limestone-quarry, owned by F. J. Beale, is the only one operating in the Northern district. The production from the quarry for 1933 was 6,301 tons of limestone, all of which was shipped to the Pacific Mills, Ocean Falls. Four men were employed for about seven months and the general conditions were in accordance with the requirements of the "Quarries Regulation Act."

GOVERNMENT MINE-RESCUE STATIONS.

MINE-RESCUE STATION, NANAIMO.

REPORT BY J. D. STEWART, INSTRUCTOR.

Two teams of trained rescuemen from the Western Fuel Corporation of Canada, Limited, carried out regular practice throughout 1933 and several other teams came in for an annual training.

Two calls to stand by with the apparatus were received in connection with gob heatings in No. 5 mine, South Wellington, but the work of sealing off the heated areas did not require the use of the machines.

Twenty-five emergency calls for the use of oxygen-supplying apparatus were received. Five calls from Nanaimo Hospital, six calls from Ladysmith Hospital, thirteen calls from Nanaimo doctors, and one call from the Provincial Police, in the case of a Chinaman who attempted suicide by hanging, were answered. The Chinaman recovered after an extended use of the oxygen inhalator.

The 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; with supplies and spare parts to maintain the equipment in service.

MINE-RESCUE STATION, CUMBERLAND.

REPORT BY JOHN THOMSON, INSTRUCTOR.

During 1933 twenty-four men from the Canadian Collieries (Dunsmuir), Limited, carried out a monthly training course for the full yearly period.

An emergency call was received on September 23rd in connection with a fire discovered on the face-line of one of the long-wall sections in No. 5 mine, Comox Colliery; the Burrell all-service gas-mask was used in this emergency.

The equipment at this station consists of eleven sets of the Paul two-hour oxygen apparatus; eleven sets of the McCaa two-hour oxygen apparatus; twelve sets of the Burrell all-service gas-masks; twenty-two self-rescuers; and one oxygen inhalator. Sufficient supplies are on hand to maintain the equipment in service.

Two teams trained at this station competed at the mine-rescue competition held at Nanaimo in June; one of the teams gained the first prize for efficient work.

MINE-RESCUE STATION, PRINCETON.

REPORT BY ALFRED GOULD, INSTRUCTOR.

During 1933 fourteen new men took the full training course and obtained the Government certificates of competency in mine-rescue work. A number of previously trained men took occasional practices with the machines.

On April 13th a call was received for the use of five machines for use in reopening a sealed-off section in No. 4 mine, Coalmont Colliery; five emergency calls for the oxygen inhalator were received from the Princeton Hospital.

During 1933 the Princeton centre of the St. John Ambulance Association used the station as a practice-room for first-aid work.

The equipment at this station consists of eleven sets of the McCaa apparatus; eleven sets of the Burrell all-service gas-masks; seventeen self-rescuers; and one oxygen inhalator. An adequate supply of materials to maintain the equipment is maintained.

MINE-RESCUE STATION, FERNIE.

REPORT BY JOHN T. PUCKEY, INSTRUCTOR.

Due to the reduced number of men employed at the local mines, no new men took up mine-rescue training during 1933, but some previously trained men took occasional practice training. The local fire brigade used the station on several occasions to test out their gas-masks.

Visits were made to inspect the rescue apparatus owned by the mining companies at Michel, Corbin, and Kimberley.

The equipment at this station consists of six Gibbs two-hour oxygen machines; eleven McCaa two-hour oxygen machines; twelve Burrell all-service gas-masks; forty-six self-rescuers; and one inhalator. Adequate supplies are on hand to maintain the equipment in service.

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, now consists of James Dickson, Chief Inspector of Mines, 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. 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 1933. The first was held on May 17th, 18th, and 19th, and the second on November 22nd, 23rd, and 24th.

The total number of candidates at the examinations were as follows: For First-class Certificates, 3 (1 passed and 2 failed); for Second-class Certificates, 2 (2 failed); for Third-class Certificates, 7 (4 passed and 3 failed); for Mine Surveyors, none.

The following is a list of the candidates who successfully passed in the various classes:—

First-class Certificate.—Robert Pettigrew.

Third-class Certificates.—Robert Shaw, James Biggs, Robert Carruthers, and John C. Biggs.

There is every evidence of a decided improvement in the work of most candidates, but some candidates, particularly Third-class, still seem to have only a hazy idea of what is required to become a fully qualified fireboss.

EXAMINATIONS FOR CERTIFICATES OF COMPETENCY AS COAL-MINERS.

In addition to the examination 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 1933 examinations have been held in the various coal-mining districts of the Province. One hundred and four candidates presented themselves for examination, eighty-eight passed and sixteen 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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PHOTOGRAPHS.

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Series.

British Columbia. *Department of Mines.*

Annual Report of the Minister of Mines for the year ended 31st December, 1933, being an account of mining operations in the Province. Compiled by A. M. Richmond, Resident Mining Engineer. 365 pp., plates, maps, 1933.

Victoria, Government Printing Bureau, 1934.

Author.

Richmond, A. M. *(Resident Mining Engineer.)*

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