Minister of Mines

PROVINCE OF BRITISH COLUMBIA

ANNUAL REPORT

For the Year ended 31st December

1949

VICTORIA, B.C.:
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1950.

BRITISH COLUMBIA DEPARTMENT OF MINES

VICTORIA, B.C.

Hon. R. C. MacDONALD, *Minister.*
JOHN F. WALKER, *Deputy Minister.*
JAMES STRANG, *Chief Inspector of Mines.*
G. CAVE-BROWNE-CAVE, *Chief Analyst and Assayer.*
HARTLEY SARGENT, *Chief Mining Engineer.*
P. J. MULCAHY, *Chief Gold Commissioner.*

To His Honour CHARLES ARTHUR BANKS, C.M.G.,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Mining Industry of the Province for the year 1949 is herewith respectfully submitted.

R. C. MACDONALD,
Minister of Mines.

Minister of Mines' Office,
May, 1950.

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ANNUAL REPORT OF THE MINISTER OF MINES, 1949.

Introduction.

A Report of the Minister of Mines of the Province of British Columbia has been published each year since 1874. This 1949 issue, therefore, is the seventy-sixth Annual Report of the Minister of Mines.

The Annual Report records the salient facts in the progress of the industry, also much detail about individual mining operations, including those undertaken in the search for exploration and development of mineral deposits as well as the actual winning of material from mineral deposits.

The Annual Report of the Minister of Mines now contains introductory sections dealing with statistics and Departmental work, followed by sections dealing with Metal-mining (Lode); Placer-mining; Structural Materials and Industrial Minerals; Inspection of Lode Mines, Placer Mines, and Quarries; Coal-mining; and Inspection of Electrical Equipment and Installations of Mines and Quarries, each with its own table of contents.

An introductory review of the mining industry and notes at the first of several of the main sections deal generally with the industry or its principal subdivisions. Notes in the various sections deal briefly with the work done on individual properties during the year or describe a property in more complete detail, outlining the history of past work and the geological setting as well as describing the workings and the mineral deposits exposed in them. Some notes deal with areas rather than with a single mine or property.

The work of the branches of the Department is outlined briefly in the section headed " Departmental Work." This section is followed by notes dealing briefly with the work of the British Columbia or Dominion Government services of particular interest to the mining industry of British Columbia. Information concerning mine operations and some of the activities of the Inspection Branch of the Department of Mines is contained in the section on " Inspection of Lode Mines, Placer Mines, and Quarries," early in the section on " Coal-mining " and in the section on " Inspection of Electrical Equipment and Installations at Mines and Quarries."

The section on " Statistics " consists of tables supplemented by brief notes. A statement of current and past practice in arriving at quantities and calculating the value of the various products is given under " Statistics " (pp. 13 and 14). Quantities and values of the principal mineral products for 1949 and 1948 are given in Table I (p. 15). The average prices for each of the principal metals and coal for each year, beginning with 1901, are given in Table II (p. 16). Other tables record the details of mineral output from year to year for the Province and for the various mining divisions. The numbers employed in various divisions of the mining industry; the expenditures for salaries and wages, fuel, electricity, and process supplies; the dividends disbursed; the quantity of ore mined and the freight and treatment charges incurred are also tabulated, and the lode-metal producers are listed.

The section on " Statistics " is supplemented by data on the production of individual properties found in notes on properties in the succeeding sections, and by data relating to the production of individual coal mines and of coal-mining areas tabulated early in the section on " Coal-mining."

Review of the Mining Industry of British Columbia, 1949.

By Hartley Sargent.

The gross value of mineral production in British Columbia in 1949 was $133,012,968, and the value to the end of 1949 (1852 to 1949, inclusive) is $2,567,036,472. The value for 1949 is exceeded only by the value for 1948, which was $152,524,752.

Placer gold mined in 1949 had a value of $529,524, compared with $585,200 in 1948. Lode gold, silver, copper, lead, and zinc in 1949 had a gross value of $105,259,001, compared with $125,979,961 in 1948. The total quantity of ore mined was 6,095,441 tons, compared with 5,655,266 tons in 1948, and the number of productive lode mines was 118, compared with 97 in 1948. The total quantity of coal mined was 1,917,296 tons, valued at $12,462,424, compared with 1,809,018 tons, valued at $10,854,108, in 1948. In both years twenty-one underground mines and three strip mines were operated. The output of strip-mined coal was almost 200,000 tons less, and the output of underground mines was about 300,000 tons more than in 1948. Miscellaneous metals, minerals, and materials had a value of $4,806,129* in 1949 and $6,137,261 in 1948, and structural materials were valued at $9,955,890 in 1949, compared with $8,968,222 in 1948.

The average number employed in all branches of the mining industry in 1949 was 16,621. Some of the major expenditures were for salaries and wages, $41,023,786; fuel and electricity, $7,206,637; process supplies, $17,884,408; freight and treatment on ores and concentrates of metals, $19,613,185; Dominion taxes, $13,655,842; Provincial taxes, $3,769,785; municipal and other taxes, $511,037; Workmen's Compensation, silicosis, unemployment insurance, and other levies, $1,458,149. Dividends paid amounted to $33,651,096.

The prices for the principal base metals, although less than the 1948 prices, are high compared with the long-time average. In the United States the prices for copper, lead, and zinc fell in the first six months of 1949 and rose again moderately in the final six months. The price of silver rose moderately from the low reached near the end of 1948. Following devaluation of British, Canadian, and other currencies, in September, Canadian producers of gold, silver, copper, lead, and zinc received a 10-per-cent. exchange premium or equivalent benefit. Some gold-producers benefited under the "Emergency Gold Mining Assistance Act" throughout 1949.

Duties on zinc imported into the United States are 0.75 cent per pound of zinc in ores and concentrates and 0.875 cent per pound of slab zinc. The import duties on lead became effective again on July 1st, 1949; they are 0.75 cent per pound of lead in ores and concentrates and 1.065 cents per pound of refined lead. The duty on copper remained suspended throughout 1949. Unless other provision is made, the duty will become effective again on July 1st, 1950, and will be 2 cents per pound of copper in concentrates, matte, blister, or refined copper.

A small increase in the output of lode gold and increased price consequent upon revaluation of the Canadian dollar resulted in an increase of 3.6 per cent. in the value of lode gold. Silver production was greater than in 1948 by 13.7 per cent. in quantity and 12.5 per cent. in value. Copper output exceeded that in 1948 by 27.5 per cent., but because the average price was 2.4 cents per pound less than in 1948, the value of 1949 production was only 13.9 per cent. higher than in 1948. Lead output was 20.8 per cent. less in quantity, and the value was 30.7 per cent. less than in 1948. Zinc production was 6.6 per cent. less in quantity and 11.2 per cent. less in value than in 1948. These two metals have contributed 55 per cent. of the total gross value of our

* Does not include tungstate (WO_3), valued at about $3,500, recovered from placer operations near Atlin.

mineral production in the past ten years, and the percentage was 72.4 in 1949 and 77.7 in 1948; consequently substantial changes in the output and in the prices for lead and zinc have an important bearing on the total value of mineral production.

The minor metals and sulphur had a combined value of $3,852,604 in 1949, compared with $5,215,540 in 1948. This decrease comes very largely from the suspension of production of tungsten concentrates. Late in 1948 production of tungsten concentrates was stopped and the Emerald mill was converted for treating silver-lead-zinc ore from the Jersey part of the same property. Decreases in the value of the output of antimony, bismuth, and tin were more than offset by increases in the value of cadmium and sulphur.

Lode-gold production came principally from the mines in the Bridge River District, at Tulsequah, Wells, Hedley, and Sheep Creek. The Hedley Mascot mine was shut down in April. Milling at the Silbak Premier was resumed in November. At the Polaris-Taku the first unit of a plant for roasting concentrates and a cyanide plant for extracting the gold from the roasted concentrates were ready for testing at the end of 1948. This method of treatment is expected to remove the necessity for shipping the concentrates to the smelter at Tacoma.

The Granby Consolidated Mining, Smelting and Power Company celebrated its fiftieth anniversary in 1949 at the site of its current operations, Copper Mountain. The Granby Company previously operated copper mines at Phoenix and Anyox, and smelters at Grand Forks and Anyox. The Copper Mountain and Britannia mines yielded, in addition to most of the copper and some silver, about 7½ per cent. of the 1949 gold output. The copper output, including production from the Little Billie at Vananda and the copper in dross from the lead smelter at Trail, exceeded the 1948 production by almost 12,000,000 pounds. Britannia also produced a large quantity of zinc and some lead.

Ores containing silver, lead, and zinc, or at least two of these metals, were mined at eighty properties, with production ranging from a few tons to more than 2,000,000 tons. Customs shipments from British Columbia silver-lead-zinc properties to the Trail smelter included almost 15,000 tons of crude ore, 10,200 tons of lead concentrates, and 46,200 tons of zinc concentrates. The Highland Bell at Beaverdell and the Violamac property at Sandon were the principal customs shippers of crude ore. Concentrates from the ten principal shippers ranged from a total of 1,270 tons to 11,910 tons. Five new or remodelled mills began treating silver-lead or silver-lead-zinc ore; five mills accepted ore from other mines for milling on a custom basis. Exploratory work was done on many properties, and substantial development programmes were carried out at several. At the Sullivan mine in the past few years the ore hoisting and transfer arrangements within the mine have been completely revised, primary crushers have been installed underground, a new adit has been driven, and storage and loading pockets have been provided. The ore is hauled from the new adit to the mill in mine cars, replacing haulage from the old main adit by the Canadian Pacific Railway Company. A sink-float plant has been installed at the mill, and waste rejected in the sink-float plant is returned to the mine for fill.

Work on a programme involving thorough revision of the installations for preparing and smelting lead ores and concentrates at the Trail smelter was started in 1949. Practical production of the metal indium was begun at the smelter in 1949. In addition to treating the very large quantities of concentrates from the Sullivan mine, and of customs ores and concentrates from British Columbia mines, the Trail smelter received customs shipments averaging more than 2,500 tons of lead ores and concentrates and more than 2,000 tons of zinc concentrates each month from points outside British Columbia, including Yukon Territory, Quebec, the States of Idaho, Montana, Oklahoma, Texas, and Washington, and also from Australia, South America, New Caledonia, Korea, and Hong Kong.

In 1948 most of the placer-gold production was recovered by dragline dredges. In 1949 less gold was recovered by dredging, but recovery by other methods increased moderately. In 1950 recovery by other methods will probably be greater than in 1949.

Black-sand concentrates from placer operations on Boulder Creek, after cleaning by Clarence M. Sands, of Atlin, were sold to Derby and Company of London, England. The shipment amounted to 3 tons and averaged 48.5 per cent. tungstate (WO_3) and some tin in addition to gold, silver, and metals of the platinum group (*see* p. 239).

Coal production in 1949 amounted to 1,917,296 short tons, an increase of 6 per cent., which, with an increase of 50 cents a ton in the price, resulted in a value almost 15 per cent. higher than the 1948 value. Drawing pillars permitted a substantially increased output at No. 10 mine, South Wellington. The new Tsable River Colliery near Comox produced almost 80,000 tons of coal, an increase of 50,000 tons. The Nicola-Princeton District yielded almost exactly the same quantity of coal as in 1948. In the East Kootenay District the colliery at Corbin was not operated, but increased production at Michel and Coal Creek resulted in an output for the district only 50,000 tons below the 1948 output. A new battery of coke-ovens was added to the coking plant at Michel.

About a fifth of the coal mined in the East Kootenay District is made into coke, principally for metallurgical use. Much of the coal mined in British Columbia is used on railways or shipped beyond the boundaries of the Province. The quantity of Alberta coal used for industrial and domestic purposes in British Columbia exceeds the quantity of British Columbia coal used for these purposes. Sales of British Columbia coal for industrial and domestic use within the Province were less in 1949 than in 1948.

The value of industrial minerals produced was higher in 1949 than in 1948; the increase was principally in gypsum and gypsum products. Gypsum production was principally from the Falkland quarries of Gypsum Lime and Alabastine, Canada, Limited, but trial shipments were made from the newly opened gypsum deposit of Columbia Gypsum Products, Inc., at Windermere, and gypsum from the Mayook quarry was shipped to the Canada Cement Company at Exshaw, Alta.

A deposit of perlite rock at Francois Lake was under development by Western Gypsum Products, Limited. Trial shipments were made from the deposit, and testing indicated that the material could be expanded to yield a satisfactory product. Expanded perlite is being used extensively in California and Oregon for light-weight plaster and wallboard.

The value of structural materials, including clay and clay products, cement, lime and limestone, rubble, riprap, sand, and gravel, produced in 1949 was $9,955,890, compared with $8,968,222 in 1948. High production of cement, and of rubble, riprap, sand, and gravel, accounts for the record value. These items were required in the construction industry and in large public works projects, including highway construction, flood-prevention works, and riprap protection to control river erosion. Destruction of the plant of the Clayburn Company at Kilgard in January, 1949, materially reduced the output of clay products. A plant built at Kilgard to produce flue-lining, sewer-pipe, and firebrick in special shapes was in use in November. A plant being built at Abbotsford to make brick in standard shapes is expected to be in full operation in 1950.

Statistics.

Mining statistics are collected and compiled and the statistical tables for this Report are prepared by the Bureau of Economics and Statistics, Department of Trade and Industry.

METHOD OF COMPUTING PRODUCTION.

The tables of statistics recording the mineral production of the Province for each year are compiled from certified returns made by the operators of mines, augmented by some data obtained from the Dominion of Canada assay office and from the operators of customs smelters. The value of each mineral product, in Canadian funds, is calculated at the average price for the year (*see* below). The quantities of metals are net after making deductions for losses in smelting and refining.

Prior to 1925 the average prices for gold and copper are true average prices, but, as a means of correcting for losses in smelting and refining, the prices of other metals were taken at the following percentages of the year's average price for the metal: Silver, 95 per cent.; lead, 90 per cent.; and zinc, 85 per cent. For 1925 and subsequent years the value has been calculated using the true average price and the net metal contents. The procedures adopted for the 1925 Report are still used essentially unchanged, and the same arrangement of tables has been retained, but new tables have been added from time to time.

Beginning with the Annual Report for 1948, production figures, given in notes dealing with individual lode-mining operations, are the assay contents of the products shipped (ore, concentrates, or bullion), no deductions being made for losses in smelting and refining. In previous Annual Reports the production figures given for individual properties are net, after deductions for smelting and refining losses, in accordance with the procedures adopted by the Dominion Bureau of Statistics and the co-operating Provincial Departments of Mines.

METALS.

Placer Gold.

The data on placer-gold production were very largely obtained from the Gold Commissioners until 1925. The value of placer gold in dollars is now obtained from returns received annually from the operators. At the old standard price, $20.67 per ounce of fine gold, $17 was regarded as a close approximation of the average value per ounce of crude placer gold produced in British Columbia. Dividing the production reported in dollars by 17 gave the equivalent in crude ounces. The average value $17 per ounce is equivalent to a fineness of 822½. Beginning with 1932 the average value per crude ounce has been based on the same fineness but has recognized the varying price of gold. The average price per ounce of crude placer gold for each year is given in Table II.

Lode Metals, Net Contents.

From the total assay contents of silver, copper, lead, and zinc, the net contents are calculated by making deductions for smelting and refining losses at rates agreed upon with the Dominion Bureau of Statistics and co-operating Provincial Departments of Mines. For the procedure prior to the year 1925, *see* foot-note under Table II, page 16.

Average Prices.

In the interests of uniformity the Statistical Bureaus of the Provinces and the Dominion Bureau of Statistics use the same average metal prices in valuing mineral production. Up to and including the year 1939 the prices used in evaluating metal and mineral production were:—

Gold and silver: The average United States prices for the year, as quoted in the Engineering and Mining Journal, converted into Canadian funds at the average exchange rate.

Copper, lead and zinc: The average London Metal Market prices for the year converted into Canadian funds at the average exchange rate. Until 1932 the New York price for copper was used.

Suspension of trading on the London Metal Exchange in September, 1939, and the controls of metals during the war years necessitated changes from the procedures which had been followed.

The method of arriving at the price for gold continued unchanged, but the prices for the metals controlled were those set by the Canadian Metals Controller. In 1945 the controls were largely removed from sales but not from prices. Control of metal prices ended on June 6th, 1947. For 1945 and subsequent years the prices are those computed by the Dominion Bureau of Statistics, using information supplied by the principal Canadian refiners of silver and the base metals.

In the period 1945–47 the prices received for silver, lead, and zinc sold for use in Canada were substantially less than the prices received for these metals exported to the United States. The prices for silver in 1945 and 1946 and for copper, lead, and zinc in 1946 and 1947 are weighted averages, taking into consideration sales in Canada at the ceiling prices and sales abroad at New York prices converted into Canadian funds.

In the period 1940–45 and until July 5th, 1946, and beginning again on September 18th, 1949, the Canadian price of gold has been increased by the premium on United States funds.

In computing the average metal prices for 1948, the Dominion Bureau of Statistics used generally the monthly quotations in the Engineering and Mining Journal and, where possible, evaluated at the world market. For some metals such as silver, antimony, and tin, Montreal quotations have been used.

In addition to metal sold in Canada, British Columbia silver, lead, and zinc are exported to the United States, Great Britain, and other markets abroad, and for some years all British Columbia copper has been sold in the United States. If the United States prices had been used instead of the Dominion Bureau of Statistics average price, additional amounts could be credited to the copper production values, as follows: 1943, $473,845; 1944, $315,815; 1945, $82,728; 1946, $458,513; 1947, $515,614; a total for the five years of $1,846,515. For 1948 and subsequent years, copper production is valued at the United States average for export f.o.b. refinery.

Fuel.

In 1926 a change was made in computing coal and coke statistics. The practice in former years had been to list as coke production only the coke made in bee-hive ovens, the coal used in making it not being listed; coke 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 both the coal and 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 mine production. Coke-making is considered a manufacturing industry. As it is, however, of interest to the mining 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 mine production of the Province.

Coal production is given in Table XIV. Up to and including the year 1947, production was recorded in long tons (2,240 pounds). Beginning with 1948, production is given in short tons (2,000 pounds). The quantity of coal produced in the preceding years has been recalculated in short tons. Prices per short ton that give the value previously published when quantities were expressed in long tons, and the price per short ton, used for 1948 and 1949, are shown in Table II.

TABLE I.—British Columbia Mine Production, 1948 and 1949.

	Quantity, 1948.	Quantity, 1949.	Value, 1948.	Value, 1949.	Per Cent. Increase (+) or Decrease (—).	
					Quantity.	Value.
Metallics.			$	$		
Antimony			113,173	61,020		—46.1
Bismuth			444,000	210,972		—52.5
Cadmium			1,126,437	1,364,170		+21.1
Copper lb.	43,025,388	54,856,808	9,616,174	10,956,550	+27.5	+13.9
Gold, lode fine, oz.	286,230	288,396	10,018,050	10,382,256	+0.7	+3.6
Gold, placer crude, oz.	20,332	17,886	585,200	529,524	—12.0	—9.5
Indium oz.				1,550		
Iron ore			3,735	27,579		+638.4
Lead lb.	332,996,351	263,580,549	60,072,542	41,645,726	—20.8	—30.7
Platinum			21,175	7,468		—64.7
Silver oz.	6,718,122	7,636,053	5,038,592	5,669,769	+13.7	+12.5
Tin lb.			688,567	633,047		—8.1
Tungsten concentrates			1,409,297			
Zinc lb.	296,012,941	276,324,451	41,234,603	36,604,700	—6.6	—11.2
Totals			130,371,545	108,094,331		—17.1
Fuel.						
Coal (2,000 lb.) tons	1,809,018	1,917,296	10,854,108	12,462,424	+6.0	+14.8
Non-metallics.						
Barites, diatomite, and mica			25,734	19,783		—23.2
Fluxes—limestone, quartz tons	83,389	108,531	248,977	213,773	+30.1	—14.1
Granules—slate and rock tons	4,958	5,941	68,937	79,661	+19.8	+15.5
Gypsum and gypsum products			546,707	616,490		+12.8
Iron oxides			30,472	23,301		—23.5
Sodium carbonate tons				517		
Sulphur tons	144,448	160,435	1,409,156	1,546,798	+11.1	+9.8
Totals			2,330,877	2,500,323		+7.3
Clay Products and other Structural Materials.						
Clay Products.						
Brick—						
Common No.	3,810,000	3,220,000	111,300	95,075	—15.5	—14.6
Face, paving, sewer brick No.	2,584,752	509,560	129,268	24,793	—80.3	—80.8
Firebricks, blocks			392,458	135,391		—65.5
Fireclay			32,922	22,339		—32.1
Structural tile—hollow blocks			116,513	145,512		+24.9
Drain-tile, sewer-pipe, flue-linings			597,541	265,098		—55.6
Pottery—glazed or unglazed			5,138	5,176		
Other clay products			9,611	9,676		
Totals			1,394,751	703,060		—49.6
Other Structural Materials.						
Cement			2,441,304	3,029,425		+24.1
Lime and limestone tons	209,453	179,400	1,177,632	1,295,087	—14.3	+10.0
Sand and gravel			3,060,535	3,967,132		+29.6
Stone tons	3,579	2,287	54,220	44,345	—36.1	—18.2
Rubble, riprap, crushed rock tons	896,780	1,112,272	839,780	916,841	+24.0	+9.2
Totals			7,573,471	9,252,830		+22.2
Total value			152,524,752	133,012,968		—12.8

TABLE II.—AVERAGE METAL PRICES USED IN COMPILING VALUE OF PROVINCIAL PRODUCTION OF GOLD, SILVER, COPPER, LEAD, ZINC, AND COAL.

Year.	Placer Gold, Oz.	Fine Gold, Oz.	Silver, Fine Oz.	Copper, Lb.	Lead, Lb.	Zinc, Lb.	Coal, Short Tons.
	$	$	Cents.	Cents.	Cents.	Cents.	$
1901	17.00	20.67	56.002 N.Y.	16.11 N.Y.	2.577 N.Y.	....	2.679
1902	....	....	49.55 ,,	11.70 ,,	3.66 ,,	....	....
1903	....	....	50.78 ,,	13.24 ,,	3.81 ,,	....	....
1904	....	....	53.36 ,,	12.82 ,,	3.88 ,,	....	....
1905	....	....	51.33 ,,	15.59 ,,	4.24 ,,	....	....
1906	....	....	63.45 ,,	19.28 ,,	4.81 ,,	....	....
1907	....	....	62.06 ,,	20.00 ,,	4.80 ,,	....	3.125
1908	....	....	50.22 ,,	13.20 ,,	3.78 ,,	....	....
1909	....	....	48.93 ,,	12.98 ,,	3.85 ,,	....	....
1910	....	....	50.812 ,,	12.738 ,,	4.00 ,,	4.60 E. St. L.	....
1911	....	....	50.64 ,,	12.38 ,,	3.98 ,,	4.90 ,,	....
1912	....	....	57.79 ,,	16.341 ,,	4.024 ,,	5.90 ,,	....
1913	....	....	56.80 ,,	15.27 ,,	3.93 ,,	4.80 ,,	....
1914	....	....	52.10 ,,	13.60 ,,	3.50 ,,	4.40 ,,	....
1915	....	....	47.20 ,,	17.28 ,,	4.17 ,,	11.25 ,,	....
1916	....	....	62.38 ,,	27.202 ,,	6.172 ,,	10.88 ,,	....
1917	....	....	77.35 ,,	27.18 ,,	7.91 ,,	7.566 ,,	....
1918	....	....	91.93 ,,	24.63 ,,	6.67 ,,	6.94 ,,	4.464
1919	....	....	105.57 ,,	18.70 ,,	5.19 ,,	6.24 ,,	....
1920	....	....	95.80 ,,	17.45 ,,	7.16 ,,	6.52 ,,	....
1921	....	....	59.52 ,,	12.50 ,,	4.09 ,,	3.95 ,,	....
1922	....	....	64.14 ,,	13.38 ,,	5.16 ,,	4.86 ,,	....
1923	....	....	61.63 ,,	14.42 ,,	6.54 ,,	5.62 ,,	....
1924	....	....	63.442 ,,	13.02 ,,	7.287 ,,	5.39 ,,	....
1925	....	....	69.065 ,,	14.042 ,,	7.848 Lond.	7.892 Lond.	....
1926	....	....	62.107 ,,	13.795 ,,	6.751 ,,	7.409 ,,	....
1927	....	....	56.37 ,,	12.92 ,,	5.256 ,,	6.194 ,,	....
1928	....	....	58.176 ,,	14.570 ,,	4.575 ,,	5.493 ,,	....
1929	....	....	52.993 ,,	18.107 ,,	5.050 ,,	5.385 ,,	....
1930	....	....	38.154 ,,	12.982 ,,	3.927 ,,	3.599 ,,	....
1931	....	....	28.700 ,,	8.116 ,,	2.710 ,,	2.554 ,,	4.018
1932	19.30	23.47	31.671 ,,	6.380 Lond.	2.113 ,,	2.405 ,,	3.795
1933	23.02	28.60	37.832 ,,	7.454 ,,	2.391 ,,	3.210 ,,	....
1934	28.37	34.50	47.461 ,,	7.419 ,,	2.436 ,,	3.044 ,,	....
1935	28.94	35.19	64.790 ,,	7.795 ,,	3.133 ,,	3.099 ,,	....
1936	28.81	35.03	45.127 ,,	9.477 ,,	3.913 ,,	3.315 ,,	....
1937	28.77	34.99	44.881 ,,	13.078 ,,	5.110 ,,	4.902 ,,	....
1938	28.93	35.18	43.477 ,,	9.972 ,,	3.344 ,,	3.073 ,,	....
1939	29.72	36.14	40.488 ,,	10.092 ,,	3.169 ,,	3.069 ,,	....
1940	31.66	38.50	38.249 ,,	10.086 ,,	3.362 ,,	3.411 ,,	....
1941	31.66	38.50	38.261 ,,	10.086 ,,	3.362 ,,	3.411 ,,	....
1942	31.66	38.50	41.166 ,,	10.086 ,,	3.362 ,,	3.411 ,,	....
1943	31.66	38.50	45.254 ,,	11.75 ,,	3.754 ,,	4.000 ,,	....
1944	31.66	38.50	43.000 ,,	12.000 ,,	4.500 ,,	4.300 ,,	....
1945	31.66	38.50	47.000 ,,	12.550 ,,	5.000 ,,	6.440 ,,	....
1946	30.22	36.75	83.650 ,,	12.80 ,,	6.750 ,,	7.810 ,,	....
1947	28.78	35.00	72.000 ,,	20.39 ,,	13.670 ,,	11.230 ,,	4.464
1948	28.78	35.00	75.000 Mont.	22.35 U.S.	18.040 ,,	13.930 ,,	6.000
1949	**29.60**	**36.00**	**74.250** U.S.	**19.973** ,,	**15.800** U.S.	**13.247** U.S.	**6.500**
Average, 1945–49, incl.	29.80	36.25	70.38	17.252	11.850	10.531	....

The average price of an ounce of crude placer gold is taken as $17 divided by $20.67 times the price of an ounce of fine gold.

Prices for fine gold are the Canadian Mint buying prices. Prices for other metals are those of the markets indicated, converted in Canadian funds. The abbreviations are: Mont.=Montreal; N.Y.=New York; Lond.= London; E. St. L.=East St. Louis; and U.S.=United States.

Prior to 1925 the prices for gold and copper are true average prices, but the prices of other metals were taken at the following percentages of the year's average price for the metal: Silver, 95 per cent.; lead, 90 per cent.; and zinc, 85 per cent.

For coal *see* last paragraph under "Fuel," page 14.

The bases for the prices listed are discussed in detail on pages 13 and 14.

TABLE III.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1949.

Gold, placer	$93,093,524
Gold, lode	366,145,555
Silver	180,490,566
Copper*	369,577,896
Lead	525,130,237
Zinc	370,392,803
Coal and coke	467,883,277
Structural materials	126,783,356
Miscellaneous metals, minerals, and materials	67,539,258
Total	$2,567,036,472

* *See* last paragraph under "Average Prices," page 14.

NOTE.—The total value of placer gold has been adjusted to correct errors in the amounts credited to several of the earlier years. This fact should be kept in mind if the above table is compared with previous publications.

TABLE IV.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1949, INCLUSIVE.

1852 to 1895 (inclusive)	$93,552,273	1923	$41,304,320
1896	7,507,956	1924	48,704,604
1897	10,455,268	1925	61,492,242
1898	10,906,861	1926	67,188,842
1899	12,393,131	1927	60,729,358
1900	16,344,751	1928	65,372,583
1901	19,671,572	1929	68,245,443
1902	17,486,550	1930	55,391,993
1903	17,495,954	1931	34,883,181
1904	18,977,359	1932	28,798,406
1905	22,461,325	1933	32,602,672
1906	24,980,546	1934	42,305,297
1907	25,882,560	1935	48,821,239
1908	23,851,277	1936	54,081,967
1909	24,443,025	1937	74,475,902
1910	26,377,066	1938	64,485,551
1911	23,499,072	1939	65,681,547
1912	32,440,800	1940	75,701,155
1913	30,296,398	1941	78,479,719
1914	26,388,825	1942	75,551,093
1915	29,447,508	1943	65,892,395
1916	42,290,462	1944	54,923,803
1917	37,010,392	1945	63,343,949
1918	41,782,474	1946	71,807,951
1919	33,296,313	1947	113,221,254
1920	35,543,084	1948	152,524,752
1921	28,066,641	1949	133,012,968
1922	35,162,843	Total	$2,567,036,472

NOTE.—The total value of placer gold has been adjusted to correct errors in the amounts credited to several of the earlier years. This fact should be kept in mind if the above table is compared with previous publications.

TABLE V.—QUANTITIES AND VALUE OF MINE PRODUCTS FOR 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, AND 1949.

Description.	1940.		1941.		1942.		1943.		1944.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer.....oz.	39,067	$1,236,928	43,775	$1,385,962	32,904	$1,041,772	14,600	$462,270	11,433	$361,977
Gold, lode.....oz.	583,416	22,461,516	571,026	21,984,501	444,518	17,113,943	224,403	8,639,516	186,632	7,186,332
Silver.....oz.	12,327,944	4,715,315	12,175,700	4,658,545	9,677,881	4,080,775	8,526,310	3,858,496	5,705,334	2,453,293
Copper*.....lb.	77,980,223	7,865,085	66,435,583	6,700,693	50,097,716	5,052,856	42,307,510	4,971,132	36,300,589	4,356,070
Lead.....lb.	485,364,420	16,317,952	490,185,657	16,480,042	463,269,005	15,575,104	405,285,476	15,214,417	294,797,469	13,265,886
Zinc.....lb.	310,767,251	10,600,271	363,302,195	12,392,238	396,857,260	13,536,801	335,137,014	13,405,481	280,356,477	12,055,328
Coal.....tons, 2,000 lb.	1,867,966	7,088,265	2,018,635	7,660,000	2,170,737	8,237,172	2,040,253	7,742,030	2,165,676	8,217,966
Structural materials.....	.....	2,534,840	.....	2,845,262	.....	3,143,382	.....	3,039,148	.....	3,025,445
Miscellaneous metals, minerals, and materials.....	.....	2,880,983	.....	4,372,476	.....	7,769,288	.....	8,559,905	.....	4,002,506
Totals.....	.....	$75,701,155	.....	$78,479,719	.....	$75,551,093	.....	$65,892,395	.....	$54,923,803

Description.	1945.		1946.		1947.		1948.		1949.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer.....oz.	12,589	$398,591	15,729	$475,361	6,969	$200,585	20,332	$585,200	17,886	$529,524
Gold, lode.....oz.	175,373	6,751,860	117,612	4,322,241	243,282	8,514,870	286,230	10,018,050	288,396	10,382,256
Silver.....oz.	6,157,307	2,893,934	6,365,761	5,324,959	5,707,691	4,109,538	6,718,122	5,038,592	7,636,053	5,669,769
Copper*.....lb.	25,852,366	3,244,472	17,500,538	2,240,070	41,783,921	8,519,741	43,025,388	9,616,174	54,856,808	10,956,550
Lead.....lb.	353,497,689	17,674,884	347,990,146	23,489,335	306,400,709	41,884,977	332,996,351	60,072,542	263,580,549	41,645,726
Zinc.....lb.	301,737,902	19,431,921	270,718,128	21,143,086	268,450,926	30,147,039	296,012,941	41,234,603	276,324,451	36,604,700
Coal.....tons, 2,000 lb.	1,700,914	6,454,360	1,639,277	6,220,470	1,923,573	8,587,380	1,809,018	10,854,108	1,917,296	12,462,424
Structural materials.....	.....	3,401,229	.....	5,199,563	.....	5,896,803	.....	8,968,222	.....	9,955,890
Miscellaneous metals, minerals, and materials.....	.....	3,092,698	.....	3,392,866	.....	5,360,321	.....	6,137,261	.....	4,806,129
Totals.....	.....	$63,343,949	.....	$71,807,951	.....	$113,221,254	.....	$152,524,752	.....	$133,012,968

* *See* last paragraph under "Average Prices," page 14.

TABLE VI.—Production of Lode Gold, Silver, Copper, Lead, and Zinc.

Year.	Gold.		Silver.		Copper.		Lead.		Zinc.		Total Value.
	Ounces.	Value.	Ounces.	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	39,270	785,400	1,496,522	977,229	952,840	47,642	16,475,464	532,255	.....	.....	2,342,526
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	4,348,605	4,396,447	2,462,008	27,603,746	4,446,963	51,582,906	2,010,260	.....	.....	13,267,836
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

TABLE VI.—PRODUCTION OF LODE GOLD, SILVER, COPPER, LEAD, AND ZINC—*Continued.*

Year.	Gold.		Silver.		Copper.		Lead.		Zinc.		Total Value.
	Ounces.	Value.	Ounces.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
		$		$		$		$		$	$
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	4,261,307	7,130,838	2,258,453	49,841,009	3,179,956	254,488,952	5,378,878	192,120,091	4,621,641	19,700,235
1933	223,529	6,392,929	7,006,406	2,650,720	42,608,002	3,176,341	271,606,071	6,495,731	195,963,751	6,291,416	25,007,137
1934	297,130	10,250,985	8,572,916	4,068,792	48,084,658	3,567,401	347,366,967	8,461,859	247,926,844	7,546,893	33,895,930
1935	365,244	12,852,936	9,251,544	5,994,075	38,791,127	3,023,768	344,268,444	10,785,930	256,239,446	7,940,860	40,597,569
1936	404,472	14,168,654	9,521,015	4,296,548	20,806,672	1,971,848	377,971,618	14,790,029	254,581,393	8,439,373	43,666,452
1937	460,781	16,122,727	11,308,685	5,075,451	46,057,584	6,023,411	419,118,371	21,416,949	291,192,278	14,274,245	62,912,783
1938	557,522	19,613,624	10,861,578	4,722,288	65,769,906	6,558,575	412,979,182	13,810,024	298,497,295	9,172,822	53,877,333
1939	587,180	21,221,272	10,771,585	4,361,199	73,254,679	7,392,862	378,743,763	12,002,390	278,409,102	8,544,375	53,522,098
1940	583,416	22,461,516	12,327,944	4,715,315	77,980,223	7,865,085	485,364,420	16,317,952	310,767,251	10,600,271	61,960,139
1941	571,026	21,984,501	12,175,700	4,658,545	66,435,583	6,700,693	490,185,657	16,480,042	363,302,195	12,392,238	62,216,019
1942	444,518	17,113,943	9,677,881	4,080,775	50,097,716	5,052,856	463,269,005	15,575,104	396,857,260	13,536,801	55,359,479
1943	224,403	8,639,516	8,526,310	3,858,496	42,307,510	4,971,132*	405,285,476	15,214,417	335,137,014	13,405,481	46,089,042
1944	186,632	7,185,332	5,705,334	2,453,293	36,300,589	4,356,070*	294,797,469	13,265,886	280,356,477	12,055,328	39,315,909
1945	175,373	6,751,860	6,157,307	2,893,934	25,852,366	3,244,472*	353,497,689	17,674,884	301,737,902	19,431,921	49,997,071
1946	117,612	4,322,241	6,365,761	5,324,959	17,500,538	2,240,070*	347,990,146	23,489,335	270,718,128	21,143,086	56,519,691
1947	243,282	8,514,870	5,707,691	4,109,538	41,783,921	8,519,741*	306,400,709	41,884,977	268,450,926	30,147,039	93,176,165
1948	286,230	10,018,050	6,718,122	5,038,592	43,025,388	9,616,174	332,996,351	60,072,542	296,012,941	41,234,603	125,979,961
1949	288,396	10,382,256	7,636,053	5,669,769	54,856,808	10,956,550	263,580,549	41,645,726	276,324,451	36,604,700	105,259,001
Totals	13,170,083	366,145,555	333,667,961	180,490,566	2,564,517,948	369,577,896	9,922,092,438	525,130,237	6,827,234,146	370,392,803	1,811,737,057

* *See* last paragraph under "Average Prices," page 14.

TABLE VII.—VALUE OF GOLD PRODUCTION TO DATE.

Year.	Placer Gold.		Lode Gold.		Total.
	Crude (Oz.).	Value.	Fine (Oz.).	Value.	
1858–1862	580,680	$9,871,636	....	....	$9,871,636
1863–1867	957,855	16,283,592	....	....	16,283,592
1868–1872	523,250	8,895,318	....	....	8,895,318
1873–1877	530,600	9,020,101	....	....	9,020,101
1878–1882	328,230	5,579,911	....	....	5,579,911
1883–1887	225,970	3,841,515	....	....	3,841,515
1888–1892	148,780	2,529,427	....	....	2,529,427
1893	20,950	356,131	1,170	$23,404	379,535
1894	23,850	405,516	6,252	125,014	530,530
1895	28,330	481,683	39,270	785,400	1,267,083
1896	32,000	544,026	62,259	1,244,180	1,788,206
1897	*30,210*	*513,520*	*106,141*	*2,122,820*	*2,636,340*
1898	37,840	643,346	110,061	2,201,217	2,844,563
1899	79,110	1,344,900	138,315	2,857,573	4,202,473
1900	75,220	1,278,724	167,153	3,453,381	4,732,105
1901	57,060	970,100	210,384	4,348,605	5,318,705
1902	63,130	1,073,140	236,491	4,888,269	5,961,409
1903	62,380	1,060,420	232,831	4,812,616	5,873,036
1904	65,610	1,115,300	222,042	4,589,608	5,704,908
1905	57,020	969,300	238,660	4,933,102	5,902,402
1906	55,790	948,400	224,027	4,630,639	5,579,039
1907	48,710	828,000	196,179	4,055,020	4,883,020
1908	38,060	647,000	255,582	5,282,880	5,929,880
1909	28,060	477,000	238,224	4,924,090	5,401,090
1910	31,760	540,000	267,701	5,533,380	6,073,380
1911	25,060	426,000	228,617	4,725,513	5,151,513
1912	32,680	555,500	257,496	5,322,442	5,877,942
1913	30,000	510,000	272,254	5,627,490	6,137,490
1914	33,240	565,000	247,170	5,109,004	5,674,004
1915	45,290	770,000	250,021	5,167,934	5,937,934
1916	34,150	580,500	221,932	4,587,334	5,167,834
1917	29,180	496,000	114,523	2,367,190	2,863,190
1918	18,820	320,000	164,674	3,403,812	3,723,812
1919	16,850	286,500	152,426	3,150,645	3,437,145
1920	13,040	221,600	120,048	2,481,392	2,702,992
1921	13,720	233,200	135,663	2,804,154	3,037,354
1922	21,690	368,800	197,856	4,089,684	4,458,484
1923	24,710	420,000	179,245	3,704,994	4,124,994
1924	24,750	420,750	247,716	5,120,535	5,541,285
1925	*16,476*	*280,092*	*209,719*	*4,335,269*	*4,615,361*
1926	20,912	355,503	201,427	4,163,859	4,519,362
1927	9,191	156,247	178,001	3,679,601	3,835,848
1928	8,424	143,208	188,087	3,888,097	4,031,305
1929	6,983	118,711	145,339	3,004,419	3,123,130
1930	8,955	152,235	160,778	3,323,576	3,475,811
1931	17,176	291,992	146,039	3,018,894	3,310,886
1932	20,400	395,542	181,564	4,261,307	4,656,849
1933	*23,928*	*562,787*	*223,529*	*6,392,929*	*6,955,716*
1934	25,181	714,431	297,130	10,250,985	10,965,416
1935	30,929	895,058	365,244	12,852,936	13,747,994
1936	43,389	1,249,940	404,472	14,168,654	15,418,594
1937	54,153	1,558,245	460,781	16,122,727	17,680,972
1938	57,759	1,671,015	557,522	19,613,624	21,284,639
1939	49,746	1,478,492	587,180	21,221,272	22,699,764
1940	39,067	1,236,928	583,416	22,461,516	23,698,444
1941	43,775	1,385,962	571,026	21,984,501	23,370,463
1942	32,904	1,041,772	444,518	17,113,943	18,155,715
1943	14,600	462,270	224,403	8,639,516	9,101,786
1944	11,433	361,977	186,632	7,185,332	7,547,309
1945	12,589	398,591	175,373	6,751,860	7,150,451
1946	15,729	475,361	117,612	4,322,241	4,797,602
1947	6,969	200,585	243,282	8,514,870	8,715,455
1948	20,332	585,200	286,230	10,018,050	10,603,250
1949	17,886	529,524	288,396	10,382,256	10,911,780
Totals	5,102,521	$93,093,524	13,170,083	$366,145,555	$459,239,079

NOTE.—Errors in the value for placer gold credited to several of the earlier years have been corrected. This fact should be kept in mind if the above table is compared with previous publications.

TABLE VIII.—VALUE OF MINE PRODUCTION BY DIVISIONS, 1944, 1945, 1946, 1947, 1948, AND 1949.

Mining Division.	1944.	1945.	1946.	1947.	1948.	1949.
	$	$	$	$	$	$
Ainsworth	277,435	254,429	77,057	242,020	565,648	912,814
Alberni	9,725	6,194	112,613	503,699	412,872	35,224
Atlin	255,539	321,227	459,965	868,658	1,096,922	1,467,527
Cariboo	979,399	1,033,181	988,815	1,486,961	1,693,656	1,845,807
Clinton	1,803	3,368	2,310	7,124	2,596	2,968
Fort Steele	31,668,064	42,910,466	54,256,000	80,933,067	110,156,469	82,619,311
Golden	324,525	825,803	290,143	279,206	1,155,232	1,472,627
Greenwood	275,571	191,767	484,670	593,539	789,523	881,700
Kamloops	138,939	137,184	310,877	577,372	755,958	843,961
Lillooet	3,072,599	2,412,843	1,394,343	2,962,585	3,531,186	4,205,790
Nanaimo	3,353,930	2,981,253	3,038,046	3,368,234	4,105,205	5,656,627
Nelson	544,663	516,283	372,005	1,137,752	2,391,739	3,282,152
New Westminster	597,569	677,220	1,028,101	1,229,047	2,007,835	1,837,700
Nicola	83,032	27,099	6,967	15,094	13,718	17,937
Omineca	1,409,984	142,315	70,216	99,622	204,939	786,046
Osoyoos	1,837,959	2,069,351	1,057,802	1,767,818	2,287,295	1,905,267
Peace River	58,251	32,342	14,586	32,934	52,124	85,791
Portland Canal	732,087	736,125	410,892	786,837	514,565	1,133,204
Quesnel	13,804	14,533	43,731	16,078	18,632	50,086
Revelstoke	20,952	35,904	39,658	42,151	42,964	83,334
Similkameen	3,242,076	2,205,091	1,634,831	4,898,314	7,353,503	8,414,632
Skeena	32,211	37,443	58,841	47,032	129,149	131,246
Slocan	1,193,092	954,479	628,445	1,300,194	2,475,242	2,738,380
Stikine	1,520	348	5,954	2,660	250,404	120,172
Trail Creek	1,111,591	1,247,960	1,274,603	2,139,817	1,525,519	1,594,489
Vancouver	2,233,911	2,124,478	1,668,492	5,343,934	5,916,470	7,093,622
Vernon	3,225	1,338	3,049	46,795	104,867	140,936
Victoria	1,450,347	1,443,925	2,074,940	2,492,720	2,970,520	3,653,618
Totals	54,923,803	63,343,949	71,807,951	113,221,254	152,524,752	133,012,968

NOTE.—In 1949 the Lardeau Mining Division was amalgamated with Revelstoke Mining Division and Ashcroft Mining Division with Kamloops Mining Division. In the current series of Statistical Tables VIII to XI, inclusive, the respective production and value data of the amalgamated divisions have been combined under the surviving division.

TABLE IXA (1948 AND 1949).—PRODUCTION IN DETAIL OF PLACER GOLD, LODE GOLD, SILVER, COPPER, LEAD, AND ZINC.

Division.	Year.	Tons.	Gold—Placer.		Gold—Lode.		Silver.		Copper.		Lead.		Zinc.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.	Pounds.	Value.*	Pounds.	Value.	Pounds.	Value.
				$		$		$		$		$		$
Ainsworth	1948	48,889			106	3,710	77,418	58,063			1,165,309	210,222	2,108,056	293,653
	1949	**73,678**			**209**	**7,524**	**142,134**	**105,534**			**2,165,742**	**342,187**	**3,454,136**	**457,569**
Alberni	1948	14,628			11,018	385,630	5,997	4,498	7,912	1,768	3,807	687		
	1949	**27**	**2**	**59**	**239**	**8,604**	**91**	**67**						
Atlin	1948	102,624	2,571	73,999	29,156	1,020,460	1,245	934						
	1949	**94,006**	**1,637**	**48,464**	**39,373**	**1,417,428**	**1,332**	**989**						
Cariboo	1948	114,478	6,473	186,307	39,664	1,388,240	4,809	3,607						
	1949	**112,132**	**9,174**	**271,601**	**39,779**	**1,432,044**	**4,536**	**3,368**			**2,159**	**341**		
Clinton	1948		3	86										
	1949		**9**	**267**										
Fort Steele	1948	2,283,958	52	1,497			5,153,000	3,864,750			325,703,450	58,756,902	268,327,700	37,378,049
	1949	**2,298,341**	**28**	**829**			**3,884,157**	**2,883,987**			**245,417,726**	**38,776,001**	**228,962,999**	**30,330,728**
Golden	1948	34,688					23,642	17,732			2,045,960	369,091	5,266,344	733,602
	1949	**53,626**					**35,829**	**26,603**			**4,901,401**	**774,421**	**4,741,890**	**628,158**
Greenwood	1948	6,026	6	173	385	13,475	730,288	547,716			408,365	73,669	456,077	63,531
	1949	**9,449**			**385**	**13,860**	**845,685**	**627,921**	**54,446**	**10,874**	**504,731**	**79,748**	**530,238**	**70,241**
Kamloops	1948		16	461										
	1949		**15**	**444**										
Lillooet	1948	200,330	70	2,015	99,102	3,468,570	26,507	19,880						
	1949	**245,981**	**109**	**3,227**	**114,714**	**4,129,704**	**27,926**	**20,735**						
Nanaimo	1948	4,994	4	115	495	17,325	852	639	57,265	12,799				
	1949	**24,223**	**5**	**148**	**3,482**	**125,352**	**10,473**	**7,776**	**482,125**	**96,294**				
Nelson	1948	65,065			20,125	704,375	21,432	16,074			383,493	69,182	426,179	59,367
	1949	**193,781**			**18,276**	**657,936**	**39,812**	**29,560**			**5,274,085**	**833,305**	**12,197,720**	**1,615,832**
New Westminster	1948													
	1949		**43**	**1,273**										
Nicola	1948													
	1949													
Omineca	1948	3,543	727	20,925	195	6,825	45,627	34,220			59,665	10,764	217,151	30,249
	1949	**17,516**	**615**	**18,207**	**1,267**	**45,612**	**371,310**	**275,698**			**573,755**	**90,653**	**1,478,844**	**195,902**
Osoyoos	1948	158,602			56,415	1,974,525	6,747	5,060	101,485	22,682	205	37	263	37
	1949	**135,610**			**48,220**	**1,735,920**	**8,383**	**6,224**	**157,341**	**31,426**	**590**	**93**	**600**	**80**
Peace River	1948		1	29										
	1949		**12**	**355**										
Portland Canal	*1948*	*41,399*			*8,566*	*299,810*	*60,043*	*45,032*			*822,619*	*148,400*	*97,186*	*13,538*
	1949	**99,612**			**101**	**3,636**	**1,443,544**	**1,071,831**			**309,049**	**48,830**	**36,748**	**4,868**
Quesnel	1948		612	17,615										
	1949	**55**	**1,416**	**41,921**	**10**	**360**	**215**	**160**			**3,129**	**494**		
Revelstoke	1948		2	57										
	1949	**64**	**14**	**415**	**3**	**108**	**1,593**	**1,183**			**24,427**	**3,860**	**10,945**	**1,450**
Similkameen	*1948*	*1,653,029*	*1,135*	*32,868*	*8,362*	*292,670*	*191,462*	*143,597*	*26,593,152*	*5,943,569*				
	1949	**1,734,469**	**746**	**22,086**	**11,944**	**429,984**	**255,938**	**190,034**	**35,694,011**	**7,129,165**				
Skeena	1948													
	1949		**10**	**296**										
Slocan	1948	122,100			53	1,855	293,039	219,779			2,051,965	370,174	13,477,635	1,877,434
	1949	**120,500**			**314**	**11,304**	**463,858**	**344,415**			**3,704,846**	**585,366**	**13,520,382**	**1,791,045**
Stikine	1948	5	8,636	248,563			184	138			5,810	1,048		
	1949		**4,046**	**119,784**										
Trail Creek	1948	1,393			890	31,150	16,249	12,187	618,465	138,227	96,461	17,402	12,201	1,699
	1949	**1,523**			**99**	**3,564**	**18,086**	**13,429**	**799,328**	**159,650**	**221,431**	**34,986**	**71,962**	**9,533**
Vancouver	1948	799,502			11,698	409,430	59,334	44,501	15,647,109	3,497,129	247,536	44,656	5,620,225	782,897
	1949	**880,846**			**9,981**	**359,316**	**81,076**	**60,199**	**17,669,557**	**3,529,141**	**476,716**	**75,321**	**11,317,987**	**1,499,294**
Vernon	1948	13	16	460			247	185			1,706	308	3,924	547
	1949	**2**	**5**	**148**			**75**	**56**			**762**	**120**		
Victoria	1948		8	230										
	1949													
Totals	1948	5,655,266	20,332	585,200	286,230	10,018,050	6,718,122	5,038,592	43,025,388	9,616,174	332,996,351	60,072,542	296,012,941	41,234,603
	1949	**6,095,441**	**17,886**	**529,524**	**288,396**	**10,382,256**	**7,636,053**	**5,669,769**	**54,856,808**	**10,956,550**	**263,580,549**	**41,645,726**	**276,324,451**	**36,604,700**

* *See* last paragraph under "Average Prices," page 14.

NOTE.—In 1949, Lardeau Mining Division was amalgamated with Revelstoke Mining Division and Ashcroft Mining Division with Kamloops Mining Division. In the current series of Statistical Tables VIII to XI, inclusive, the respective production and value data of the amalgamated divisions have been combined under the surviving division.

TABLE IXB.—PRODUCTION VALUE OF PLACER GOLD, LODE GOLD, SILVER, COPPER,* LEAD, AND ZINC IN 1944, 1945, 1946, 1947, 1948, AND 1949.

Division.	1944.	1945.	1946.	1947.	1948.	1949.
	$	$	$	$	$	$
Ainsworth	272,678	248,479	69,107	242,020	565,648	912,814
Alberni	5,631	63	99,492	467,214	392,583	8,730
Atlin	253,242	318,147	457,602	868,383	1,095,393	1,466,881
Cariboo	947,593	950,292	908,622	1,401,214	1,578,154	1,707,354
Clinton	1,330	222	....	288	86	267
Fort Steele	25,549,264	37,656,140	48,381,626	72,618,140	100,001,198	71,991,545
Golden	267,048	763,883	260,248	236,979	1,120,425	1,429,182
Greenwood	183,763	142,489	402,764	521,871	698,564	802,644
Kamloops	2,210	1,362	665	1,871	461	444
Lillooet	3,068,573	2,407,569	1,381,993	2,957,103	3,490,465	4,153,666
Nanaimo	190	....	....	....	30,878	229,570
Nelson	276,616	425,304	317,912	379,880	848,998	3,136,633
New Westminster	728	317	574	849	....	1,273
Nicola	760	....	42	4,791	....	....
Omineca	30,141	19,250	20,642	22,094	102,983	626,072
Osoyoos	1,793,878	2,001,678	1,023,909	1,666,351	2,002,341	1,773,743
Peace River	....	538	272	950	29	355
Portland Canal	732,087	736,125	410,892	785,612	506,780	1,129,165
Quesnel	13,614	13,171	42,704	14,228	17,615	42,935
Revelstoke	2,649	823	302	861	57	7,016
Similkameen	2,949,189	1,967,074	1,457,031	4,635,551	6,412,504	7,771,269
Skeena	601	380	332	144	....	296
Slocan	1,193,092	954,479	628,446	1,291,675	2,469,242	2,732,130
Stikine	1,520	348	5,954	1,900	249,749	119,784
Trail Creek	13,772	5,715	10,215	861,249	200,665	221,162
Vancouver	1,959,227	1,781,529	1,112,478	4,268,554	4,778,613	5,523,271
Vernon	398	285	1,229	576	1,500	324
Victoria	158,092	....	....	126,402	230	....
Totals	39,677,886	50,395,662	56,995,052	93,376,750	126,565,161	105,788,525

* *See* last paragraph under "Average Prices," page 14.

NOTE.—In 1949 the Lardeau Mining Division was amalgamated with Revelstoke Mining Division and Ashcroft Mining Division with Kamloops Mining Division. In the current series of Statistical Tables VIII to XI, inclusive, the respective production and value data of the amalgamated divisions have been combined under the surviving division.

TABLE IXc.—Production and Value of Placer Gold,* and of Lode Gold, Silver, Copper, Lead, and Zinc, 1900–49.

Division.	Gold—Placer.*		Gold—Lode.		Silver.		Copper.		Lead.		Zinc.		Division Total.
	Ounces.	Value.	Ounces.	Value.	Ounces.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
		$		$		$		$		$		$	$
Ainsworth	212	5,690	4,215	125,319	6,825,869	4,146,336	10,175	1,201	128,845,128	6,826,351	48,550,334	2,270,042	13,374,939
Alberni	1,583	32,157	298,893	11,190,958	160,421	76,910	2,233,880	335,145	112,439	4,408			11,639,637
Atlin (1898)*	667,714	15,394,502	201,882	7,089,161	61,239	37,244	83,161	11,949	109,945	7,036			22,539,892
Cariboo (1858)*	1,932,637	39,620,024	678,049	24,801,303	74,891	37,728			2,815	371	492	16	64,459,442
Clinton	10,006	238,385	23,388	827,260	31,564	14,214	57,548	5,905	193	7			1,085,771
Fort Steele	17,221	399,259	2,532	56,964	165,950,013	84,228,687	28,592	6,193	9,084,639,580	485,074,518	6,094,588,515	327,967,389	897,733,010
Golden	467	11,213	74	1,587	1,474,267	885,920	57,378	10,590	105,795,739	4,850,872	129,538,177	5,993,429	11,753,611
Greenwood	4,044	94,807	1,086,814	23,439,523	25,351,192	13,322,346	441,226,021	70,504,065	10,788,380	581,158	10,950,359	508,935	108,450,834
Kamloops	14,441	340,079	47,852	1,607,821	298,033	176,722	6,400,908	1,177,415	368,761	20,741	409,170	26,063	3,348,841
Lillooet (1874)*	90,864	1,864,428	2,133,621	74,595,664	561,873	276,805	400	41	62,463	2,542			76,739,480
Nanaimo	605	13,974	71,867	1,568,952	529,970	306,938	20,762,795	3,310,796					5,200,660
Nelson	3,187	80,017	1,294,725	40,665,770	4,241,424	2,299,618	5,685,261	889,008	59,397,278	3,266,541	37,565,903	3,164,726	50,365,680
New Westminster	11,397	237,697	4,311	110,307	13,529	6,072	26,489	6,379	28,425	1,119	12,755	481	362,055
Nicola	230	4,652	8,525	234,914	267,098	126,317	549,975	106,230	2,235,137	90,469	320,486	10,566	573,148
Omineca	49,631	1,315,658	10,100	249,982	2,767,459	1,764,155	6,126,209	1,345,688	6,873,802	447,331	5,656,181	474,824	5,597,638
Osoyoos	190	4,142	1,330,076	39,044,131	536,527	342,722	2,462,582	305,688	253,213	7,605	6,072	280	39,704,568
Peace River	4,129	95,361											95,361
Portland Canal	201	4,260	1,939,757	48,845,610	50,631,914	28,473,636	649,677,707	96,796,399	39,999,794	1,961,425	2,027,724	131,594	176,212,924
Quesnel (1858)*	625,342	13,036,064	216	7,796	526	299	82	17	3,129	494			13,044,670
Revelstoke	5,862	127,282	24,904	652,809	2,857,117	1,152,576	6,277	909	10,536,486	442,635	468,070	22,525	2,398,736
Similkameen	8,961	215,195	127,425	4,335,079	3,072,230	1,597,051	429,988,017	58,545,470	238,577	9,006	64,377	2,616	64,704,417
Skeena	3,929	87,220	414,794	9,979,046	265,198	182,759	7,671,642	1,215,720	39,539	1,287	15,277	490	11,466,522
Slocan	150	3,596	6,806	171,744	41,440,817	25,145,966	219,318	42,287	305,077,578	15,325,916	297,539,712	20,097,569	60,787,077
Stikine	45,661	1,141,307	114	4,120	204	146			5,810	1,048			1,146,621
Trail Creek†	848	24,176	2,605,949	55,629,935	3,422,572	1,928,428	121,796,349	18,392,624	17,826,708	813,667	158,004,774	5,303,887	82,092,717
Vancouver	182	5,306	341,722	10,557,938	3,890,168	2,135,960	791,317,228	110,710,700	9,281,106	464,620	38,547,022	3,253,495	127,128,019
Vernon	2,171	57,298	5,212	175,639	8,023	4,056	614	89	9,079	737	6,898	708	238,527
Victoria	620	15,453	37,081	795,590	780,932	424,088	21,208,627	3,148,167	139,900	6,932	2,961,848	163,158	4,553,388
Provincial totals	3,502,485	74,469,261	12,700,904	356,764,922	315,565,070	169,093,698	2,507,597,235	366,868,675	9,779,671,004	520,208,836	6,827,234,146	369,392,793	1,856,798,185

* For certain mining divisions the figures under "Gold—Placer" include production prior to 1900. For those divisions the figures are the total estimated production of placer gold from and including the year noted after the name of the division. The placer gold recorded for the other divisions includes no production prior to 1900.

† Includes zinc and lead recovered at the Trail smelter, from current and reclaimed slags, derived from mines in several mining divisions.

Note.—In 1949 the Lardeau Mining Division was amalgamated with Revelstoke Mining Division and Ashcroft Mining Division with Kamloops Mining Division. In the current series of Statistical Tables VIII to XI, inclusive, the respective production and value data of the amalgamated divisions have been combined under the surviving division.

TABLE X.—PRODUCTION IN DETAIL OF STRUCTURAL MATERIALS, 1948 AND 1949.

Division.	Year.	Cement.	Lime and Limestone.	Building-stone.	Rubble, Riprap, and Crushed Rock.	Sand and Gravel.	Brick (Common).	Face, Paving, and Sewer Brick.	Firebrick, Blocks.	Fireclay.	Structural Tile (Hollow Blocks), Roof-tile, Floor-tile.	Drain-tile and Sewer-pipe.	Pottery, Glazed or Unglazed.	Other Clay Products.	Division Totals.
		$	$	$	$	$	$	$	$	$	$	$	$	$	$
Atlin and Stikine	1948				320	1,864									2,184
	1949				26	1,008									1,034
Portland Canal and Skeena	1948		31,151		54,107	51,676									136,934
	1949		25,753		77,983	31,253									134,989
Cariboo and Quesnel	1948				629	105,579									106,208
	1949				7,611	131,355									138,966
Omineca and Peace River	1948				20,494	14,871									35,365
	1949				47,420	43,654									91,074
Nicola, Vernon, and Kamloops	1948		400	500	117,119	197,188									315,207
	1949		22,774	600	197,347	182,337									403,058
Greenwood, Osoyoos, and Similkameen	1948				255,850	505,364	6,000								767,214
	1949				30,094	323,179	1,000								354,273
Fort Steele and Golden	1948				7,922	58,552									66,474
	1949				5,219	302,344									307,563
Ainsworth, Slocan, and Nelson	1948			16,070	893	101,781									118,744
	1949			10,595	2,644	127,829									141,068
Trail Creek and Revelstoke	1948			200	33,055	66,646									99,901
	1949				45,359	87,696									133,055
Alberni, Nanaimo, and Victoria	1948	2,441,304	1,119,888		877	566,612	104,400	19,090			44,397	39,797	5,138		4,341,503
	1949	3,029,425	1,240,647		1,659	651,216	91,750				39,697	52,623	5,176		5,112,193
Lillooet and Clinton	1948				648	42,583									43,231
	1949				1,375	52,933									54,308
Vancouver and New Westminster	1948		26,193	37,450	347,866	1,347,819	900	110,178	392,458	32,922	72,116	557,744		9,611	2,935,257
	1949		5,913	33,150	500,104	2,032,328	2,325	24,793	135,391	22,339	105,815	212,475		9,676	3,084,309
Totals	1948	2,441,304	1,177,632	54,220	839,780	3,060,535	111,300	129,268	392,458	32,922	116,513	597,541	5,138	9,611	8,968,222
	1949	3,029,425	1,295,087	44,345	916,841	3,967,132	95,075	24,793	135,391	22,339	145,512	265,098	5,176	9,676	9,955,890

NOTE.—In 1949 the Lardeau Mining Division was amalgamated with Revelstoke Mining Division and Ashcroft Mining Division with Kamloops Mining Division. In the current series of Statistical Tables VIII to XI, inclusive, the respective production and value data of the amalgamated divisions have been combined under the surviving division.

TABLE XI.—Production in Detail of Miscellaneous Metals, Minerals, and Materials, 1948 and 1949.

Division.	Year.	Antimony.	Barite.	Bismuth.	Cadmium.	Diatomite, Mica.	Flux (Limestone and Quartz).	Gypsum Products.	Iron and Oxides.	Platinum, Indium.	Slate and Rock Granules.	Sodium Carbonate.	Sulphur.	Tin.	Tungsten Concentrates.	Division Total.
		$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Cariboo and Omineca	1948					9,494										9,494
	1949					5,675										5,675
Peace River and Quesnel	1948					817										817
	1949					963										963
Clinton, Kamloops, and Greenwood	1948						39,860	546,707								586,567
	1949						54,319	587,490				517				642,326
Osoyoos and Similkameen	1948						189,509			21,175						210,684
	1949						113,494			7,468						120,962
Fort Steele, Golden, and Lardeau	1948	113,173*	16,317	444,000*	1,126,437*									688,567†		2,388,494
	1949	61,020*	13,145	210,972*	1,364,170*			29,000		1,550				633,047†		2,312,904
Ainsworth, Nelson, and Revelstoke	1948								20,700						1,409,297	1,429,997
	1949								10,701							10,701
Trail Creek and Slocan	1948												1,267,860			1,267,860
	1949												1,316,590			1,316,590
Lillooet and Nanaimo	1948						19,608		3,735							23,343
	1949						45,960		27,579							73,539
Vancouver, New Westminster, and Victoria	1948								9,772		68,937		141,296			220,005
	1949								12,600		79,661		230,208			322,469
Totals	1948	113,173	16,317	444,000	1,126,437	10,311	248,977	546,707	34,207	21,175	68,937		1,409,156	688,567	1,409,297	6,137,261
	1949	61,020	13,145	210,972	1,364,170	6,638	213,773	616,490	50,880	9,018	79,661	517	1,546,798	633,047		4,806,129

* Recovered at smelter, principally from concentrates originating in Fort Steele Mining Division, may be in part from other mining divisions.

† Recovered from Sullivan mine, Fort Steele Mining Division.

Note.—In 1949 the Lardeau Mining Division was amalgamated with Revelstoke Mining Division and Ashcroft Mining Division with Kamloops Mining Division. In the current series of Statistical Tables VIII to XI, inclusive, the respective production and value data of the amalgamated divisions have been combined under the surviving division.

TABLE XII.—BRITISH COLUMBIA MINE PRODUCTION, 1895–1949.

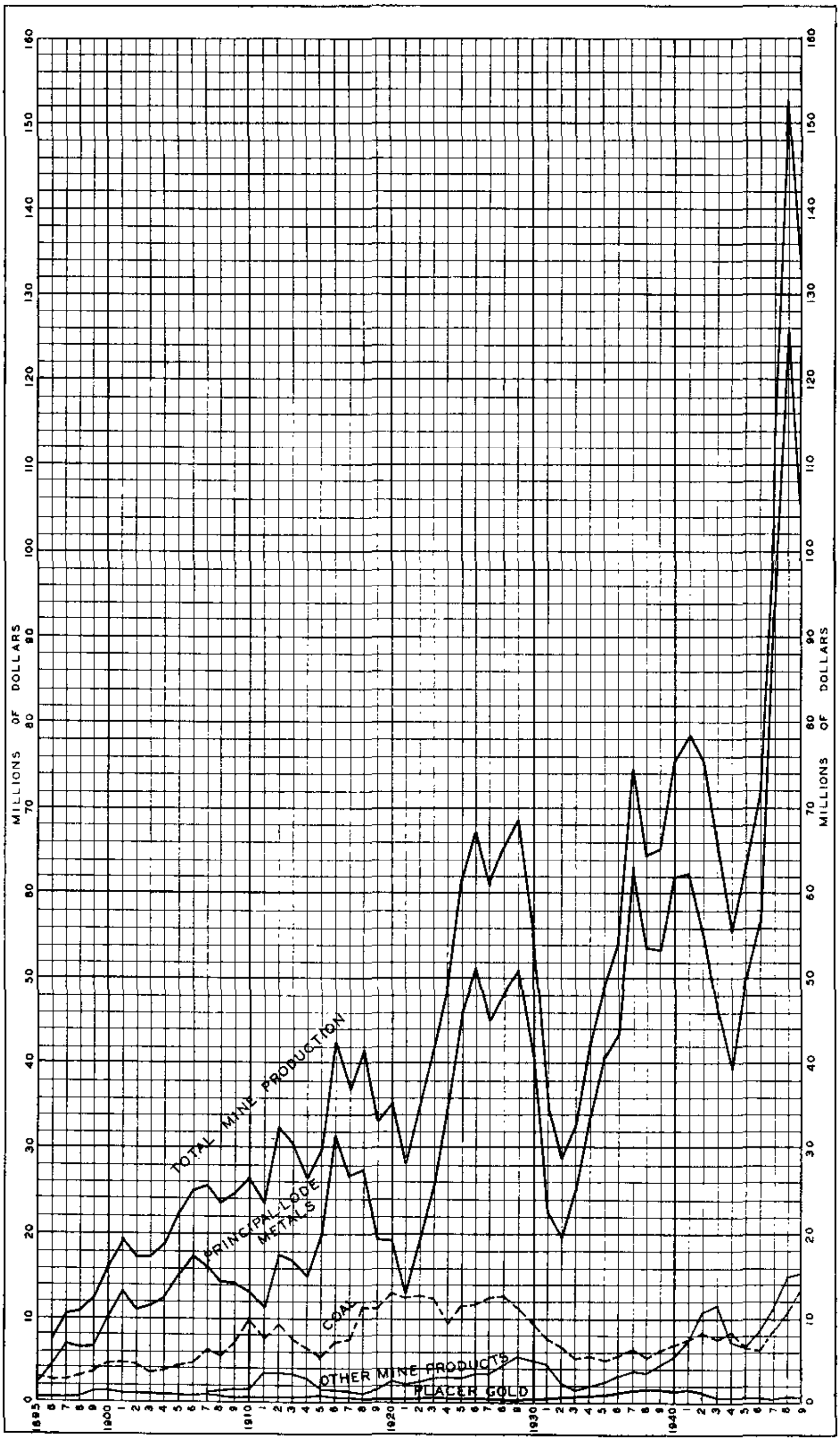

TABLE XIII.—BRITISH COLUMBIA LODE-MINES PRODUCTION, 1913–49.

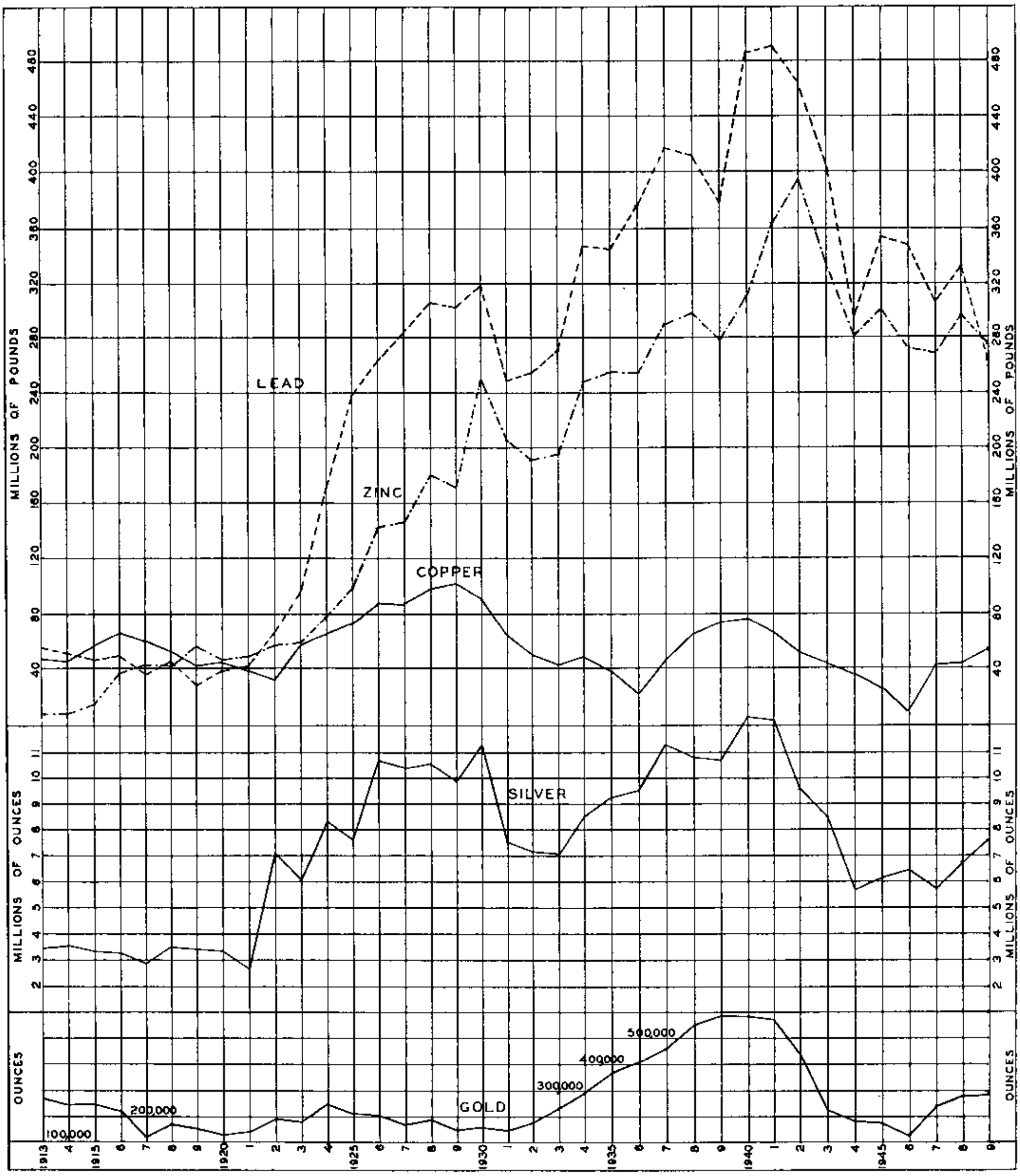

TABLE XIV.—Coal Production per Year to Date.*

	Tons. (2,000 Lb.)	Value.		Tons. (2,000 Lb.)	Value.
1836–85	3,392,492	$9,468,557	1919	2,539,646	$11,337,705
1886	365,832	979,908	1920	2,906,540	12,975,625
1887	462,963	1,240,080	1921	2,782,074	12,419,975
1888	548,017	1,467,903	1922	2,813,264	12,559,215
1889	649,410	1,739,490	1923	2,747,610	12,266,115
1890	759,517	2,034,420	1924	2,172,269	9,697,630
1891	1,152,589	3,087,291	1925	2,607,945	11,642,610
1892	925,495	2,479,005	1926	2,609,640	11,650,180
1893	1,095,689	2,934,882	1927	2,748,286	12,269,135
1894	1,134,507	3,038,859	1928	2,829,906	12,633,510
1895	1,052,413	2,818,962	1929	2,521,402	11,256,260
1896	1,003,769	2,688,666	1930	2,113,586	9,435,650
1897	988,797	2,648,562	1931	1,912,501	7,684,155
1898	1,272,169	3,407,595	1932	1,719,172	6,523,644
1899	1,463,083	3,918,972	1933	1,416,516	5,375,171
1900	1,612,346	4,318,785	1934	1,508,741	5,725,133
1901	1,635,571	4,380,993	1935	1,330,524	5,048,864
1902	1,565,081	4,192,182	1936	1,508,048	5,722,502
1903	1,308,377	3,504,582	1937	1,618,049	6,139,920
1904	1,404,063	3,760,884	1938	1,466,559	5,565,069
1905	1,550,429	4,152,936	1939	1,655,217	6,280,956
1906	1,699,379	4,551,909	1940	1,867,966	7,088,265
1907	2,016,075	6,300,235	1941	2,018,635	7,660,000
1908	1,879,191	5,872,472	1942	2,170,737	8,237,172
1909	2,247,253	7,022,666	1943	2,040,253	7,742,030
1910	3,136,052	9,800,161	1944	2,165,676	8,217,966
1911	2,456,229	7,675,717	1945	1,700,914	6,454,360
1912	2,944,261	9,200,814	1946	1,639,277	6,220,470
1913	2,393,981	7,481,190	1947	1,923,573	8,587,380
1914	2,028,283	6,338,385	1948	1,809,018	10,854,108
1915	1,804,465	5,638,952	1949	1,917,296	12,462,424
1916	2,334,184	7,294,325			
1917	2,407,972	7,524,913	Totals	120,049,268	$442,209,677
1918	2,578,514	11,511,225			

* 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. **Commencing with 1948 production the short ton (2,000 lb.) has been used in all statistical tables, and to facilitate comparison with previous years, the tonnages as noted in Table XIV above, from 1836 to 1947, have all been converted from long tons to short tons.**

TABLE XV.—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	412,483
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	4,393,265	$25,673,600
1912	264,333	1,585,998			

TABLE XVI.—Coke and By-products Production of British Columbia, for Years 1940 to 1949.

Description.	1940.		1941.		1942.		1943.		1944.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Coal used in making coke, short tons	184,160	$577,706	235,809	$717,584	255,862	$866,795	260,334	$983,910	212,883	$1,439,891
Coke made in bee-hive ovens, short tons	37,845	$220,211	64,707	$392,473	66,824	$439,464	42,766	291,843	36,966	$301,201
Coke made in by-product ovens, short tons	29,124	151,931	86,656	467,440	96,428	608,521	43,895	274,402	47,401	347,245
Coke made in gas plants, short tons	60,726	303,421	8,378	43,758	6,528	54,307	93,714	647,482	88,430	565,393
Total coke made, short tons	127,695	$675,563	159,741	$903,671	169,780	$1,102,292	180,375	$1,213,727	172,797	$1,213,839
Gas sold and used	....	1,810,083	....	1,925,270	....	2,165,888	....	2,453,592	....	2,562,610
Tar produced	....	54,379	....	63,569	....	86,113	....	96,249	....	56,476
Other by-products	....	3,060	....	1,716	....	22,028	....	18,321	....	19,046
Total production value of coke industry	....	$2,543,085	....	$2,894,226	....	$3,376,321	....	$3,781,889	....	$3,851,971

Description.	1945.		1946.		1947.		1948.		1949.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Coal used in making coke, short tons	230,868	$1,211,584	251,954	$1,441,415	284,049	$1,682,602	235,297	$1,440,415	323,899	$1,979,138
Coke made in bee-hive ovens, short tons	13,464	$117,369	20,545	$178,556	44,517	$427,330	47,461	$559,735	66,407	$690,045
Coke made in by-product ovens, short tons	59,098	434,876	50,154	416,267	55,233	527,810	52,478	616,488	89,268	1,018,288
Coke made in gas plants, short tons	91,682	577,479	81,908	619,266	75,656	557,754	56,490	454,697	67,449	496,933
Total coke made, short tons	164,244	$1,129,724	152,607	$1,214,089	175,406	$1,512,894	156,429	$1,630,920	223,124	$2,205,266
Gas sold and used	....	2,721,690	....	3,079,009	....	3,390,713	....	4,520,886	....	4,148,124
Tar produced	....	83,828	....	88,947	....	124,885	....	153,130	....	194,728
Other by-products	....	20,756	....	81,798	....	50,965	....	33,790	....	27,406
Total production value of coke industry	....	$3,955,998	....	$4,470,931	....	$5,079,457	....	$6,338,726	....	$6,575,524

TABLE XVII.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1949.

*Lode-gold Mines.**

Company or Mine.	Locality.	Class.	Amount paid.
Arlington	Erie	Gold	$94,872
Athabasca	Nelson	Gold	25,000
Bayonne	Tye Siding	Gold	25,000
Bralorne Mines, Ltd.	Bridge River	Gold	15,327,850
Belmont-Surf Inlet	Princess Royal Island	Gold	1,437,500
Cariboo Gold Quartz Mining Co., Ltd.	Wells	Gold	1,679,976
Cariboo-McKinney Con. M. & M. Co.	Camp McKinney	Gold	565,588
Canadian Pacific Exploration (Porto Rico)	Nelson	Gold	37,500
Centre Star	Rossland	Gold-copper	472,255
Fairview Amalgamated	Oliver	Gold	5,254
Fern Gold Mining & Milling Co., Ltd.	Nelson	Gold	9,375
Gold Belt Mining Co., Ltd.	Sheep Creek	Gold	†668,595
Goodenough (leasers)	Ymir	Gold	13,731
Hedley Mascot Gold Mines, Ltd.	Hedley	Gold	1,290,553
Island Mountain Mines, Ltd.	Wells	Gold	1,413,202
I.X.L.	Rossland	Gold	134,025
Jewel-Denero	Greenwood	Gold	11,751
Kelowna Exploration, Ltd. (Nickel Plate)	Hedley	Gold	1,740,000
Kootenay Belle Gold Mines, Ltd.	Sheep Creek	Gold	357,856
Le Roi Mining Co.	Rossland	Gold-copper	1,475,000
Le Roi No. 2, Ltd.	Rossland	Gold-copper	1,574,640
Lorne (later Bralorne)	Bridge River	Gold	20,450
Motherlode	Sheep Creek	Gold	163,500
Mount Zeballos Gold Mines, Ltd.	Zeballos	Gold	165,000
Nickel Plate (Hedley Gold Mining Co., Ltd.)	Hedley	Gold	3,423,191
Pioneer Gold Mines of B.C., Ltd.	Bridge River	Gold	9,299,393
Poorman	Nelson	Gold	25,000
Premier Gold Mining Co., Ltd.	Premier	Gold	‡18,858,075
Privateer Mine, Ltd.	Zeballos	Gold	1,914,183
Queen	Sheep Creek	Gold	85,000
Relief Arlington Mines, Ltd. (Second Relief)	Erie	Gold	†308,000
Reno Gold Mines, Ltd.	Sheep Creek	Gold	†1,433,640
Sheep Creek Gold Mines, Ltd.	Sheep Creek	Gold	3,065,625
Silbak Premier Mines, Ltd.	Premier	Gold	‡2,375,000
Spud Valley Gold Mines, Ltd.	Zeballos	Gold	168,000
Sunset No. 2	Rossland	Gold-copper	115,007
Surf Inlet Consolidated Gold Mines, Ltd.	Surf Inlet	Gold	120,279
War Eagle	Rossland	Gold-copper	1,245,250
Ymir Gold	Ymir	Gold	300,000
Ymir Yankee Girl	Ymir	Gold	†415,002
Miscellaneous mines		Gold	108,623
Total, lode-gold mines			71,967,741

* The gold-copper properties of Rossland are included in this table.

† Includes "Return of Capital" distributions.

‡ Up to and including 1936, dividends paid by Premier Gold Mining Company, Limited, were derived from operations of the company in British Columbia. Subsequent dividends paid by Premier Gold Mining Company, Limited, have been derived from the operations of subsidiary companies in British Columbia and elsewhere and are not included in the figure given. In 1936, Silbak Premier, a subsidiary of Premier Gold Mining Company, took over the former gold operations of that company in British Columbia. Dividends paid by Silbak Premier are given above.

TABLE XVII.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1949—*Continued.*

Silver-Lead-Zinc Mines.

Company or Mine.	Locality.	Class.	Amount paid.
Antoine	Rambler	Silver-lead-zinc	$10,000
Base Metals Mining Corp., Ltd. (Monarch and Kicking Horse)	Field	Silver-lead-zinc	*586,143
Beaverdell-Wellington	Beaverdell	Silver-lead-zinc	97,200
Beaver Silver Mines, Ltd.	Greenwood	Silver-lead-zinc	48,000
Bell	Beaverdell	Silver-lead-zinc	388,297
Bosun (Rosebery-Surprise)	New Denver	Silver-lead-zinc	25,000
Capella	New Denver	Silver-lead-zinc	5,500
Consolidated Mining and Smelting Co. of Canada, Ltd.	Trail	Silver-lead-zinc	†241,931,521
Couverapee	Field	Silver-lead-zinc	5,203
Duthie Mines, Ltd.	Smithers	Silver-lead-zinc	50,000
Florence Silver	Ainsworth	Silver-lead-zinc	35,393
Goodenough	Cody	Silver-lead-zinc	45,668
H.B. Mining Co.	Hall Creek	Silver-lead-zinc	8,904
Highland Lass, Ltd.	Beaverdell	Silver-lead-zinc	132,464
Highland Bell, Ltd.	Beaverdell	Silver-lead-zinc	1,006,561
Horn Silver	Similkameen	Silver-lead-zinc	6,000
Idaho-Alamo	Sandon	Silver-lead-zinc	400,000
Iron Mountain (Emerald)	Salmo	Silver-lead-zinc	20,000
Jackson	Retallack	Silver-lead-zinc	20,000
Last Chance	Three Forks	Silver-lead-zinc	213,000
Lone Bachelor	Sandon	Silver-lead-zinc	50,000
Lucky Jim	Three Forks	Silver-lead-zinc	80,000
Mercury	Sandon	Silver-lead-zinc	6,000
Meteor	Slocan City	Silver-lead-zinc	10,257
Monitor and Ajax	Three Forks	Silver-lead-zinc	70,500
Mountain Con	Cody	Silver-lead-zinc	71,387
McAllister	Three Forks	Silver-lead-zinc	45,088
Noble Five	Cody	Silver-lead-zinc	72,859
North Star	Kimberley	Silver-lead-zinc	497,901
No. One	Sandon	Silver-lead-zinc	6,754
Ottawa	Slocan City	Silver-lead-zinc	110,429
Payne	Sandon	Silver-lead-zinc	1,438,000
Providence	Greenwood	Silver-lead-zinc	‡142,328
Queen Bess	Alamo	Silver-lead-zinc	25,000
Rambler-Cariboo	Rambler	Silver-lead-zinc	467,250
Reco	Cody	Silver-lead-zinc	334,992
Ruth Mines, Ltd.	Sandon	Silver-lead-zinc	125,490
St. Eugene	Moyie	Silver-lead-zinc	566,000
Silversmith and Slocan Star§	Sandon	Silver-lead-zinc	1,267,600
Spokane-Trinket	Ainsworth	Silver-lead-zinc	10,365
Standard Silver Lead	Silverton	Silver-lead-zinc	2,734,688
Sunset and Trade Dollar	Retallack	Silver-lead-zinc	88,000
Utica	Kaslo	Silver-lead-zinc	64,000
Wallace Mines, Ltd. (Sally)	Beaverdell	Silver-lead-zinc	135,000
Washington	Rambler Station	Silver-lead-zinc	20,000
Whitewater	Retallack	Silver-lead-zinc	592,515
Miscellaneous mines		Silver-lead-zinc	70,239
Total, silver-lead-zinc mines			$254,137,496

* Includes $466,143 " Return of Capital " distribution prior to 1949.
† Earnings of several company mines, and customs smelter at Trail.
‡ Includes $10,504 paid in 1944 but not included in the yearly figure.
§ These two properties were amalgamated as Silversmith Mines, Limited, in August, 1939.

TABLE XVII.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1949—*Continued.*

Copper Mines.

Company or Mine.	Locality.	Class.	Amount paid.
Britannia M. & S. Co.*	Britannia Beach	Copper	$12,502,887
Canada Copper Corporation	Greenwood	Copper	615,399
Cornell	Texada Island	Copper	8,500
Granby Cons. M.S. & P. Co.†	Copper Mountain	Copper	28,151,503
Marble Bay	Texada Island	Copper	175,000
Hall Mines	Nelson	Copper	233,280
Miscellaneous mines		Copper	261,470
Total, copper mines			$41,948,039

* Britannia Mining and Smelting Company, Limited, is a subsidiary of the Howe Sound Company, which is the holding company for Britannia and for other mines in Mexico and the State of Washington. Dividends paid by the Howe Sound Company, therefore, cannot be credited to British Columbia. Dividends in the above table for Britannia have been paid by that company, none being paid subsequent to 1930, until 1939. In making comparison with yearly totals the amounts shown as paid by the Howe Sound Company have been deducted for the years shown, so the total in the annual report concerned will show the higher figure.

† The Granby Consolidated Mining, Smelting and Power Company dividends commenced in 1904 and cover all company activities in British Columbia to date, the present operations being conducted at Allenby and Copper Mountain. The dividends as set out in the table in the Minister of Mines Annual Report for 1942 were incorrect; the correct total is as above. The figure now includes all dividends, capital distributions, and interim liquidating payments, the latter being $4,500,000, paid, in 1936, prior to reorganization.

The term "Miscellaneous" noted in each class of dividend covers all payments of $5,000 and under, together with payments made by companies or individuals requesting that the item be not disclosed.

In compiling the foregoing table of dividends paid, the Department wishes to acknowledge the kind assistance given by companies, individuals, and trade journals in giving information on the subject.

Coal.

Wellington Collieries, Ltd., Nanaimo	$16,000,000
Crow's Nest Pass Coal Co., Ltd., Fernie	14,234,614
Canadian Collieries (Dunsmuir), Ltd.	225,280
Total	$30,459,894

Miscellaneous, Structural, and Placer Gold.

Various	$3,851,655

Aggregate of all Classes.

Lode-gold mining	$71,967,741
Silver-lead-zinc mining and smelting	254,137,496
Copper mining	41,948,039
Coal-mining	30,459,894
Miscellaneous, structural, and placer gold	3,851,655
Total	$402,364,825

TABLE XVII.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1949—*Continued.*

Dividends paid Yearly, 1917–49, inclusive.

Year.	Amount paid.	Year.	Amount paid.
1917	$3,269,494	1934	$4,745,905
1918	2,704,469	1935	7,386,070
1919	2,494,283	1936	10,513,705
1920	1,870,296	1937	15,085,293
1921	736,629	1938	12,068,875
1922	3,174,756	1939	11,865,698
1923	2,983,570	1940	14,595,530
1924	2,977,276	1941	16,598,110
1925	5,853,419	1942	13,627,104
1926	8,011,137	1943	11,860,159
1927	8,816,681	1944	11,367,732
1928	9,572,536	1945	10,487,395
1929	11,263,118	1946	15,566,047
1930	10,543,500	1947	27,940,213
1931	4,650,857	1948	37,672,319
1932	2,786,958	1949	33,651,096
1933	2,471,735		
		Total	$339,211,965

Dividends paid during 1948 and 1949.

	1948.	1949.
Base Metals Mining Corporation, Ltd.		$120,000
Bralorne Mines, Ltd.	$124,700	498,800
Britannia Mining and Smelting Co., Ltd.	271,000	
Canadian Collieries (Dunsmuir), Ltd.		225,280
The Consolidated Mining and Smelting Co. of Canada, Ltd.	36,035,160	31,121,502
The Crow's Nest Pass Coal Co., Ltd.	186,354	248,472
Granby Consolidated Mining, Smelting, and Power Co., Ltd.	450,231	787,906
Highland Bell, Ltd.	125,268	156,586
Island Mountain Mines, Ltd.	73,550	73,550
Sheep Creek Gold Mines, Ltd.	150,000	150,000
Others	256,056	269,000
Totals	$37,672,319	$33,651,096

TABLE XVIII.—Salaries and Wages, Fuel and Electricity, and Process Supplies, 1949.

Class.	Salaries and Wages.	Fuel and Electricity.	Process Supplies.
Lode-mining	$30,782,815	$5,217,335	$14,178,538
Placer-mining	314,992	71,534	95,031
Coal-mining	6,134,227	403,043	1,083,946
Miscellaneous metals, minerals, and materials	988,433	148,306	1,688,247
Structural materials industry	2,803,319	1,366,419	838,646
Totals, 1949	**$41,023,786**	**$7,206,637**	**$17,884,408**
Grand totals, 1948	$38,813,506	$6,139,174	$11,532,121
Grand totals, 1947	32,160,338	5,319,470	13,068,948
Grand totals, 1946	26,190,200	5,427,458	8,367,705
Grand totals, 1945	22,620,975	7,239,726	5,756,628
Grand totals, 1944	23,131,874	5,788,671	6,138,084
Grand totals, 1943	26,051,467	7,432,585	6,572,317
Grand totals, 1942	26,913,160	7,066,109	6,863,398
Grand totals, 1941	26,050,491	3,776,747	7,260,441
Grand totals, 1940	23,391,330	3,474,721	6,962,162
Grand totals, 1939	22,357,035	3,266,000*	6,714,347
Grand totals, 1938	22,765,711	3,396,106	6,544,500
Grand totals, 1937	21,349,690	3,066,311	6,845,330
Grand totals, 1936	17,887,619	2,724,144	4,434,501
Grand totals, 1935	16,753,367	2,619,639	4,552,730
Grand totals, 1935–49	387,460,529	73,853,498*	119,497,680

* Estimated.

Note.—The above figures, compiled from returns on the subject made by companies and individuals, illustrate the amount of money distributed in salaries and wages, fuel and electricity, and process supplies (explosives, *chemicals, drill-steel, lubricants, etc.*).

TABLE XIX.—LODE METAL MINES—TONNAGE, NUMBER OF MINES, NET AND GROSS VALUE OF MINERALS, 1901–49.

Year.	Tonnage.*	Number of Shipping-mines.	Number of Mines shipping over 100 Tons.	Gross Value of Lode Minerals as reported by Shipper.†	Freight and Treatment.	Net Value to Shipper of Lode Minerals produced.‡	Gross Value of Lode Minerals produced.§
1901	920,416	119	78	....	....	....	$14,100,282
1902	998,999	124	75	....	....	....	11,581,153
1903	1,286,176	125	74	....	....	....	12,103,237
1904	1,461,609	142	76	....	....	....	12,909,035
1905	1,706,679	146	79	....	....	....	15,980,164
1906	1,963,872	154	77	....	....	....	18,484,102
1907	1,804,114	147	72	....	....	....	17,316,847
1908	2,083,606	108	59	....	....	....	15,847,411
1909	2,057,713	89	52	....	....	....	15,451,141
1910	2,216,428	83	50	....	....	....	14,728,731
1911	1,770,755	80	45	....	....	....	11,454,063
1912	2,688,532	86	51	....	....	....	17,662,766
1913	2,663,809	110	58	....	....	....	17,190,838
1914	2,175,971	98	56	....	....	....	15,225,061
1915	2,690,110	132	59	....	....	....	19,992,149
1916	3,188,865	169	81	....	....	....	31,483,014
1917	2,761,579	193	87	....	....	....	26,788,474
1918	2,892,849	175	80	....	....	....	27,590,278
1919	2,112,975	144	74	....	....	....	19,750,498
1920	2,178,187	121	60	....	....	....	19,444,365
1921	1,562,645	80	35	....	....	....	12,920,398
1922	1,573,186	98	33	....	....	....	19,227,857
1923	2,421,839	77	28	....	....	....	25,347,092
1924	3,397,105	86	37	....	....	....	35,538,247
1925	3,849,269	102	40	....	....	....	46,200,135
1926	4,775,073	138	55	....	....	$38,558,613	51,508,031
1927	5,416,021	132	52	....	....	27,750,364	44,977,082
1928	6,241,310	110	49	....	....	29,070,075	48,281,825
1929	6,977,681	106	48	....	....	34,713,887	51,174,859
1930	6,803,846	68	32	....	....	21,977,688	40,915,395
1931	5,549,103	44	22	....	....	10,513,931	22,535,573
1932	4,340,158	75	29	....	....	7,075,393	19,700,235
1933	4,030,978	109	47	....	....	13,976,358	25,007,137
1934	5,116,897	145	69	....	....	20,243,278	33,895,930
1935	4,916,148	177	72	....	....	25,407,914	40,597,569
1936	4,381,027	168	70	....	....	30,051,207	43,666,452
1937	6,145,144	185	113	$48,617,920	$4,663,843	43,954,077	62,912,783
1938	7,377,021	211	92	40,222,237	4,943,754	35,278,483	53,877,333
1939	7,211,223	217	99	45,133,788	4,416,919	40,716,869	53,522,098
1940	7,937,358	216	92	50,004,909	6,334,611	43,670,298	62,848,642
1941	7,938,803	200	96	52,354,870	5,673,048	46,681,822	62,216,019
1942	6,708,277	126	76	50,494,041	5,294,637	45,199,404	55,359,479
1943	5,429,557	48	32	37,234,070	3,940,367	33,293,703	46,089,042
1944	4,763,332	51	31	29,327,114	2,877,706	26,449,408	39,315,910
1945	4,377,722	36	27	34,154,917	2,771,292	31,383,625	49,997,071
1946	3,705,375	50	32	48,920,971	2,904,130	46,016,841	56,519,691
1947	4,953,030	75	33	81,033,093	4,722,010	76,311,087	93,176,165
1948	5,655,266	97	51	118,713,859	18,585,183	100,128,727	125,979,961
1949	**6,095,441**	**118**	**54**	**99,426,678**	**19,613,185**	**79,814,604**	**105,259,001**

* Does not include mercury nor tungsten ores.

† Data not collected before 1937.

‡ Previous to 1937 the shipper reported "Net Value at Shipping Point," no indication being given as to how the net value was arrived at. From 1937 on the shipper has reported "Gross Value" from which deduction of freight and treatment gives "Net Value."

§ Gross value as represented by valuing lode metals at yearly average prices.

TABLE XX.—Average Number employed in the Mining Industry of British Columbia, 1901–49.

Year.	Placer-mining.	Lode-mining.			In Concentrators.	In Smelters.	Coal-mining.			Structural Materials.		Miscellaneous.	Total.*
		Under.	Above.	Total.			Under.	Above.	Total.	Quarries and Pits.	Plants.		
1901	......	2,736	1,212	3,948	......	......	3,041	931	3,974	......	......	......	7,922
1902	......	2,219	1,126	3,345	......	......	3,101	910	4,011	......	......	......	7,356
1903	......	1,662	1,088	2,750	......	......	3,137	1,127	4,264	......	......	......	7,014
1904	......	2,143	1,163	3,306	......	......	3,278	1,175	4,453	......	......	......	7,759
1905	......	2,470	1,240	3,710	......	......	3,127	1,280	4,407	......	......	......	8,117
1906	......	2,680	1,303	3,983	......	......	3,415	1,390	4,805	......	......	......	8,788
1907	......	2,704	1,239	3,943	......	......	2,862	907	3,769	......	......	......	7,712
1908	......	2,567	1,127	3,694	......	......	4,432	1,641	6,073	......	......	......	9,767
1909	......	2,184	1,070	3,254	......	......	4,713	1,705	6,418	......	......	......	9,672
1910	......	2,472	1,237	3,709	......	......	5,903	1,855	7,758	......	......	......	11,467
1911	......	2,435	1,159	3,594	......	......	5,212	1,661	6,873	......	......	......	10,467
1912	......	2,472	1,364	3,837	......	......	5,275	1,855	7,130	......	......	......	10,967
1913	......	2,773	1,505	4,278	......	......	4,950	1,721	6,671	......	......	......	10,949
1914	......	2,741	1,433	4,174	......	......	4,267	1,465	5,732	......	......	......	9,906
1915	......	2,709	1,435	4,144	......	......	3,708	1,283	4,991	......	......	......	9,135
1916	......	3,357	2,036	5,393	......	......	3,694	1,366	5,060	......	......	......	10,453
1917	......	3,290	2,198	5,488	......	......	3,760	1,410	5,170	......	......	......	10,658
1918	......	2,626	1,764	4,390	......	......	3,658	1,769	5,247	......	......	......	9,637
1919	......	2,513	1,746	4,259	......	......	4,145	1,821	5,966	......	......	......	10,225
1920	......	2,074	1,605	3,679	......	......	4,191	2,158	6,349	......	......	......	10,028
1921	......	1,355	975	2,330	......	......	4,722	2,163	6,885	......	......	......	9,215
1922	......	1,510	1,239	2,749	......	......	4,712	1,932	6,644	......	......	......	9,393
1923	......	2,102	1,516	3,618	......	......	4,342	1,807	6,149	......	......	......	9,767
1924	......	2,353	1,680	4,033	......	......	3,894	1,524	5,418	......	......	......	9,451
1925	......	2,298	2,840	5,138	......	......	3,828	1,615	5,443	......	......	......	10,581
1926	299	2,606	1,735	4,341	808	2,461	3,757	1,565	5,322	493	324	124	14,172
1927	415	2,671	1,916	4,587	854	2,842	3,646	1,579	5,225	647	138	122	14,830
1928	355	2,707	2,469	5,176	911	2,748	3,814	1,520	5,334	412	368	120	15,424
1929	341	2,926	2,052	4,978	966	2,948	3,675	1,353	5,028	492	544	268	15,565
1930	425	2,316	1,260	3,576	832	3,197	3,389	1,256	4,645	843	344	170	14,032
1931	688	1,463	834	2,297	581	3,157	2,957	1,125	4,082	460	526	380	12,171
1932	874	1,355	900	2,255	542	2,036	2,628	980	3,608	536	329	344	10,524
1933	1,134	1,786	1,335	3,121	531	2,436	2,241	853	3,094	376	269	408	11,369
1934	1,122	2,796	1,729	4,525	631	2,890	2,050	843	2,893	377	187	360	12,985
1935	1,291	2,740	1,497	4,237	907	2,771	2,145	826	2,971	536	270	754	13,737
1936	1,124	2,959	1,840	4,799	720	2,678	2,015	799	2,814	931	288	825	14,179
1937	1,371	3,603	1,818	5,421	1,168	3,027	2,286	867	3,153	724	327	938	16,129
1938	1,303	3,849	2,266	6,115	919	3,158	2,088	874	2,962	900	295	369	16,021
1939	1,252	3,905	2,050	5,955	996	3,187	2,167	809	2,976	652	311	561	15,890
1940	1,004	3,923	2,104	6,027	1,048	2,944	2,175	699	2,874	827	334	647	15,705
1941	939	3,901	1,823	5,724	1,025	3,072	2,229	494	2,723	766	413	422	15,084
1942	489	2,920	1,504	4,424	960	3,555	1,892	468	2,360	842	378	262	13,270
1943	212	2,394	1,699	4,093	891	2,835	2,240	611	2,851	673	326	567	12,448
1944	255	1,896	1,825	3,721	849	2,981	2,150	689	2,839	690	351	628	12,314
1945	209	1,933	1,750	3,683	822	2,834	1,927	503	2,430	921	335	586	11,820
1946	347	1,918	1,817	3,735	672	2,813	1,773	532	2,305	827	555	679	11,933
1947	360	3,024	2,238	5,262	960	3,461	1,694	731	2,425	977	585	869	14,899
1948	348	3,143	2,429	5,572	1,126	3,884	1,594	872	2,466	1,591	656	754	16,397
1949	**303**	**3,034**	**2,724**	**5,758**	**1,203**	**3,763**	**1,761**	**545**	**2,306**	**2,120**	**542**	**626**	**16,621**

* The average number employed in the industry is the sum of the averages for individual companies. The average for each company is obtained by taking the sum of the numbers employed each month and dividing by 12, regardless of the number of months worked.

TABLE XXI.—Lode-metal Producers in 1949.*

Mine or Group.	Location of Mine.	Mining Division.	Owner or Agent.	Process.	Character of Ore.
Ainsmore (Kootenay Florence)	Ainsworth	Ainsworth	Ainsmore Consolidated Mines, Ltd., Ainsworth	Flotation	Silver, lead, zinc.
Atlanta	Riondel	Ainsworth	D. F. Sutcliffe, Riondel		Silver, lead, zinc.
Black Diamond	Ainsworth	Ainsworth	Thos. and J. E. Hawes, Ainsworth		Silver, lead, zinc.
Cork Province	Keen Creek	Ainsworth	Base Metals Mining Corp., Ltd., Vancouver		Silver, lead, zinc.
Crow-Fledgling	Ainsworth	Ainsworth	E. Emilson, Balfour		Silver, lead, zinc.
Daisy Bell	Ainsworth	Ainsworth	W. J. Turner, Ainsworth		Silver, lead, zinc.
Doherty	Retallack	Ainsworth	E. H. Lovitt, Ltd., Vancouver		Silver, lead, zinc.
Early Bird	Ainsworth	Ainsworth	W. C. Robinson, Ainsworth		Silver, lead, zinc.
Hector	Ainsworth	Ainsworth	R. Sherraden, Ainsworth		Silver, lead, zinc.
Highland	Ainsworth	Ainsworth	Stanley McLellan, Ainsworth		Silver, lead, zinc.
Highland Leasers	Ainsworth	Ainsworth	Geo. L. Green, Ainsworth	Concentration	Silver, lead, zinc.
Index	Kaslo	Ainsworth	Kaslo Silver Lead Co. (Inc.), Vancouver		Silver, lead, zinc.
Laurier	Ainsworth	Ainsworth	Ed. Emilson, Nelson		Silver, lead, zinc.
Neosho	Ainsworth	Ainsworth	S. Hallgren, Ainsworth		Silver, zinc, lead.
Nicolet	Ainsworth	Ainsworth	J. G. Isaacs, Ainsworth		Silver, lead, zinc.
Olson and Hansen	Ainsworth	Ainsworth	Olson & Hansen, Ainsworth		Silver, lead, zinc.
Scranton	Woodbury Creek	Ainsworth	Scranton Consolidated Mining Co., Kaslo		Silver, lead, zinc.
Selkirk (Jackson)	Retallack	Ainsworth	Selkirk Mining Co., Ltd., Vancouver		Silver, lead, zinc.
Silver Hill	Ainsworth	Ainsworth	Silver Hill Mines, Ltd., Vancouver		Silver, lead, zinc.
Silver Hoard	Ainsworth	Ainsworth	W. E. Lane, Ainsworth		Silver, lead, zinc.
Spokane	Ainsworth	Ainsworth	W. R. Glasspoole and T. Lane, Ainsworth		Silver, lead, zinc.
Star	Ainsworth	Ainsworth	A. G. Norcross, Nelson		Silver, lead, zinc.
Twin	Ainsworth	Ainsworth	Hans A. Hansen, Ainsworth		Silver, lead, zinc.
Utica	Kaslo Creek	Ainsworth	Utica Mines (1937), Ltd., Kaslo		Silver, lead, zinc.
Voyageur (Empire Mining Corp.)	Kaslo	Ainsworth	Bank of Montreal, Kaslo		Silver, lead, zinc.
Whitewater	Retallack	Ainsworth	Retallack Mines, Ltd., Vancouver	Flotation	Silver, lead, zinc.
Woodbury group	Woodbury Creek	Ainsworth	L. D. Besecker, Kaslo (includes production by Privateer Mine, Ltd.)		Silver, lead, zinc.
Yale (Highlander)	Ainsworth	Ainsworth	Yale Lead and Zinc Mines, Ltd., Ainsworth		Silver, lead, zinc.
Davies, V. D.	Zeballos	Alberni	Victor D. Davies, Zeballos		Gold, silver, copper.
Privateer	Zeballos	Alberni	Zeballos Leasing Co., Zeballos		Gold.
Engineer	Tagish Lake	Atlin	N. Forbes and W. Sweet, Atlin		Gold.
Polaris-Taku	Tulsequah Creek	Atlin	Polaris-Taku Mining Co., Ltd., Vancouver	Flotation	Gold, silver.
Cariboo Gold Quartz	Wells	Cariboo	Cariboo Gold Quartz Mining Co., Ltd., Vancouver	Cyanidation	Gold, silver.
Island Mountain	Wells	Cariboo	Island Mountain Mine, Ltd., Wells	Cyanidation	Gold, silver.
Rex	Wells	Cariboo	J. J. Gunn, Wells		Silver, gold, lead.
Society Girl	Moyie	Fort Steele	Mark Nicholson, Moyie		Silver, lead, zinc.
Sullivan	Kimberley	Fort Steele	Cons. Mining & Smelting Co. of Canada, Ltd., Trail	Flotation	Silver, lead, zinc.

* Includes lode producers of gold, silver, copper, lead, zinc, and siliceous flux.

TABLE XXI.—LODE-METAL PRODUCERS IN 1949*—*Continued.*

Mine or Group.	Location of Mine.	Mining Division.	Owner or Agent.	Process.	Character of Ore.
Monarch and Kicking Horse	Field	Golden	Base Metals Mining Corp., Ltd., Field	Flotation	Silver, lead, zinc.
Paradise	Invermere	Golden	Sheep Creek Gold Mines, Ltd., Vancouver	Flotation	Silver, lead, zinc.
Bounty Fraction	Beaverdell	Greenwood	J. Hagmo and P. Sandmo, lessees, Greenwood		Silver, lead, zinc.
Brooklyn-Stemwinder	Phoenix	Greenwood	Brooklyn-Stemwinder Gold Mines, Ltd., Vancouver		Gold, silver, copper.
Dynamo	Greenwood	Greenwood	Dynamo Mine Syndicate, c/o M. M. Butorac, Trail		Silver, lead, zinc.
Halifax	Greenwood	Greenwood	Walter W. Schwartzenhauer, Rossland		Silver, lead.
Highland-Bell	Beaverdell	Greenwood	Highland Bell, Ltd., Vancouver		Silver, gold, lead, zinc.
Highland Silver	Beaverdell	Greenwood	Cranberry Creek Gold Mining Co., Ltd., Penticton		Silver, lead, zinc.
Imperial	Rock Creek	Greenwood	John Powelson, Cranbrook		Silver, gold, lead, zinc.
McKinley	Franklin Camp	Greenwood	W. E. McArthur & Son, Greenwood		Gold, silver, zinc, lead.
Maybe	Westbridge	Greenwood	Wanke & Johnson, Greenwood		Gold, silver, lead, zinc.
Silver Bounty	Beaverdell	Greenwood	Silver Bounty Mines, Ltd., Vancouver		Silver, lead, zinc.
W.S.	Coreyell	Greenwood	W. Schwartzenhauer, Rossland		Silver, lead, zinc.
Zamora	Rock Creek	Greenwood	Geo. E. White and O. D. Frith, Westbridge		Silver, zinc, lead.
Bralorne	Bridge River	Lillooet	Bralorne Mines, Ltd., Vancouver	Amalgamation, flotation	Gold, silver.
Pioneer	Bridge River	Lillooet	Pioneer Gold Mines of B.C., Ltd., Vancouver	Cyanidation	Gold, silver.
Vananda	Vananda	Nanaimo	Vananda Mines (1948), Ltd., Vancouver	Flotation	Gold, silver, copper.
Arlington	Erie	Nelson	Kenville Gold Mines, Ltd., Toronto		Gold, silver, lead, zinc.
Bayonne	Tye	Nelson	H. Moore and D. Macdonald, Ymir		Gold, silver, lead, zinc.
California	Nelson	Nelson	R. M. McDougall, Creston		Silver, lead, zinc.
Centre Star (Wesko)	Ymir	Nelson	S. W. Barclay, T. Wilkinson, and S. C. Wasneg, Ymir.		Gold, silver, zinc, lead.
Crawford	Creston	Nelson	F. E. Crawford, Creston		Silver, lead, zinc.
Daylight	Nelson	Nelson	Rollick Bros., Nelson		Gold, silver.
Dewey	Ymir	Nelson	H. Erickson, Ymir		Gold, silver, zinc, lead.
Dundee	Ymir	Nelson	Burgess Bros. & Lundgren		Gold, silver, lead, zinc.
Emerald	Salmo	Nelson	Canadian Exploration, Ltd., Vancouver	Flotation, gravity	Tungsten.
Gold Belt	Sheep Creek	Nelson	Gold Belt Mining Co., Ltd., Nelson (production by lessees)		Gold, silver.
H.B.	Salmo	Nelson	Cons. Mining & Smelting Co. of Canada, Ltd., Trail		Silver, zinc, lead.
International	Salmo	Nelson	International Lead & Iron Co., Nelway		Silver, lead, zinc.
Granite-Poorman (Kenville)	Taghum	Nelson	Kenville Gold Mines, Ltd., Toronto	Cyanidation and flotation	Gold, silver, lead, zinc.
Kootenay Belle	Sheep Creek	Nelson	J. R. Thompson, Sheep Creek		Gold, silver.
Lakeview	Sanca	Nelson	Messrs. Nathe, Powelson, Bullock, and Mrs. Olsen, Sanca		Silver, zinc, lead.
Michaely (Red Rock)	Pend-d'Oreille	Nelson	Wm. C. Holland, Salmo		Silver, lead, zinc.
Molly Gibson	Nelson	Nelson	R. J. Johnston and J. D. Spiers, Trail		Silver, lead, zinc.
Nugget	Sheep Creek	Nelson	A. Endersby, Sr. and Jr., Fruitvale		Gold, silver.
Pilot Bay	Pilot Bay	Ainsworth	H. D. Stearns, c/o D. Smith, 806 Baker St., Nelson		Silver, lead, zinc.
Protection (Goodenough)	Ymir	Nelson	Messrs. Turk, Sterna, and Myers, Ymir		Silver, lead, zinc.

Reeves MacDonald	Remac	Nelson	Reeves MacDonald Mines, Ltd., Vancouver	Flotation	Silver, zinc, lead.
Queen (Sheep Creek)	Sheep Creek	Nelson	Sheep Creek Gold Mines, Ltd., Vancouver	Cyanidation	Gold, silver.
Spokane	Tye	Nelson	Kootenay Central Mines, Ltd., Rossland		Gold, silver, lead, zinc.
Sun	Nelson	Nelson	W. Rozan, Nelson		Gold, silver, lead.
Victoria-Jessie	Nelson	Nelson	Rollick Bros., Nelson		Gold, silver.
Silver Standard	Hazelton	Omineca	Silver Standard Mines, Ltd., New Hazelton	Flotation	Silver, lead, zinc.
Fairview and Morning Star	Oliver	Osoyoos	Cons. Mining & Smelting Co. of Canada, Ltd., Trail		Silica flux, gold.
Hedley Mascot	Hedley	Osoyoos	Hedley Mascot Mines, Ltd., Vancouver	Flotation, cyanidation	Gold, silver.
Nickel Plate	Hedley	Osoyoos	Kelowna Exploration Co., Hedley	Cyanidation, flotation	Gold, silver.
Osoyoos	Fairview	Osoyoos	Wm. Hegan, Penticton		Gold, silver, lead, zinc.
Stemwinder-Susie	Fairview	Osoyoos	Fairview Mining Co., Ltd., Wallace, Idaho (production by lessees)		Gold, silver, lead, zinc.
East Gold Group	Tide Lake	Portland Canal	A. A. Phillips, Stewart		Gold, silver.
Mobile Group	Stewart	Portland Canal	R. Jokanovich, Stewart		Silver, zinc, lead.
Silver Tip	Stewart	Portland Canal	Silver Tip Gold Mines, Ltd., Victoria		Gold, silver, zinc, lead.
Terminus	Stewart	Portland Canal	Owen McFadden, Stewart		Silver, lead, zinc.
Torbrit	Kitsault River	Portland Canal	Torbrit Silver Mines, Ltd., Toronto, Ont.	Flotation and cyanidation	Silver, lead, zinc.
Midas	Yanks Peak	Quesnel	Midas Mines (partnership), c/o Lieut.-Col. F. H. M. Codville, Duncan		Gold, silver.
Providence	Black Bear Creek	Quesnel	Providence Mining & Milling Syndicate, Williams Lake		Silver, lead.
Spider	Camborne	Revelstoke	Sunshine Lardeau Mines, Ltd., Vancouver		Gold, silver, lead, zinc.
Stannite	Pool Creek	Revelstoke	Stannite Mines, Ltd., Vancouver		Silver, lead, zinc.
Copper Mountain	Copper Mountain	Similkameen	Granby Cons. M.S. & P. Co., Ltd., Copper Mountain	Flotation	Copper, gold, silver.
El Alamein	Tulameen	Similkameen	El Alamein Mines, Ltd		Gold, silver.
Bosun	Silverton	Slocan	Santiago Mines, Ltd., Vancouver, and lessees		Silver, lead, zinc.
Galena Farm	Silverton	Slocan	Frank Mills, Silverton		Silver, lead, zinc.
McAllister	Three Forks	Slocan	Noonday Mines, Ltd., Nelson		Silver, lead, zinc.
Metallic	Silverton	Slocan	W. Crowe and A. K. Lotze, Waneta		Silver, lead, zinc.
Morning Star	Springer Creek	Slocan	G. A. MacMillan, New Denver		Silver, lead, zinc.
Okanagan	Slocan	Slocan	L. P. Gormley, Nelson		Silver, lead, zinc.
Ottawa	Springer Creek	Slocan	A. Olson, E. Grovè, and P. Grove, Slocan City		Silver.
Pay Cheque	Edgewood	Slocan	H. A. McKen, Blewett		Silver, lead, zinc.
Rose Marie	New Denver	Slocan	L. E. and R. G. Hale and W. E. Graham, Nelson		Silver, lead, zinc.
Ruth Hope	Sandon	Slocan	Black & Higgins, Sandon		Silver, lead, zinc.
Silverite and Black Colt	Sandon	Slocan	Excelda Mines, Ltd. (Lloyd N. Smith, Vernon)		Silver, zinc, lead.
Silversmith	Sandon	Slocan	E. H. Petersen, Sandon		Silver, lead, zinc.
Standard, Mammoth, and Enterprise	Silverton	Slocan	Western Exploration Co., Ltd., Silverton	Flotation	Silver, lead, zinc.
Van Roi	Silverton	Slocan	Van Roi Mines (1947), Ltd., New Denver		Gold, silver, lead, zinc.
Violamac	New Denver	Slocan	Violamac Mines (B.C.), Ltd., New Denver		Silver, lead, zinc.
Zincton (Lucky Jim)	Zincton	Slocan	Zincton Mines, Ltd., Vancouver	Flotation	Silver, lead, zinc.
I.X.L.	Rossland	Trail Creek	Gunnar Nordholm and Kootenay Central Mines, Ltd., Rossland		Gold, silver.

* Includes lode producers of gold, silver, copper, lead, zinc, and siliceous flux.

TABLE XXI.—LODE-METAL PRODUCERS IN 1949*—*Continued.*

Mine or Group.	Location of Mine.	Mining Division.	Owner or Agent.	Process.	Character of Ore.
Mayflower	Rossland	Trail Creek	E. H. Lovitt, Ltd., Vancouver		Gold, silver.
Midnight	Rossland	Trail Creek	Kootenay Central Mines, Ltd., Rossland		Gold, silver.
Nature Boy	Rossland	Trail Creek	James Pearson, Trail		Silver, lead, zinc.
Britannia	Britannia Beach	Vancouver	Britannia Mining & Smelting Co., Ltd., Britannia Beach	Flotation	Copper, gold, silver.
Caron	Pender Harbour	Vancouver	Caron Mining Co., Vancouver		Gold, silver, copper.
Dud	Allison Harbour	Vancouver	H. T. Jefferies, Allison Harbour		Gold, silver, lead, zinc.
Silver Star	Vernon	Vernon	R. Wilkie, Kamloops		Silver, lead.

* Includes lode producers of gold, silver, copper, lead, zinc, and siliceous flux.

TABLE XXII.—MINING COMPANIES EMPLOYING AN AVERAGE OF TEN OR MORE MEN DURING 1949.*

Shipping Mines.

Name of Mine or Company.	Days Operating.		Tons.		Average Number Employed.	
	Mine.	Mill.	Mined.	Milled.	Mine.	Mill.
Ainsmore Consolidated Mines, Ltd.	288	288	......	11,907	20	4
Cork-Province (Base Metals Mining Corp., Ltd.)	306	......	7,050	......	14	......
Whitewater (Retallack Mines, Ltd.)	131	285	......	49,692	14	13
Yale Lead and Zinc Mines, Ltd.	280	......	11	......	15	......
Polaris-Taku Mining Co., Ltd.	365	365	......	93,806	183	12
Cariboo Gold Quartz Mining Co., Ltd.	365	365	......	67,793	181	15
Island Mountain Mines Co., Ltd.	281	365	......	44,336	105	12
Sullivan (Cons. M. & S. Co. of Canada, Ltd.)	254	302	......	2,297,672	1,630	450
Base Metals Mining Corp., Ltd. (Monarch and Kicking Horse)	304	289	50,800	49,619	74	11
Paradise (Sheep Creek Gold Mines, Ltd.)	307	91	......	4,007	33	2
Brooklyn-Stemwinder Gold Mines, Ltd.	300†	......	2,109†	2,109†	12†	......
Highland Bell, Ltd.	268	......	8,942	6,530	45	......
Bralorne Mines, Ltd.	365	365	179,929	178,995	450	26
Pioneer Gold Mines of B.C., Ltd.	363	365	72,396	66,986	226	11
Vananda Mines (1948), Ltd.	223	255	24,223	24,223	47	5
Canadian Exploration, Ltd. (Emerald)	279	219	81,786	81,786	96	20
H.B. (Cons. M. & S. Co. of Canada, Ltd.)	365	......	8,910	......	25	......
Kenville Gold Mines, Ltd.‡	365	365	......	25,819‡	46	11
Reeves MacDonald Mines, Ltd.	289	169	......	46,681	141	4
Sheep Creek Gold Mines, Ltd. (Queen)	307	207	......	27,992	60	7
Silver Standard Mines, Ltd.	365	365	23,033	17,516	60	11
Fairview and Morning Star (Cons. M. & S. Co. of Canada, Ltd.)	365	......	24,547	......	17	......
Hedley Mascot Gold Mines, Ltd.	105	105	......	13,760	32	11
Kelowna Exploration Co., Ltd.	274	353	......	121,732	123	70
Torbrit Silver Mines, Ltd.	365	331	......	99,570	168	24
Copper Mountain (Granby Cons. M.S. & P. Co., Ltd.)	359	359	1,803,916	1,734,269	590	262
Bosun (Santiago Mines, Ltd.)	200	......	986	571	12	......
Van Roi Mines (1947), Ltd.	277	......	5,132	5,102	16	......
Violamic Mines (B.C.), Ltd.	272	......	1,717	......	24	......
Western Exploration Co., Ltd. (Standard, Enterprise, Mammoth)	240	120	13,367	11,698	59	14
Zincton (Sheep Creek Gold Mines, Ltd.)	308	298	......	98,453	66	11
Britannia Mining and Smelting Co., Ltd.	281	273	......	880,580	588	196

Non-shipping Mines.

Bluebell (Cons. M. & S. Co. of Canada, Ltd.)	......	......	......	......	46	......
Big Bull (Cons. M. & S. Co. of Canada, Ltd.)	......	......	......	......	41	......
Tulsequah Chief (Cons. M. & S. Co. of Canada, Ltd.)	......	......	......	......	28	......
Silbak Premier Mines, Ltd.	......	......	......	......	65	......
Carnation (Kelowna Exploration Co., Ltd.)	......	......	......	......	16	......
Kennco Exploration (Canada), Ltd.	......	......	......	......	15	......
B.R.X. (1935) Cons. Mines, Ltd.	......	......	......	......	12	......

* The average number employed includes wage-earners and salaried employees. The average is obtained by adding the monthly figures and dividing by 12, irrespective of the number of months worked.

† Estimated.

‡ Including 4,964 tons from other mines the total quantity of ore milled in the Kenville mill was 30,783 tons.

Departmental Work.

ADMINISTRATIVE BRANCH.

The administrative branch is responsible for the administration of the Provincial mining laws regarding the acquisition of mineral rights, and deals with other departments of the Provincial service for the Department or for any branch.

Gold Commissioners, Mining Recorders, and Sub-mining Recorders, whose duties are laid down in the "Mineral Act" and the "Placer-mining Act," administer these Acts and other Acts relating to mining. Mining Recorders, in addition to their own functions, may also exercise the powers conferred upon Gold Commissioners with regard to mineral claims within the mining division for which they have been appointed. Similar duties may be performed by Mining Recorders with regard to placer claims but not in respect of placer-mining leases. Recording of location and of work upon mineral claims, placer claims, and placer-mining leases as required by the various Acts must be made at the office of the Mining Recorder for the proper mining division. Information concerning claims and leases and concerning the ownership and standing of claims and leases in any division may be obtained from the Mining Recorder for the mining division in which the property is situated and from the Central Records Offices. Sub-mining Recorders, who act as forwarding agents, are appointed at various places throughout the Province. They are authorized to accept documents and fees, and forward them to the office of the Mining Recorder for the correct mining division. Officials and their offices in various parts of the Province are listed in the table on pages 47 and 48.

Copies of the various Acts, upon payment of the prices listed on page 338, can be obtained from the office of the Chief Gold Commissioner; the King's Printer, Victoria; the Central Records Office in Vancouver; or from the offices of the Gold Commissioners throughout the Province.

Central Records Offices (Victoria and Vancouver).

Complete records of the recorded owners of mineral claims held by record, of placer-mining leases, and of leases of reverted Crown-granted mineral claims, together with the numbers of certificates of work and the names of principals and their interests in bills of sale recorded, are available at the general office, Department of Mines, Victoria, B.C. The approximate positions of mineral claims held by record and of placer-mining leases are shown on maps from details supplied by the locators. The maps conform in geographical detail, size, and number to the reference and mineral reference maps issued by the Department of Lands. The information outlined, so far as possible, is brought up to date on receipt of semi-monthly returns from Gold Commissioners and Mining Recorders. Semi-monthly returns are forwarded to the Central Records Office, Vancouver,* from Victoria, together with copies of the cards provided by the Gold Commissioners and Mining Recorders. The maps and records may be inspected at either office by anyone who calls in business hours. Provision has been made to supply the general public, on request to the Department at Victoria, with copies of the maps.

* The office is to be moved in the summer of 1950 from 305 Federal Building to 808–810 Hastings Street West.

Amalgamation of Mining Divisions.

(Particulars of Mining Divisions amalgamated since 1939.)

Date.	Mining Divisions amalgamated.	New Name.	Mining Recorder's Office.
July 2, 1939	Yale and New Westminster	New Westminster	New Westminster.
Sept. 18, 1939	Bella Coola and Skeena	Skeena	Prince Rupert.
Nov. 20, 1939	Slocan City and Slocan	Slocan	New Denver.
Aug. 1, 1940	Queen Charlotte and Skeena	Skeena	Prince Rupert.
Aug. 5, 1940	Grand Forks and Greenwood	Greenwood	Grand Forks.
Oct. 15, 1942	Arrow Lake and Slocan	Slocan	New Denver.
Oct. 15, 1942	Golden and Windermere	Golden	Golden.
Nov. 30, 1942	Nanaimo and Quatsino	Nanaimo	Nanaimo.
Dec. 1, 1942	Alberni and Clayoquot	Alberni	Alberni.
Oct. 1, 1949	Revelstoke and Lardeau	Revelstoke	Revelstoke.
Dec. 1, 1949	Kamloops and Ashcroft	Kamloops	Kamloops.

Peace River Mining Division.

The office of the Gold Commissioner for the Peace River Mining Division was established at Victoria, effective May 1st, 1949. A Sub-mining Recorder was appointed at Pouce Coupe, and other sub-mining recording offices for the Peace River Mining Division are at Fort St. John and Prince George.

Gold Purchasing.

Late in 1935 the Department of Finance, co-operating with the Department of Mines, undertook to purchase placer gold, in quantities of not less than 3 pennyweight and not more than 2 ounces in weight, from individual placer-miners. The Gold Commissioners throughout the Province are paying a cash price of $31 per ounce for clean placer gold and are purchasing dirty placer gold and amalgam on a deferred-payment basis. Purchases made under this arrangement are as follows:—

Year.	No. of Lots.	Paid.	Paid per Oz.
1937	1,657	$52,250	$28.00
1938	2,397	72,000	28.00
1939	2,322	60,000	29.00
1940	1,336	31,600	29.00
1941	631	16,825	29.00
1942	229	8,068	29.00
1943	93	2,705	29.00
1944	59	1,196	29.00
1945	63	1,604	29.00
1946	115	3,911	28.00*
1947	107	3,502	28.00
1948	100	3,224	28.00
1949	69	2,072	31.00†
Totals	9,178	$258,957	....

* Price paid by Gold Commissioners following the reduction of the official Canadian price for fine gold.

† Price paid, effective October 1st, 1949, following the devaluation of the Canadian dollar. For the earlier purchases made in 1949 the price paid for gold was $28 per ounce.

This purchasing scheme was established during the depression years to give the individual miner the best possible price for his gold, and this was realized in that the total price paid has been almost exactly the same as the receipts from the Royal Canadian Mint.

List of Gold Commissioners, Mining Recorders, and Sub-mining Recorders in the Province.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-recorder.
Ainsworth	Kaslo	C. Macdonald	B. F. Palmer.	
Sub-office	*Poplar*			*A. Robb.*
Alberni	Alberni	T. W. Harding	T. W. Harding	R. MacGregor.
Sub-office	Nanaimo			W. H. Cochrane.
Sub-office	Quatsino			Axel Hansen.
Sub-office	Tofino			R. R. Barr.
Sub-office	Zeballos			H. M. B. Sutton.
Atlin	Atlin	A. E. Roddis	A. E. Roddis.	
Sub-office	Lower Post			R. A. Farrell.
Sub-office	Pouce Coupe			H. O. Callahan.
Sub-office	Squaw Creek			Mrs. F. Muncaster.
Sub-office	Telegraph Creek			Mrs. M. C. Allen.
Sub-office	Tulsequah			T. G. Emery.
Cariboo	Barkerville	W. L. Draper	W. L. Draper.	
Sub-office	Fort McLeod			J. E. McIntyre.
Sub-office	McBride			T. R. Maxwell.
Sub office	Prince George			G. H. Hallett.
Sub-office	Quesnel			S. Allen.
Clinton	Clinton	W. H. Cope	W. H. Cope.	
Sub-office	Haylmore			W. Haylmore.
Sub-office	Williams Lake			Miss J. Foster.
Fort Steele	Cranbrook	E. L. Hedley	E. L. Hedley.	
Sub-office	Fernie			F. E. P. Hughes.
Golden	Golden	S. M. Carling	S. M. Carling.	
Sub-office	Invermere			T. N. Weir.
Greenwood	Grand Forks	W. E. McLean	W. E. McLean.	
Sub-office	Beaverdell			L. F. Crump.
Sub-office	Greenwood			S. W. Dobbie.
Sub-office	Oliver			L. M. McKinnon.
Kamloops	Kamloops	D. Dalgleish	D. Dalgleish.	
Sub-office	Ashcroft			D. H. Bruce.
Sub-office	Chu Chua			G. M. Fennell.
Sub-office	Salmon Arm			W. T. McGruder.
Lillooet	Lillooet	G. H. Beley	G. H. Beley	Miss D. M. Eggie.
Sub-office	Haylmore			W. Haylmore.
Nanaimo	Nanaimo	W. H. Cochrane	W. H. Cochrane.	
Sub-office	Alberni			T. Harding and R. MacGregor.
Sub-office	Alert Bay			A. J. Dillabough.
Sub-office	*Cumberland*			*G. W. McFarland.*
Sub-office	Quatsino			Axel Hansen.
Sub-office	Stuart Island			J. B. Willcock.
Sub-office	Vananda			Henry Carter.
Nelson	*Nelson*	*S. Hamilton*	*S. Hamilton*	Miss W. M. Palethorpe.
Sub-office	Creston			B. J. H. Ryley.
Sub-office	Salmo			M. C. Donaldson.
New Westminster	New Westminster	J. F. McDonald	G. C. Kimberley.	
Sub-office	Chilliwack			E. L. Anderson.
Sub-office	Hope			J. H. Richmond.
Nicola	Merritt	D. Dalgleish (Kamloops)	T. G. O'Neill.	
Omineca	Smithers	K. D. McRae	K. D. McRae.	
Sub-office	Burns Lake			A. Fisher.
Sub-office	Copper River			L. G. Skinner.
Sub-office	Dorreen			W. E. Horwill.
Sub-office	Fort St. James			Norman Henry.
Sub-office	Fort St. John			R. H. Rashleigh.
Sub-office	Hazelton			W. A. A. West.
Sub-office	Manson Creek			T. C. Hamilton.
Sub-office	Prince George			G. H. Hallett.
Sub-office	Takla Landing			Mrs. G. M. Henry.
Sub office	Telkwa			T. J. Thorp.
Sub-office	Vanderhoof			George Ogsdon.

LIST OF GOLD COMMISSIONERS, MINING RECORDERS, AND SUB-MINING RECORDERS IN THE PROVINCE—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-recorder.
Osoyoos	Penticton	T. S. Dalby	T. S. Dalby.	
Sub-office	Hedley			L. A. Doree.
Sub-office	Keremeos			L. S. Coleman.
Sub-office	Oliver			L. M. McKinnon.
Peace River	Victoria	K. B. Blakey.		
Sub-office	Fort St. John			R. H. Rashleigh.
Sub-office	Pouce Coupe			H. O. Callahan.
Sub-office	Prince George			G. H. Hallett.
Portland Canal	Stewart	G. Forbes (Prince Rupert)	C. G. Tran.	
Sub-office	Alice Arm			Mrs. J. F. Butler.
Quesnel	Williams Lake	Miss J. Foster	Miss J. Foster.	
Sub-office	Barkerville			W. L. Draper.
Sub-office	Horsefly			Mrs. H. Gibbons.
Sub-office	Keithley Creek			Mrs. E. Rae.
Sub-office	Likely			L. R. Speed.
Sub-office	Quesnel			S. Allen.
Revelstoke	Revelstoke	W. G. Fleming	W. G. Fleming.	
Sub-office	Beaton			A. W. Menzies.
Similkameen	Princeton	Chas. Nichols	Chas. Nichols.	
Sub-office	Hedley			L. A. Doree.
Skeena	Prince Rupert	G. Forbes	G. Forbes.	
Sub-office	Burns Lake			A. Fisher.
Sub-office	Copper River			L. G. Skinner.
Sub-office	Queen Charlotte			H. R. Beaven.
Sub-office	Stewart			C. G. Tran.
Slocan	New Denver	C. Macdonald (Kaslo)	F. Broughton	Miss M. Butler.
Sub-office	Slocan			W. E. Graham.
Stikine	Victoria	K. B. Blakey.		
Sub-office	Telegraph Creek			Mrs. M. C. Allen.
Sub-office	Burns Lake			A. Fisher.
Sub-office	Fort St. James			N. Henry.
Sub-office	Fort St. John			R. H. Rashleigh.
Sub-office	Lower Post			R. A. Farrell.
Sub-office	Pouce Coupe			H. O. Callahan.
Trail Creek	Rossland	E. B. Offin	E. B. Offin.	
Vancouver	Vancouver	J. Egdell	Mrs. D. White (Deputy)	Miss F. Schachter.
Sub-office	Alert Bay			A. J. Dillabough.
Sub-office	Powell River			J. P. Scarlett.
Sub-office	Stuart Island			J. B. Willcock.
Vernon	Vernon	A. E. Wilson	A. E. Wilson.	
Sub-office	Kelowna			E. R. Oatman.
Victoria	Victoria	K. B. Blakey	R. H. McCrimmon (Deputy)	Miss D. T. Arnott.

Gold Commissioners' and Mining Recorders' Office Statistics, 1949.

Mining Division.	Free Miners' Certificates.				Lode-mining.					Placer-mining.				Revenue.		
	Individual.	Company.	Special.	Provisional (Placer).	Mineral Claims recorded.	Certificates of Work.	Certificates of Improvements.	Bills of Sale, etc.	Leases of Reverted Crown-granted Mineral Claims.	Placer Claims recorded.	Placer Leases granted.	Certificates of Work, Placer Leases.	Bills of Sale, etc.	Free Miners' Certificates.	Mining Receipts.	Totals.
Ainsworth	133	4	1	.....	171	196	.....	68	91	.....	.....	.....	.....	$920.00	$5,450.00	$6,370.00
Alberni	106	5	.....	1	145	230	8	.....	40	.....	.....	1	.....	849.25	4,934.15	5,783.40
Atlin	154	7	.....	.....	69	129	.....	23	5	9	18	82	21	1,241.25	9,275.75	10,517.00
Cariboo	399	16	6	25	175	302	.....	24	.....	5	90	468	125	3,315.50	26,567.50	29,883.00
Clinton	41	.....	.....	1	29	94	.....	17	.....	2	5	11	25	186.75	1,648.50	1,835.25
Fort Steele	171	.....	1	2	80	167	.....	39	3	.....	16	33	14	757.50	4,187.71	4,945.21
Golden	77	4	1	.....	91	193	.....	26	13	1	.....	2	.....	979.50	2,204.00	3,183.50
Greenwood	131	2	1	.....	98	121	5	15	43	1	5	3	3	646.25	2,528.50	3,174.75
Kamloops	373	.....	1	23	483	253	.....	24	10	3	5	13	.....	1,633.75	4,685.09	6,318.84
Lillooet	277	6	6	6	187	549	16	62	19	.....	7	32	4	1,895.50	5,147.45	7,042.95
Nanaimo	109	.....	4	.....	68	105	2	14	1	.....	3	3	1	523.00	1,497.25	2,020.25
Nelson	316	7	7	6	326	431	17	49	30	13	1	12	2	2,770.50	6,409.00	9,179.50
New Westminster	245	2	5	28	235	182	.....	31	2	.....	2	20	4	1,538.00	2,423.25	3,961.25
Nicola	31	.....	.....	.....	40	163	.....	8	.....	.....	.....	.....	.....	149.50	796.50	946.00
Omineca	370	4	2	.....	337	551	.....	55	24	6	9	102	26	1,960.25	13,588.25	15,548.50
Osoyoos	122	1	.....	3	70	65	7	4	6	.....	.....	.....	.....	548.00	728.50	1,276.50
Peace River	46	.....	.....	.....	24	25	.....	.....	.....	.....	.....	.....	.....	196.25	70.00	266.25
Portland Canal	71	2	1	.....	111	315	.....	21	.....	.....	.....	.....	1	556.25	2,159.00	2,715.25
Quesnel	328	11	4	3	43	197	.....	12	.....	9	20	153	26	2,405.00	10,492.50	12,897.50
Revelstoke	80	.....	5	1	94	380	.....	22	13	.....	9	6	1	532.00	7,390.00	7,922.00
Similkameen	214	8	3	2	136	117	.....	12	3	1	10	57	17	1,618.75	3,411.00	5,029.75
Skeena	79	.....	2	.....	56	29	15	21	40	1	2	.....	1	372.00	1,743.00	2,115.00
Slocan	86	1	2	.....	78	137	.....	27	.....	.....	7	.....	8	522.75	3,260.50	3,783.25
Stikine	98	1	1	.....	131	159	.....	35	5	.....	14	47	26	543.50	5,233.60	5,777.10
Trail Creek	83	3	6	2	34	18	.....	1	1	.....	.....	1	.....	624.25	187.75	812.00
Vancouver	1,095	85	27	43	117	185	.....	17	12	.....	.....	.....	.....	13,401.25	7,777.18	21,178.43
Vernon	152	2	4	14	54	41	.....	22	2	1	1	6	.....	1,056.25	1,037.50	2,093.75
Victoria	218	13	3	5	44	32	.....	.....	.....	2	1	5	.....	2,129.25	4,037.00	6,166.25
Totals for Province, 1949	5,605	184	93	165	3,526	5,366	70	649	363	54	225	1,057	305	$43,872.00	$138,870.43	$182,742.43
Totals for Province, 1948	5,658	194	90	152	3,803	5,762	100	862	324	66	361	1,068	493	43,347.90	156,587.20	199,935.10

ANALYTICAL AND ASSAY BRANCH.

During 1949 the chemical laboratory in Victoria issued reports on 2,747 rock samples and specimens from prospectors and Departmental engineers. A laboratory examination of a prospector's sample generally consists of the following: (1) A mineralogical determination of visible minerals and a classification of the type of rock; (2) a spectrographic analysis to determine if any base metals are present in interesting percentages; (3) assays for precious metals, and for base metals shown by the spectrographic analysis to be present in interesting percentages; (4) test for radioactivity. The laboratory reports were distributed in the following manner amongst bona-fide prospectors, bona-fide prospectors who were grantees under the "Prospectors' Grubstake Act," and Departmental engineers:—

	Samples and Specimens.	Mineralogical Determinations.	Spectrographic Analyses.	Assays.	Radio-assays reported.
Bona-fide prospectors	1,205	1,111	1,092	1,703	250
Bona-fide prospectors (grantees)	567	559	540	1,033	70
Departmental engineers	975	7	156	2,771	175
Totals	2,747	1,677	1,788	5,507	495

Proximate analyses and calorific determinations were made on eleven coal samples, and ash determinations were made on a further seventy coal samples, all for the Department of Mines.

Work for other departments included the analysis of nine samples of agricultural material for the Department of Agriculture, eight samples of liquor for the Liquor Control Board, five samples of a miscellaneous nature for the British Columbia Research Council, and one each for the Department of Public Works, Department of Health and Welfare, and Department of Lands and Forests. Analyses for the University of British Columbia included two samples of ore and one sample of water.

For the Attorney-General's Department, sixty-two cases of a chemico-legal nature were undertaken, involving the study of 194 exhibits. These cases included sixteen analyses of a toxicological nature, two analyses of blood for alcohol, nine analyses of liquors, two analyses involving narcotics, and three analyses of gasoline seized under the "Coloured Gasoline Tax Act." The remaining cases were of a widely varied nature. One of especial interest involved the examination of traces of gold on a screwdriver. Spectrochemical analysis conclusively proved this gold to be identical to a large piece of stolen sponge gold.

In co-operation with the Department of Mining and Metallurgy, University of British Columbia, the investigation of possible sources of the metals gallium and germanium, commenced in 1948, was continued. This involved the spectrochemical analysis of twenty-two samples of flue ash for these metals.

At the request of the British Columbia Research Council and in connection with an investigation concerning possible deficiencies of certain trace elements in some specimens of sugar-cane, work was commenced on the analysis of a series of sugar-cane juices for these trace elements. This work is to be continued during 1950.

The policy adopted in 1948 of examining all samples for the possible presence of radioactivity was continued throughout 1949. Radioassays were made on 3,306 samples.

A total of sixty-nine lots of placer gold, amounting to 72.2193 ounces and representing purchases from individual placer-miners, was received from Gold Commissioners.

Provincial Government examinations for certificates of competency and licence to practice assaying in British Columbia were held in Trail in October. Of the nine candidates who sat for the examination, five failed and four were granted supplementals in wet assaying.

INSPECTION BRANCH.

Organization and Staff.

Inspectors and Resident Engineers.

James Strang, Chief Inspector	Victoria.
H. C. Hughes, Senior Inspector of Metalliferous Mines	Victoria.
L. Wardman, Electrical Inspector	Victoria.
J. A. Mitchell, Resident Engineer	Victoria.
J. H. Bennett, Resident Engineer	Victoria.
Robert B. King, Inspector and Resident Engineer	Vancouver.
John MacDonald, Inspector and Resident Engineer	Nanaimo.
J. E. Merrett, Inspector and Resident Engineer	Lillooet.
E. R. Hughes, Inspector and Resident Engineer	Princeton.
J. W. Peck, Inspector and Resident Engineer	Nelson.
Robert B. Bonar, Inspector and Resident Engineer	Fernie.
F. J. Hemsworth, Inspector and Resident Engineer	Prince Rupert.
D. R. Morgan, Inspector and Resident Engineer	Fernie.

Effective February 1st, 1950, H. C. Hughes succeeds James Strang as Chief Inspector of Mines, and Robert B. Bonar becomes Senior Inspector of Coal Mines. Effective April 15th, A. R. C. James becomes Inspector and Resident Engineer for the Vancouver Island Inspection District with headquarters at Cumberland.

The Inspectors are stationed at the places listed and inspect coal mines, metalliferous mines, and quarries in their respective districts. They also examine prospects and mining properties.

Board of Examiners for Coal-mine Officials.

James Strang, Chairman	Victoria.
Robert B. Bonar, Member	Fernie.
John MacDonald, Member	Nanaimo.

R. B. Bonar, John MacDonald, and the Inspector of Mines for 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 coal-miners for a period not exceeding sixty days between regular examinations.

Instructors, Mine-rescue Stations.

Richard Nichol	Nanaimo Station.
Arthur Williams	Cumberland Station.
Thomas H. Cunliffe	Princeton Station.
Joseph J. Haile	Fernie Station.

Staff Changes.

D. R. Morgan, Coal-mine Inspector, was appointed to the staff in December, 1949. He is to be stationed at Fernie.

John MacDonald retired at the end of the year.

MINERALOGICAL BRANCH.

Field work by officers of the Mineralogical Branch consists principally of geological mapping and the examination of mineral deposits. The results are published partly in the Annual Report of the Minister of Mines and partly in a series of bulletins. The activities of the Branch include identification of rock and mineral specimens submitted by prospectors and others, and the examination of all samples submitted by prospectors to the Analytical Branch. The Mineralogical Branch also supplies information regarding mineral deposits and the mineral industry in response to inquiries received in great number.

Eight officers of the Mineralogical Branch were engaged in field work during the 1949 field season, and one field party was led by a geologist employed for the season. Twelve temporary assistants were employed on the field parties.

Staff Changes.

C. B. Newmarch left the staff of the Mineralogical Branch in May to become geologist for the Crow's Nest Pass Coal Company.

Dr. W. H. Mathews left the staff of the Mineralogical Branch of the Department in September to accept a position in the Department of Geological Sciences at the University of California, Berkeley, Calif.

W. R. Bacon joined the staff of the Mineralogical Branch at midsummer.

J. W. McCammon joined the staff of the Mineralogical Branch at midsummer and has taken over the work on industrial minerals.

J. T. Fyles and M. C. Robinson were appointed to the staff of the Mineralogical Branch and were granted leave of absence for the winter months to carry on post-graduate studies.

Dr. W. H. White, of the Department of Geology of the University of British Columbia, was engaged as party chief for the summer months.

Field Work.

W. R. Bacon examined mineral properties south of Lillooet, in the southern part of the Chilcotin area, and at Adams Plateau.

J. M. Black made a detailed examination of an area containing zinc mineralization at Alice Arm. He also examined a lead-zinc property at Smithers, copper prospects on Duckling Creek, Omineca Mining Division, and an iron prospect north of Kitimat.

J. T. Fyles continued geological mapping and examination of prospects near Cowichan Lake.

M. S. Hedley continued the detailed structural study in the Slocan District and examined silver-lead-zinc properties in the East Kootenay District.

S. S. Holland continued the detailed study at Yanks Peak in the Cariboo District, and examined some dragline placer dredging operations.

W. H. Mathews completed detailed mapping of the Sheep Creek gold camp.

J. W. McCammon examined deposits of perlite rock, fluorite, clay, and other industrial minerals, from Vanderhoof to Vancouver and on the North Thompson River.

M. C. Robinson began detailed mapping of an area near Silverton.

J. S. Stevenson examined mineral properties at Princeton, in the Bridge River District, and on Vancouver Island, and examined occurrences of uranium near Hazelton and elsewhere.

W. H. White examined mining properties at Nicola, Beaverdell, Phoenix, Rossland, Ymir, Nelway, and near Hope.

GRUB-STAKING PROSPECTORS.

The "Prospectors' Grub-stake Act," as amended in March, 1944, provides for grub-stakes of up to $300 to prospectors, plus an additional amount of up to $200 if travelling expenses are to be paid. For the 1943 season, $25,000 was appropriated by the Legislature; for each of the 1944, 1945, and 1946 seasons, $50,000 was appropriated; and for each of the 1947, 1948, and 1949 seasons, $40,000 was appropriated.

STATISTICS.

Field Season.	Approximate Expenditure.	Men Grub-staked.	Samples and Specimens received at Department Laboratory.	Mineral Claims recorded.
1943	$18,500	90	773	87
1944	27,215	105	606	135
1945	27,310	84	448	181
1946	35,200	95	419	162
1947	36,230	91	469	142
1948	35,975	92	443	138
1949	31,175	98	567	103

Samples and specimens sent in by grub-staked prospectors are examined by an engineer, after which examination further study is made by mineralogical determination, spectrographic analysis, and assay.

Grub-staked prospectors were active in most parts of the Province in 1949. Representatives of mining companies examined several of their discoveries, and one property was optioned by a large company. Reports of interesting discoveries came from various sections, and several prospectors found properties that seemed worthy of more exploration.

The grub-stake programme was supervised by J. A. Mitchell and J. H. Bennett, assisted by D. H. Rae.

MUSEUMS.

The Department has a large exhibit of ores and minerals in the museum on Superior Street, Victoria; smaller collections are displayed in the joint office in Vancouver* and in the offices of the Inspectors of Mines in Nelson and Prince Rupert.

Information regarding collections of specimens of rocks and minerals available to prospectors and schools in British Columbia will be found on page 327.

PUBLICATIONS.

Annual Reports of the Minister of Mines, bulletins, and other publications of the Department, with prices charged for them, are listed on pages 324 to 326.

Publications may be obtained from the offices of the Department in Victoria and elsewhere in the Province. They are also available for reference use in the Department's library (Mineralogical Branch) at Victoria, in the joint office in Vancouver,* and in the offices of the Inspectors of Mines in Nelson and Prince Rupert, as well as in public libraries listed on page 327.

MAPS SHOWING MINERAL CLAIMS, PLACER CLAIMS, AND PLACER-MINING LEASES.

From the details supplied by the locators, the approximate positions of mineral claims held by record and of placer-mining leases are shown on maps that may be

* The office is to be moved in the summer of 1950 from 305 Federal Building to 808–810 Hastings Street West.

inspected in the Central Records Offices of the Department of Mines in Victoria and in Vancouver.* Copies of these maps may be obtained on request, as outlined on page 326. The boundaries of surveyed claims and leases are shown on the reference maps and other maps of the British Columbia Department of Lands and Forests.

JOINT OFFICES OF THE BRITISH COLUMBIA DEPARTMENT OF MINES AND OF THE DEPARTMENT OF MINES AND TECHNICAL SURVEYS, CANADA.

The Provincial Department's engineer, the Gold Commissioner and Mining Recorder for the Vancouver Mining Division, and the officers of the Dominion Geological Survey now occupy one suite of offices. All official information relating to mining is now available to the public in the one suite of offices in Vancouver.

The services offered to the public include technical information on mining, the identification of mineral specimens, distribution of Dominion and Provincial mining publications, a reference library, a display of rocks and minerals, and a central records office.

Topographic Maps and Air Photographs.

Topographic mapping and air photography are carried on by the Surveys and Mapping Service of the British Columbia Department of Lands and Forests and by services of the Dominion Government Departments of Mines and Technical Surveys and of National Defence. Air-photograph coverage of British Columbia has increased rapidly and is now almost complete. Good progress has been made in topographic mapping in recent years. Map and photograph coverage to date and the work done by the British Columbia Department of Lands and Forests in the year are outlined in the Annual Report of the Deputy Minister of Lands. In 1949 the British Columbia Department of Lands and Forests had six parties doing field work for standard topographic maps at 1 mile to the inch and 100-foot contour interval. These parties obtained ground control for 4,765 square miles of 1-mile mapping. The Dominion Government had fifteen parties engaged in mapping at 4 miles to the inch and 500-foot contour interval, and two parties engaged in mapping at 1 mile to the inch and 100-foot contour interval. These parties obtained ground control for 46,580 square miles of 4-mile mapping and 1,190 square miles of 1-mile mapping. A winter survey established 300 miles of linear control.

Interim maps showing planimetry, based on air photographs and existing ground control, are being compiled by the map compilation division of the Air Survey Division of the Surveys and Mapping Service. These maps record much topographic information and show the centres of vertical air photographs in the area covered. They are a very valuable source of topographic information in advance of the more detailed standard topographic maps.

Complete information about topographic maps, interim maps, and air photographs for British Columbia made by the Dominion or Provincial service may be obtained from the Topographic Division and the Geographic Division of the Department of Lands and Forests. Air photographs may be bought or, under some circumstances, may be borrowed from the Air-photo Library of that Department.

* *See* footnote, page 53.

Department of Mines and Technical Surveys.

The Dominion Government Department of Mines and Technical Surveys, created by an Act of Parliament introduced in November, 1949, took over most of the branches and functions related to mining of the former Department of Mines and Resources. The Mines Branch, Geological Survey of Canada, and Surveys and Mapping Branch are the three branches of the Department of the most direct interest to the mining industry. Brief reference to the work of the Surveys and Mapping Branch in British Columbia is made in the preceding note headed "Topographic Maps and Air Photographs." A note on the Geological Survey of Canada follows this paragraph and is followed by a note on the Mines Branch.

GEOLOGICAL SURVEY OF CANADA.

By an arrangement made at the time the Province of British Columbia entered Confederation, geological investigations and mapping in the Province are carried on by the Geological Survey of Canada. Several geological parties are in the field each year. Many excellent reports and maps covering areas of British Columbia have been issued by the Geological Survey of Canada, and they have made available a great amount of information that has been of much benefit to the mining and prospecting activities in British Columbia.

A branch office of the Geological Survey of Canada is maintained at 305 Federal Building, Vancouver.* Maps and reports on British Columbia can be obtained there. W. E. Cockfield is in charge of this office.

FIELD WORK BY THE GEOLOGICAL SURVEY IN BRITISH COLUMBIA, 1949.

J. E. Armstrong nearly completed geological mapping of the adjoining Vancouver North and Vancouver South areas (longitude 123° to 123° 30′, latitude 49° to 49° 30′). He commenced and completed a ground-water survey of the Hazelton Indian Reserve No. 1 and Saanich Indian Reserve No. 1; aided the Dominion Soils Survey in the interpretation of the Pleistocene geology of the Peace River Block, and the Dominion and United States Soils Surveys in the interpretation of the Pleistocene geology in northwestern Washington and southwestern British Columbia.

R. L. Christie commenced geological mapping of the Bennett area (longitude 134° to 136°, latitude 59° to 60°).

W. E. Cockfield assisted the Dominion Water and Power Bureau in investigating the Columbia River drainage systems, and in other engineering work. He assisted in work on the Fraser drainage system in connection with power developments and flood control, and assisted soil-survey parties in the Cranbrook area on problems of Pleistocene geology. In addition, several mining properties were visited to obtain information for other Government departments.

S. Duffell continued geological mapping of the Whitesail Lake area (longitude 126° to 128°, latitude 53° to 54°), commenced by him in 1947.

E. Hall continued his services throughout the year at Columbia River dam-sites, examining and correlating drill cuttings and cores for the Dominion Water and Power Bureau.

J. W. Hoadley continued geological mapping of the Zeballos area (longitude 126° 30′ to 127°, latitude 49° 45′ to 50°), commenced by him in 1947.

J. A. Jeletzky conducted a detailed stratigraphic study of the fossiliferous Mesozoic formations along the west coast of Vancouver Island between Kyuquot Sound and Esperanza Inlet.

* *See* footnote, page 53.

A. G. Jones continued geological mapping of the Revelstoke area (longitude 118° to 119°, latitude 50° to 51°), commenced by him in 1948.

H. W. Little continued geological mapping of the west half of the Nelson area (longitude 117° to 118°, latitude 49° to 50°), commenced by him in 1948.

J. E. Muller continued geological examination of the Groundhog coalfield, commenced in 1948 by A. F. Buckham.

R. Mulligan commenced and completed geological mapping of the Nelson area (longitude 117° 15′ to 117° 30′, latitude 49° 15′ to 49° 30′).

V. J. Okulitch made a brief stratigraphic investigation of early Palæozoic fossiliferous formations on either side of the International Boundary in the vicinity of Pend-d'Oreille River.

L. L. Price commenced geological mapping of the McDame Creek area (longitude 128° to 130°, latitude 59° to 60°).

W. H. Tipper commenced geological mapping of the Nechako area (longitude 124° to 126°, latitude 53° to 54°).

Publications of the Geological Survey.

The following maps and reports relating to British Columbia published by the Geological Survey were received by the British Columbia Department of Mines between midsummer 1948 and December 31st, 1949:—

- Map 932A: Geological Map of British Columbia; scale 1 inch to 20 miles.
- Map 962A: McConnell Creek, Cassiar District, British Columbia; scale 1 inch to 4 miles, geology.
- Map 971A: Smithers-Fort St. James, British Columbia; scale 1 inch to 8 miles, geology.
- Map 979A: Carp Lake, Cariboo District, British Columbia; scale 1 inch to 4 miles, geology.
- Map 980A: Carp Lake, Cariboo District, British Columbia (surface deposits); scale 1 inch to 4 miles.
- Paper 48-4: Salmon Arm Map-area, British Columbia, by H. M. A. Rice and A. G. Jones.
- Paper 48-5: Geology and Mineral Deposits of Aiken Lake Map-area, British Columbia, by J. E. Armstrong and E. F. Roots.
- Paper 49-4: Notes on Prospecting for Uranium in Canada, by A. H. Lang.
- Paper 49-22: Preliminary Map, Nelson (West Half), British Columbia, by H. W. Little.
- Memoir 246: Lower Stikine and Western Iskut River Areas, British Columbia, by F. A. Kerr.
- Memoir 247: Physiography of the Canadian Cordillera with Special Reference to the Area North of the Fifty-fifth Parallel, by H. S. Bostock.
- Memoir 248: Taku River Map-area, British Columbia, by F. A. Kerr.
- Memoir 249: Geology and Mineral Deposits of Nicola Map-area, British Columbia, by W. E. Cockfield.
- Memoir 251: McConnell Creek, Cassiar District, British Columbia, by C. S. Lord.
- Memoir 252: Fort St. James Map-area, Cassiar and Coast Districts, British Columbia, by J. E. Armstrong.
- Geological Survey Bulletin No. 12: Jurassic Formations of Maude Island and Alliford Bay, Skidegate Inlet, Queen Charlotte Islands, British Columbia, by F. H. McLearn.
- Geological Survey Bulletin No. 14: Geology of part of the Selkirk Mountains in the vicinity of the main line of the Canadian Pacific Railway, British Columbia, by V. J. Okulitch.

MINES BRANCH.

The Mines Branch has branches dealing with mineral resources, mineral dressing and process metallurgy, physical metallurgy, radioactivity, and fuels and explosives. Publications of the Mines Branch received in 1949 include "Canadian Mineral Industry in 1947"; Memorandum Series 99, "Lead Occurrences in Canada," by W. R. McClelland; and tabular pamphlets dealing with coal mines, gold mines, stone quarries, petroleum refineries, and milling plants in Canada.

The Mineral Dressing and Process Metallurgy Division investigates the milling of ores and industrial minerals from many deposits and also tests clays and other ceramic materials. In addition to the results of tests on samples of clays submitted by the British Columbia Department of Mines, the Department has received the following reports on work performed by the Mineral Dressing and Process Metallurgy Division, in 1949, on British Columbia ores:—

Investigation No.	Title.
2543.	Sink-and-Float Tests on a Sample of Lead-Zinc Ore from the Jersey Mine at Salmo, B.C.
2545.	Sintering Tests on a Limonite Iron Ore from the Moberly River, Peace River Mining District, B.C.
2573.	Flotation Tests on a Sample of Gold, Copper and Silver Ore from the Brooklyn-Stemwinder Gold Mines, Limited, Greenwood, B.C.
2575.	Flotation and Gravity Concentration Tests on a Lead Ore from the Beverly Mines, Limited, Golden, B.C. (McMurdo Creek).
2576.	Preliminary Concentration Tests on a Lead-Barite Ore from Silver Giant Mines, Spillimacheen, B.C.
2594.	Tests on a Shipment of Asbestos Ore from near Arrowhead, B.C.
MD2599.	Concentration and Cyanidation Tests on a Sample of Low Grade Dump Material, containing Gold, Silver, Lead, and Zinc, from the Arlington Mine, Ymir Area, Nelson District, B.C.

Metal-mining (Lode).

CONTENTS.

NOTES ON METAL MINES—*Continued.*

DRAWINGS.

GENERAL REVIEW.

Production from lode-metal mines in 1949 compared favourably in quantity with the record production of 1948. More copper was produced than in 1948, and gold production remained about the same even though the Hedley Mascot mine was closed in April and the Privateer mine was not operated in 1949. Sharp drops in the prices of base metals caused considerable uneasiness early in the year, but prices remained high enough to encourage production throughout 1949. The average number of men employed in the lode-metal mining industry in 1949 at mines, mills, and smelters was 10,724; in 1948 the number was 10,582 and in 1947 was 9,683.

In 1949 lode mines yielded gold, silver, copper, lead, and zinc valued at $105,259,000. In 1948 this value was $125,980,000. The quantities and values of these metals produced each year to date are shown in Table VI, page 19. The quantities of lode gold, silver, and copper produced were greater in 1949 than in 1948; the output of lead was materially less and the output of zinc was moderately less than in 1948. Metal prices are recorded and discussed on pages 13 and 16. The prices for gold and for all metals exported were increased by the premium on United States funds, following the revaluation of Canadian currency in September.

Twenty-four mines equipped with mills were in production in 1949. Fourteen of these mills were operated continuously, two were operated intermittently, three were closed, and five were started. The Silbak Premier mill was reopened in November. Milling was started at the Torbrit, Paradise, and Reeves MacDonald mines, and at the Jersey lead-zinc mine of Canadian Exploration, Limited. At the Vananda mine, milling was suspended although development work continued.

Production was recorded from 120 properties. Many of these properties, mostly in the Kootenay and Boundary areas, shipped crude ore to smelters. The Trail smelter recorded customs receipts of 14,966 tons of crude ore from eighty-five properties in British Columbia, mostly in the Kootenay and Boundary areas. The smelter also recorded receipt of 10,194 tons of lead concentrates and 46,163 tons of zinc concentrates from seventeen customs shippers in British Columbia. The Kenville mill near Nelson, the Western Exploration mill at Silverton, the Whitewater mill at Retallack, and the Kootenay Florence (Ainsmore), and Highland mills at Ainsworth all accepted ore from other mines for milling. Shipments to the Tacoma smelter included the copper concentrates produced at the Britannia, Copper Mountain, and Little Billie mines, gold-bearing concentrates from the Polaris-Taku, Bralorne, Nickel Plate, and Hedley Mascot mines. Crude ore was shipped to Tacoma, Wash., from the Caron (Cambrian Chieftain), Little Billie, and several other properties. Although the Silbak Premier mill was operated in November and December, no production was credited for 1949 as the concentrates produced had not reached the smelter at the end of the year.

Development work at several producing mines was successful. At the Polaris-Taku mine, a new body of ore was found. A new and rich vein was discovered at the Silver Standard mine. Important discoveries of replacement ore were made at the Cariboo Gold Quartz mine, and more ore was found at the neighbouring Island Mountain mine. At Britannia, development work was done on a large body of zinc ore found in the old upper part of the mine.

Exploration and development work was done on many properties not yet producing, and some of them show promise of developing into mines. The Consolidated Mining and Smelting Company continued underground work at the Big Bull and Tulsequah Chief properties near Tulsequah, at the H.B. property near Salmo, and at the Bluebell property near Riondel. Diamond drilling was done on the Big Ledge property on Pingston Creek. Underground work was done at the Golden Contact property, near

McGillivray, and at the Copperado property of Guichon Mine, Limited, near Merritt. A road was built by Canam Mines to the A.M. group of claims in the Skagit River area. Road repair and construction was started by Camac Mining Co., Limited, who plan to develop the Fandora property on Tranquil Creek near Tofino. At the Mastodon property, near Revelstoke, underground work was done and a road to the property was started.

Prospecting and surface exploration was done by many companies and by large numbers of individual prospectors, and reports indicate that some of this work was successful in finding deposits worthy of further development.

NOTES ON METAL MINES.

The following section includes short notes on mines and prospects, and detailed reports. In general, material for the short notes was supplied by Inspectors of Mines. The more detailed reports are written by Engineers of the Mineralogical Branch, but may include information supplied by an Inspector. Authorship is shown by foot-notes. Information about companies was obtained from the office of the Registrar of Companies. Statistics of development and production were obtained from the Bureau of Economics and Statistics. Production figures shown are the gross metal content of bullion, concentrates, or crude ore shipped, except where noted otherwise. Net contents were shown for the years prior to 1948.

The notes are arranged in geographical order under headings which are place-names that suggest the area in which the properties lie. Also, the approximate position is shown by numbers and letters, in parentheses, that follow the place-name or the name of the property. The numbers give the latitude and longitude of the southeast corner of the 1-degree quadrilateral, and the letters show the quarter of the quadrilateral in which the property is situated.

ALASKA HIGHWAY.*

Silver-Lead-Zinc.

Holliday Ranson. (59° 130° N.W.) This property, also called the Eva and Molly, consists of eighteen claims, thirteen recorded in British Columbia, and five in the Yukon Territory. The claims are owned by Allan F. Holliday, of Watson Lake, Y.T., and Roy R. Ranson, of Sault Ste. Marie, Mich. The claims lie on both sides of the British Columbia-Yukon Boundary, 6½ miles south by trail from Mile 707 on the Alaska Highway. They occupy a cirque basin and extend from timberline at elevation 4,000 feet to the crest at elevation 6,000 feet. The slopes are steep and the lower reaches are covered by a heavy overburden of slide rock.

The rock exposures and talus are of light-grey coarse-grained granite, an intrusive of the Cassiar batholith. The contact of the intrusive crosses the Alaska Highway about 3 miles to the east, at Mile 703, and strikes north. Two quartz veins were seen; one at the top of the mountain, between two jagged peaks, is called the Discovery vein; and the other, near the foot of the east slope, is known as the Shipment vein. The veins are similar in composition but differ in strike. They consist of quartz and weathered granitic rock and are mineralized with galena, hematite, and pyrite.

The property was located in the fall of 1947, after Allan Holliday had found the Discovery showing while he was on a goat-hunting trip. In 1948 a 65-per-cent. interest was optioned by M. K. Pickard for the Yukon Ranges Exploration Syndicate, of Toronto. The syndicate built a trail to the claims. A portable gasoline drill was used to mine 5 tons of ore from the Shipment vein. This was sacked, packed out to the highway on horseback, and shipped to the Trail smelter. This test shipment assayed: Gold, 0.04 oz. per ton; silver, 40.1 oz. per ton; lead, 65.4 per cent.; zinc, 1.5 per cent. The option was relinquished at the end of the 1948 season, and no work was done in 1949.

* By F. J. Hemsworth.

The Discovery vein is the widest showing, but no work has been done on it because of its almost inaccessible location. It is on the north side of a steep slope, about 20 feet below the peak of the mountain. The outcrop is quartz with some galena, pyrite, and hematite. Both walls are composed of rusty, weathered granite. The vein is exposed for a width of 6 feet and a length of 10 feet. Both ends are covered by talus. The vein strikes north 35 degrees east and dips vertically. A sample across the 6 feet of vein material and weathered granite assayed: Gold, trace; silver, 2.2 oz. per ton; lead, 1.7 per cent.

Several open-cuts have been made about 1,500 feet east of the Discovery vein and 1,000 feet lower in elevation. The largest of these is a trench 4 feet wide, 6 feet deep, and 150 feet long from which ore was sorted for the test shipment. About 2 tons of sacked ore still remains. The Shipment vein, as far as exposed by the trench, is a quartz vein striking north 65 degrees east and dipping 80 degrees south. At the upper or south end of the trench, the vein consists of 0.8 foot of quartz and 0.8 foot of altered granite. Both the quartz and the granite within the walls of the vein are mineralized with galena and some pyrite. A sample across the 1.6 feet assayed: Gold, 0.05 oz. per ton; silver, 9.1 oz. per ton; lead, 29.2 per cent. The vein widens toward the middle of the trench and narrows again at the north end. A sample across 2.1 feet in the middle section assayed: Gold, *nil;* silver, 0.9 oz. per ton; lead, 9.6 per cent.

Other open-cuts in the vicinity are caved, but little or no quartz was seen on any of the various dumps. Undoubtedly, there are other showings on the mountain that were not seen by the writer. Some mineralized float was observed while climbing the south side of the mountain, and further prospecting should result in finding other veins in that area.

Gem. (59° 130° N.E.) The Hudson Bay Exploration and Development Company, a subsidiary of the Hudson Bay Mining and Smelting Company, of Flin Flon, Man., owns the Gem group of thirty-eight mineral claims. The claims are 30 miles east of McNaughton Lake, at latitude 59° 55′ north, longitude 130° 25′ east. They are about 16 miles south of the Alaska Highway at Mile 703, but there is no trail from the highway. The property is serviced by aircraft. Landings are made on Lord Lake, about 4 miles south of the property. Supplies may be flown in from the Pine Lake airstrip at Mile 722 on the Alaska Highway, a flight distance of 17 miles. The company has built a pack-trail from the east end of Lord Lake (elevation 3,800 feet) to the campsite (elevation 4,200 feet).

The claims cover the southern slope of an unnamed mountain between elevations of 4,000 and 6,000 feet. Most of the area is covered by scrub spruce and drift, but rock outcrops on the high ridges and in the creek beds.

The Gem group of claims was located in the summer of 1948 by the Hudson Bay Exploration Company, and some preliminary prospecting was done that season. In 1949 the company engineers made a geological survey of the claims, and a diamond-drill contract was let to the Mid-West Diamond Drillers. Eight holes were drilled, totalling 2,935 feet. Seven men were employed on the drilling and five on the geological work.

Bands of limestone, in a series of altered sediments, strike northwest and dip 60 degrees to the south. The sediments have been intruded by granite of the Cassiar batholith. The contact strikes in a northwest direction through the centre of the claims. Granite stocks and sills outcrop north of the main intrusive.

The mineralization consists of replacement bodies of lead and zinc sulphides in the limestone close to the granite contact. The main showing is on the Gem No. 4 claim, where stripping has exposed a replacement zone, up to 10 feet wide, mineralized with galena, sphalerite, and hematite.

Six open-cuts were made on the limestone replacement zone on the Gem No. 4 claim at an elevation of 4,700 feet. These trace the mineralization for 100 feet along the strike. The second open-cut is excavated in a southeast direction along the strike, is 15 feet long, 6 feet wide, and 10 feet deep, and shows unconsolidated material for a depth of 6 feet underlain by blue limestone containing small crystals of pyrite. A sample across the upper 6 feet of altered limestone, hematite, galena, and sphalerite assayed: Gold, trace; silver, 79.2 oz. per ton; lead, 11.6 per cent.; zinc, 6.7 per cent.

Thirty feet to the southeast, in open-cut No. 4, a sample across 4½ feet of the best mineralized limestone on the hangingwall at the south end of the pit assayed: Gold, 0.02 oz. per ton; silver, 111.9 oz. per ton; lead, 15.9 per cent.; zinc, 4.5 per cent.

All the diamond-drill holes were directed to determine the extension and grade of this mineralized zone on the Gem No. 4 claim. The eight holes showed the length of the replacement zone to be at least 570 feet and the depth to be more than 300 feet. However, the Hudson Bay Exploration Company reports that the results of the drilling were disappointing and that the widths and values of the zone indicated in the drill cores were much less than those shown on the surface. The company has no plans for returning to the property.

McDAME CREEK (59° 129° S.E.).*

Silver-Lead-Zinc.

Carlick. The Carlick group of four claims, located by Beal Carlick early in the summer of 1949, is on the northeast slope of the McDame Creek valley, 2 miles northwest by road from McDame Post. In July, 1949, the property was optioned by Moccasin Mines, Ltd., and fourteen more claims were located. The area covered is thickly wooded with birch, pine, and spruce; overburden is heavy, and rock outcrops are few.

Moccasin Mines built half a mile of new road to link the showing with the McDame Creek Road. Access to the property is from the Alaska Highway at Mile 648 by truck-road, a distance of 75 miles. An alternate route is by river boat up the Stikine River to Telegraph Creek, thence by road to Dease Lake, thence to McDame Post by river boat.

Bedrock, where exposed on the Carlick claims, consists of a series of limestones, argillaceous limestones, and quartzites, striking east-southeast and dipping steeply to the south. Felsite dykes have intruded the sedimentary rocks along a zone striking north 75 degrees west. The dykes contain small crystals of pyrite, which have partly oxidized to limonite, producing a distinctive rust colour. Adjacent to the dykes, light and dark limestone beds are impregnated with galena, and some of the limestone has been replaced by barite and siderite. In the replacement zone, masses of barite and coarse-grained galena are common. Small amounts of pyrite, sphalerite, and copper carbonates accompany the lead sulphides. The mineralized zone is exposed by four trenches and some surface stripping over a length of about 600 feet.

The showing was discovered by the children of Beal Carlick while out hunting squirrels. The children were attracted by the glitter of galena crystals reflecting the rays of the sun.

After the property was taken over by Moccasin Mines, a systematic programme of exploration was followed. The work was under the direction of Charles Smith, chief engineer for the company. A tractor and portable drill equipment were brought in. Roads were built, and the bulldozer blade was used to strip large areas of overburden. Trenches were cut at intervals along the strike of the mineralization or wherever galena or mineralized dyke rock was uncovered. No underground work was done.

Bluffs of black limestone outcrop below the lowest workings, but no mineralized rock has been uncovered. At the lowest trench, galena is exposed in two sections, 9 feet and 5 feet wide, separated by 10 feet of mixed dyke rock and black limestone. A sample

* By F. J. Hemsworth.

across the 9-foot section assayed: Gold, *nil;* silver, 0.7 oz. per ton; lead, 6.8 per cent. A sample across the 5-foot section assayed: Gold, *nil;* silver, *nil;* lead, 10.6 per cent. Rough stripping and outcrops expose a zone of lead mineralization along the claim location lines as far as the next trench, 400 feet to the southeast. A cross-section of this trench from north to south shows mixed limestone and quartzite, black limestone, 5 feet of felsite dyke with iron oxides, 8 feet of barite and limestone with galena, mixed barite and limestone, felsite dyke with pyrite, and limestone to end of trench. A sample across the 8 feet of barite and limestone with galena assayed: Gold, *nil;* silver, 0.2 oz. per ton; lead, 1.2 per cent.

The next open-cut, about 200 feet higher, consists of two trenches. A sample across the best mineralized section, 10 feet in the middle of the larger trench, assayed: Gold, *nil;* silver, 0.6 oz. per ton; lead, 10 per cent.

The next trench, 400 feet to the southeast, showed some black limestone with barite and siderite but no galena. At a further 200 feet southeast, the last trench showed light and dark limestone with little or no mineralization. These two trenches appear to be off the general strike of the zone, being too far to the east. Some stripping to the southwest of the last trench might uncover the felsite dyke that is associated with the galena in the lower trenches.

Haskins Mountain.

(59° 129° S.W.) Yukon Ranges Exploration, Limited, 804, 217 Bay Street, Toronto. Murray Pickard, engineer in charge. This prospecting syndicate holds claims by location and lease on Haskins Mountain, at the headwaters of the second north fork of McDame Creek. In addition, the company optioned the Iron Cap group of sixteen claims, north of Holloway's Bar. A Warsop gasoline drill was taken in, and considerable stripping, trenching, and sampling were done on a galena showing.

TAKU RIVER (58° 133° N.W.)*

Gold.

Polaris-Taku (Taku River Gold Mines Ltd.).

Company office, 1500 Royal Bank Building, Vancouver. W. B. Milner, president; G. W. Robinson, manager. Capital: 3,000,000 shares, no par value. The mine is on the west side of the Tulsequah River valley. Transportation is by aircraft from Juneau, or river boat from Taku Arm, to the landing at the junction of the Tulsequah and Taku Rivers. A road, 7 miles long, connects the landing with the mine camp. All heavy freight is brought in by river boat and barge. Concentrates are shipped downstream on the return trips. The river is open for about five months of the year, from June till October. During the shipping season in 1949 all the concentrate stockpile was shipped out to the smelter at Tacoma, Wash.

Except for a brief shut-down in April, caused by a labour dispute, the plant operated steadily throughout the year. In the mine 84,488 tons of ore was broken. Of this tonnage, 8,003 tons came from development headings. Shrinkage stoping produced 49,960 tons and open stoping 21,077 tons.

Development advance for the year was 3,981 feet of drifting and crosscutting, 1,986 feet of raising, and 951 feet of slashing. Total diamond drilling amounted to 17,987 feet. A new oreshoot was opened up on the 450 level on the "B" zone. Ore from this section was responsible for the increase in grade of the ore milled during the last half of the year.

Production: Ore milled, 93,806 tons; concentrates produced, 13,111 tons. Gross contents: Gold, 39,345 oz.; silver, 1,384 oz.

An Edwards roaster, with a rated capacity of 15 tons of concentrates per day, was installed during the second half of the year, and a cyanide plant, to handle 30 tons of concentrates, was built. These plants were completed and run for short test periods.

* By F. J. Hemsworth.

A new building was constructed, on the waste dump at the mine portal, to centralize the service departments. It will house the machine-shop, the blacksmith-shop, and the electrical shop.

Gold-Silver-Copper-Lead-Zinc.

Big Bull. The Consolidated Mining and Smelting Company of Canada, Limited. J. C. MacLean, manager. The Big Bull mine is on the north side of the Taku River, about 5 miles east of Polaris-Taku. During 1949 a programme of intensive development was carried out. Installation of two diesel engines, a compressor, and a generator was completed, and a steel-shop, hoist-house, and headframe were built. A three-compartment vertical shaft was sunk to a depth of 367 feet. Stations were cut at 185 feet and at 350 feet, and crosscuts were directed toward the ore zone. At the year-end, drifting in the ore zone on the first level was in progress and the crosscut on the second level was approaching the ore zone. Total development footage for the year was: Sinking, 367 feet; slashing, 59 feet; crosscutting, 517½ feet; and drifting, 133 feet. The average number of men employed was forty.

Tulsequah Chief. The Consolidated Mining and Smelting Company of Canada, Limited. F. Burnet, manager. The Tulsequah Chief mine is on the east side of the Tulsequah River, 4 miles north of Polaris-Taku. It is 8 miles by road and trail from the Big Bull property. In 1949 a pile trestle bridge was constructed across the Tulsequah River to improve transportation to the airport.

From the 5900 adit level (elevation, 900 feet) 532 feet of drifting and crosscutting and 131 feet of raising were done. A programme of underground diamond drilling below the 5900 level totalled 17,391 feet, and indicated some new ore.

The average number of men employed was thirty. In November the operation was suspended for the winter months.

PORTLAND CANAL.*

Unuk River (56° 130° S.E.).

Gold.

Halport Mines, Limited. Company office, 844 Hastings Street West, Vancouver. K. J. Springer, president; Desmond F. Kidd, manager. Capital: 3,000,000 shares, $1 par value. The property is opposite Cabin Creek, on the south fork of the Unuk River, and is reached by trail from Burroughs Bay, Alaska. The trail is reported to be in poor condition, owing to the large number of windfalls. The ropes on the three cable crossings were renewed by the company. Supplies were flown in from Stewart and dropped at the property.

Work done by Halport Mines in 1949 is reported to have consisted of 2,080 feet of drilling done on the Q 25 vein. The purpose was to prove the underground lateral extension of this vein. Core intersections showed spotty gold values. Four men were employed for the summer season.

Tide Lake (56° 130° S.E.).

Gold-Silver.

East Group. The East group is owned by A. Phillips, of Hyder, Alaska, and is about 1 mile north of Tide Lake. Small shipments of very high-grade ore were back-packed and flown out from this property during the summer of 1949. About 4 tons of ore was shipped to Trail, and an additional 1,780 pounds containing 91 ounces of gold and 154 ounces of silver, which are included in the totals below, was shipped to the smelter at Tacoma, Wash.

* By F. J. Hemsworth.

Production: Ore shipped, 5 tons. Gross contents: Gold, 96 oz.; silver, 923 oz.; lead, 1,706 lb.; zinc, 897 lb.

SUMMIT LAKE (56° 130° S.E.).

Gold.

Morris Summit Gold Mines, Limited.—Because of the difficulties of financing, this company was unable to proceed with its programme of road construction and mine development during 1949.

In September E. E. Harris, the manager, flew in to the property from Stewart with a crew of five men. The camp was winterized and a small amount of road work was done.

SALMON RIVER (56° 130° S.E.).

Gold-Silver-Lead-Zinc.

Silbak Premier Mines, Limited. Company office, 911 Birks Building, Vancouver; mine office, Premier. D. L. Pitt, managing director; J. C. McCutcheon, manager; S. F. MacDonald, mill superintendent; A. Kirby, Jr., mine superintendent. The Premier mine is in the Salmon River valley, about 15 miles from the town of Stewart, and is reached by a good motor-road. The mine was reopened in the late summer of 1949, after having been closed since July, 1948. The shut-down was due to a disagreement between the management and the mine union.

The winter of 1948–49 was particularly severe, and although several watchmen were left at the camp to remove the snow, considerable damage was done to the structures about the camp. In the buildings some of the rafters and beams were broken, but most of the damage was to snowsheds covering walkways between various parts of the plant. Some of these snowsheds were completely rebuilt, while others had only to be straightened up and braced. Some damage was done to power-lines and pipe-lines. It was necessary to rebuild completely the flume carrying water to the penstock of the No. 2 pelton. Very little rehabilitation work was required underground. The ground stands well, and it was not necessary to replace any of the timber.

The mine was operated sixty-four days in 1949. A total of 35,350 pounds of powder, 6,290 caps, 171 electric detonators, and 90,558 feet of fuse were used.

The development work underground was confined to investigating the known ore-bodies and intersections of ore previously obtained by diamond drilling. Although 885 feet of diamond drilling was done during the year, no new ore was found. Other development footage totalled: Drifting, 234½ feet; crosscutting, 101½ feet; raising, 373½ feet.

The mill was started on November 7th, 1949, and up until the end of the year 10,348 wet tons was delivered to the mill which turned out a lead and zinc concentrate. The concentrates were not shipped to the smelter at Tacoma, Wash., until 1950, so no metal recovery for 1949 is reported.

The tramway, which had previously been used to haul concentrates from the mine to the dock at Stewart, has been abandoned, and the concentrates are now carried to the dock by trucks. The trucks can be fitted with oil tanks to transport oil back to the diesel plant at the mine.

Silver-Lead.

Silver Tip. Company office, 211 Pemberton Building, Victoria; mine address, Stewart. George Winkler, managing director. Capital: 3,000,000 shares, 50 cents par value. This group is on the headwaters of Silver Creek, in the upper Salmon Valley. During the summer of 1949 three men were employed under the direction of W. R. Tooth. A short distance above the lower tunnel, an open-cut was made on a new showing. Sacked ore from this cut was packed on horses to the road at the Big Missouri camp, trucked to Stewart, and shipped to the smelter.

Gold-Silver-Lead.

Unicorn Mines, Limited. Company office, 475 Howe Street, Vancouver. John Hovland, managing director. Capital: 1,000,000 shares, $1 par value. The company's claims lie east of the most northerly claims of the Big Missouri group. During 1949 the No. 3 tunnel was advanced 20 feet by hand-mining. The total length from the portal is now 570 feet. It is estimated that a further advance of 80 feet is required to cut the "A" vein, at a depth of 150 feet.

On the surface two open-cuts were made on a vein a short distance west of the No. 3 portal.

ALICE ARM.*

Silver-Lead.

Torbrit Silver Mines, Limited. (55° 129° N.W.) Registered office, 309 Royal Bank Building, Vancouver; executive office, 350 Bay Street, Toronto; mine office, Alice Arm. G. B. Tribble, manager; A. M. Cormie, mine superintendent; R. W. Burton, mill superintendent. Capital: 3,000,000 shares, $1 par value. The Torbrit mine camp and mill are on the west side of the Kitsault River, 17 miles by road from Alice Arm. The 1,000-foot or main haulage level of the mine is on the opposite side of the river, half a mile north of the mill. The mine and the mill are connected by a narrow-gauge railway. Five miles farther up the valley, the company operates a hydro-electric power plant of 1,600 horsepower capacity. A tractor-trail connects Clearwater River, the site of the power plant, with the camp.

The mill commenced operations on February 4th, 1949, and by the end of the year 99,570 tons of ore had been treated. This is equivalent to 301 tons per working day.

For the first four months of operation all the ore was treated by cyanidation. During this period it was found that recovery in the plant did not equal that of the original test work. Silver minerals not amenable to cyanidation were found in the ore, and it was apparent that some other method of treatment was required. After trying several combinations of cyanidation and flotation, it has been found that the best recovery can be obtained by grinding the ore in a water circuit, floating off the bulk of the silver minerals, and passing the flotation tailings to cyanidation. Experimental work is still under way to further improve recovery.

In the mine, development work was largely confined to preparing known blocks of ore for mining. A small amount of exploratory drifting was also done.

Diamond drilling for the year totalled 6,194 feet. Of this footage, 4,582 feet was drilled from the 1000 level, 406 feet from the 1150 level, and 1,206 feet from the 1300 level.

Two systems of stoping are practised, depending on the size and plunge of the particular ore section. In flat-lying sections, open stoping, using scrapers to pass the broken material to draw points, is used. In steeper sections, shrinkage stoping is employed. On the 1000 level the broken ore is loaded by mucking-machines at the draw points and on the 1150 level is scraped from draw points to an ore-pass which feeds out on the 1000 level.

* By F. J. Hemsworth, except as noted.

The following is a summary of the work done during 1949:—

Level.	Advance.	Ore.	Waste.
Drifting.	Feet.	Tons.	Tons.
1000	2,033.0	14,396	4,888
1150	337.5	1,685	....
1300	388.0	1,214	946
Total drifting	2,758.5	17,295	5,834
Raising.			
1000	894.5	2,172	1,232
1150	394.5	1,331	222
1300	....	....	....
Total raising	1,289.0	3,503	1,454
Stope Raising.			
1000	1,395.0	5,077	473
1150	479.0	2,391	....
1300	275.0	1,280	42
Total stope raising	2,149.0	8,748	515
Stoping.			
1000	....	62,720	....
1150	....	64,859	....
1300	....	7,317	....
Total stoping	....	134,896*	....
Total ore broken	....	164,442	7,803

* Tons broken.

New construction included an addition to the mill building to house a fourteen-cell flotation circuit, a six-suite apartment building, three duplex residences, and a small recreation building, which is operated by the Canadian Legion. Further work was also done on the snowsheds, pipe-lines, and buildings at the mill-site, and on the penstock and dams at Clearwater power-site.

Production: Ore milled, 99,570 tons. Gross contents: Silver, 1,444,925 oz.; lead, 280,646 lb.; zinc, 30,719 lb.

Zinc.

McGrath Mountain, Standard, etc.*

(55° 129° N.E. and S.E.) Four Crown-granted claims, the Standard and Standard Nos. 1 to 3, on the south and east slopes of McGrath Mountain, are owned by M. Donald, N. Olsen, W. M. McLean, and N. McLeod, all of Alice Arm. In 1948 Mr. Donald located two claims south of the Standard claims to include some of the ground previously part of the Highland and Billy Mac claims. He also located in 1948 four claims northwest of the Standard claims to include some of the ground previously part of the Sunrise claims.

The ground covered includes numerous occurrences of zinc, found before and during the First World War. Several claims had been located by 1916; between then and 1928 these occurrences were explored by open-cuts and short adits. During the period from 1929 to 1930 the downward extensions of some mineralized zones exposed in Sunrise Creek were sought by driving the Sunrise adit about 500 feet below the outcrops. The adit was driven about 1,100 feet westerly, but the mineralized zones were not found and work was stopped. Between 1930 and 1948 all claims except the four Crown-granted claims, were cancelled and very little prospecting was done.

* By J. M. Black.

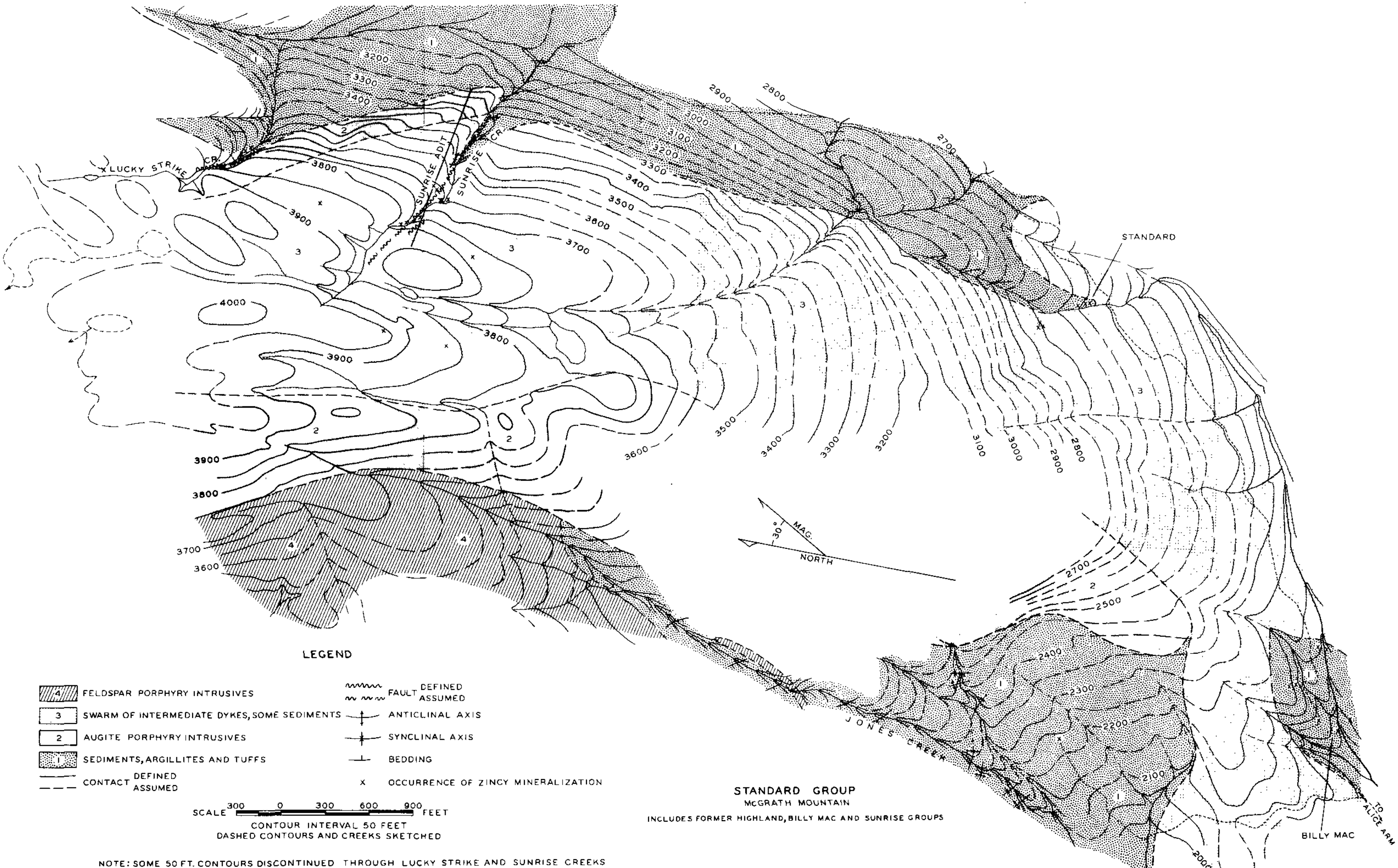
STANDARD GROUP
McGRATH MOUNTAIN
INCLUDES FORMER HIGHLAND, BILLY MAC AND SUNRISE GROUPS
LEGEND
4 FELDSPAR PORPHYRY INTRUSIVES
3 SWARM OF INTERMEDIATE DYKES, SOME SEDIMENTS
2 AUGITE PORPHYRY INTRUSIVES
1 SEDIMENTS, ARGILLITES AND TUFFS
CONTACT DEFINED ASSUMED
FAULT DEFINED ASSUMED
ANTICLINAL AXIS
SYNCLINAL AXIS
BEDDING
x OCCURRENCE OF ZINCY MINERALIZATION
SCALE 300 0 300 600 900 FEET
CONTOUR INTERVAL 50 FEET
DASHED CONTOURS AND CREEKS SKETCHED
NOTE: SOME 50 FT. CONTOURS DISCONTINUED THROUGH LUCKY STRIKE AND SUNRISE CREEKS
LUCKY STRIKE CR.
SUNRISE ADIT
SUNRISE CR.
STANDARD
JONES CREEK
BILLY MAC
TO ALICE ARM
MAG. NORTH
30°
4000
3900
3800
3700
3600
3500
3400
3300
3200
3100
3000
2900
2800
2700
2500
2400
2300
2200
2100
2000

FIG. I.

McGrath Mountain, elevation about 4,000 feet, is a ridge with fairly steep sides and a gently rolling top. The ridge is heavily timbered nearly to the top, which is at timberline; undergrowth is fairly thick.

Alice Arm, the community at the head of Alice Arm, is served by weekly steamer from Vancouver. McGrath Mountain, about 4 miles northeast of Alice Arm, is reached by a trail, with a cable crossing over Kitsault River. The trail follows a fairly gentle grade to the zinc occurrences on the steep south and east slopes near the top of the mountain.

About six weeks in June and July, 1949, were spent examining and mapping the mineralized area by plane-table survey and some pace and compass traverses. At the end of July some of the creek beds and some old trenches were still filled with snow. The accompanying map (Fig. 1) shows the main features of the geology and the topography. Probably most of the showings found during the period of active prospecting were examined, but occurrences on Jones Creek, accessible at one time by means of a ladder, were not seen, and possibly a few other occurrences were not found. The walls of many of the open-cuts have caved, and in these the mineralization is not well exposed. The long Sunrise adit is open. In the early part of the 1949 season M. Donald was cleaning out an open-cut on the southwest slope of the mountain.

Rock exposures are scarce on the uniform slopes and the top of the mountain, but are plentiful in the canyons cut into the slopes by the creeks. A series of dark-coloured sedimentary rocks is cut by a swarm of nearly parallel dykes and other intrusive bodies which, as shown on Figure 1, form the high ground. The sediments, being less resistant to erosion, underlie the steep slopes and basins.

Most of the sedimentary rocks are on the eastern and western slopes of the mountain. Some of these rocks, at the top of the mountain and not shown on Figure 1, probably are long, narrow remnants between dykes, similar to partitions of sedimentary rocks that separate some of the dykes in Sunrise adit. The sediments are less resistant to erosion than are the intrusive rocks, consequently the draws on the rolling top of the mountain are believed to be underlain by sediments.

The sedimentary series comprises argillites and sandy tuffs, with argillites predominating. The argillites are thin to thick bedded, most of them are dark grey to black and some are graphitic. The tuffs, which are dark-coloured also, are common only in outcrops on the western slope. The sediments generally are much altered, and carbonate replaces the original minerals.

The sediments are folded into open folds with gentle plunges and near dykes into crumpled and broken folds. The axes of some of the open folds are indicated on Figure 1. Between dykes the sediments tend to be parallel to the walls of the dykes.

The sediments are shattered at their contacts with some of the many dykes that intrude them, and in places fragments formed by shattering are surrounded by dyke rock. Many of the fragments have been partly resorbed in the dykes, but in a few places the fragments are abundant and unaltered and the rock is a breccia.

Most of the area is underlain by a northerly trending intrusive complex. In the northern part of the area the complex is composed of four members, all of which continue beyond the northern boundary of the area mapped. One member (unit No. 3), referred to as a swarm of dykes, also continues southerly beyond the southern boundary of the area mapped. Another member (unit No. 4), represented by exposures of feldspar porphyry, may also be formed by dykes cutting older rocks; it extends westerly beyond the northern part of the western boundary. These members from east to west are:—

(*a*) Augite porphyry (mapped as unit No. 2), a dyke-like mass, about 200 feet wide and 2,000 feet long within the area.

(*b*) Swarm of dykes (mapped as unit No. 3) more than 1,000 feet wide and extending the length of the area mapped.

(*c*) Augite porphyry (same rock type as (*a*) and mapped as unit No. 2). This member is as much as 1,400 feet wide and appears to be about 7,000 feet long within the area. The southern margin is not completely mapped because of the scarcity of outcrops, but this augite porphyry body appears to terminate abruptly southward. An area, unmapped because the lack of trails leading to it indicated that any mineral occurrences within it had little work done on them, is probably underlain chiefly by augite porphyry.

(*d*) Feldspar and hornblende porphyry (unit No. 4), may include older rocks.

The augite porphyry (unit No. 2) is a dark grey-green rock, of medium to coarse grain, and typically has phenocrysts of very dark-green augite. The rock looks unaltered in hand specimens, but under the microscope it can be seen that all but the augite has been intensely altered to carbonate, sericite, and chlorite. It is the most resistant rock in this area and forms bluffs near its contacts with the sediments. The only place where the contact of the augite porphyry is well exposed is underground in the Sunrise adit. There the western contact of the eastern augite porphyry body has a very steep dip and the body appears to be a steeply dipping dyke.

The contacts of the members of the dyke swarm (unit No. 3) are not well exposed on the surface. Underground it can be seen that a group of nearly parallel, steeply dipping irregular dykes are separated by thin partitions of sediments. In the canyon of Sunrise Creek one of these dykes widens abruptly upward and others have small irregularities. Some of these dykes are as much as 100 feet wide and some possibly are wider, but the exposures are so scarce that these dykes were not mapped separately.

Most of these dykes are rich in feldspar, some contain hornblende phenocrysts, and a few narrow ones contain augite phenocrysts. Because the feldspar is generally altered and most of the hornblende is altered also, the original composition is unknown, but most of these dykes were probably feldspar and hornblende porphyries. Pyrite is common and in a few places is plentiful. The intense alteration has resulted in the formation of much carbonate, sericite, and chlorite.

That part of the northwestern intrusive member (unit No. 4) mapped is rich in feldspar and contains hornblende, but the composition is not uniform, and it is possible that this member is a group of dykes or dyke-like masses similar to those of the central swarm and, like them, separated by blocks of sediments. These intrusive rocks, like the others in this area, are intensely altered.

In a few places augite porphyry is cut by fine-grained feldspar porphyry dykes, so probably the larger augite porphyry masses are older than the feldspar porphyry dykes.

The sediments are cut by many dykes which are particularly abundant in the southern part of the area. Most of the dykes are of feldspar porphyry, and some of them may be the continuations of dykes in the central swarm.

The Sunrise adit exposes numerous faults that strike northerly parallel to the trend of the dykes. Some of these faults are in the dykes, but most are in the sediments or at contacts of the two.

Sunrise Creek is believed to follow the trace of a fault indicated by the presence of sheared and crushed argillites, and the fact that some narrow dykes are offset in Sunrise Creek canyon and by the marked offsetting of the eastern boundary of the sediments at the creek. The water in the creek and some overburden prevent close examination, but the evidence available indicates the presence of a fault that is referred to in the remainder of this report as the Sunrise Creek fault. It is of probable economic interest because of exposures of massive mineralization near it.

Underground, near the face of the Sunrise adit, a steeply dipping shear zone as much as 6 feet wide, consisting of sheared argillite, gangue minerals, and gouge, cuts across intrusive rocks. This shear zone is approximately parallel to the Sunrise Creek fault.

Near the head of Lucky Strike Creek, the eastern contact of the augite porphyry dyke with the argillites is faulted.

The mineral occurrences, with the exception of the Standard showings and those on Sunrise Creek, are much alike. The following notes apply generally to the various mineral occurrences, except the Standard and Sunrise Creek showings, which are described separately.

The sediments and some of the dykes are cut by fractures, most of which strike northerly. Many of the fractures are filled with quartz and carbonate forming veins. Most of these veins are only about an inch wide and comparatively few of them are more than a foot wide. The attitude and width of these veins change along the strike. Groups of these veins are closely spaced in the sediments, and unveined sediments separate one group of veins from another. Each group may be referred to as a zone. In some zones, several veins appear to have coalesced to form a lens as much as 2 feet wide, but the lenses exposed are not more than 10 feet long.

Some of these veins contain no metallic minerals, but, in many, sphalerite is irregularly distributed. Generally, sphalerite is the only metallic mineral, and in some short sections of veins it is more abundant than the gangue minerals, but generally it forms less than one-fifth of a vein. Some zones about 5 feet wide are intensely veined, but of this width only about one-third is vein material, and the amount of sphalerite in these zones is estimated as less than 10 per cent. and the zinc content as less than 5 per cent.

Some of these veins also contain minor amounts of pyrite and galena. The results of sampling this predominantly sphalerite mineralization, when these occurrences were being explored, indicate that the veins contain little gold and silver.

Most of the veins are in the sediments near the intrusive complex. Near the head of Sunrise Creek a few cuts, at which some zinc float is seen, are near exposures of intrusive rock, but the wallrocks are not exposed, and it is likely that some of the veins from which this float came also are in sediments.

Mineralized bodies wider than the numerous veins are partly exposed at the Standard showings and at Sunrise Creek.

Standard.—The Standard showings consist of three outcrops that protrude slightly above the overburden near the 2,600- and 2,700-foot contours in the southeastern part of the area mapped. These outcrops have been partly stripped and were trenched in 1925 when The Granby Consolidated Mining, Smelting and Power Company, Limited, had this part of the property under option. The most westerly of these three exposures outcrops almost continuously for about 50 feet, measured along the contour, and the exposure, steepened by trenching along its foot, measures several feet on the slope. The other two exposures are roughly circular and 10 to 15 feet across. These appear to have been trenched on the downhill side and blasted so that some big blocks broke off and are strewn around.

These three showings look much alike and consist of quartz and rusty carbonate and pockets and irregular veinlets of sphalerite, fragments of argillite, and a small proportion of galena. These exposures were not sampled, but they include only a small proportion of argillaceous fragments, and sphalerite probably makes up 10 to 20 per cent. of each exposure. The grade of zinc in these exposures is estimated to be between 5 and 10 per cent.

The walls of these mineralized masses are not exposed, so their form and attitude are not known. From northwest to southeast the three alined outcrops are separated by distances of 300 and 100 feet. From the lack of exposures between them it is doubtful that similarly mineralized material is continuous between the outcrops. The presence of the argillaceous fragments suggests that these exposures are parts of bodies that are in or are close to argillites.

Sunrise.—Mineralization several feet wide is exposed at three points in the upper part of Sunrise Creek canyon. One of these exposures is in the Sunrise Creek fault, which is about 15 feet wide here, though only 3 to 5 feet of this width is mineralized. The other showings are in the banks of the creek close to the trace of the fault. None of these showings is well exposed now; the walls cannot be seen and the attitude and form are not apparent. The quartz and sphalerite tend to be in irregular vein-like masses, which strike northerly and northwesterly and dip steeply. These partly exposed bodies may be gash veins related to the fault and mineralized when the fault was mineralized.

These exposures at Sunrise Creek were sampled in 1927 and 1929 when they were being explored. Some of them were described as being 20 feet wide, and one sample of a width of 10 feet assayed: Zinc, 8.8 per cent. (*Minister of Mines, B.C.*, Ann. Rept., 1927, p. 72), and samples of 3 feet and 2 feet widths assayed respectively: Zinc, 26 per cent. and 28 per cent. (*Minister of Mines, B.C.*, Ann. Rept., 1929, p. 90). These indicate the range of values over selected widths.

The Sunrise adit, which was driven to explore the ground under this mineralization, exposes little sphalerite. About 800 feet from the portal one lenticular quartz vein a few inches wide with only a small amount of sphalerite is exposed. The fault zone, cut near the face, is approximately parallel to the Sunrise Creek fault, but the trace of this fault, projected to the surface, would be south of the Sunrise Creek fault. However, no other nearly parallel fault which could be the extension of Sunrise Creek fault was seen in the adit. It seems likely that the fault near the face is the Sunrise Creek fault or a major branch of it and that some roll or displacement by another fault has caused the apparent offset. Some gangue but no sphalerite is exposed in a drift that follows the fault for about 100 feet. Where the fault is mineralized at the surface, the wallrock is argillite, but in the drift the walls are of intrusive rock.

Most of the veins are only a few inches wide, and the groups of veins or zones several feet wide are estimated to contain less than 5 per cent. zinc. The only exposures of mineralized bodies wider than the veins are the Standard showings and those near Sunrise Creek; all these are in or near argillites close to the swarm of dykes. The mineralized bodies near Sunrise Creek are associated with a northwesterly striking fault, and the alinement of the partly exposed Standard bodies in a northwesterly direction suggests that these also are related to a fault, possibly parallel to the Sunrise Creek fault. The relationship of the exposed mineralization to the inferred fault is not known.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1918, pp. 68, 69; 1925, pp. 73, 74; 1927, pp. 66, 71–73; 1929, pp. 89–91. *Geol. Surv., Canada*, Mem. 175, pp. 17, 23, 28, 41, 42, 55, 66, 68, 80, and 81.]

IRON MOUNTAIN (54° 128° S.W.).*

Iron.

Mineral Hill. Three reverted Crown-granted mineral claims—the Mineral Hill Nos. 1 to 3 located in 1919 and Crown-granted in 1925—are on the southwest slope of Iron Mountain in Kitimat Valley, about 13 miles from the head of Kitimat Arm.

* By J. M. Black.

The three claims are shown on Departmental Reference Map 19A, which shows also Moore Creek, near which are the occurrences found by the writer in 1949, and Canyon Creek, a tributary of Wedeene River, into which Moore Creek flows. Outcrops are scarce, except at a few small bluffs near the base of the main slope of Iron Mountain and in a canyon cut by Moore Creek. Most of the outcrops are covered with moss. The lower showings, at about 325 feet altitude, are 300 to 400 feet west of the lower end of the canyon of Moore Creek. An adit at about 300 feet altitude, driven to explore the ground under these occurrences, is about 200 feet north of a cabin on a small knoll. The upper showings and another adit, at about 1,200 feet altitude, are in the east wall of the Moore Creek canyon about half a mile north of the lower adit.

The present means of access is by a foot-trail cut during 1949 from the head of Kitimat Arm, up Kitimat Valley west of the river for about 12 miles to Little Wedeene River. About 3 additional miles must be traversed and the Wedeene River crossed to reach Iron Mountain from the end of the trail. Fording Wedeene River is practical only during low water.

Occurrences of iron were found on the southwestern slope of Iron Mountain early in the century, when the valley between Terrace and Kitimat was being considered for part of the route for the Grand Trunk Pacific Railway, which would have had its western terminus at Kitimat. A location line surveyed in 1908 for the railroad passed within a mile of the showings, which had been explored by open-cuts and several adits. Interest in the area dwindled after the route terminating at Prince Rupert was selected. However, between 1919 and 1929 additional work was done on the showings, probably mostly on the surface.

Two days at the end of August were spent finding and examining the occurrences. The timber sets, at the portals of the two adits found, have collapsed; the portals are partly blocked, and the adits were not entered. The small size of dumps suggests that these workings are not extensive and probably have not been extended much since 1908. Any trenches have been overgrown, so only natural exposures could be examined.

The rock in which the bodies of magnetite are found is medium grained, generally dark green, and, under the microscope, is seen to consist of hornblende, epidote, diopside, and small amounts of quartz, magnetite, biotite, zoisite, and remnants of feldspar crystals that have been largely replaced by the other minerals. The texture suggests that the rock originally was an intrusive. The rock is not uniform, but no contacts and no sediments were recognized. This rock grades into masses of skarn composed of abundant magnetite and reddish-brown garnet, hornblende, diopside, actinolite, quartz, epidote, and pyrite.

At the upper occurrence found, an adit has been driven on a lenticular body, about 5 feet wide, composed of magnetite and minor amounts of pyrite. The strike is northeasterly and the dip 55 degrees northwestward. Other narrower lenticular bodies of magnetite, with skarn between them, are exposed for several feet along their strike. The skarn contains vugs lined with tiny crystals of epidote and magnetite, and some magnetite is also found in veinlets that cut granite. Across a total width of 30 feet, magnetite may constitute about 25 per cent. of the total area.

The lower occurrence consists of numerous northeasterly striking lenticular and irregular elongated masses composed largely of magnetite. Some of these masses grade into the surrounding skarn, and others have fairly sharp contacts with it. In one area, about 50 feet wide and 15 feet along the strike, more than half the exposed rock is magnetite.

Because of their condition, the old workings now yield little information, and the natural exposures do not permit a complete appraisal of the possibilities.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1908, p. 57; 1932, p. 32.]

HAZELTON (55° 127° S.W.).*

Gold-Silver-Lead-Zinc.

Silver Standard Mining Company, Limited. Company office, 475 Howe Street, Vancouver. R. W. Wilson, managing director; H. B. Gilleland, manager. Capital: 4,000,000 shares, 50 cents par value. The mine is on Glen Mountain, 6 miles by road north of Hazelton. In 1949 the mine and mill were operated continuously, except for a shut-down of three weeks in January because the water-lines froze. During the year the mine was in operation 299 days, and 6,152 man-shifts were worked underground. Explosives used amounted to 1,468 cases of powder, 27,780 caps, and 275,000 feet of fuse.

Ore was mined from seven stopes. One stope was worked on the No. 1 vein from the 1300 level, and six stopes on the No. 4 vein, three from the 1300 level, and three from the 1500 level. Ore drawn from the seven stopes totalled 21,313 tons. Of this total, 4,875 tons came from the No. 1 vein and 16,438 tons from the No. 4 vein.

The most important development work done was the crosscut east on the 1300 level, which resulted in the intersection of the No. 6 vein. Drifts north and south on the No. 6 vein have opened up a new oreshoot. Total development footages: Drifting, 785 feet; crosscutting, 582 feet; raising, 240 feet. Ore mined from development faces totalled 1,520 tons.

Diamond-drill footage was 778 feet. Seven holes were drilled. One hole was drilled from the face of 1306 crosscut to intersect the old shaft on the No. 7 vein. This drill hole was used to drain the water from the old workings between the 1300 and 1500 levels on the No. 7 vein. Other holes were drilled to intersect the No. 5 vein south of the crosscut and to intersect the No. 4 vein below the 1300 level.

No major changes were made in the mill flow-sheet. Two Denver flotation cells were added to the zinc circuit to increase the capacity for zinc recovery. A 4,000-gallon settling-tank was installed above the grinding circuit to settle the fines in the sorting-belt wash-water. The fines contain valuable minerals.

A third diesel-electric set, powered by a D 13000 Caterpillar, was installed in the mill power-house during December. A diesel engine and C.P. compressor, left on the property by former operators, are being operated to increase the output of compressed air for the mine.

During the year 23,033 tons of ore was mined. After some waste was sorted out, 17,516 tons was milled. From this quantity of ore, 993 tons of lead concentrate and 1,723 tons of zinc concentrate were produced. Mill recovery was calculated to be over 90 per cent. Lead and zinc concentrates were trucked to the Canadian National Railway at Hazelton and shipped to the Trail smelter.

Production: Ore milled, 17,516 tons; gold, 1,267 oz.; silver, 378,888 oz.; lead, 603,953 lb.; zinc, 1,739,817 lb.; cadmium, 18,209 lb.

Gold-Silver-Cobalt-Uranium.

Victoria.† Western Uranium Cobalt Mines, Limited, 789 Pender Street West, Vancouver (James McKee, president; W. F. McGowan, in charge of operations), owns this gold-cobalt-uranium property, 5 miles south of Hazelton, on the northwestern slopes of Rocher Déboulé Mountain. It is reported to consist of the following claims: Victoria (L. 3303), Belle (L. 3304), View Fraction (L. 3305), Belle Fraction (L. 3306), Mammoth (L. 3307), Red Cross (L. 3310), Monoplane

* By F. J. Hemsworth, except as noted.

† By J. S. Stevenson. The workings on this property have been variously described under the name Hazelton View, the name of a Crown grant and of a group of claims adjoining the Victoria group on the south; the New Hazelton Gold-Cobalt Mines, Limited; and Aurimont Gold Mines, Limited—companies which at one time or another owned both the Victoria and Hazelton View groups of claims; however, as the present property does not include the Hazelton View claim or group, it is described as the Victoria.

(L. 3313), and Bowl Fraction (L. 3315). Some of the claims had reverted and are under lease from the Government, and applications for Crown grants of these claims have been made; others are Crown grants held under option with agreement to purchase from R. C. McCorkell. The claims are shown in Figure 2.

The camp cabins (Fig. 2), built in 1916 near timberline at elevation 4,115 feet,* are reached by 4½ miles of pack-horse trail from Denis Comeau's farm, elevation 1,175 feet, 1.2 miles south of a point on the Hazelton–Terrace Highway that is 5.2 miles south of the post-office at South Hazelton. The workings (Figs. 2 and 3) are on a steep, rocky mountainside, above timberline, between elevations of 5,265 and 6,150 feet. A pack-horse trail leads from the cabin to the lowest adit, No. 2, elevation 5,265 feet, near the portal of which a tent was used during the summer months of 1949. A steep foot-path leads from this adit to the upper adits, No. 1 at elevation 5,510 feet and No. 00 at elevation 5,890 feet. A two-bucket aerial tramway was built in 1918 from No. 1 adit to near the portal of No. 2 adit. In 1928 it was lengthened to a total length of 1,900 feet. From the lower end of the tramway, elevation 4,400 feet, ore, hand-sorted at No. 1 adit, was packed 6 miles on horses to the abandoned station of Carnaby on the Canadian National Railway. Since 1928 the aerial tramway has fallen into disrepair, but the pack-trail has been cleaned out from time to time—most recently in the summer of 1949.

The writer visited this property in 1940, on July 8th and 9th, to determine the amount of cobalt ore present. A second visit was made in 1949, from July 28th to August 2nd, inclusive, to determine the amount of uranium ore present. On this visit all the surface showings and No. 00 and No. 1 adits (Fig. 2) were examined with a Geiger counter and samples of vein matter were taken for assay. Samples taken by the writer in vein sections of high Geiger count contained from 0.25 to 0.42 per cent. U_3O_8,† and carefully selected specimens contained up to several per cent. U_3O_8. Few samples taken in vein sections of medium count were higher than 0.25 per cent. U_3O_8, and most of the samples taken in sections of low count were less than 0.01 per cent. U_3O_8.

Adits Nos. 0 and 2 were inaccessible because of caving at the times of both visits.

The early work on this property was directed toward the development of four similarly mineralized veins. Some gold-cobalt-molybdenum ore was mined from the principal or No. 1 vein, and between 1918 and 1941, 64 tons of hand-sorted ore (*see* table, p. 85) was shipped. In 1948 it was recognized that the ore in these veins contained uranium, and further development of the showings was begun, having in mind the value of the uranium content of the ore. This recent work has consisted chiefly of cleaning out the old adits, a small amount of open-cutting, and prospecting the surface showings of all veins. Since August, 1949, No. 00 adit has been extended 28 feet and a new crosscut adit (not shown in Fig. 2), started about 90 feet below No. 2 adit, had been driven 85 feet by December 25th, 1949.

The amount and nature of ore shipped from the property for individual years is given in the following table, taken from the report by Black (1948, p. 81). As uranium had not been recognized when these shipments were made, no record of the amount in them is available.

* The elevations of the cabins and of Nos. 1 and 2 adits were carried by aneroid from South Hazelton station, elevation 985 feet.

† Radioactivity of each sample, measured in the laboratory, is reported as "equivalent per cent. U_3O_8" and may be due either to uranium or thorium. However, spectrochemical analyses of representative samples from the Victoria indicate that on this property the radioactive element is uranium.

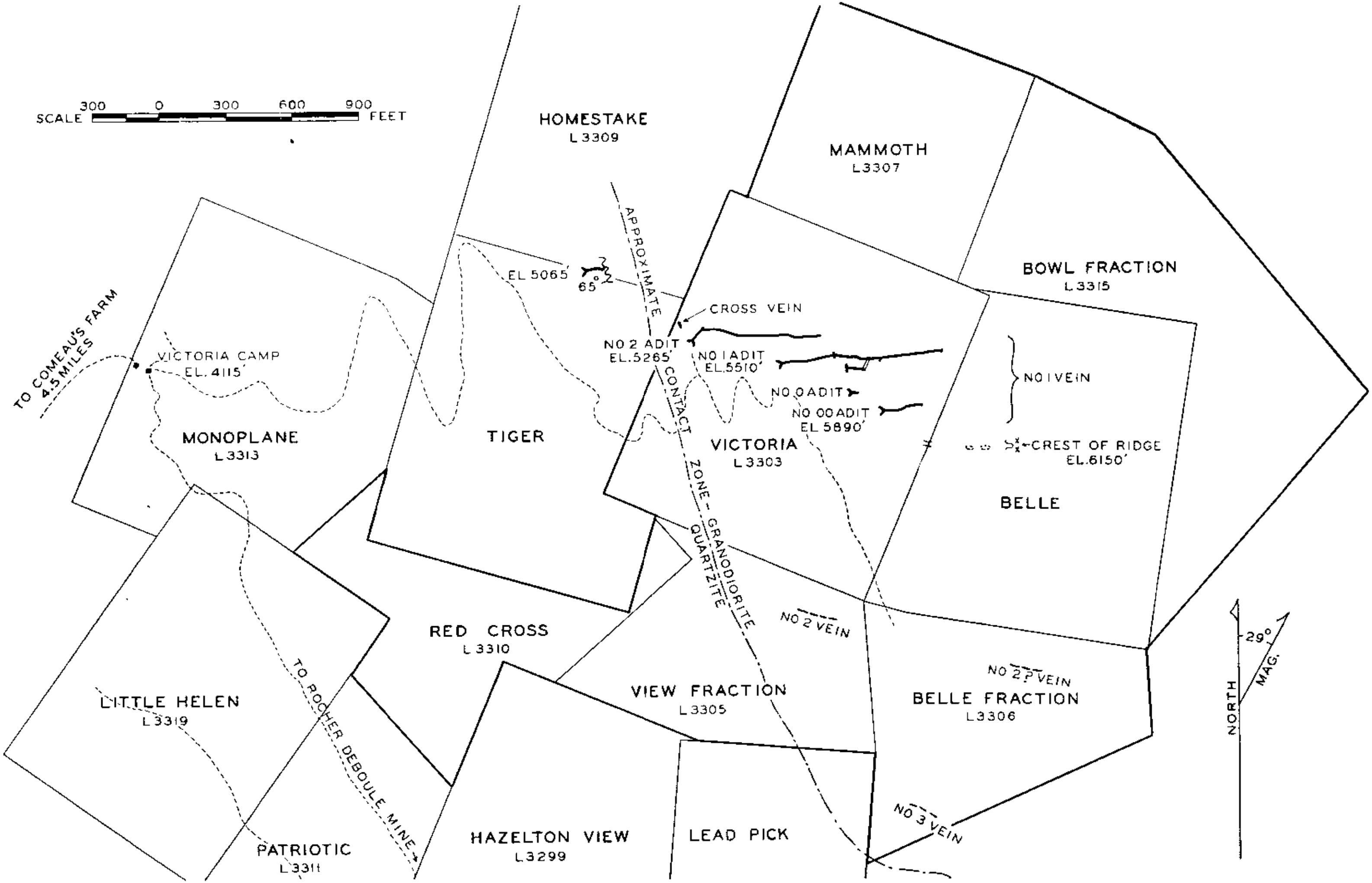

Fig. 2. Victoria (Western Uranium Cobalt Mines, Limited)—plan of property adapted from company's plans.

Year.	Tons.	Gold.	Silver.	Arsenic.	Molybdenum.	Cobalt.	Zinc.
		Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1918	26.6	1.24	*	8.98	0.96	1.18	*
1926	22.0	4.65	*	42.3	*	4.6	*
1940	7.7	2.18	0.2	6.6	*	2.6	*Nil*
1941	7.3	2.02	0.2	6.1	*	1.4	0.6

* Not available.

Four veins have been found on the property (Fig. 2). Three of them—Nos. 1, 2, and 3—approximately parallel to each other, strike easterly and dip 40 to 60 degrees northward, and a fourth—the Cross vein—strikes northwesterly and dips north 50 degrees eastward. Nos. 1, 2, and 3 veins are principally in granodiorite. The Cross vein is in a northwesterly trending contact zone about 100 feet wide, between granodiorite on the northeast and hornfelsed sediments on the southwest.

The sediments strike easterly and dip northward. They are predominantly brown quartz-biotite hornfels but include limy beds up to 6 inches thick that consist of flesh-coloured lime garnet and light-green diopside. The granitic rock exposed in the contact zone westerly from No. 2 adit consists of quartz diorite rather than granodiorite and is in irregular bodies a few feet wide. Lack of outcrops between No. 1 and No. 2 adits prevents determining the contact relations between the granodiorite and the quartz diorite.

The granodiorite and quartz diorite belong to the Rocher Déboulé batholith, which is mainly northeasterly of the property. This batholith belongs to the Coast intrusions of Early Cretaceous age and is definitely younger than the hornfelsed sediments, which belong to the Hazelton group of Late Jurassic to Early Cretaceous age.

As all the underground work and much of the surface work have been done on the most northerly or No. 1 vein, the structure and vein matter of this vein will be described in detail.

Structurally, No. 1 vein, strike north 80 degrees east and dip 60 degrees northward, is principally a single hornblende-filled fracture that ranges in width from a few inches to 2 feet and is usually less than a foot wide. Toward the face of No. 1 adit the vein becomes a sheeted zone up to 4 feet wide that consists of several parallel stringers of hornblende a few inches wide separated by altered wallrock. In No. 4 open-cut the vein, 3 feet wide, is banded and consists of successive bands of vein matter, each band several inches wide. Branch veins from a fraction of an inch to 8 inches wide extend for a few feet from No. 1 vein.

No. 1 vein tends to follow a fine-grained dark-green andesite dyke, 18 inches to 2 feet wide. Although the vein is usually along the footwall of the dyke, in some places it is entirely within the dyke, and in other places, for long distances, it is as much as 5 feet into the footwall of the dyke.

The vein matter consists of moderate amounts of cobalt-nickel sulpharsenides, molybdenite, and uraninite in a gangue that is predominantly hornblende. However, the gangue also includes a moderate amount of pegmatitic material in streaks and lenses from an inch to 2 feet wide and from several inches to 10 feet long. The pegmatitic vein matter consists principally of pink orthoclase, white plagioclase, and quartz. Both the pegmatitic and the surrounding hornblende vein matter contain small amounts of other minerals that include cream-coloured apatite crystals up to an inch long, smaller grains of cream-coloured titanite, dark-brown allanite, and, immediately surrounding some of the feldspar grains, cream-coloured scapolite.

The cobalt-nickel sulpharsenides occur as small clusters of fine grains varyingly disseminated in both the hornblende and the pegmatitic vein matter, and as streaks of solid sulpharsenides from an inch to several inches wide and from a foot to several tens of feet long. These streaks constitute the gold-cobalt oreshoots from some of which shipments of hand-sorted ore were made several years ago. In hand specimens the individual grains and larger solid masses of cobalt-nickel sulpharsenides appear to consist of only one, uniformly tin-white, mineral; however, under a microscope they are seen to consist of arsenopyrite associated with complex cobalt-nickel sulpharsenide minerals. The variable cobalt-nickel ratio seen in the analyses (N.B.—Nos. 28, 33, and 34 in table on p. 87) confirms the thought that more than one sulpharsenide mineral is present. In the subsequent paragraphs in this report, the mixture of arsenopyrite and cobalt-nickel sulpharsenides will be referred to simply as sulpharsenides.

The molybdenite occurs as nodules up to 2 inches in diameter of nearly pure mineral and as films of pure mineral. It is usually found in those parts of the hornblende vein matter that contain patches of pink feldspar and related gangue minerals.

The uraninite occurs as small black crystals from microscopic to about an eighth of an inch in diameter, widely disseminated in the vein matter or in short streaks, an inch or less long. It is usually associated with films and nodules of molybdenite near lenses of pegmatitic quartz and feldspar.

Photomicrograph showing black octahedral crystals of uraninite, and blades of molybdenite, also black. Gangue consists of grey blade-like crystals of hornblende, white prisms and hexagonal crystals of apatite, and white quartz lacking crystal form. Magnification 55×.

Alteration of the wallrock of the vein is not extensive and is best developed in No. 1 adit between 410 and 460 feet from the portal. In this section the wallrock, consisting of the andesite dyke and granodiorite, has been altered to sericite-carbonate rock for about 2 feet from the vein. Although the dyke has been completely altered, the granodiorite still retains unreplaced grains of quartz. In a lens of pegmatitic vein matter between 450 and 460 feet from the portal, the feldspar has been completely altered to coarsely cleaved carbonate; the quartz has remained unaltered.

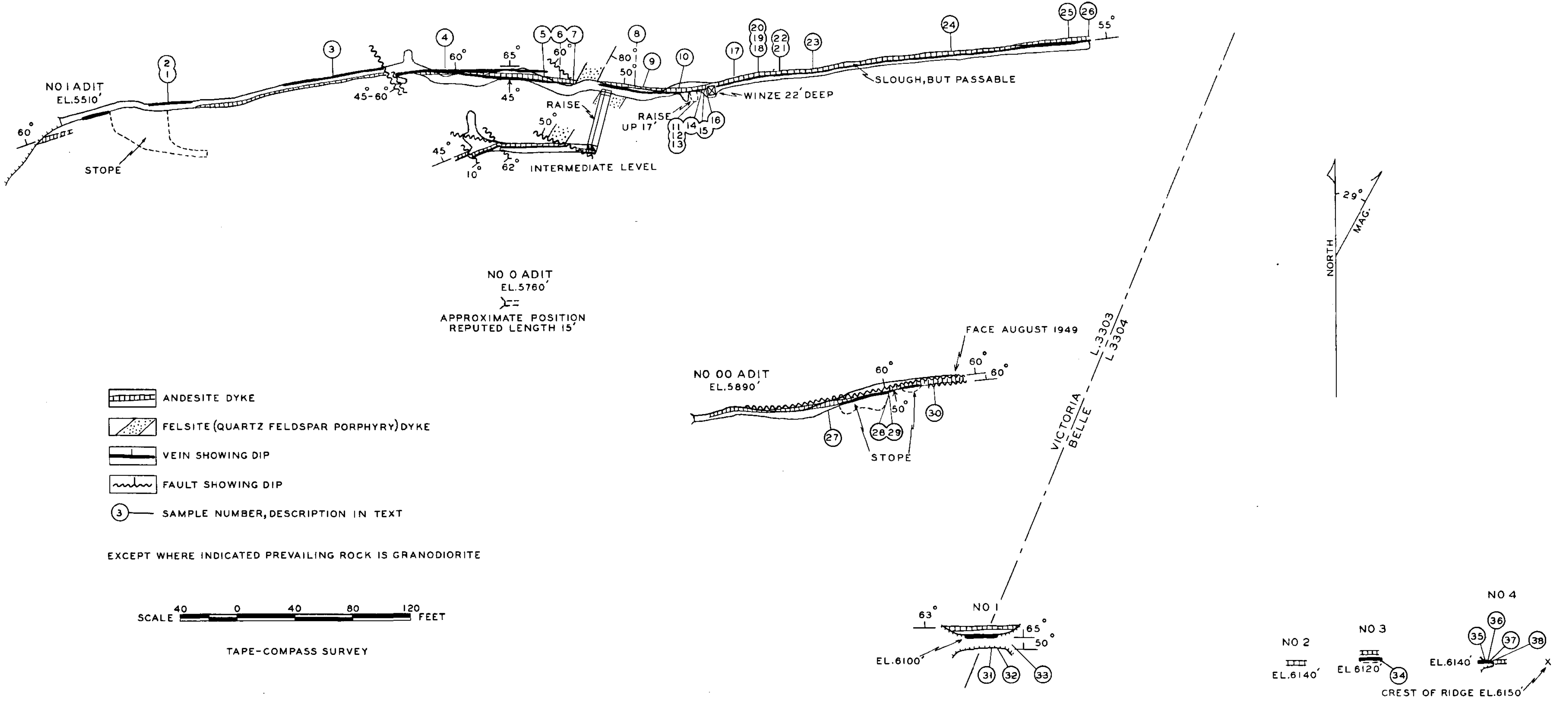

FIG. 3. VICTORIA (WESTERN URANIUM COBALT MINES LTD.) GEOLOGY AND ASSAY PLAN OF ACCESSIBLE WORKINGS ON NO. 1 VEIN

ASSAYS OF SAMPLES FROM No. 1 VEIN.*

Sample No.	Width of Vein Matter.	Description.	Gold.	Silver.	Cobalt.	Uranium-Oxide Equivalent.†
	Inches.	*No. 1 Adit.*	Oz. per Ton.	Oz. per Ton.	Per Cent.	
1	8	Hornblende, cobalt-nickel sulpharsenides and limonite	3.73	0.6	2.5	0.03
2	10	Hornblende, in footwall of Sample No. 1	0.01	*Nil*	‡	0.001
3	10	Hornblende, some disseminated cobalt-nickel sulpharsenides (nickel, 0.3 per cent.)	1.04	0.4	1.9	0.01
4	8	Hornblende, a small amount of pegmatitic quartz and pink feldspar	0.11	*Nil*	‡	0.007
5	6	Gash vein of cobalt-nickel sulpharsenides 1 inch wide, extending for 4 feet into hangingwall of main vein	7.75	4.3	3.3	0.42
6*	4	Streak of cobalt-nickel sulpharsenides (nickel, 0.4 per cent.)	6.04	0.8	3.2	§
7	8	Hornblende, some pink feldspar	0.10	Trace	‡	0.028
8	12	Hornblende, some pink feldspar	0.08	*Nil*	‡	0.25
9	18	Hornblende, some pink feldspar	0.14	*Nil*	‡	0.013
10	8	Hornblende, some pink feldspar	*Nil*	*Nil*	‡	0.14
11	10	Across a lens of pegmatitic quartz and calcite in hangingwall of hornblende vein matter	*Nil*	*Nil*	‡	0.008
12	8	Hornblende in footwall of Sample No. 11	0.01	*Nil*	‡	0.16
13	12	Silicified granodiorite in footwall of Sample No. 12	0.01	*Nil*	‡	0.004
14	10	Hornblende plus small amount of disseminated cobalt-nickel sulpharsenides, adjacent to pegmatitic quartz and calcite	0.20	0.2	0.4	0.37
15	12	Hornblende, some pink feldspar	0.02	*Nil*	‡	0.41
16	24	Hornblende, some pink feldspar	0.01	*Nil*	‡	0.19
17	....	Along 1 inch of pink feldspar in hornblende vein matter	Trace	*Nil*	‡	0.019
18	6	Along lens of oxidized vein matter 3 feet long	2.24	0.2	0.6	0.003
19	6	Across hornblende and cobalt-nickel sulpharsenides in floor of drift	*Nil*	*Nil*	0.3	0.011
20	2	Across gash veins of hornblende on south wall of drift	0.04	0.5	‡	0.003
21	4	Along streak of pink feldspar, quartz and disseminated cobalt sulpharsenides in hornblende vein	0.05	*Nil*	‡	0.017
22	2	Along gash veins of pink feldspar and hornblende in footwall granodiorite	0.01	*Nil*	‡	0.006
23	16	Typical hornblende vein matter	*Nil*	*Nil*	‡	0.003
24	24	Across vein where in dyke, includes quartz-feldspar stringers	Trace	*Nil*	‡	0.005
25	10	Across vein, hornblende plus pink feldspar	0.02	*Nil*	‡	0.006
26	10	Across vein in face, mostly pink feldspar and quartz	*Nil*	*Nil*	‡	0.003
		No. 00 Adit.				
27	10	Across sheared dyke, vein only a narrow shear	Trace	*Nil*	‡	0.009
28	10	Hornblende plus considerable cobalt-nickel sulpharsenides (nickel, 0.2 per cent.)	2.81	0.2	3.2	0.12
29	8	Hornblende plus considerable cobalt-nickel sulpharsenides (nickel, 0.4 per cent.)	5.09	1.0	3.8	0.011
30	10	Across dyke, including vein-hornblende	0.01	*Nil*	‡	0.006
		No. 1 Showing.				
31	....	Hornblende mineralization from along footwall	0.53	*Nil*	0.7	0.011
32	10	Across lens of quartz and feldspar in footwall	0.18	0.2	‡	0.003
33*	4	Hand specimen of cobalt-nickel sulpharsenides and hornblende vein matter found in bottom of cut; also contains molybdenum, 0.81 per cent.; and nickel, 2.8 per cent	7.88	1.1	5.9	0.75
34	8	No. 3 showing, hornblende and cobalt-nickel sulpharsenides (nickel, 3.4 per cent.)	1.75	0.2	1.9	0.16
35	30	Across full width of vein, including pegmatite and hornblende plus cobalt-nickel sulpharsenide clusters, at west end of cut	0.20	Trace	0.4	0.13
36	4	Across lens of pegmatite quartz and feldspar 2 feet long	0.17	*Nil*	0.5	0.10
37	16	Hornblende and pegmatitic quartz and feldspar, at east end of cut	0.73	*Nil*	0.5	0.04
38*	4	Across rib of cobalt-nickel sulpharsenides exposed in 1940 easterly over ridge from Showing No. 4 and containing molybdenum, 0.9 per cent, and nickel, 4 per cent	5.66	2.9	2.4	§

* Samples taken in 1949, except those marked with an asterisk, which were taken in 1940.

† Radioactivity of each sample, measured in the laboratory, is reported as "equivalent per cent. U_3O_8" and may be due either to uranium or thorium. However, spectrochemical analyses of representative samples from the Victoria indicate that on this property the radioactive element is uranium.

‡ Less than 0.03 per cent. § Not determined.

The surface showings on No. 1 vein are above the upper adit. They comprise a series of natural outcrops, strippings, and open-cuts, which extend from a hogsback at elevation 6,100 feet for about 500 feet easterly to a narrow northerly trending ridge, elevation 6,150 feet. There are reported to have been other surface showings, and open-cuts were dug between the portals of the adits during the early years of development, but they were covered by snow, talus, and dump material.

No. 1 showing is an open-cut 30 feet long, 10 feet wide, and 15 feet deep that has been excavated at the site of the " Prospect Shaft " shown on older plans of the property. The first development work on the property appears to have been done here, and later a few tons of ore was shipped from the cut. The cut is now partly filled with rubble. It has two unusually well-defined walls. The northern wall, strike north 80 degrees east, dip 65 degrees northward, is the hangingwall of the main vein. The southern wall, strike east, dip 50 degrees northward, is the footwall of a branch of the main vein. Thin crusts of hornblende vein matter (*see* No. 31, table on p. 87) may be seen adhering to both walls. Pegmatite vein matter up to 10 inches thick (*see* No. 32, table on p. 87) may be seen along the footwall. The andesite dyke lies 5 feet in the hangingwall of the vein, and granodiorite intervenes between it and the vein.

No. 2 showing, a natural outcrop, exposes the hangingwall of the vein for a length of 6 feet and a depth of 4 feet. Where exposed, this wall gives moderate Geiger count.

No. 3 showing, a stripping, exposes the vein, 8 inches wide, for 8 feet along its strike. Here the vein consists of hornblende with clusters of sulpharsenides and has a moderate count. Sample No. 34 in the table on page 87 is from this showing. The andesite dyke in this stripping is 2½ feet in the hangingwall of the vein, and granodiorite occurs between the dyke and the vein.

In No. 4 showing, an open-cut 5 feet long by 4 feet wide, the vein is 3 feet wide and consists of alternating bands, several inches wide, of mixed hornblende, sulpharsenides and molybdenite, pegmatitic quartz and feldspar, and silicified wallrock. The mineralized material (Samples Nos. 35, 36, and 37 in table on p. 87) in this exposure shows a good count.

Easterly beyond No. 4 showing the ground rises to the crest of a narrow saddle, elevation 6,150 feet, and then descends steeply as a talus-covered slope. The vein was formerly exposed at several places in the first 100 yards down this slope, but little work has been done on the exposures. When the writer visited the property in 1940, a rib of sulpharsenides, 4 inches wide (Sample No. 38 in table on p. 87), was exposed above the snow a few feet below the top of the ridge.

No. 00 adit (Figs. 2 and 3), elevation 5,890 feet, was started in 1925, driven to 150 feet, and 30 tons of ore was obtained; in 1928 it was continued to 170 feet. In 1949 it had been extended 15 feet when examined and was extended a further 28 feet before operations were suspended in December of that year. The vein in this drift is from 2 to 10 inches wide and consists principally of hornblende. Some stoping was done in the section between 110 and 160 feet from the portal. This section contains lenses of solid sulpharsenides and gives a high Geiger count; elsewhere along the drift the Geiger count obtained was generally low.

It is reported that the drifting between August and December, 1949, encountered sulpharsenides at 205 feet that continued to the face at 213 feet. At the face the vein is reported to consist of a footwall band of sulpharsenides 6 inches wide separated by 6 inches of hornblende vein matter and disseminated sulpharsenides from a hangingwall band of sulpharsenides, also 6 inches wide.

In this adit strike-faulting has reduced the width of the vein in places to a fraction of an inch and the greenstone dyke beside the vein is reduced to a few inches from a normal width of 1 or 2 feet.

The portal of No. 0 adit, approximate elevation 5,760 feet, was completely covered by snow at the time of the writer's visit. An early profile of the workings indicates that this adit started in ore but was only driven about 15 feet.

No. 1 adit, a drift on the vein at elevation 5,510 feet, was started in 1916, extended in 1917 and 1918 to 712 feet and to its present face at 725 feet probably in 1925. The vein matter for long distances along this drift is predominantly hornblende, with only small amounts of sulpharsenides. Oreshoots of abundant sulpharsenides, containing appreciable amounts of gold and some molybdenum, occur at several places along the vein and some have been partly stoped. The vein matter in these oreshoots consists of hornblende with numerous clusters of sulpharsenides and often a single layer of solid sulpharsenides from an inch to 6 inches wide. The first oreshoot is between 35 and 75 feet from the portal, the second between 140 and 160 feet, and shorter shoots are found in the section between 275 and 475 feet, and between 490 and 496 feet, and 505 and 510 feet. In 1918 ore was shipped from the shoot near the portal, from the raise at 390 feet, and from the winze at 440 feet, and a short raise a few feet west of it. Most of the gold-cobalt ore mined and the best molybdenum ore appear to have come from the oreshoot near the portal. It is reported (O'Neill, 1919, p. 21) that the first 3 tons mined assayed: Gold, 5.20 oz. per ton; cobalt, 4 per cent.; and molybdenite, 22 per cent. Molybdenite is not abundant in the vein matter left in this adit, but the analyses show that it occurred in the oreshoot, and it is further reported (Galloway, 1917, p. 104) that small amounts were to be seen between a fault at 230 feet and the winze at 460 feet.

In detail, the vein in No. 1 adit from the portal to 35 feet is about 6 inches wide and consists principally of hornblende, but in the stoped section from 35 to 75 feet it appears to have been wider and to have contained 3 to 14 inches of solid sulpharsenides. From 100 to 160 feet there is no vein matter, but an open fissure 6 to 12 inches wide extends along the drift. Galloway (1917, p. 104) reports that this open fissure extended nearly to the surface and downward for about 100 feet. From 160 feet to near the face the vein ranges in width from 3 inches to 1 foot but is usually about 10 inches wide and consists principally of hornblende, a little pink feldspar, and a small amount of disseminated sulpharsenides. Between 450 and 460 feet a lens of pegmatitic vein matter 10 feet long and 2 feet thick lies along the footwall of the hornblende. Between 580 and 690 feet the vein is within the andesite dyke described on page 85, and the single vein fissure becomes a sheeted zone 3 feet wide. This sheeted zone consists of parallel stringers of hornblende and pink feldspar, from a fraction of an inch to several inches wide, separated by dyke rock.

As seen in this adit, several branch veins and stringers leave both the footwall and the hangingwall of the vein. A hangingwall branch vein, strike east and dip 60 degrees northward, leaves the main vein, strike south 85 degrees east, dip 45 degrees northward, at 260 feet, and for about 75 feet eastward both veins may be seen in the drift. This branch vein reaches the maximum width of 8 inches and consists principally of hornblende with a few scattered grains of sulpharsenide minerals. At 345 feet a gash vein consisting of an inch of solid sulpharsenides extends for 4 feet into the hangingwall of the main vein and, as shown by Sample No. 4 in the table on page 85, contains gold. Several branch stringers less than an inch wide consist principally of barren hornblende and are therefore of little economic importance.

Faults, both across and along the vein, were noted at several places in this adit. Between 230 and 234 feet from the portal a fault zone, strike northwesterly and dip 45 to 60 degrees southwestward, offsets the vein 5 feet to the right. At 355 feet a well-defined fault slip, strike northwest and dip 60 degrees northeastward, cuts the vein and displaces it a few inches to the right. From 410 feet easterly to the face a well-defined strike-fault follows the hangingwall of the vein and in places develops up to 8 inches of gouge and crushed vein matter. Between 440 and 465 feet the vein passes unbroken and without any deflection through a shatter zone, strike northwesterly and dip vertical, in which the granodiorite is broken into 6-inch blocks.

Two white to very light-grey felsite dykes, mineralogically quartz-feldspar porphyry, are cut by the vein in this adit. Between 355 and 410 feet the vein passes through a felsite dyke and narrows from 8 inches in the granodiorite to 4 inches in the felsite dyke. The drift was stopped where the vein shear entered the second white felsite dyke. This dyke is whiter than the felsite between 355 and 410 feet but under the microscope is seen to be similar to it mineralogically.

As elsewhere in the workings, the vein in No. 1 adit tends to follow the greenstone dyke, which ranges in width from a few inches to 3 feet. At the portal the vein is 4 feet in the hangingwall of the dyke, but easterly it gradually approaches and crosses to the footwall, so that from 240 to 580 feet it is either along the footwall of the dyke or in some places several inches into the footwall rock. From 580 to 690 feet the vein is well within the dyke as noted on page 89, and becomes a sheeted zone, 3 feet wide, in which parallel stringers of hornblende and pink feldspars, a fraction of an inch to several inches wide, are separated by dyke rock. Locally in the sheeted zone the stringers are so numerous and replacement of the intervening dyke rock so complete that very little of the original dyke remains. The vein returns to the footwall of the dyke and follows it from 690 feet to the face.

The Geiger count in this adit was medium from the portal to 100 feet; this is an ore-bearing section of the vein that appears to have contained considerable molybdenite. From 100 to 160 feet, the section along which the vein fissure is open, the count was low. From 160 to 180 feet the count was medium; a moderate amount of sulpharsenide mineralization was noted along the vein in this section. From 180 to 320 feet the count was generally low, with a few short sections of moderate count. From 360 feet, near the raise, to 475 feet, just east of the winze, the count was generally high and particularly high between 440 and 475 feet. From 440 feet to the face the count is generally low. It is to be noted that the highest counts in No. 1 adit were recorded between 440 and 475 feet, where pegmatitic vein matter is well developed and where a moderate amount of both sulpharsenides and molybdenite are present.

Additional workings in No. 1 adit include a raise inclined at 60 degrees, driven 90 feet in 1918, at 390 feet from the portal, and an intermediate drift (Fig. 3), driven 85 feet westerly from the raise, on the vein. The raise is now completely timbered and the drift partly lagged, but a profile of the workings drawn about 1918 indicates that the raise passed through ore about 60 feet above the level and the drift cut ore about 30 feet west of the top of the raise. A moderate count was found between 25 and 40 feet west of the raise; elsewhere along the drift the count was low.

The vein in the intermediate level is in the footwall of the andesite dyke and in general appearance is similar to its downward extension in the main drift below. It has been cross-faulted at three places. The well-defined fault, which on the No. 1 level about 15 feet west of the raise cuts the vein and displaces it a few inches to the right, is 2 inches wide on the intermediate level 10 feet west of the raise, where it displaces the vein about 4 feet to the right. At 60 feet from the raise the vein is displaced 2 feet to the right by a fault, strike northwesterly, dip 60 degrees southwest, that cuts the vein on No. 1 level at 230 feet from the portal. On the intermediate level this fault is much narrower than on No. 1 level and consists of a single well-defined break containing 6 inches to 2 feet of gouge. At 80 feet a well-defined slip, strike northwesterly and dip 10 degrees southwestward, offsets the vein 1 foot to the right.

The felsite dyke intersected on No. 1 level at the foot of the raise is exposed along the north wall of the intermediate level 15 feet west of the top of the raise. Because it is shifted to the left by the vein shear, the dyke does not appear on the south wall of the level and is probably east of the top of the raise.

No. 2 adit, elevation 5,265 feet, was started in 1918, and the crosscut and 149 feet of drift were driven that year. In subsequent years the working has been extended to its present face 540 feet from the portal. No work has been done in this adit in recent years, and as it was caved near the portal at the time of the writer's visit, the following description is taken from Kindle (1940, p. 45):—

"The fissured zone (No. 1 vein) is intersected 55 feet from the portal and is followed for 485 feet east to the face of the drift. For the first 200 feet the zone averages 12 inches in width. It consists largely of sheared granodiorite with much chlorite and considerable glassy quartz, and contains occasional small seams of arsenopyrite and safflorite. A 12-inch channel sample taken across a particularly rich-looking part of the zone containing a 2-inch seam coloured with crimson cobalt bloom, 150 feet from the portal, assayed: gold, 2.04 ounces a ton; silver, 0.26 ounce a ton; nickel, 0.02 per cent.; cobalt, 1.81 per cent. Midway along the drift the fissuring pinches to a single fault line marked by vertical striæ, but widens again within 50 feet. For 200 feet at the east end of the drift the width of shearing and alteration ranges from 1 to 3 feet, but the altered rock contains very little quartz or sulphide. A 12-inch sample of the altered granodiorite, collected 150 feet from the face, assayed: gold, a trace; silver, a trace."

In addition to making Geiger counts along No. 1 vein, thirty-eight samples were taken at frequent intervals along it. An object was to determine the amount of uranium in different types of vein matter; accordingly, the samples were taken where a particular type was found rather than at predetermined intervals along the vein. All samples were taken across the full width of the particular type of vein matter. By careful testing with a Geiger counter it would be possible to select individual specimens that would assay considerably higher in U_3O_8 than the complete section sampled. Although very fine grained, the uraninite is erratically distributed in the ore, and a few small grains of uraninite produce a very marked difference in assay value. The reader is referred to the marked variation in U_3O_8 content of three small pieces cut from a single piece of vein matter described on page 92.

The 1949 sampling did not attempt to delimit the amount of gold-cobalt-molybdenite ore in the vein. Earlier mining had removed the best ore of this type, leaving only vein sections lacking or poor in sulpharsenides. A better picture of the amount of this type of ore in the vein can be obtained by reference to the description of the distribution of the oreshoots on page 89.

The Cross vein (Fig. 2), strike northwesterly and dip north 50 degrees eastward, is exposed in a stripping along the hillside between points 110 feet and 130 feet westerly from the portal of No. 2 adit. In the stripping this vein, 14 inches wide, may be seen to be more conspicuously banded than the other veins. The walls are less well defined and show more evidence of wallrock replacement. Mineralogically the Cross vein is similar to the other veins on the property and, like them, consists of hornblende, pink feldspar, and scattered sulpharsenides and gives a moderate to high Geiger count. However, it differs from them in containing more of the calcium minerals, scapolite and titanite. Where exposed in the stripping this vein is in the contact zone described on page 85, between granodiorite and hornfelsed sediments. This zone consists of irregular bodies of quartz diorite, cutting hornfelsed sediments that are in part limy. It is probable that the presence of these limy sediments induced the formation of more titanite and scapolite in the Cross vein than in the other veins.

Little work has been done on the Cross vein. A sample taken by the writer across the vein, 14 inches wide, in the stripping assayed: Gold, 0.89 oz. per ton; silver, *nil;* cobalt, 1.1 per cent; molybdenum, trace; uranium oxide, 0.12 per cent. W. F. McGowan submitted to the writer a small specimen of hornblende-molybdenite vein matter of very high Geiger count. The specimen, measuring 1½ inches by 1 inch by one-half inch, was cut into three approximately equal pieces, and one half of each piece was assayed. The other halves were made into thin sections for microscopic study. The assays on these three pieces were 0.55, 5.8, and 13.2 per cent. in U_3O_8, and serve to illustrate the erratic distribution of uraninite.

Prior to 1949 the only working in the contact zone was the stripping on the Cross vein. The new crosscut (*see* p. 83) commenced late in the summer of 1949, at a point 90 feet below No. 2 adit, is probably in this zone. The writer has not seen this working. Specimens of hornblende-molybdenite sulpharsenide vein matter from a point several feet in the footwall of the projected downward extension of the Cross vein were submitted by Mr. McGowan for study. They represent an altered phase of the quartz diorite. The vein matter exemplified by these specimens consists of narrow stringers of hornblende in altered wallrock, both of which are mineralized with molybdenite and uraninite. It may be noted that the feldspar in this altered diorite is markedly pink in colour; however, it is not orthoclase, which is commonly pink, but is plagioclase, which is normally white. The pink colour of the feldspars in this deposit is probably related to the presence of numerous crystals of uraninite in the altered diorite near the hornblende stringers. The pink colour of the feldspars may be of use in guiding further prospecting on this property or elsewhere in the vicinity.

When operations were suspended on the property, December 25th, 1949, the crosscut was about 50 feet short of the downward extension of the Cross vein.

The remaining two veins on the property are parallel to No. 1 vein, No. 2 vein is 1,100 feet westerly, and No. 3 vein a further 700 feet westerly from No. 1 vein. These veins lack the continuity of No. 1 vein but are similar to it structurally and mineralogically. They appear to be somewhat narrower and less continuous than No. 1, and little work has been done on them.

No. 2 vein is exposed at an elevation of about 5,400 feet on the southern side of a talus-filled draw. A well-defined rock wall, strike easterly, dip 50 degrees northward, trends easterly up the south side of the draw for about 200 feet and appears to be the footwall of a shear now covered by talus. Adhering to this wall are scattered patches, up to 4 inches thick, of vein matter consisting of green hornblende, and scattered grains of pink feldspar and of sulpharsenides. Uraninite is also present, as a moderate Geiger count is obtainable wherever this vein matter is present. Two selected samples of this vein matter assayed: Gold, 0.14, 0.02 oz. per ton; silver, *nil;* cobalt, trace; uranium oxide (U_3O_8), 0.49, 0.93 per cent. respectively. At this showing the footwall rock, principally granodiorite, is intensely carbonatized and weathers to a brownish-buff colour as a result of the oxidation of the iron in the carbonate. The mica in this altered rock, originally black biotite, has been bleached to a silver-coloured variety.

Although this showing has not been traced more than 200 feet up the mountainside, its eastern continuation may be in a stripping at elevation 5,940 feet directly up the slope from the exposure of No. 2 vein at 5,400 feet elevation. The stripping is 10 feet in diameter and is on the top of the hogsback formed by a dyke of feldspar-hornblende porphyry. The dyke is 35 feet wide and appears to dip about 50 to 60 degrees northward; it trends southwesterly down the hillside from the main mountain mass to the northeast. The stripping exposes a shear zone 8 feet wide, which contains three veinlets of sheared hornblende, 3 to 6 inches wide, strike easterly, dip 45 degrees northeast. The hornblende contains massive sulpharsenides in scattered grains and in streaks up to 2 inches thick. A sample taken across 8 feet, the full width of the main shear zone, included the three mineralized veinlets; it assayed: Gold, 0.61 oz. per ton; silver, *nil;* cobalt, trace; uranium oxide (U_3O_8), 0.011 per cent. A sample taken along 3 feet of a stringer of sulpharsenides, 1 to 2 inches thick, in the middle of the shear, assayed: Gold, 2.66 oz. per ton; silver, 0.2 oz. per ton; cobalt, 0.5 per cent.; uranium oxide (U_3O_8), 0.01 per cent. A parallel shear, 4 inches wide, also containing sulpharsenides, occurs 2 feet in the footwall of the main zone and a similar one within

5 feet of the hangingwall. Some silicified wallrock and a small amount of quartz-feldspar pegmatite are associated with these shears. A sample taken across the hangingwall shear, consisting largely of silicified feldspar hornblende porphyry, assayed: Gold, 0.78 oz. per ton; silver, *nil;* cobalt, 0.7 per cent.; uranium oxide (U_3O_8), 0.0065 per cent. The highest Geiger count was found to be along the hangingwall shear in the dyke about a foot from the contact with the granodiorite; a sample along this shear assayed: Gold, 6.42 oz. per ton; silver, 0.3 oz. per ton; cobalt, 0.6 per cent.; uranium oxide (U_3O_8), 0.10 per cent.

About 50 feet down the slope from the stripped area, a gash vein, strike northwesterly and dip 50 degrees northeastward, cuts the granodiorite about 2 feet in the hangingwall of the dyke. This vein contains up to 2 inches of solid sulpharsenides, a sample of which assayed: Gold, 3.72 oz. per ton; silver, 0.2 oz. per ton; cobalt, 2.1 per cent.; uranium oxide (U_3O_8), 0.0005 per cent.

No. 3 vein, about 700 feet westerly from No. 2 vein, was not seen by the writer. This vein is reported to contain gold and cobalt and small amounts of radioactive material. Little, if any, work appears to have been done on it.

Uranium could be a valuable by-product in ore of the type found and mined on this property in the past. This ore contains gold, silver, and cobalt, and in some sections also contains molybdenite.

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Homestake.* This property, adjacent on the west to the Victoria, comprises the two Crown grants Homestake (L. 3309) and Tiger (L. 3308) (Fig. 2) that are at present (November, 1949) leased from the Crown to George Royles, Box 1713, Prince Rupert.

The only working on the property known to the writer is an adit 75 feet long, elevation 5,065 feet, on the boundary between the Homestake and Tiger claims (Fig. 2). This adit was started in the middle of a diorite dyke 10 feet wide, strike south 80 degrees east, dip 75 degrees northward, and was driven in a direction north 75 degrees east for 45 feet diagonally across the dyke. It was then driven at north 120 degrees east for 15 feet along the hangingwall of the dyke and finally in an easterly direction for 15 feet in the adjacent brown hornfelsed tuff to the face, where it intersects a strong shear in the tuff, 1 foot wide, strike north 20 degrees west and dip 65 degrees southwestward. No vein matter or other mineralization of economic value was seen in this adit.

* By J. S. Stevenson.

DORREEN (54° 128° N.E.).*

Gold-Copper-Lead-Zinc.

Fiddler Group (Dorreen Gold Mines, Limited). Company office, 553 Granville Street, Vancouver; mine office, Dorreen. Alex Mackenzie, president; P. E. Peterson, manager. This private company has acquired the Fiddler group of claims from J. W. Tredway and L. W. Patmore. The property is on Knauss Creek, a tributary of Fiddler Creek and about 5 miles from Dorreen, a station on the Canadian National Railway 125 miles east of Prince Rupert. A full account of the property may be found in the Annual Reports of the Minister of Mines for the years 1916 and 1925. No work has been done since 1926.

Work done by Dorreen Gold Mines was confined to road building. In October, 1949, construction was started on a truck-road to the property from the station at Dorreen. The road follows the grade of the former wagon-road. By the end of the year about 4 miles of road had been graded, half a mile of which was corduroyed, two bridges had been replaced and two other bridges by-passed, and about half a mile of road gravelled. Seven men were employed on this road work.

The company plans to erect a mill on the property during 1950.

SMITHERS.†

Silver-Lead-Zinc.

Cronin Babine Mines, Limited. (54° 126° N.W.) Company office, 85 Richmond Street West, Toronto. G. F. MacDonnell, president. Capital: 3,000,000 shares, $1 par value. This company has an option to buy from the Babine Bonanza Mining and Milling Company, Limited, the Crown-granted claims Lucky Strike, Homestake, Bonanza, Eureka, Babine Chief, Bulkley Pioneer, Sunflower, and Sunflower Fraction, and by record holds two claims southeast of these, all on the eastern slope of Cronin Mountain.

The property is between 4,750 and 5,250 feet altitude near the top of a long slope and on a gently rolling upland surface. The workings are just below the change of slope. The camp, which is in fair condition, is at about 5,000 feet altitude, just at timberline.

The property is about 17 miles northeast of Smithers and at present is reached by following a road from Bulkley Valley up Driftwood Creek valley to Lamarr camp, about 16 miles by road from Smithers. The last few miles of this road can be travelled only in a jeep. From Lamarr camp it is about 4 miles by pack-trail, over the divide of the Babine Mountain Range, at 6,000 feet altitude, to the Cronin camp on the eastern slope.

A road built in 1949 from Bulkley Valley to Chapman Lake provides an alternate route to the property that does not go over the high divide. From a point on this new road, about 3 miles west of Chapman Lake, a trail about 10 miles long leads to the property. This trail was a sleigh-road, and in September the lower part of it was being improved for use as a winter tractor-road. The distance from Smithers to the property by this route is about 37 miles.

Veins containing lead, zinc, and silver minerals were found on the eastern slopes of the Babine Mountains early in the century. In 1909 some of the claims, located to include the mineralized area, were acquired by a company of which J. Cronin was the manager, and since that time the property has been called generally Cronin's mine.

Exploration and development started in 1909 and continued intermittently until 1930. During that time the property was explored by several shafts and raises and by four levels called the 5095, 5065, 5000, and 4775, corresponding to their altitudes.

Production:—

1917: Ore mined, 79 tons. Silver, 4,257 oz.; lead, 57,462 lb.

1929: Ore mined, 30 tons. Silver, 673 oz.; lead, 13,013 lb.; zinc, 14,550 lb.

* By F. J. Hemsworth.

† By J. M. Black.

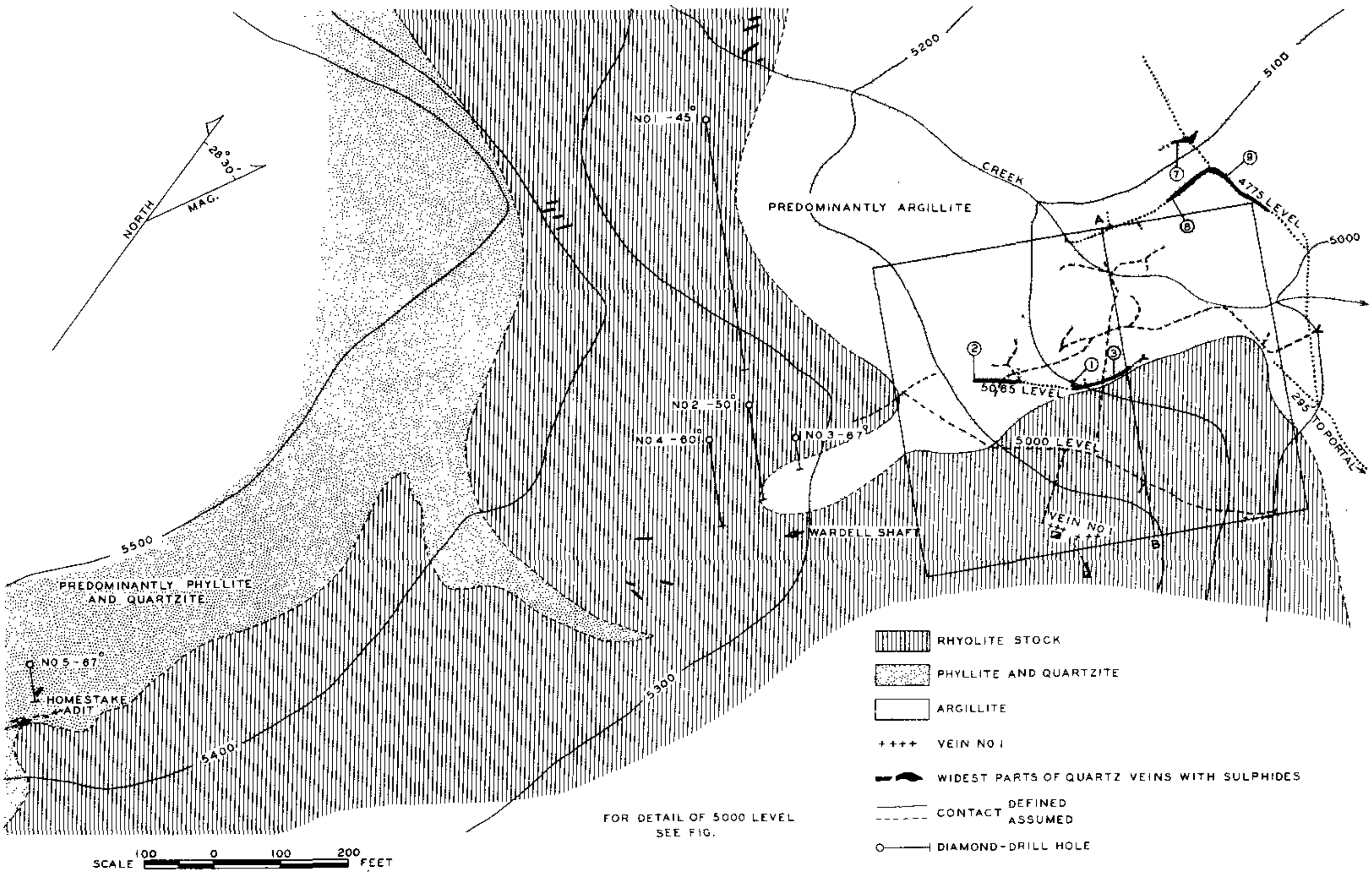

FIG.4. CRONIN BABINE MINES LTD. PLAN SHOWING GEOLOGY, WORKINGS AND DRILL HOLES.

SALMO (49° 117° S.E.).*

Erie Creek.

Gold-Silver-Lead-Zinc.

Arlington. This mine, 7 miles by road from Salmo, was operated by Kenville Gold Mines, Limited under an agreement with F. C. Buckland, who optioned the property in 1948. The bulk of the ore shipped in 1949 came from the 60 and 80 level dumps. It was handled with a Mobil-loader and then trucked to the Kenville mill at Nelson. Underground, some backfill from the flat-lying stopes was removed and trucked to Kenville. This fill came chiefly from the 260 stope, on the 60 level in the north end of the mine. Some of the backfill and ore from remnants mined 90 feet inside the 60 portal was trucked to the smelter at Trail.

On the surface a large stripping and trenching programme was carried out northwest of the Arlington mine. Three narrow stringers reportedly carrying gold were exposed, cutting the flat-lying argillite beds. These stringers, when sunk on for distances varying from 5 to 20 feet, were found to be offshoots from veins between 2 and 3 feet wide that lie with the bedding. The main exploration centred around a shaft sunk 700 feet west and 900 feet north of the 60 level portal of the Arlington mine. Ore obtained here was trucked to Trail. Ten men were employed, under the direction of W. Baker.

Production: Ore shipped to Trail, 646 tons. Gross contents: Gold, 254 oz.; silver, 1,023 oz.; lead, 14,691 lb.; zinc, 14,123 lb. Ore shipped to Kenville mill, 124 tons; contents included with other company ore treated in the Kenville mill.

[Reference: *Geol. Surv., Canada*, Mem. 172, p. 75.]

Sheep Creek.

Gold.

Sheep Creek Gold Mines, Limited. Company office, 616 Stock Exchange Building, Vancouver; mine office, Sheep Creek. A. E. Jukes, president; H. E. Doelle, managing director; F. R. Thompson, mine superintendent. Capital: 2,000,000 shares, 50 cents par value. The mill, reopened November 3rd, 1948, was operated until June 23rd, 1949, at which time all broken ore had been milled. Mining, however, continued throughout the year, and on October 5th enough ore had been accumulated to start the mill again. Ore was broken on all levels from No. 2 to No. 7, with production by veins as follows: 92, 950 tons; 85, 1,004 tons; 83, 7,692 tons; 81, 600 tons; 75, 8,308 tons; 68, 4,273 tons; 64, 276 tons; 57, 5,874 tons. The main development was the completion of the long drive on No. 9 level to the 57 vein and the raising on this vein to No. 7 level. This connection materially improved the ventilation of the lower levels. Development footages were as follows: Drifting and crosscutting, 1,229 feet; raising, 360 feet; diamond drilling, 418 feet. The number of man-shifts totalled 14,925; the number of men employed per day averaged sixty-seven.

At the Udiville group, which lies south of Sheep Creek along Bennett Creek, surface stripping by bulldozer and 654 feet of diamond drilling were done.

Production: Ore milled, 27,992 tons. Gross contents: Gold, 10,853 oz.; silver, 4,264 oz.

Gold Belt Mining Company, Limited. This mine remained closed throughout 1949. On February 22nd a snowslide totally demolished the mill building, from which most of the equipment had been removed in 1948. A small crew was employed by the Keno Hill Company to salvage what remained after the slide. Some dump ore at the mill level portal, reported to have been saved during the development drive on the 6600 vein, was trucked to Trail.

Production: Ore shipped, 154 tons. Gross contents: Gold, 45 oz.; silver, 76 oz.

* By J. W. Peck.

little gouge and appears to weaken, but its possible extension is crosscut 100 feet away along the strike.

The stock is much fractured, especially near its margin. These fractures in general strike northeasterly or are parallel to the contact. Some of the veins filling these fractures are indicated on Figure 4. One fault zone in the stock is exceptional in that it consists of several branching faults. It has been followed across the north end of the stock, from near the contact for about 350 feet to where it weakens and splits.

The veins are poorly exposed at the surface, but underground are well exposed by drifts and raises. Most of the veins with sulphide mineralization exposed by the workings are in contact fault zones, and most of the others are in the fault zone cutting part way across the north end of the stock. Numerous veins south and west of the workings have been trenched, and one vein on the Homestake claim has been explored by a short adit; but these veins in the southwest part of the property are not as wide or as well mineralized as those in the workings. The argillites north of the rhyolite are cut by quartz veins, but these veins contain little galena or sphalerite. The veins are composed of white or watery-looking quartz and several sulphides, and some of them include some gouge and elongated inclusions of wallrock. In some places several parallel veins, separated by wallrock, form a vein zone. The veins in the workings, for most of their length, range in width from 1 to 3 feet; some parts of the veins are wider, and at one point a width of 15 feet is exposed. Most of these wider parts have argillite as the hangingwall and rhyolite as the footwall. Most of the veins contain sphalerite and galena, and some contain also pyrite and tetrahedrite. The total sulphide content varies greatly and seems to be somewhat higher in the wider parts of the veins. The proportions of the sulphides present also vary greatly; sphalerite or galena tends to be the predominant sulphide in any section, and in a few short sections one or other of these sulphides is more abundant than quartz. On the whole, sphalerite is more abundant than galena.

The widest and most abundantly mineralized parts of the veins exposed in the workings are indicated on Figures 4 and 5. The veins continue beyond the ends of the parts indicated but are not shown because they are only about a foot wide. One shoot, 90 feet long, in Vein 2 near the portal of 5065 level may rake northward to join a similar shoot on 5000 level. Several veins, containing abundant sphalerite, in the rhyolite near the north portal of 5000 level, strike westerly and dip steeply northward, about parallel to the contact of the rhyolite. These probably join a lens, composed mostly of sphalerite, which outcrops. The veins on 4775 level are not known to be continuous with any of those exposed at higher levels. One of these veins on 4775 level is at a rhyolite-argillite contact and is nearly parallel to Vein 2, and another is in the rhyolite near to and about parallel to another contact. These veins come together, and at their junction the vein matter is 10 feet wide.

Only the wider or more abundantly mineralized parts of the veins are shown in Figures 4 and 5. The position from which samples were taken within these parts of the veins are shown on Figures 4 and 5, and the assay results are tabulated below:—

Sample No.	Level.	Width.	Gold.	Silver.	Lead.	Zinc.
		Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
1	5065	48	0.03	16.9	20.9	19.3
2	5065	20	0.04	20.5	12.2	9.0
3	5065	54	0.04	10.7	4.3	3.4
4	5000	38	0.05	19.5	4.3	35.2
5	5000	27	0.05	14.3	7.5	6.3
6	5000	30	0.01	11.7	11.5	23.6
7	4775	36	0.02	3.3	2.4	3.7
8	4775	21	*Nil*	6.2	5.5	2.9
9	4775	24	0.03	5.3	2.5	4.1

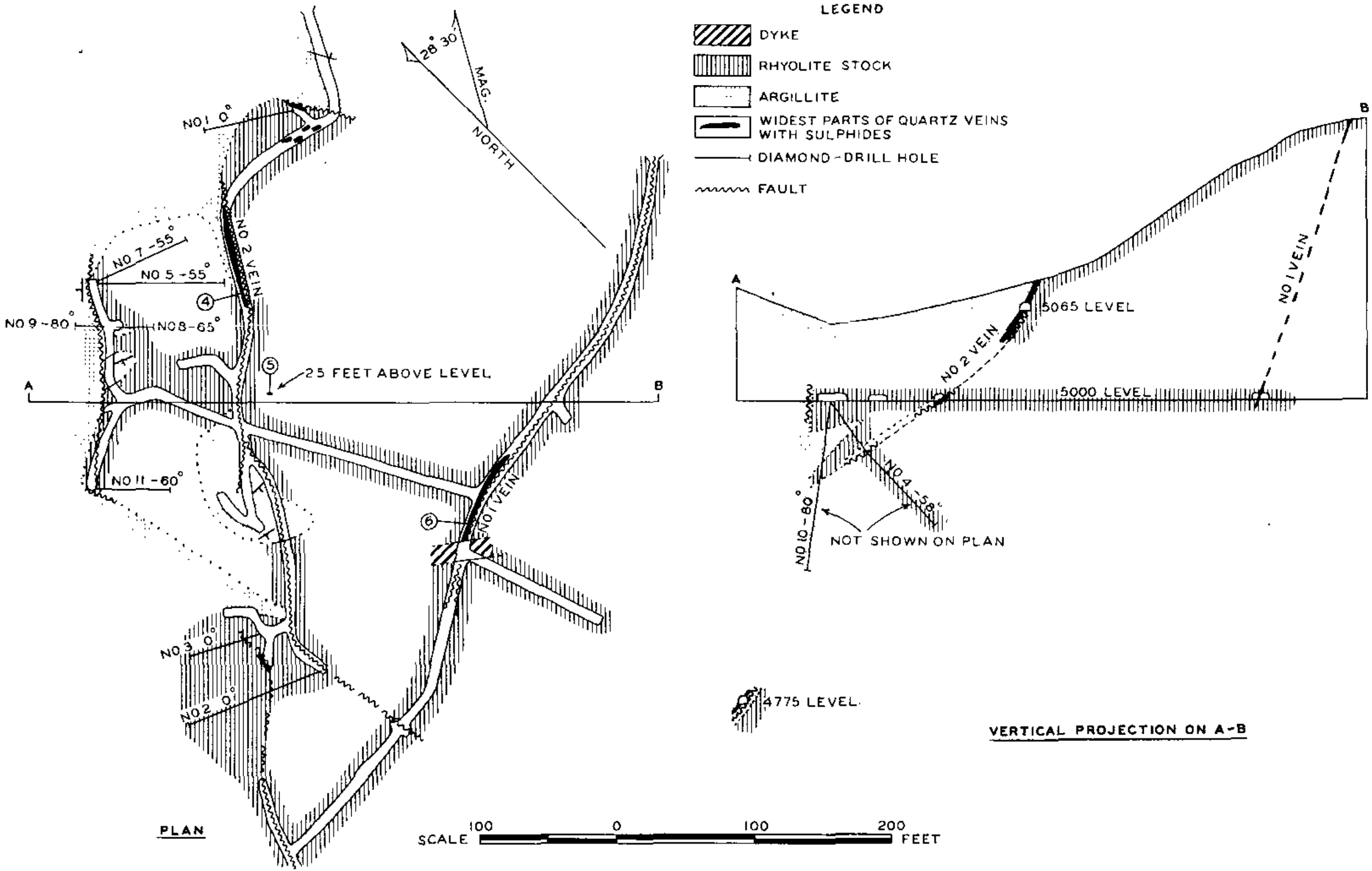

Fig. 5. Cronin Babine Mines, Limited—plan of 5000 level and vertical projection.

Eleven holes were drilled from the 5000 level; three of the holes were drilled horizontally to search for the continuation along its strike of Vein 2, and parallel veins; the other eight holes were drilled downward to explore the ground below Vein 2. These eight holes are not long enough to reach the projected extension downward of Vein 1. The drill core from these holes includes a few intersections with quartz stringers containing sphalerite and galena, but these stringers are only a few inches wide and none of them can be correlated certainly with Vein 2.

A few veins containing sphalerite and galena are exposed southwest of the workings in the neck that joins the northwesterly trending lobe of rhyolite to the main rhyolite stock. These veins are near an elongated mass of argillite almost surrounded by rhyolite, toward which Veins 1 and 2 strike. This mass of argillite is continuous with the argillite in and near which Vein 2 is, and the vein at Wardell shaft is close to the argillite contact which is not exposed. For these reasons it may be inferred that veins, not exposed at the surface, are likely to occur in and near this argillite. Four exploratory holes, 1 to 4, were drilled under this area. The cores from Holes 1 to 3 contain only a small amount of argillite, which indicates that the argillite narrows southwestward. In the core from the four holes are vein intersections only a few inches wide, not correlative with certainty with each other or with Vein 1 or 2.

Hole 5 was drilled to explore the downward extension of the Homestake vein; the core contains only vein intersections a few inches wide.

Many dykes cut the argillite and the stock, and a few cut the vein zones. Most of these dykes, strike northerly, are light-coloured rhyolite; a few are lamprophyres. Some of the mineralizing solutions may have continued to circulate after the emplacement of the dykes because the shoot in Vein 1 appears to widen as it approaches the dyke at which it ends. Some of the dykes that cut the vein zones are cut, and some are displaced slightly, by late movements on the vein faults.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1920, pp. 87–89. *Geol. Surv., Canada*, Sum. Rept. 1924, Pt. A, pp. 30–32.]

DUCKLING CREEK (55° 125° N.E.).*

Copper.

Kennco Explorations (Canada), Limited. Company office, 25 King Street West, Toronto. W. J. Dean, manager; P. Hammond, engineer. Capital: 5,000 shares, $10 par value. This company owns the Lorraine, the Dorothy, the Elizabeth, the Kay, and the Jeno properties, comprising a total of sixty-six mineral claims. The Lorraine, Kay, and Jeno claims are near the headwaters of Duckling Creek, and the Dorothy and Elizabeth claims are on the east slope of Duckling Creek valley about 8 miles from the mouth of the creek. The location of the claims is shown on Figure 6.

Access to the area is by a road from Vanderhoof north for about 165 miles to Germansen Landing on Omineca River. From Germansen Landing shallow-draught boats can operate in the summer up the river for about 40 miles to a landing a few miles below the mouth of Duckling Creek. From this landing a pack-trail leads up Duckling Creek valley. The claims are within a few miles of a camp about 12 miles from Omineca River or of a second camp about 22 miles from Omineca River.

All the copper showings are on steep slopes near timberline, which is between 5,000 and 5,500 feet altitude. One occurrence, where malachite is exposed over a considerable area above timberline, is said by local prospectors to have been known to Indians for many years and to have been shown to white prospectors during the First World War. Claims located on this showing for the Consolidated Mining and Smelting Company were held from 1943 to 1947. In 1947 eight claims (Lorraine) were located

* By J. M. Black.

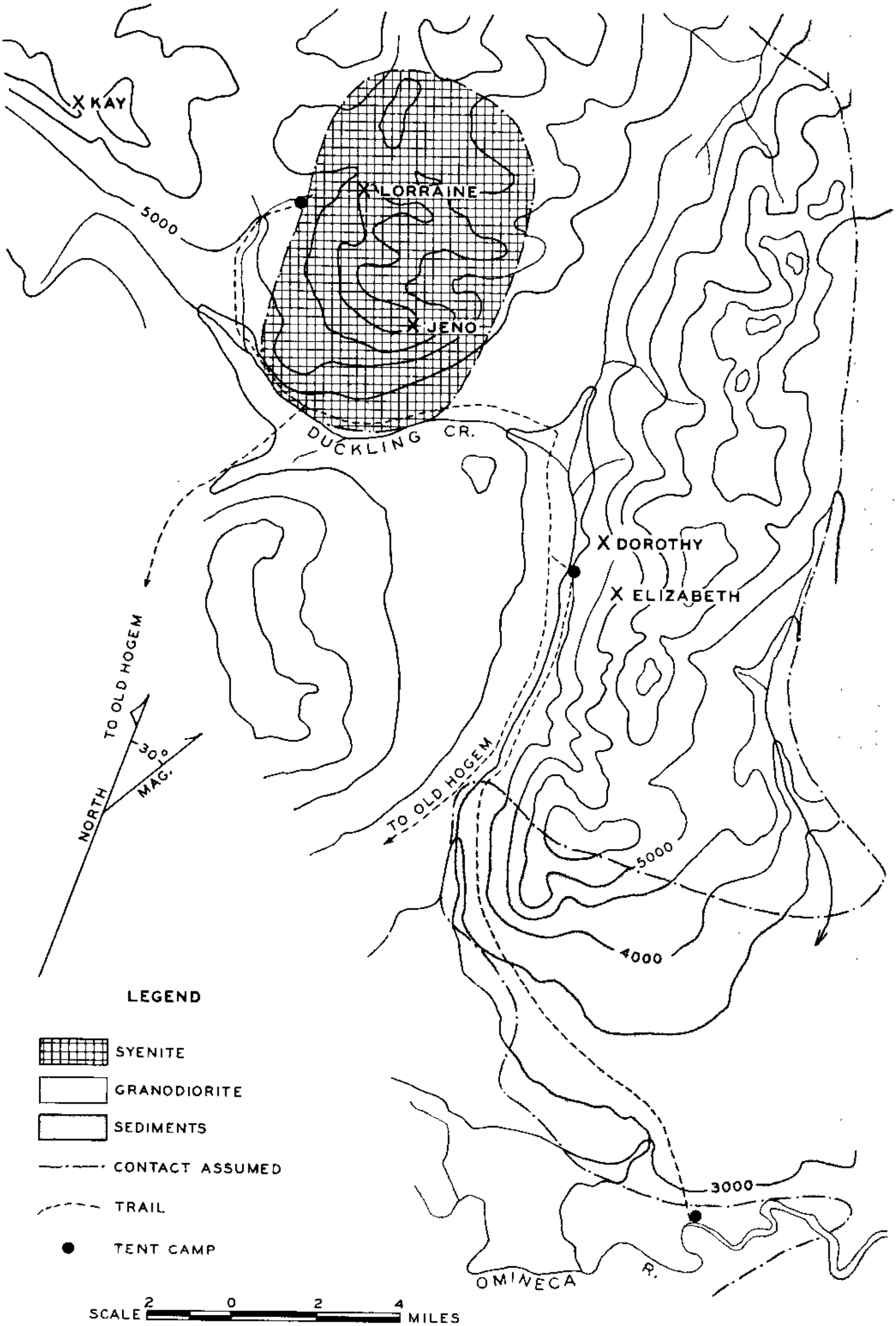

Fig. 6. Geology and topography of Duckling Creek area, showing location of some copper occurrences.

at this showing for the Kennco company; in 1948 the number of claims held by this company was increased to twenty. In 1948 prospectors for this company found four other occurrences of copper and, at each, located claims. In 1948 the showings on the Elizabeth and Dorothy claims were explored with trenches, and in 1949 the showings on the Lorraine and Dorothy claims were explored by holes drilled from the surface.

Three of the occurrences are in the predominantly granodioritic Hogem batholith, and two are in the Duckling Creek syenite, which is considered by Armstrong* to be possibly a late phase of the batholith. The contacts and topography on Figure 6 are taken from his maps. Four days in August were spent in the area, during which time all showings except the Jeno were seen.

Lorraine.—This property consists of twenty claims held by the Kennco company. The claims are on a ridge near the head of the north fork of Duckling Creek. Copper mineralization is exposed between 5,750 and 6,300 feet altitude on the steep, bare slopes of the ridge. One prominent bluff on the southwest slope is so coated with malachite that the green colour is apparent at a distance of several hundred yards.

The rock is medium-grained pink-grey or green hornblende syenite, composed largely of feldspar with some hornblende. It also contains magnetite, epidote, apatite, pyrite, and several copper minerals. The copper mineralization is exposed in a roughly elliptical area about 2,000 feet by 800 feet, with the longest dimension trending slightly west of north. Southeast of this area the intrusive rock is slightly coarser and darker, and contains less copper. The other limits of the mineralized area are not exposed because of talus and other overburden.

In the mineralized area the syenite varies in appearance, depending upon the relative proportion, arrangement, and grain size of the minerals present. Some of it is gneissic. The syenite is cut by pegmatitic dykes as much as a few feet wide and by numerous quartz stringers a few inches wide.

Many faults cut the syenite; the movement on some of them appears to have taken place before crystallization of the syenite was complete.

The copper minerals seen are chalcopyrite, malachite, azurite, and bornite, of which the last two are present in small proportions. All these minerals occur in all the phases of the intrusive rock and also in the pegmatitic dykes that cut it. The chalcopyrite and the bornite tend to be associated with the magnetite and pyrite. These metallic minerals are irregularly disseminated throughout the syenite but are more common near the quartz stringers. The malachite occurs as small flakes coating the surface of the other minerals, especially near fractures.

When examined in August, four holes, 910, 583, 500, and 266 feet long, had been drilled from the southwest slope of the ridge, northeastward under the exposed mineralization. The mineralized body is thought to dip southwestward, and was to be explored further by a hole to be drilled southwestward from the northeast slope of the ridge. In the core from the four holes the chalcopyrite and bornite decrease downward, and at the bottom of the holes these minerals are very sparsely disseminated. The malachite and azurite occur mostly within 50 feet of the surface, and practically none is seen more than 200 feet from the surface.

In the cores from the lower parts of the holes a dark-green micaceous intrusive rock that appears to grade into the syenite is common. It contains very little copper mineralization. Outcrops of similar rock are reported to occur south of the mineralized area.

The exposures were not sampled by the writer, and it would require a great number of samples to determine the grade. However, it is estimated that the grade at the surface is probably less than 1 per cent.

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* *Geol. Surv., Canada*, Mem. 252, p. 109 (1949).

Kay.—This property consists of four claims held by the Kennco company. The claims are northwest of the head of Duckling Creek and are about 3½ miles west of the Lorraine showing. They are west of a narrow northerly trending draw on a high ridge trending westerly. The showing is at the edge of a cirque at about 6,200 feet altitude.

Some dark gneissic layers, strike northwesterly, dip steeply southwestward, contain malachite, bornite, and chalcopyrite. These gneissic layers are between coarser, massive granitic rock. The mineralized area exposed is much smaller than that at the Lorraine claims, and the grade is probably about the same.

Elizabeth.—The Kennco company holds twenty claims east of Duckling Creek, about 7½ miles north of Omineca River. The showing is about three-quarters of a mile east of Duckling Creek at 4,800 feet altitude.

This occurrence is at the intersection of two faults and consists of a mass several feet in diameter of brecciated intrusive rock cemented by malachite, cuprite, and chrysocolla. The mineralization extends, a few inches wide, for several feet along a southerly striking fault and pinches out downwards in a few feet.

Trenches near the showing expose a heterogeneous intrusive rock ranging from granitic to gabbroic, cut by pegmatitic stringers and by two sets of faults that are filled with gouge and crushed fragments. One set of faults strikes southerly and the other set strikes west-southwesterly and both dip steeply. The mineralization is at the intersection of two of these faults, but no similar mineralization is exposed in any of the other faults uncovered by the trenches.

The presence of secondary copper minerals at the intersection only and the lack of a vertical continuity suggest that the copper minerals were deposited by near-surface solutions that probably travelled down the faults to a favourable intersection. From this it may be inferred that a primary source of the copper may exist somewhere up the slope above this occurrence.

Dorothy.—The Kennco company owns eighteen claims east of Duckling Creek, 8 miles north of Omineca River. The showing is about 4,400 feet altitude in an area of few outcrops nearly half a mile east of Duckling Creek.

In 1948 easterly trending trenches were dug in an area 500 feet from north to south and 200 feet from east to west.

The trenches were dug to the east—that is, up the slope from talus that contains copper-stained blocks. The walls of these trenches are mostly caved and little bedrock is exposed. Four holes, 571, 487, 72, and 310 feet long respectively, have been drilled downward, inclined to the east, to explore below the southern part of the area, in which the trenches are. Holes 1, 2, and 4 are about equally spaced along a line extending about 700 feet southward. Hole No. 4 is near Hole No. 3, which had not been drilled as far as originally planned.

The talus and the rock exposed by the trenches is a dioritic intrusive composed of feldspar, quartz, sericite, hornblende, augite, epidote, and small proportions of apatite, titanite, pyrite, molybdenite, and chalcopyrite. Some of the feldspar has been altered to sericite. The composition is not uniform, and the colour ranges from grey to dark green. This intrusive is cut by many quartz veins and pegmatitic dykes as much as a foot wide, and the veins have pyrite and chalcopyrite in and near them.

The copper mineralization is exposed in two trenches. It consists of chalcopyrite disseminated sparsely in diorite that contains a higher than average proportion of silica and pyrite. In the core from the drill holes the chalcopyrite is generally sparsely disseminated. In a few sections of core as much as 50 feet long, the proportion of chalcopyrite and pyrite is greater than average, but without some information as to the extent or attitude of the mineralized body at the surface, it is not possible to correlate these sections in the widely spaced holes.

Very little copper mineralization is exposed at the surface, and complete sampling of the core would be necessary to determine the grade. However, it is probable that the average copper content of the higher-grade sections is as high as or somewhat higher than that of the surface material at the Lorraine claims.

[Reference: *Geol. Surv., Canada*, Mem. 252, p. 183.]

CARIBOO.

Wells-Barkerville Area (53° 121° S.W.).*

Gold.

Cariboo Gold Quartz Mining Company, Limited. Company office, 1007 Royal Bank Building, Vancouver; mine office, Wells. W. B. Burnett, president; G. A. Gordon, general manager; T. E. Vear, mine superintendent; J. Boulding, mill superintendent. Capital: 2,000,000 shares, $1 par value. The Cariboo Gold Quartz mine is a short distance south of the town of Wells, which is 56 miles east by road from Quesnel, the present terminus of the Pacific Great Eastern Railway.

New development work comprised 1,503 feet of drifting, 1,211 feet of crosscutting, 133 feet of raising, and 10,863 feet of diamond drilling.

Ore was obtained principally from the Tailings, No. 1, Rainbow, and Goldfinch zones. Mining methods used to obtain the ore are cut and fill and longwall advance. In both methods the ore and waste fill are moved with scrapers.

A crosscut is being driven on 2000 level toward Island Mountain mine and is within 400 feet of the boundary. This crosscut is under the Lowhee placer tailings that have filled the east end of Jack of Clubs Lake. In addition to intersecting several quartz veins, this crosscut intersected a high-grade replacement deposit along the Rainbow-Baker contact.

In the Goldfinch zone, the 53 vein, which crosses the main haulage 1,500 feet west of the B.C. shaft, has been mined both horizontally and vertically more than 100 feet. As there are no levels cut from the shaft in this section, subdrifts on the vein will be driven, and serviced by tugger hoists. Diamond drilling in this area found a second strong vein which is now being explored.

The cook-house and bunk-house were closed in October, and all employees are now living in Wells.

The average number of men employed during the year was 170.

Production: Ore milled, 67,793 tons. Gross contents: Gold, 20,944 oz.; silver, 1,900 oz.

Island Mountain Mines Company, Limited. Company office, 744 Hastings Street West, Vancouver; mine office, Wells. F. W. Guernsey, president; J. A. Pike, mine manager; G. G. Sullivan, general superintendent; T. Bethune, mine superintendent; J. Stone, mill superintendent. Capital: 1,100,000 shares, 50 cents par value. This company, a subsidiary of Newmont Mining Corporation, operates Island Mountain mine, which is immediately west of the town of Wells.

Development work during 1949 comprised 4,440 feet of development drifting and crosscutting and 560 feet of raising. In addition, 422 cubic feet of rock was mined to open stations and 2,500 cubic feet was mined to open pockets. The major part of this development work continued to be done on the levels below 3125. On 2550 level, which is at present the bottom level, the station is being prepared so that crosscutting to the ore zone can be started from it. Ore was mined on all levels from the 4000 level down to the 2700 level. Stoping is being done by cut and fill methods in the quartz veins and by longwall advance in the replacement bodies. In both types of stopes, scrapers are being used to move broken ore and waste fill.

* By J. E. Merrett.

The drift at the sump on 3000 level was extended 14 feet, and a concrete dam 6 feet high was erected at the outer edge of the sump. This will increase the sump storage capacity on this level from 11,000 gallons to 27,500 gallons.

The average number of men employed was 117.

Production: Ore milled, 44,336 tons. Gross contents: Gold, 18,834 oz.; silver, 2,570 oz.

KEITHLEY CREEK (52° 121° N.E.).*

Gold.

Midas. F. H. M. Codville, of Duncan, V.I., and J. Pickering, of Keithley Creek, in partnership, have installed a 15-ton Gibson mill and a Wilfley table at the Midas mine on Yanks Peak, 11 miles by road from Keithley Creek P.O. In 1949 ore was hauled from the shaft vein and from the dump at the shaft to the mill by Bren carrier. Test runs were made, but the returns from the concentrates were insufficient to continue treating this ore.

Crosscutting on the Jim group, located north of the Midas group, was resumed in an endeavour to intersect a vein previously found. It was anticipated that 21 feet of crosscut would be required.

An average of four men was employed.

LIKELY (52° 121° N.E.).*

Silver-Lead.

Providence Mining & Milling Syndicate. Mine office, Williams Lake. L. O. Gostling, manager. Mr. Gostling and associates hold eight claims by record on Black Bear Creek, a tributary of Spanish Creek. The property is reached from the highway bridge across the Cariboo River by 3 miles of trail extending up the north side of Black Bear Creek. In 1949 the crosscut from the winze was extended 100 feet to a point 400 feet from the bottom of the winze. Work was halted in February, when the crosscut broke through into gravel. At this time a crew of five men was employed. These workings are now flooded to creek level in the winze. Since then Mr. Gostling, working alone, has drifted westerly from the lower adit for more than 80 feet. A shipment of 4½ tons of hand-sorted galena ore was made to Trail in September. Production: Ore mined, 5 tons. Gross contents: Silver, 319 oz.; lead, 3,294 lb.; zinc, 12 lb.

LONE CABIN CREEK.†

Gold.

Porcupine Mountain. (51° 122° S.E.) The main showings on Porcupine (Black Dome) Mountain were described in detail in the Annual Report of the Minister of Mines, 1948 (p. 92). They were revisited in September of this year by the following route: by car from Clinton to the Empire Valley ranch on the west bank of the Fraser River; by jeep to the old Higginbottom place (Lot 5151) on the north bank of Lone Cabin Creek (7 miles); by foot over trail leading up Porcupine Creek and the east slope of Porcupine Mountain to L. Frenier's camp (9.5 miles).

Little work has been done on the showings during the past season. Mr. Frenier has devoted all his energy to trail improvement and the hauling-in and installation of a small mill at the property. He has set up a Gibson 2-ton Elliptic roll mill, which has an attached mercury feeder. The power is supplied by a 1.5-horsepower Lawson motor. With this arrangement Mr. Frenier hopes to increase his production of gold, which to date has been 6 ounces.

* By J. E. Merrett.
† By W. R. Bacon.

BLUE CREEK (51° 122° S.E.).*

Gold.

Bralorne Yalakom Operation (Elizabeth, Yalakom No. 1).

This property, comprising fifty-three claims, owned by Bralorne Mines, Limited, is on Blue Creek, a tributary of Yalakom River. It is reached by 48 miles of road from Lillooet by way of Moha. The principal working on this property is a crosscut driven westerly for 2,204 feet. *From this crosscut, drifts were driven in 1948 on "B" vein, intersected at 1,611 feet,* and on "C" vein, intersected at 2,103 feet from the portal. During 1949 the company drove a raise from a point in the "B" vein drift about 60 feet south of the main crosscut. The raise was driven to a point 271 feet above the level; it did not follow the vein throughout its length, but near the top cut the vein. At that point the vein is 4 feet wide and consists of quartz but contains insufficient gold to encourage driving the raise farther.

The company also drove a raise up 76 feet from a point in the drift on "C" vein about 100 feet north of the main crosscut, but without encouraging results.

In 1948 a mass of quartz, 5 feet thick and several feet long, was uncovered about 500 feet southwest of the camp. Two adits were driven in the overburden to explore this quartz, but failure to discover bedrock around the quartz led the management to conclude that it may be a glacial erratic, and work on it was discontinued in the fall.

In the middle of the summer, some large boulders of gold-bearing quartz were found on the Yalakom No. 2 claim. The boulders were in a talus slide over a stock of diorite porphyry, about 800 feet in diameter. In search of the source of this float, a cross-stripping was bulldozed in the slide and two cuts were dug. These workings exposed a vein, strike northerly, dip 70 degrees westward, that is 2 to 3 feet wide and traceable for 200 feet. This vein has been named No. 9. Although No. 9 vein in the cuts contained encouraging amounts of gold, it did not contain the spectacular free gold found in the float, and there is some doubt about its being the source of that float.

An average of eighteen men was employed under the supervision of James Mollard. When operations were suspended in September because of snow, a watchman was left on the property.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1947, p. 132; 1948, p. 95.]

BRIDGE RIVER (50° 122° N.W.).†

Gold.

Bralorne Mines, Limited.

Company office, 555 Burrard Street, Vancouver; mine office, Bralorne P.O. A. C. Taylor, president; M. M. O'Brien, vice-president and managing director; D. N. Matheson, general manager; C. M. Manning, mine superintendent; D. Cameron, assistant mine superintendent; A. Almstrom, mill superintendent. Capital: 1,250,000 shares, no par value.

Bralorne mine is on Cadwallader Creek and is 53 miles by road from Shalalth Station on the Pacific Great Eastern Railway.

In 1949 development work comprised 6,995 feet of drifting and crosscutting, 1,476 feet of raising, 4,246 feet of diamond drilling, and 877 feet of shaft sinking.

No spectacular occurrences of gold were found during the year, although some high assays were obtained from the 53 E block on 2000 level, which is a favourable indication that the grade of the ore on 1600 level will continue.

Broken reserves totalled 40,726 tons at January 1st, 1949, and 39,563 tons at November 30th. Grade at both times averaged more than half an ounce of gold per ton.

Sinking in the Empire shaft was resumed on February 3rd. At the end of the year the shaft had been deepened from 2000 level to 2600 level and stations had been

* By J. E. Merrett and J. S. Stevenson.

† By J. E. Merrett, except as noted.

cut at 150-foot intervals. A new vein was intersected 55 feet below 2500 level. Reported assays and widths indicate grades comparable to the mine average.

The daily average of underground shifts worked remained consistently high for the year, bettering the showing of the past few years and indicating a trend back to normalcy. The month of February showed an average of 315 shifts. A spring exodus reduced this figure in April to a low for the year of 238 shifts. An increase in the labour force started again in May and continued throughout the balance of the year. An average of 312 shifts per day was recorded in November. Total average number of men employed was 476. There were two fatalities during 1949.

In May the local union signed a three-year agreement with the management and accepted an efficiency bonus based on the average operating costs over each four-month period.

On the surface one twelve-man bunk-house, five houses, each of six rooms, a Canadian Legion Quonset-type hall, and a four-room addition to the school were constructed.

Production: Ore mined, 179,929 tons; ore milled, 178,995 tons. Gross contents: Gold, 82,404 oz.; silver, 21,682 oz.

Pioneer Gold Mines of B.C., Limited. Company office, 711 Yorkshire Building, Vancouver; mine office, Pioneer Mine P.O. Victor Spencer, president; H. T. James, managing director; J. Graham, mine manager; H. A. Rose, general superintendent; P. Schutz, mill superintendent. Capital: 2,500,000 shares, $1 par value. Pioneer mine is on Cadwallader Creek and about 55 miles by road from Shalalth Station on the Pacific Great Eastern Railway.

New development work comprised 1,832 feet of drifting, 1,725 feet of crosscutting, 2,000 feet of raising, and 1,113 feet of diamond drilling.

Drifting has been completed on all levels between 1900 and 2500 levels. In addition, a main ore transfer raise system has been completed between these levels. On 2500 level a trolley haulage extends from the transfer raise to No. 3 shaft, which was conditioned and put into service down to 2500 level.

Two ore and waste pockets, each with a capacity of 250 tons and equipped with mechanically operated chute gates, have been installed below 2500 level station on No. 3 shaft. On 2200 level a waste transfer dump and pocket have been made.

An automatic pump was installed on 500 level to remove mine water. On 2200 level, near the 27 vein, storage for 12,000 gallons of water was provided.

Work has commenced on a ventilation raise system which will extend from the 27 vein on 2500 level to the surface.

Most of the ore was obtained from the 27 vein and was mined by scraper-rill methods in stopes 75 feet long. During 1949 the ore milled was 66,986 tons. Gross contents: Gold, 32,310 oz.; silver, 6,647 oz.

On the surface, six five-room dwellings were constructed and the No. 1 pipe-line from the Hurley River dam to the No. 1 power-house was rebuilt.

The average number of men employed during the year was 250. One fatality occurred during the year.

B.R.X. (1935) Consolidated Mines, Limited. Company office, 616 Stock Exchange Building, Vancouver; mine office, Shalalth P.O. A. E. Jukes, president; E. R. Shepherd, managing director. Capital: 7,000,000 shares, 50 cents par value. This property, comprising forty-two claims, lies east of the Hurley River and on the Bridge River road 3½ miles north of Bralorne. During 1949 the shaft station, 27 feet of sump, and an ore pocket were completed for the C 9 level at the California shaft. In addition, a total of 400 feet of drifting, 205 feet of crosscutting, and 1,559 feet of diamond drilling were done on this level. Of the drifting, 200 feet was driven to the north and 180 feet to the south of the shaft station.

These drifts explored the chalcopyrite-pyrite zone which was indicated in 1948 by diamond drilling from C 8 level and also exposed in the new section of the shaft. The south drift followed the zone throughout, while the north drift followed the California shear. At a point midway along the north drift a crosscut was driven to the east, where it intersected the chalcopyrite-pyrite zone. Diamond drilling has commenced at the face of the crosscut in an effort to determine the depth and grade of the known mineralized bodies.

The average number of men employed was sixteen.

Hillstake Mining Company, Limited. Company office, 640 Pender Street West, Vancouver; mine office, Shalalth P.O. E. R. Shepherd, manager. Capital: 3,000,000 shares, no par value. This property, comprising twenty-six claims, is on the south side of the Bridge River, 1 mile west of Minto and opposite the Congress mine. The road from Gold Bridge to this property was completed in 1949. In addition, the McDonald Creek bridge was renewed and the road continued to the camp and to within 3,000 feet of the old suspension bridge over the Bridge River near Minto.

Two veins containing gold and antimony were discovered on the eastern end of the property by surface prospecting. At the western end of the property a strong, steeply dipping, ribboned quartz vein that is paralleled by an albitite dyke was drifted on for 15 feet. It is reported that gold assays from this vein range from 0.16 ounce per ton to more than 1 ounce per ton across a vein width of 34 inches. No stibnite was observed in this vein.

L.A.P. Mining Company, Limited. Company office, 626 Pender Street West, Vancouver; mine office, Gold Bridge P.O. L. A. Prosser, manager; M. Retan, superintendent. Capital: 3,000,000 shares, $1 par value. This private company holds seventeen claims and seven fractions formerly held by Wayside Consolidated Gold Mines, Limited. The property is on the Bridge River road half-way between Gold Bridge and Minto.

In 1949 a crosscut 90 feet long was driven into the hangingwall on 9 level, at a point 230 feet south of the winze. On the same level, crosscuts totalling 80 feet in length were driven for diamond-drill stations, and 5,808 feet of diamond drilling was done to explore the vein laterally and at depth. The shaft was straightened and retimbered in preparation for further sinking.

On the surface the compressor-house was extended, a storage warehouse was built, and the mill was conditioned for the installation of mill machinery. The crew averaged nineteen men.

Gold-Antimony.

Congress Gold Mines, Ltd. Company office, 640 Pender Street West, Vancouver; mine office, Minto Mine P.O. A. E. Jukes, president; Miss J. Whitehouse, secretary-treasurer. Capital: 4,000,000 shares, $1 par value. This property, comprising eleven claims and nine fractions, is on the Bridge River road, 1 mile west of Minto. In December, 1949, this property was reopened, and the mine is being reconditioned for further development work.

Gold.

Conbra. This property, comprising twenty-one claims owned by W. Haylmore, of Gold Bridge P.O., is on the southeast slope of Chism Creek and extends eastward to Aggie Creek. In 1949 Mr. Haylmore continued surface stripping and prospecting on the Chism Creek slope and uncovered extensions of some of the previously discovered mineralized zones.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1948, pp. A 102–A 105.]

Antimony.

Bellore Mines, Limited.* This private company (Len Belliveau, Minto Mine P.O., president) owns a property at the head of Truax Creek formerly owned by the Gray Rock Mining Syndicate. The holdings of the present company are reported to include the following sixteen claims, held by record: June Nos. 1 to 4, staked in May, 1946, by L. Belliveau; Jean Nos. 1 to 5, staked in May, 1948, by P. R. Belliveau; and Jean Nos. 6 to 12, staked in July, 1948, by L. Belliveau.

This property was examined during the period August 15th to 18th, inclusive, 1949. The claims cover ground on both sides of Truax Creek near a sharp U-shaped bend, slightly less than half a mile from the source of the creek. Truax Creek flows northerly into the Bridge River and joins the river about 6 miles downstream from Minto Mine P.O.

A road, 12 miles long, was built during the summer and autumn of 1949 from the crossing of the Bridge River at Minto Mine townsite to the property. The road follows the southern side of the river downstream past the Olympic property, then climbs diagonally in a series of switchbacks up the heavily wooded mountainside and, 7 miles from Minto, enters Truax Creek valley about 4 miles above the mouth of the creek. The road then follows the relatively flat profile of the creek for about 5 miles and ends a short distance above timberline on a talus slope below the workings.

The camp cabin, elevation 5,900 feet, is at timberline on the northern bank of a short easterly flowing stretch of Truax Creek and is reached by a pack-horse trail that follows the west bank of the creek. The end of the new road is reported to be several hundred feet easterly across the creek from the cabin.

The principal showings and workings are between elevations of 6,600 and 7,200 feet on the northeastern slopes of a sharp ridge that separates the headwaters of Fergusson Creek from those of Truax Creek. Truax Peak, altitude 9,448 feet, is directly across Truax Creek and about 1½ miles northwesterly from the showings. The mountainside near the showings is characterized by steep rock cliffs and long talus slopes and, above these, by ridges or moraines of large-sized rubble left by a retreating alpine glacier. Small remnants of the glacier cluster at the foot of a cirque about 1,500 feet southeasterly from and 500 feet above the showings.

The showings consist of six and possibly more approximately parallel quartz veins that strike northeasterly and dip 35 to 60 degrees southeastward. Only the three most conveniently located and best mineralized veins have been prospected. The work done on them consists of strippings and open-cuts. No. 1, the principal vein, contains the minerals stibnite, tetrahedrite, galena, sphalerite, and small amounts of arsenopyrite and pyrite. In his report on the property B. T. O'Grady† mentions the presence of realgar. The mineralized material in Nos. 2 and 3 veins consists of discontinuous lenses of relatively high-grade stibnite, unaccompanied by the other sulphides found in No. 1 vein.

The veins are in metamorphosed sedimentary rocks (hornfels) about 1,000 feet northerly from a large area of quartz diorite that extends for an unknown distance southerly. The sediments strike northwesterly and dip about vertical. The contact between the quartz diorite and the sediments strikes north 70 to 80 degrees east and dips 80 degrees northward.

The metamorphosed sedimentary rocks cut by the veins include dark-grey massive hornfels, recrystallized chert breccia, and lime-silicate rocks. The hornfels consists principally of quartz, andesine feldspar, hornblende, and, in some outcrops, biotite. The chert breccia is made up of angular fragments of chert, recrystallized to a granular mosaic of medium-sized quartz grain, in a matrix similar in composition and texture to

* By J. S. Stevenson.

† *Minister of Mines, B.C.,* Ann. Rept., 1936, pp. F 43–F 47.

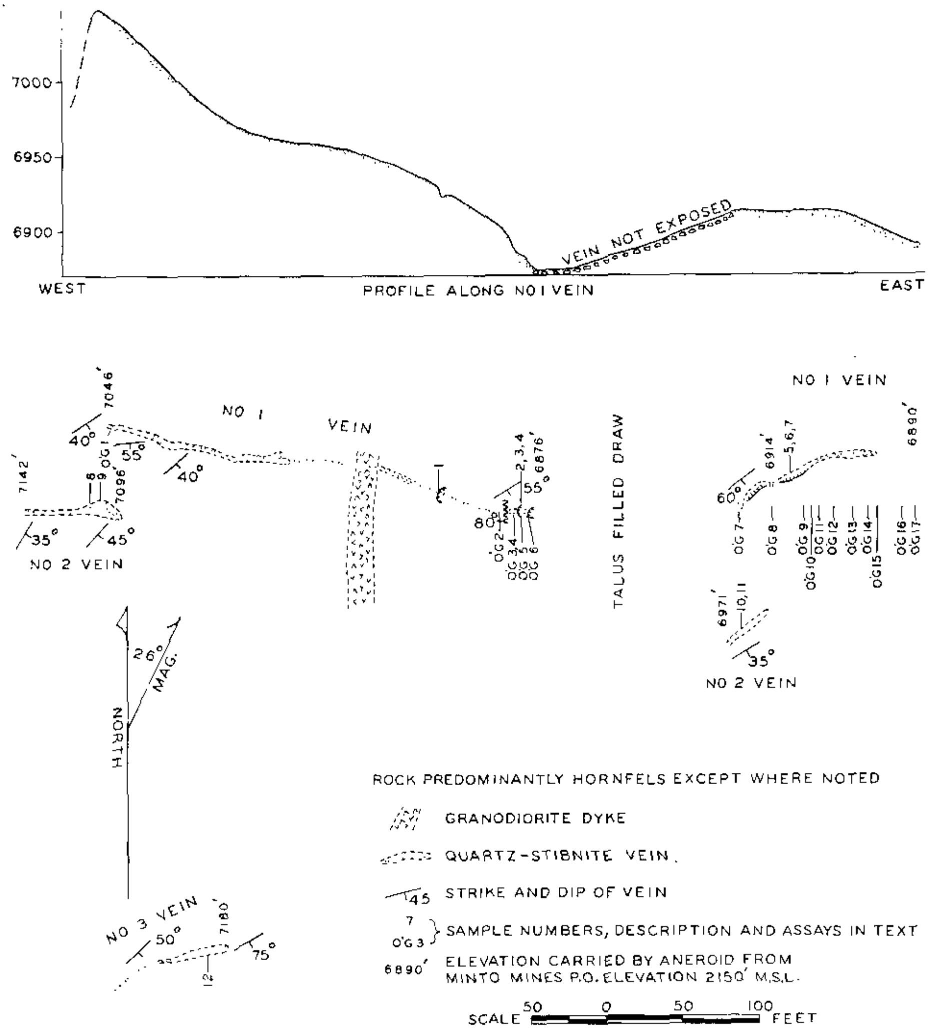

Fig. 7. Bellore—plan and profile of workings, with assays.
Tape and compass survey.

that of the hornfels. The lime-silicate rocks consist principally of diopside and quartz and some lenses of unreplaced crystalline limestone. These rocks are in broad bands—the hornfels from 25 to several tens of feet wide, the chert breccia up to 100 feet wide, and the lime-silicate rock up to 15 feet wide. It is probable that the heat accompanying the intrusion of the quartz diorite was responsible for the metamorphism of these sediments to hornfels and lime-silicate types.

The quartz diorite on the property is equigranular and non-foliated. It is a biotite-hornblende variety in which the hornblende was seen to contain remnant grains of pyroxene.

A granodiorite dyke, strike northerly, dip about vertical, cuts the sediments near the workings (Fig. 7) and is in turn cut by the veins. The dyke, 20 to 50 feet wide, is similar in composition to the quartz diorite but contains considerably more orthoclase.

Several pinkish-white aplite dykes, strike northwesterly and dip 45 degrees southwestward, cut the quartz diorite and extend northwesterly into the sediments. They have not been found close to the workings. The dykes are a few inches to 6 inches

Sample No.	Width.		Description.	Gold.	Silver.	Copper.	Lead.	Zinc.	Anti-mony.	Arse-nic.
	Ft.	In.		Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1	0	8	Face of cut, across quartz-sulphide lens 4 feet long by 3 feet deep	*Nil*	4.7	*	0.5	*	32.1	*Nil*
2	1	6	Face of cut, across zone of abundant mixed sulphides in footwall	0.10	211.8	3.0	14.1	8.2	3.4	*Nil*
3	1	2	Face of cut, middle portion of vein, moderate amount of sulphides	0.06	89.3	1.0	4.3	2.5	1.1	*Nil*
4	1	2	Face of cut, across zone of abundant mixed sulphides in hangingwall, including abundant stibnite	0.04	74.9	0.7	12.0	1.4	11.2	0.4
5	1	2	Across streak of stibnite 2 feet from hangingwall of vein	*Nil*	0.8	*	*	*	38.8	*Nil*
6	0	4	Across streak of scattered galena and tetrahedrite in middle of vein	0.02	53.9	0.6	4.2	*	2.0	*Nil*
7	6	0	Across full width of vein	Trace	5.9	*	*	*	3.8	*Nil*
8	0	8	Across lens where stibnite most abundant	*Nil*	0.3	*	*	*	54.7	*Nil*
9	0	8	Across lens where stibnite crystals coated with yellow antimony oxide	*Nil*	*Nil*	*	*	*	58.3	0.5
10	0	10	Across quartz-stibnite vein	*Nil*	0.6	*	*	*	16.4	Trace
11	0	2	Across lens of stibnite 2 feet long by 2 inches wide, within the quartz vein	*Nil*	0.3	*	*	*	52.9	*Nil*
12	1	4	Across quartz-stibnite vein	Trace	0.2	*	*	*	31.0	0.8
O'G- 1	4	7		0.02	0.2	......	......	......	5.0	......
O'G- 2	2	5		0.01	30.0	......	......	......	2.4	......
O'G- 3	2	7	Hangingwall	0.05	42.0	......	......	......	6.6	......
O'G- 4	3	10	Footwall	0.02	4.2	......	......	......	2.5	......
O'G- 5	5	6		0.02	60.4	......	......	......	12.0	......
O'G- 6	4	6		0.06	82.8	......	6.0	8.0	9.0	......
O'G- 7	3	0		0.01	0.4	......	......	......	*Nil*	......
O'G- 8	6	0		0.01	4.0	......	......	......	1.0	......
O'G- 9	6	0		Trace	3.6	......	......	......	9.0	......
O'G-10	5	0		0.04	76.8	......	......	......	5.0	......
O'G-11	4	6		0.01	15.2	......	......	......	0.9	......
O'G-12	3	0		Trace	0.6	......	......	......	1.0	......
O'G-13	5	0		0.01	1.6	......	......	......	4.9	......
O'G-14	4	0		0.01	10.2	......	......	......	2.9	......
O'G-15	3	4		0.01	5.2	......	......	......	1.0	......
O'G-16	2	6		0.02	26.2	......	......	......	0.5	......
O'G-17	1	6		Trace	0.6	......	......	......	*Nil*	......

* Indicates less than 0.3 per cent.

NOTES.—Sample Nos. 1 to 12 were taken by J. S. Stevenson in August, 1949, and Sample Nos. O'G-1 to O'G-17 were taken by B. T. O'Grady in 1936.

Assays on Sample Nos. 1 to 12 showed *nils* in tellurium, selenium, and tin.

Widths of O'Grady's samples, formerly expressed as feet and decimal parts of feet, are now expressed as feet and inches.

wide and have the typical sugary-grained texture of aplites. They consist principally of quartz and orthoclase feldspar. The proportion of orthoclase in them is much higher than in either the quartz diorite or the granodiorite. A feature of the dykes is the presence of scattered clusters of black tourmaline crystals, sometimes associated with quartz.

Fractures spaced 6 inches to several tens of feet apart cut the quartz diorite and the aplite dykes. They strike northeasterly and dip southeastward and are therefore parallel to the veins in the hornfels. Some of the fractures, a sixteenth to half an inch wide, are filled with chlorite, calcite, and quartz. A 3-inch fracture and two narrower ones in the quartz diorite are filled with quartz. Although no sulphide mineralization was seen in the outcrops of these quartz veins, some quartz mineralized with stibnite was noted in the talus below their outcrop. The similarity in strike and dip and the similar mineralogy suggest that the veins in the granodiorite and those in the sediments are genetically related.

The sediments, converted to hornfels types as the result of contact metamorphism, now have rather uniform physical characteristics. They may be considered a brittle, competent unit in which fractures may be expected to continue for long distances.

The vein fractures and, to a large extent, the vein quartz are persistent through the several hornfels types, with little evident difference in width of fracturing or in mineralization in any one rock type.

Of the three prospected veins, No. 1, the northern vein, has been traced for the greatest distance and contains the greatest widths and most continuous exposures of vein quartz. Although it contains less antimony than Nos. 2 and 3 veins, it contains, in addition to its content of antimony, moderate amounts of silver, lead, and zinc.

No. 1 vein is more or less continuously exposed for approximately 600 feet. O'Grady* reports that the vein extends 700 feet westerly beyond the western end, as shown in Figure 7, over a local summit or ridge. His sampling indicates that the vein is narrower and the amount of metals contained considerably less in this western undeveloped portion of the vein.

The vein matter within the 600-foot length that is represented in Figure 7 is in lenticular masses distributed along a shear zone. The lenses are principally of quartz and range in thickness from an inch to 7 feet. The shear is usually about a foot wider than the quartz within it. The vein contains stibnite, tetrahedrite, galena, sphalerite, and a small amount of arsenopyrite and pyrite in a gangue of massive white quartz. In general, the stibnite and other sulphides are distributed through the vein quartz. However, at the eastern end of the 600-foot length a hangingwall band of stibnite 14 inches wide is separated by 18 inches of quartz from a footwall band of mixed galena and tetrahedrite 4 inches wide. These separate bands of sulphides are not continuous, but die out and come in again along the strike of the vein. A sample across the stibnite band assayed 38.8 per cent. antimony and only very minor amounts in other metals, whereas a sample across the tetrahedrite-galena band assayed: Antimony, 2 per cent.; gold, 0.02 oz. per ton; silver, 53.9 oz. per ton; copper, 0.6 per cent.; lead, 4.2 per cent.; and zinc, less than 0.3 per cent. These samples show that the stibnite band contains principally antimony with little of the other metals, whereas the galena-tetrahedrite band contains silver and lead with but little antimony. It is probable, therefore, that, at this place in No. 1 vein, antimony ore relatively free from other sulphides could be obtained by hand-sorting. In the western exposures of the vein, however, particularly where Sample Nos. 1, 2, 3, and 4 (Fig. 7) were taken, the stibnite is not in a separate band, but is mixed with the other sulphides and could not be hand-sorted from them.

In its principal showing, No. 2 vein, strike northeasterly and dip 35 to 45 degrees southeastward, has been exposed for 60 feet along a steeply sloping ledge of rock about 60 feet southerly from the west end of No. 1 vein (Fig. 7). The vein matter is predominantly quartz, ranges in width from a few inches to a foot, and contains a long lens of relatively clean stibnite from a fraction of an inch to 8 inches thick. At the eastern end of this outcrop, moderately pure stibnite 8 inches thick (Sample Nos. 8 and 9 in Fig. 7) is exposed on a sloping rock ledge that is approximately parallel to the vein. The exposure measures about 8 feet along the strike and 25 feet on the dip. On the plan the projection of this 25-foot dimension is very much greater than the thickness of the lens. About 15 feet below the end of this exposure, five boulders of nearly pure stibnite, 2 feet in diameter and 8 inches thick, were found. It is probable that they came from the 8-inch lens of stibnite exposed in the outcrop.

The second or easterly exposure of No. 2 vein (Fig. 7) has been stripped for 38 feet to expose vein matter that is from 6 to 12 inches wide, and contains a lens 8 feet

* *Minister of Mines, B.C.*, Ann. Rept., 1936, pp. F 45, F 46.

long and a maximum of 10 inches wide that consists of mixed stibnite and quartz (Sample Nos. 10 and 11, Fig. 7).

The parts of Nos. 1 and 2 veins east of the draw shown in Figure 7 are offset about 70 feet to the south of the projected strike of the parts west of the draw. The draw is completely filled with talus. Probably it is the surface expression of a southerly trending fault that has offset these veins.

No. 3 vein, parallel to Nos. 1 and 2, outcrops in bluffs above these veins and has been exposed by a stripping 300 feet southerly from No. 2. The stripping exposes a lens of quartz stibnite vein matter 30 feet long and up to 16 inches wide, but usually about 10 inches wide. It consists of a mixture of fine-grained stibnite and grey chalcedonic quartz. Although at first glance much of the ore appears to be of relatively pure stibnite, on careful inspection with a hand-lens, a moderate amount of grey chalcedonic quartz may be seen scattered through it. A sample (No. 12, Fig. 7) taken across a width of 16 inches, the widest section, of this type of material assayed: Antimony, 31 per cent.

No work has been done on the several other approximately parallel veins higher up the mountain and westerly from Nos. 1, 2, and 3 veins since they were described by O'Grady* as follows:—

"At 7,080 feet elevation, crossing a ridge between rock-slides near the north-east corner of *Gray Rock No. 5* claim, the *No. 4* vein can be traced by outcrops for a length of 150 feet, where it is mostly from 6 to 8 inches wide but swells at the western end to 2.5 feet. A selected sample assayed: Gold, 0.03 oz. per ton; silver, 0.4 oz. per ton; antimony, 10.9 per cent. This *No. 4* vein is 300 feet, roughly estimated, to the north of the *No. 1* vein. The *Westman* vein, exposed on the *Gray Rock No. 6* claim, which adjoins the *Gray Rock No. 1* to the north, is the lowest and farthest north of the series. It is exposed by outcrops and three opencuts for a length of 400 feet or more along the 6,640-foot contour of the precipitous ground overlooking Truax Creek from the south. The showings consist of iron-stained quartz and oxidized siliceous gangue containing light sulphide mineralization without any appreciable amount of stibnite. A sample across 1 foot in the western cut assayed: Gold, 0.04 oz. per ton; silver, 4 oz. per ton; and a sample across 10 inches in a cut 150 feet to the east assayed: Gold, 0.02 oz. per ton; silver, 0.4 oz. per ton. In the third cut, 60 feet farther east, there are quartz stringers along well-marked fracturing in sheared, silicified, iron-stained rock. Two hundred feet farther east the vein, traced by outcrops throughout the interval, consists of a zone of quartz bands and stringers 8 feet wide."

About 900 feet easterly from the 600-foot length of No. 1 vein, five open-cuts were dug between elevations of 6,630 and 6,690 feet. They exposed a quartz-stibnite vein intermittently for a length of 120 feet. This vein, strike north 60 degrees east and dip about vertical, may be the northeasterly continuation of No. 1 vein, but abundant talus in the 900 feet between the exposures makes the correlation uncertain. The vein in these eastern exposures is steeper and is accompanied by considerably more shearing and wallrock alteration than the 600-foot length at No. 1 vein and may be a different vein.

At the time of the writer's examination, the open-cuts on these eastern exposures were partly sloughed, and the vein was incompletely exposed. The vein shear is up to 4 feet wide and in some places contains several 1-inch quartz stringers and in other places a single lens of quartz and stibnite up to 18 inches wide in which the pure stibnite reaches a width of 14 inches. A selected sample of relatively pure stibnite piled at the mouth of the second cut from the top assayed: Antimony, 45.5 per cent.; and a sample taken across the widest part, 14 inches, of the stibnite lens in this cut assayed: Antimony, 52.1 per cent. In July, 1945, in this cut, J. H. Bennett, of the British Columbia Department of Mines, selected a sample that assayed: Antimony, 55.6 per

* *Minister of Mines, B.C.*, Ann. Rept., 1936, pp. F 46, F 47.

cent.; tellurium, *nil;* selenium, *nil;* and took a sample across 22 inches that assayed: Antimony, 33.4 per cent. In several places the footwall of the vein shear has been intensely altered to a pale-green sericite-carbonate rock with considerable fine pyrite. A sample, taken across 2 feet of this material in the lowest cut, assayed: Gold, 0.01 oz. per ton; silver, 0.3 oz. per ton; antimony, 0.6 per cent. In general, the stibnite, particularly in the second cut from the top, is accompanied by reddish-coloured muck that has probably resulted from the oxidation of the stibnite; such material is uncommon in Nos. 1, 2, and 3 veins. An abundance of oxidized material is found with these eastern exposures because they are on the lee side of a prominent rock bluff that protected the vein from erosion by the alpine glaciers at this particular spot on the mountainside; whereas the outcrops of Nos. 1, 2, and 3 veins are unprotected by rock bluffs, and were in the path of the glaciers that scoured all accumulated oxidized material from the outcrops.

A well-defined quartz vein, strike northeasterly and dip 60 degrees southeastward, outcrops 80 feet northerly from the open-cuts on the eastern exposures. This vein is exposed in outcrops and strippings from 40 feet and is seen to be 6 to 14 inches wide and to consist principally of quartz, with no visible stibnite or other mineralization.

According to O'Grady* the westerly extension of the vein in these eastern showings is to be found in showings about 300 feet below those just described. He obtained assays from these showings as follows:—

"A sample across 1 foot, at 6,600† feet elevation, assayed: Gold, 0.01 oz. per ton; silver, 6.2 oz. per ton. At 6,650 feet elevation a sample across 6 inches on the footwall side of the 2-foot total width assayed: Gold, 0.06 oz. per ton; silver, 21.8 oz. per ton; lead, 18 per cent."

In the summary, it may be noted that Nos. 2 and 3 veins and the vein in the exposures contain lenses of stibnite that are relatively solid and free from impurities and may be readily hand-cobbed to antimony ore of shipping grade. The stibnite from these lenses is free from selenium and contains less than the usually allowable 0.5 per cent. of arsenic plus zinc, lead, gold, and tin. No. 1 vein contains less stibnite than these veins; however, it contains galena, tetrahedrite, and sphalerite, and because of silver, lead, and zinc contained, the vein is of considerable prospective interest.

ANDERSON LAKE (50° 122° N.E.).‡

Gold.

Golden Contact Mines, Limited. Company office, 850 Hastings Street West, Vancouver; executive office, 318 Vancouver Block, Vancouver; mine office, McGillivray Falls P.O. M. McGregor, president and managing director. Capital: 3,000,000 shares, 50 cents par value. This company has a gold prospect comprising seventeen claims and three options on the north slope of McGillivray Creek, 4 miles by pack-trail from McGillivray Falls Station on the Pacific Great Eastern Railway.

Work commenced early in April, 1949, and stopped in November. During this period 504 feet of drifting and 256 feet of crosscutting and slashing were done on the 49'er level (elevation, 3,187 feet). In addition, 60 feet of crosscutting was done on the new " Pep " level, 169 feet lower than the 49'er adit. This new adit is 80 feet below and 500 feet from the campsite.

In 1949 drifting was continued up to the No. 1 Fault zone on the west segment of the vein. It is reported that for 233 feet the vein in this drift contains local occurrences of fine gold and that the amount of sulphide mineralization is greater than in the vein where exposed in the upper workings. A crosscut was driven toward the east segment.

* *Minister of Mines, B.C.,* Ann. Rept., 1936, p. F 44.
† Aneroid elevations used in the 1949 report are about 100 feet lower than those given in O'Grady's report.
‡ By J. E. Merrett.

It intersected four faulted sections of the vein and then continued to a greenstone contact. A drift was started on the third faulted section and continued through faulted ground to the east segment of the vein which was followed for 105 feet. Where first intersected, this east segment was 11.5 feet wide and gradually increased in width to 22 feet at the east face, making the average width 15 feet. This vein is well ribboned throughout its length and is reported to contain local concentrations of fine and coarse gold accompanied by minor arsenopyrite, pyrrhotite, chalcopyrite, sphalerite, and sparse galena with sericite, mariposite, calcite, and ankerite.

It is reported that erratic high and low gold assays have been obtained in both the west and the east segments on the 49'er level. It is believed by the management that, because of the width of the vein and the erratic assays obtained, a reliable estimate of the grade can only be obtained by bulk sampling. A crew of nine men was employed.

TEXAS CREEK.*

Molybdenum.

Index. (50° 122° N.E.) Owned by H. Reynolds, of Lillooet. The Index Mineral Claim is on the summit between the north fork of Texas Creek and Cottonwood (Phair) Creek and is at an elevation of 8,000 to 8,500 feet. It is reached via Texas Creek, which flows into the Fraser River from the west, some 13 miles south of Lillooet. A good gravel road runs from Lillooet to Texas Creek. From this road a fair trail leads up Texas Creek 14 miles to the property. The lower 6 miles of trail is in canyon and the trail crosses the creek eight times. Floods in recent years have washed out all but one of the bridges, and it is doubtful if this part of the trail could be utilized during high water.

The remains of an old camp are situated at timberline (elevation 6,500 feet), approximately two-thirds of a mile down the north fork of Texas Creek from the Index claim.

The property, an old Crown grant, has attracted the attention of various individuals for over thirty years, but the only recorded shipment of molybdenite ore was made in 1916. It amounted to 8 tons, 300 pounds assaying 15.01 per cent. molybdenite. The development consists of a few shallow surface pits and cuts.

The writer spent two days, August 31st and September 1st, on the property. The weather was ideal and the terrain completely free of snow. The purpose of the examination was twofold:—

(1) To investigate whether a large tonnage of low-grade molybdenite ore is available.

(2) To investigate reports that radioactive material is associated with the molybdenum mineralization.

The host rock of the molybdenite mineralization is a fine- to medium-grained granite stock that is roughly elliptical in plan. The long axis of the ellipse runs in a westerly direction and is approximately 1¾ miles long. The maximum width of the stock at the surface is 3,000 feet.

The Index claim has been located to cover the most promising mineralization and is at the western end of the stock, near its contact with metamorphosed sediments.

The main showings occur on a steep southwesterly slope, which is comprised of 60 per cent. granitic talus and 40 per cent. granitic outcrop. The molybdenite occurs in and close to joints in the granite. Aside from molybdenite and a minor amount of the oxidation product, molybdic ochre, the only other metallic mineral noted was a very minor amount of fine pyrite.

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* By W. R. Bacon.

The granite is traversed by several systems of joints, the strongest of which has a north 70 degrees east strike and a steep to vertical dip. The best occurrence of molybdenite now exposed is a lens of well-mineralized material 16 feet long with a maximum width of 2 feet, formed along one such joint. A sample of this material ran 6.9 per cent. molybdenum. The other concentrations of molybdenite consist of masses not more than 3 to 4 inches by 8 to 10 feet along joints of diverse attitude. Such concentrations constitute less than 1 per cent. of the large areas of granite exposed.

The rock portion of these lenses is characterized by a pronounced rusty colour and an almost complete absence of ferro-magnesian constituents. Here, the rock consists essentially of quartz, partly kaolinized feldspar and, in places, a minor amount of fine sericite.

These lenses are in a large, rather ill-defined, slightly rusty zone that trends north 70 degrees east, roughly parallel to the strongest joint system. In places this zone attains a width of 200 feet and gives a first impression of extensive, disseminated mineralization, especially as this rusty colouration generally occurs in the form of spots on the weathered surface of the granite. Closer examination, supported by sample assays (seven chip samples all assaying less than 0.1 per cent. molybdenum), proved that the zone proper, represented on the surface by the slightly rusty granite, is essentially unmineralized.

The examination was made under favourable circumstances when the ground was free of snow. About 40 per cent. of the rock surface is free of talus or other overburden. The examination has shown that few of the lenses of more highly mineralized material have an area of as much as 5 square feet, that the lenses constitute less than 1 per cent. of the exposed area of the zone, and that the average molybdenum content of the zone, or of any considerable part of it, does not approach the minimum grade of an economic deposit of molybdenum.

The mineralized outcrops were all tested with a Geiger counter for possible radioactivity, and, although radioactive material is definitely present, it does not occur in sufficient quantity to be economically interesting. The highest assay obtained from ten samples taken by the writer was equivalent to 0.0085 per cent. U_3O_8.

RUSTY CREEK (50° 120° N.W.).*

Copper.

Copper King. George Powell and A. R. Pizzi, of Lillooet, recorded the eight claims of this group in June and July, 1948. The claims are on the headwaters of Rusty Creek, a tributary of Fountain Creek which flows into the Fraser River. A good pack-trail leaves the Fountain Valley road at a point 5 miles from its junction with the Lillooet–Pavilion Road and extends 3 miles to the claims. The trail passes through the Jackson or former Nygren ranch, on Lot 3453. The claims are recorded in the Kamloops Mining Division but lie astride the boundary of the Lillooet and Kamloops Mining Divisions. The showings are at an elevation of 4,600 to 5,000 feet.

In the late twenties John Nygren, with the aid of a partner, made open-cuts over a length of several hundred feet along the strike of the showings. He also drove an adit about 400 feet lower than the open-cuts. The adit is below the cabin on Camp Creek, a small tributary of Rusty Creek. In 1935 and 1936 the claims were restaked, surveyed, and grouped as the Rusty Creek and Bell groups of eight claims and a fraction. G. K. Burnett, of Vancouver, held the controlling interest in these claims, but little or no work was done and they were allowed to lapse.

Outcrops stained with secondary copper carbonates indicated mineralization that strikes about north 60 degrees west and dips from 35 to 45 degrees northeastward.

* By J. E. Merrett.

Several open-cuts at about 5,000 feet altitude were made to prospect the mineralized zone. Little mineralization is to be seen, except in two of the open-cuts.

One of these cuts was opened for 40 feet in length to a depth of 15 feet. In this cut a vein or lens, consisting of quartz, minor calcite, chalcopyrite, and sphalerite, has an average width of about 3 feet. The vein matter and the wallrock are broken by cross-slips, and secondary copper carbonates are found in the hangingwall and in the footwall rocks. The mineralization at the bottom of the cut is richer than in the overlying surface. In 1948 the Inspector of Mines took three samples across the vein mineralization and one in the footwall. The data for these samples and for one taken in 1949 are as follows:—

Sample No.	Description.	Width.	Gold.	Silver.	Copper.	Zinc.
		Feet.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
1	Vein, bottom of cut	3.0	Trace	1.2	2.20	0.8
2	Vein, centre of cut	3.5	0.01	1.8	4.10	2.1
3	Vein, top of cut	3.0	Trace	0.1	0.22	Trace
4	Mineralized footwall	14.5	Trace	0.2	0.33	Trace
5	Vein, centre of cut	3.5	Trace	1.5	2.70	0.5

The other cut showing mineralization is several hundred feet to the south and exposed a vein 2 feet wide containing 2 inches of chalcopyrite at the hangingwall side.

The adit on Camp Creek is caved, but reports indicate it was driven about 100 feet on the general strike of the vein without exposing copper mineralization.

NICOLA (50° 120° S.W.).*

Copper.

Guichon Mine, Limited. Company office, 125 Pacific Building, Vancouver. J. D. Ferguson, Merritt, mine manager. This company controls two mining properties —one, known as the Copperado, is about 5 miles north of the foot of Nicola Lake, and the other, known as the Guichon, is about 6 miles to the southeast, lying a mile south of Nicola Lake. The distance in a southeasterly direction from the Copperado workings to those on the Guichon group is about 6 miles.

Copperado.—The Copperado consists of the Crown-granted claim Turlight and twenty-nine claims held by location. The workings, which are about 5 miles north of the foot of Nicola Lake, are reached by a dirt road 7½ miles long, which leaves the Merritt–Kamloops Highway at Nicola village.

The property lies between 3,500 and 4,500 feet altitude on the well-timbered flank of a low ridge sloping gently southwestward toward the valley of Clapperton (Mill) Creek. The principal rock is medium-grained biotite-hornblende granodiorite. The alinement of biotite flakes and of chloritized hornblende grains gives the granodiorite a well-marked foliation, which strikes northerly and dips moderately to steeply westward. The granodiorite is traversed by numerous aplite dykes and by lenticular masses of quartz-feldspar pegmatite, both of which are believed to be genetically related to the granodiorite. Nearly all of these minor intrusives strike northerly and dip either westward, parallel to the foliation, or gently eastward, at right angles to the foliation.

The initial work on the Turlight claim was done in 1929, when a shaft inclined at about 67 degrees was sunk 60 feet on a quartz-bornite vein, and several small open-cuts were made near the shaft collar. The property remained inactive until Guichon Mine, Limited, acquired control, and work was resumed in 1947. A level started from a point

* By W. H. White.

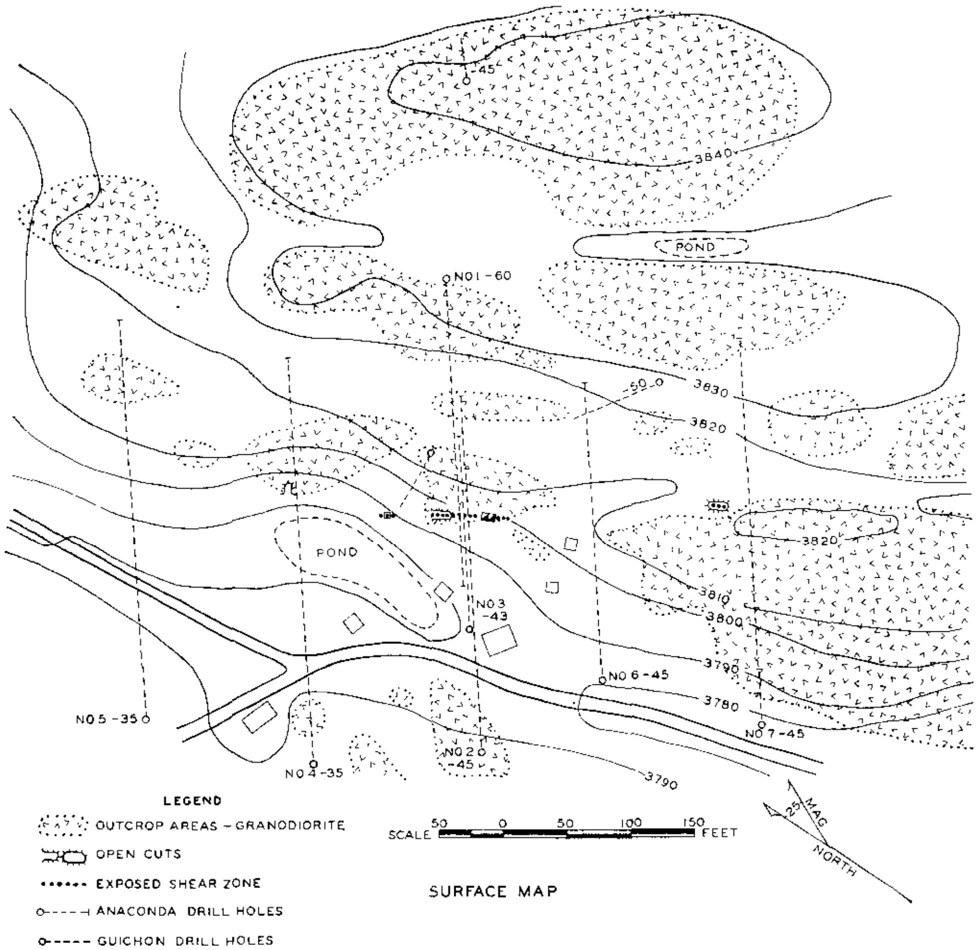


Fig. 8. Surface map of the Copperado group (Guichon Mine, Limited).

in the old shaft 46 feet below the collar was driven 105 feet northwesterly. A small stope was established, and about 125 tons of bornite ore was mined and shipped to the Tacoma smelter. During the winter of 1947–48, while the property was under option to Anaconda Copper Mining Company, seven diamond-drill holes, totalling 2,578 feet, were drilled from the surface to test the ore-bearing structure at a depth of about 300 feet. Subsequently, the option was dropped. Guichon Mine, Limited, resumed operations in 1949. The shaft was deepened to 94 feet, and from the bottom, drifts were driven 30 feet northwesterly and 80 feet southeasterly. Some surface diamond drilling was done, but no core was saved. At the end of 1949 the shaft was being deepened.

Equipment includes a 415-foot diesel-driven Gardner-Denver air compressor, a small Sullivan portable compressor, a single-drum air-hoist, and a gasoline-driven diamond drill.

Figure 8 is a map, constructed from plane-table and chain and compass surveys, which shows the surface and underground geology and development work.

The surface is characterized by low hummocks on which foliated granodiorite outcrops are separated by narrow, shallow, drift-filled depressions that trend from northerly to northwesterly. This marked lineation of the surface is attributed both to the northerly striking foliation and to one or more northwesterly trending shear zones.

Exploration work has been restricted to one shear zone that contains lenses of vein matter. The shear zone is exposed on the surface at three points—the shaft collar, a large open-cut 35 feet northwesterly from the shaft, and a small pit 180 feet southeasterly from the shaft. The large open-cut exposes weathered, copper-stained banded quartz that is 7 feet wide, strikes north 35 degrees west and dips 70 degrees northeastward. The small pit exposes sheared granodiorite and small warped lenticles of aplite cut by quartz veinlets that contain disseminated grains of bornite and chalcopyrite. Folia of sheared rock conform to the shape of the aplite lenticles which they surround. The shear zone has the same strike here as in the large open-cut, but the dip is almost vertical.

The cores of the Anaconda drill holes have sections ranging in length from 5 to 18 feet of sheared, altered, and slightly mineralized material, which agree approximately with the projected position of the main shear zone. The drill intersections indicate this shear zone to a vertical depth of 240 feet below the shaft collar and for 500 feet horizontally. Parts of the core from drill intersections of the shear zone have been removed for assaying.

The details of underground geology and mineralization are represented in Figure 9. Banded quartz, 2 to 5 feet wide and sparsely to moderately well mineralized with bornite, appears in the shaft from the collar to No. 1 level. Fault surfaces form both walls of the vein. At No. 1 level the hangingwall steepens and the quartz gradually narrows, pinching out in the shaft about 15 feet below the level. Thence to the bottom the shaft is in dark-green biotite-chlorite schist that here and there contains lenticles of quartz and a few tiny stringers of bornite. Occasional flakes of native copper are found in and along the borders of the quartz lenticles. The shear zone is bounded by smooth fault surfaces about 5 feet apart.

On No. 1 level, in and northwesterly from the shaft, the footwall diverges from the hangingwall. In the wedge-shaped area between the two fault surfaces the quartz is well mineralized with irregular masses and veinlets of bornite and forms an orebody which, below the small stope, attains a maximum width of 8 feet. Thence followed northwesterly it gradually tapers and becomes less well mineralized. A short distance beyond the sump (Fig. 9, projection A-A) the quartz gives way to a narrowing zone of unmineralized biotite-chlorite schist that continues to the face. A vertical wedge-shaped aplite dyke, which shows marked foliation due to stress, forms the footwall of this narrow unmineralized part of the shear zone. What may prove to be the same dyke appears in the footwall of the shaft near the collar.

In the northwest drift of No. 2 level there appears to be a repetition of the structural conditions on No. 1 level. A footwall slip diverges from the continuous hangingwall, and the wedge-shaped mass between them consists of quartz well mineralized with bornite. At the face the width of the orebody is 6 feet.

The exposures in No. 1 level and in the northwest end of No. 2 level indicate an orebody having a stope-length of 60 feet and a steep rake to the northwest. The approximate limits of this orebody are shown on the longitudinal projection in Figure 9.

Southeastward, from the shaft, No. 2 level follows a well-defined but unmineralized shear zone. At 50 feet from the shaft the persistent hangingwall fault swings slightly toward the east and splits into several branches. Quartz stringers appear along the footwall branch of the fault, and at the face these coalesce to form irregular masses of quartz containing some chalcopyrite and bornite.

The table on page 119 shows the results of channel samples taken underground and on the surface near the shaft. It should be noted that from the surface to No. 1 level the mineralization in the inaccessible northwest wall of the shaft appeared to be somewhat better than that sampled in the accessible southeast wall.

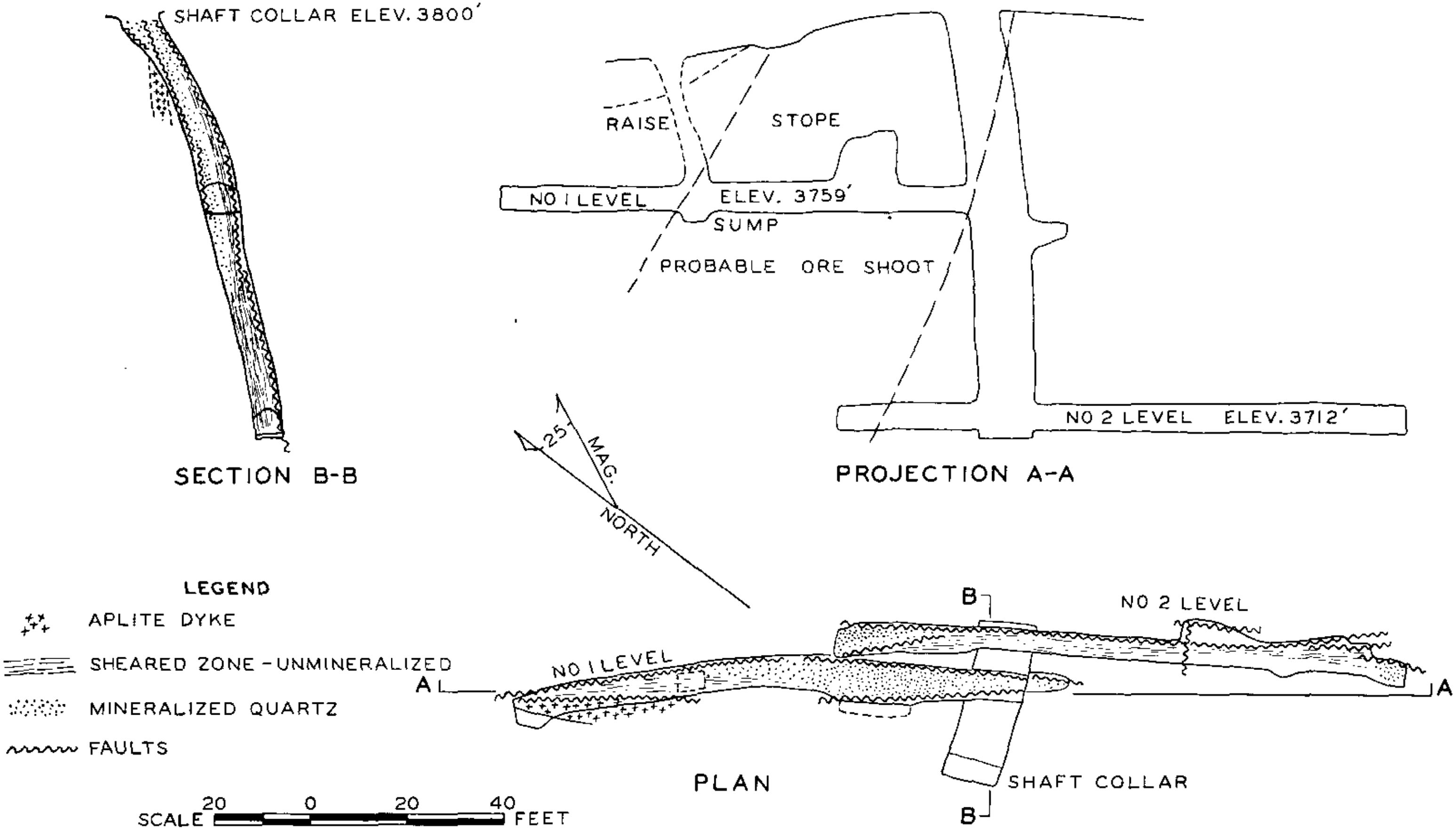


Fig. 9. Plan and projection of underground workings on the Copperado group (Guichon Mine, Limited).

Location.	Width.	Gold.	Silver.	Copper.
	Inches.	Oz. per Ton.	*Oz. per Ton.*	*Per Cent.*
Open-cut—35 feet northwest of shaft—				
Hangingwall side	24	Trace	0.5	1.2
Footwall side	60	Trace	0.1	2.4
Open-cut—180 feet southeast of shaft	24	*Nil*	*Nil*	0.54
Shaft—				
Distance down shaft from collar—				
2 feet, southeast wall	60	Trace	0.5	1.1
7 feet, southeast wall—				
Hangingwall side	26	Trace	0.8	2.6
Footwall side	32	Trace	0.3	0.58
12 feet, southeast wall—				
Hangingwall side	26	*Nil*	0.5	2.4
Footwall side	23	Trace	0.3	1.0
17 feet, southeast wall	60	0.01	0.5	1.7
27 feet, southeast wall	60	0.01	0.2	0.6
37 feet, southeast wall—				
Hangingwall side	46	Trace	0.6	1.5
Footwall side	*38*	*0.11*	*1.1*	*3.4*
47 feet, southeast wall	52	Trace	0.4	0.97
57 feet, southeast wall	53	*Nil*	0.1	0.76
67 feet, southeast wall—				
Hangingwall side	17	*Nil*	*Nil*	0.13
Footwall side	26	0.01	1.1	4.6
75 feet, southeast wall—				
Hangingwall side	44	*Nil*	0.1	0.06
Footwall side	18	*Nil*	*Nil*	0.37
75 feet, northwest wall—				
Hangingwall side	*33*	Trace	Trace	0.05
Footwall side	23	*Nil*	0.1	0.39
No. 1 level—				
Distance measured northwest from northwest wall of shaft—				
1 foot, back—				
Hangingwall side	27	0.01	1.0	5.2
Footwall side	42	0.01	1.5	5.2
6 feet, back, footwall side	46	Trace	1.1	4.6
11 feet, back—				
Hangingwall side	30	0.01	1.1	4.3
Footwall side	47	0.01	1.5	5.3
28 feet, back—				
Hangingwall side	44	0.01	0.7	2.4
Footwall side	42	*Nil*	0.8	2.8
33 feet, back—				
Hangingwall side	52	Trace	0.8	3.0
Footwall side	28	Trace	0.5	1.2
38 feet, back—				
Hangingwall side	40	*Nil*	1.1	2.7
Footwall side	26	*Nil*	0.4	0.37
42 feet, back	52	*Nil*	0.6	1.9
48 feet—				
Back	33	Trace	0.7	2.9
Floor	55	0.02	0.7	2.5
60 feet, back—				
Hangingwall side	27	Trace	1.8	6.7
Footwall side	37	Trace	0.4	0.9
65 feet, back—				
Hangingwall side	29	0.01	0.2	0.31
Footwall side	39	*Nil*	0.1	0.12
70 feet, back—				
Hangingwall side	14	*Nil*	0.4	0.76
Footwall side	28	*Nil*	*Nil*	0.19
75 feet, back	26	*Nil*	Trace	0.41
80 feet, back	17	*Nil*	*Nil*	0.30
85 feet, back	14	*Nil*	0.2	0.20
90 feet, back	12	*Nil*	*Nil*	0.26
95 feet, face	7	*Nil*	*Nil*	0.10
No. 2 level—Northwest face, 30 feet from northwest wall of shaft	48	0.02	1.8	9.1

Several other isolated and undeveloped showings were examined on the hillside northwest of the main workings. A slightly copper-stained quartz-feldspar pegmatite zone in foliated granodiorite was seen about 2,500 feet bearing north 35 degrees from the shaft, elevation about 4,350 feet. The pegmatite contains scattered non-metallic black prismatic crystals of a slightly radioactive mineral, which was subsequently identified as allanite. In the laboratory examination, part of a specimen of the pegmatite was crushed, and a small sample was obtained by sorting out allanite crystals as free as possible from other material. Spectrochemical analysis of this sample indicated the presence of uranium. However, the allanite crystals make up a small part of the composition of the pegmatite. A sample representing the specimen as a whole was tested with the laboratory Geiger counter and was found to have radioactivity equivalent to 0.002 per cent. U_3O_8.

Some old open pits about 3,500 feet northwest of the shaft at elevation 4,150 feet have been made on a very irregular and probably non-persistent, northerly trending quartz vein and stringer lode sparsely mineralized with bornite. A sample across 22 inches of the best mineralization assayed: Gold, *nil;* silver, 0.8 oz. per ton; and copper, 0.28 per cent. About 1,000 feet farther northwesterly, another quartz vein, slightly copper-stained but otherwise unmineralized, outcrops for 200 feet. This vein strikes regularly north 15 degrees west and dips 75 degrees eastward. A sample across the vein, width 12 inches, assayed: Gold, trace; silver, 0.1 oz. per ton; and copper, 0.18 per cent.

Guichon.—The Guichon consists of the seven Crown-granted claims Frindsbury, Camperdown, Ingersol, Last Post, Ensign, Quilchena, and Tete Rouge, together with fourteen located claims. The workings, a mile south of Nicola Lake and on the west side of the Quilchena Creek valley, are reached by a short road branching from the Merritt–Kamloops Highway at the Guichon ranch.

Figure 10 is a plane-table map of the area in which most of the development work has been done. The open, rolling grassy slopes are broken here and there by jagged rock bluffs which become more numerous and continuous at higher elevations to the west of the area mapped. Development work consists of seven short adit drifts at elevations ranging from 2,453 feet to 2,571 feet, having an aggregate length of 670 feet; several caved open-cuts; and an adit crosscut 1,390 feet long at elevation 2,186 feet. From the face of this crosscut 1,000 feet of diamond drilling was done in four holes, oriented as shown in Figure 10. The other adits are all old workings, but the crosscut was driven in 1946 and 1947. The property was not worked in 1949.

The rocks include amygdaloidal augite-basalt, both massive and porphyritic varieties; several beds of basalt breccia; and one small outcrop of limestone. These are conformable members of the Triassic Nicola group. The volcanic rocks are dark red to black, commonly flecked with olive green. The red coloration is caused by iron oxide abundantly dusted through the groundmass, and the green by epidote in the amygdules and in the groundmass. Within the area mapped, the strata appear to strike a few degrees west of north and to dip steeply westward. The only intrusive rock noted is a dyke of feldspar porphyry in the southwest corner of the area mapped. The dyke is about 10 feet wide, strikes northwest, and is vertical.

The position of an important vertical fault striking northerly across the property is marked by a narrow valley approximately parallel to the main valley of Quilchena Creek. The fault can be traced by alined bluffs for at least a mile south of the area mapped. The only exposure of this fault is near the face of the long crosscut, where a 50-foot zone of soft chocolate-coloured clay is sliced by numerous slickensided fault surfaces on which the mullion structure is approximately horizontal. Although the displacement on the fault is not known with certainty, it is believed to be essentially horizontal and may be large. The veins and the feldspar porphyry dyke exposed west of this fault have not been found on the east side, and one vein outcropping east of the fault cannot be correlated with any of those to the west. Numerous other faults sub-parallel to the major fault may be seen in the long crosscut. The steep bluffs east of the major fault are marked by a set of well-developed joints striking northwesterly. In places the joints are only a few inches apart, giving the rock a sheeted appearance. The joints contain films and small veins of epidote, chlorite, carbonates, and quartz.

Seven of the nine veins examined are shown diagrammatically on Figure 10. The veins all strike northwesterly and for the most part dip at high angles to the southwest. They are believed to represent tension cracks, resulting from movement along the major fault. Some details concerning the individual veins and assay results of channel samples are given below. The veins have been numbered arbitrarily for ease in referring to the map.

No. 1 Vein: This vein is exposed intermittently on surface by several old open-cuts for a horizontal distance of about 200 feet. An adit a few feet below the outcrop follows the vein for 55 feet. The vein fracture is filled chiefly with crushed basalt containing sericitized stringers of quartz, feldspar, and calcite. The width, including veins, stringers, and intervening crushed rock, ranges from 3 to 41 inches. Data on samples across the width of No. 1 vein taken in the adit are as follows:—

Location (Distance from Portal).	Description.	Width.	Gold.	Silver.	Copper.
		Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.
Portal, back	Quartz stringers and crushed rock	22	0.04	0.4	0.25
5 feet, ,,	Quartz stringers and crushed rock	20	0.04	0.5	0.58
10 ,, ,,	Quartz stringers and crushed rock	20	0.05	0.5	0.47
15 ,, ,,	Quartz calcite breccia	28	*Nil*	*Nil*	Trace
20 ,, ,,	Quartz-calcite breccia with some pink orthoclase	22	0.03	0.2	0.22
25 ,, ,,	Quartz-calcite breccia with some pink orthoclase	22	0.01	1.6	0.9
30 ,, ,,	Quartz-calcite breccia with some grains of bornite	36	0.07	0.5	1.1
35 ,, ,,	Quartz-calcite breccia with some grains of bornite	41	Trace	0.3	1.4
40 ,, ,,	Crushed quartz-calcite breccia	32	Trace	0.2	0.22
45 ,, ,,	Crushed quartz-calcite breccia	32	*Nil*	0.5	0.72
50 ,, ,,	Crushed quartz-calcite breccia	10	Trace	0.3	0.59
55 ,, face	Quartz stringers and crushed rock	12	*Nil*	*Nil*	Trace

No. 2 Vein: Several old open-cuts expose No. 2 vein at intervals for a horizontal distance of 160 feet. This vein is a breccia zone ranging in width from 3 to 24 inches; it contains quartz and calcite sparsely mineralized with bornite and chalcopyrite. A sample taken in an open-cut across 16 inches assayed: Gold, 0.24 oz. per ton; silver, 0.8 oz. per ton; copper, trace.

Four short adits have been driven in the bluffs a short distance below the outcrops at elevations of 2,454, 2,453, 2,497, and 2,527 feet. These workings explore several irregular, branching, northwesterly trending fault zones, some of which contain short, narrow veins or stringer lodes of sparsely mineralized quartz and calcite. None of the exposures underground can be correlated with certainty with the outcrops a few tens of feet above. In the adit at elevation 2,497 feet two channel samples 5 feet apart were taken across a quartz lens 15 feet long and about 12 inches wide. The first assayed: Gold, 0.54 oz. per ton; silver, 2.0 oz. per ton; copper, 0.3 per cent. The second assayed: Gold, 1.14 oz. per ton; silver, 3.6 oz. per ton; copper, 0.98 per cent. In the face of the adit at elevation 2,453 feet a channel sample taken across an 8-inch quartz vein assayed: Gold, trace; silver, 0.3 oz. per ton; copper, 1.2 per cent.

No. 3 Vein: This is an irregular, branching lode of quartz-calcite stringers partly exposed in one caved open-cut. It was not sampled.

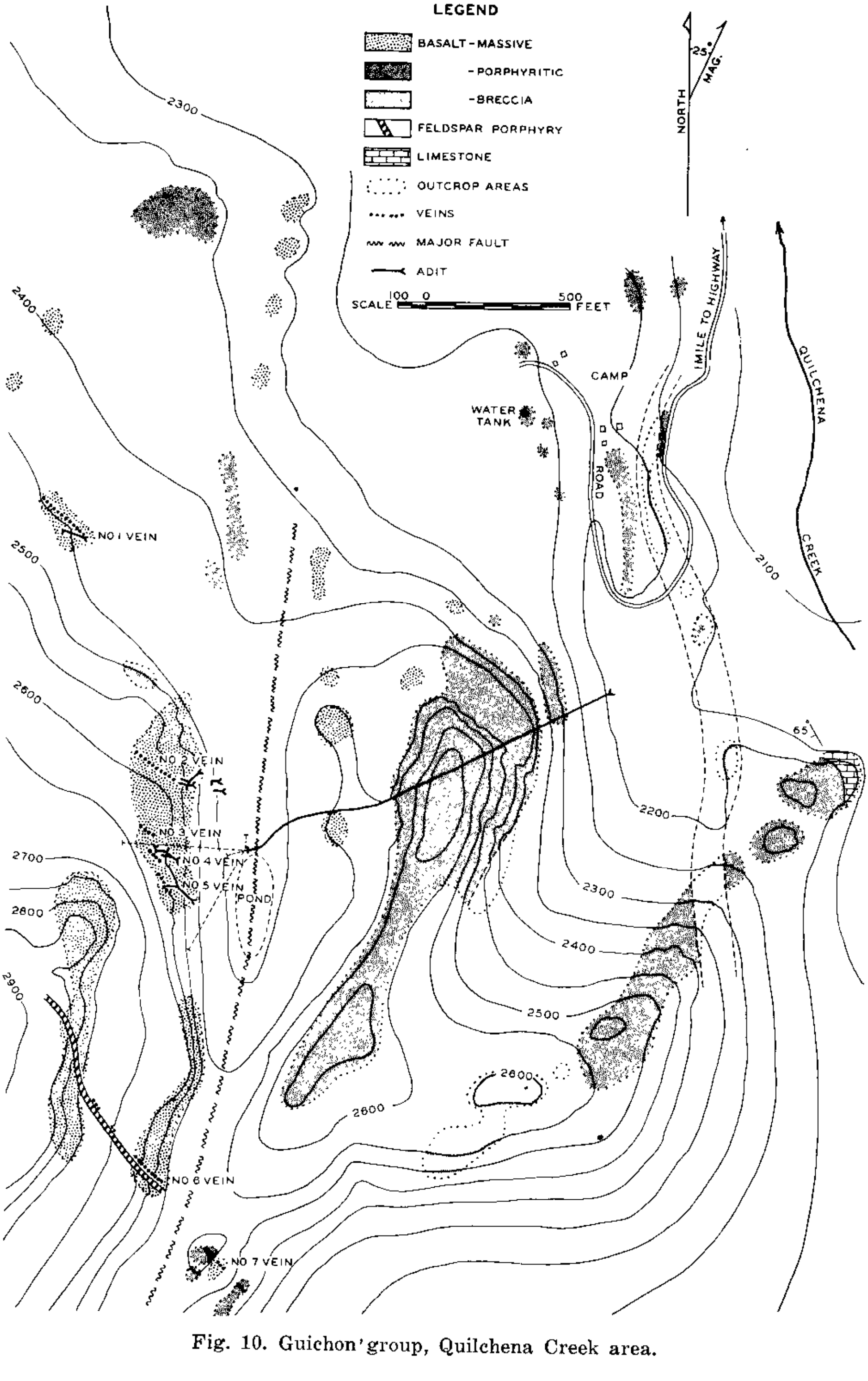


Fig. 10. Guichon group, Quilchena Creek area.

No. 4 and No. 5 Veins: These veins outcrop about 30 feet apart at the top of a line of bluffs. There is a single open-cut on each vein. A sample was taken in the open-cut on No. 4 vein across 10 inches of glassy quartz containing shreds of chlorite and shiny flakes of specular hematite. This assayed: Gold, 0.42 oz. per ton; silver, 2.6 oz. per ton; copper, 0.15 per cent. A 10-inch sample taken across the quartz-calcite breccia of No. 5 vein contained no gold or silver.

Adits at elevations of 2,571 feet and 2,511 feet explore No. 4 and No. 5 veins at depths not more than 80 feet below the outcrops, but the structures underground cannot be correlated with those on the surface. The upper adit exposes several unmineralized, sub-parallel fault zones in brecciated and altered basalt. Four channel samples cut across the main breccia zone assayed: Gold, *nil* or trace; silver, trace to 0.3 oz. per ton. The lower adit has several crooked branches. From the portal it extends 160 feet in the direction north 30 degrees west, then turns northerly for 65 feet. A drift branches to the northwest 72 feet from the adit portal, and another drift 25 feet long, branches to the northwest 180 feet from the portal. The main drift follows an irregular, branching fault zone which, for 80 feet, contains a quartz-calcite stringer lode ranging in width from 2 to 16 inches. The branch drifts explore very narrow quartz-calcite lodes. The results of samples taken in this adit are summarized below.

Location.	Width.	Gold.	Silver.	Copper.
	Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.
Branch drift—72 feet from adit portal, back	2	Trace	Trace	Trace
Branch drift—180 feet from adit portal—				
4 feet from collar, back	4	*Nil*	*Nil*	Trace
10 feet from collar, back	4	0.36	1.8	Trace
25 feet from collar, face	4	Trace	*Nil*	*Nil*
Main drift—				
75 feet from adit portal, face	4	0.03	0.7	....
85 feet from adit portal, face	2	*Nil*	Trace	Trace
95 feet from adit portal, face	2	0.01	0.4	....
110 feet from adit portal, face	6	0.16	1.2	Trace
115 feet from adit portal, face	5	0.22	1.9	Trace
122 feet from adit portal, face	6	Trace	0.3	Trace
127 feet from adit portal, face	4	0.02	0.2	Trace
133 feet from adit portal, face	3	*Nil*	*Nil*	Trace
140 feet from adit portal, face	16	0.11	0.9	Trace
145 feet from adit portal, face	16	Trace	0.1	Trace
155 feet from adit portal, face	4	0.91	4.7	Trace

No. 6 Vein: This unmineralized vein and stringer lode outcrop on the face of a steep bluff and at two other points on a bench to the northwest, the length indicated being about 350 feet. The vein is parallel to and within a few feet of the feldspar porphyry dyke. Two samples, each about 2 inches wide, taken at the top and base of the bluff, assayed either *nil* or trace in gold, silver, and copper.

No. 7 Vein: This is the only vein known east of the major fault. It is a lode containing glassy quartz stringers sparsely mineralized with grey copper. The vein outcrops or is exposed by open-cuts intermittently for a horizontal distance of 200 feet. Both its attitude and width are variable. Two samples were taken in a pit near the southeast end of the showings. The sample from the northwest face of the pit, across the vein width of 3 inches, assayed: Gold, 0.13 oz. per ton; silver, 0.5 oz. per ton; copper, trace. The second sample, taken 10 feet farther southeasterly across a width of 12 inches, assayed: Gold, 0.38 oz. per ton; silver, 1.3 oz. per ton; copper, 0.94 per cent. An outcrop of amygdaloidal porphyritic basalt 100 feet southwesterly from this vein contains minutes flakes and grains of native copper. Under the microscope the copper appears in amygdules and in minute irregular fracture zones accompanied by epidote and calcite.

No. 8 and No. 9 Veins: These veins, not shown in Figure 10, are, respectively, 100 feet and 225 feet north of the northwest corner of the area shown in the figure. Both strike north 55 degrees west and dip steeply southwestward. Both range in width from 4 to 12 inches. No. 8 vein has a total length of 90 feet between two zones of epidotized crushed basalt. No. 9 vein is exposed by outcrops and open-cuts for 95 feet, and its maximum length, as shown by outcrops on the projected strike, is less than 170 feet. No. 9 vein is made up of narrow lenses and stringer zones of glassy quartz and pink feldspar containing sparsely disseminated specular hematite, pyrite, and chalcopyrite. As this vein was reported to have high gold values, three special samples were taken. Each sample was a composite of five channels taken at 2-foot intervals. The first sample, taken near the northwestern end of the exposures, average width 8 inches, assayed: Gold, 0.02 oz. per ton; silver, 0.2 oz. per ton; copper, trace. The second sample, average width 5 inches, taken in the main open-cut 40 feet southeasterly from the first, assayed: Gold, 0.01 oz. per ton; silver, 0.2 oz. per ton; copper, 0.25 per cent. The third sample, 8 inches wide, taken 25 feet southeasterly, assayed: Gold, 0.48 oz. per ton; silver, 0.4 oz. per ton; copper, 0.43 per cent.

TULAMEEN RIVER (49° 120° N.W.).*

Gold.

El Alamein. This property on Tulameen River, 4½ miles upstream from Tulameen P.O., is owned by El Alamein Mines, Limited, Tulameen, a private company incorporated April 1st, 1948; W. A. Livingstone, president and managing director. The company is reported to have entered into agreements providing that it shall acquire ten mineral claims and a fraction held by record, variously staked between 1935 and 1949; one Crown grant, the Wildcat claim (L. 1189), staked in 1904; and three placer leases. The Wildcat claim is in the valley bottom; the western boundary of the claim is 500 feet above the mouth of Lawless Creek. The other claims lie south and southeast of the Wildcat. One placer lease extends downstream from the end line near the mouth of Lawless Creek. The other leases cover the valley bottom for a mile upstream from the same end line. The principal workings are on the Wildcat claim.

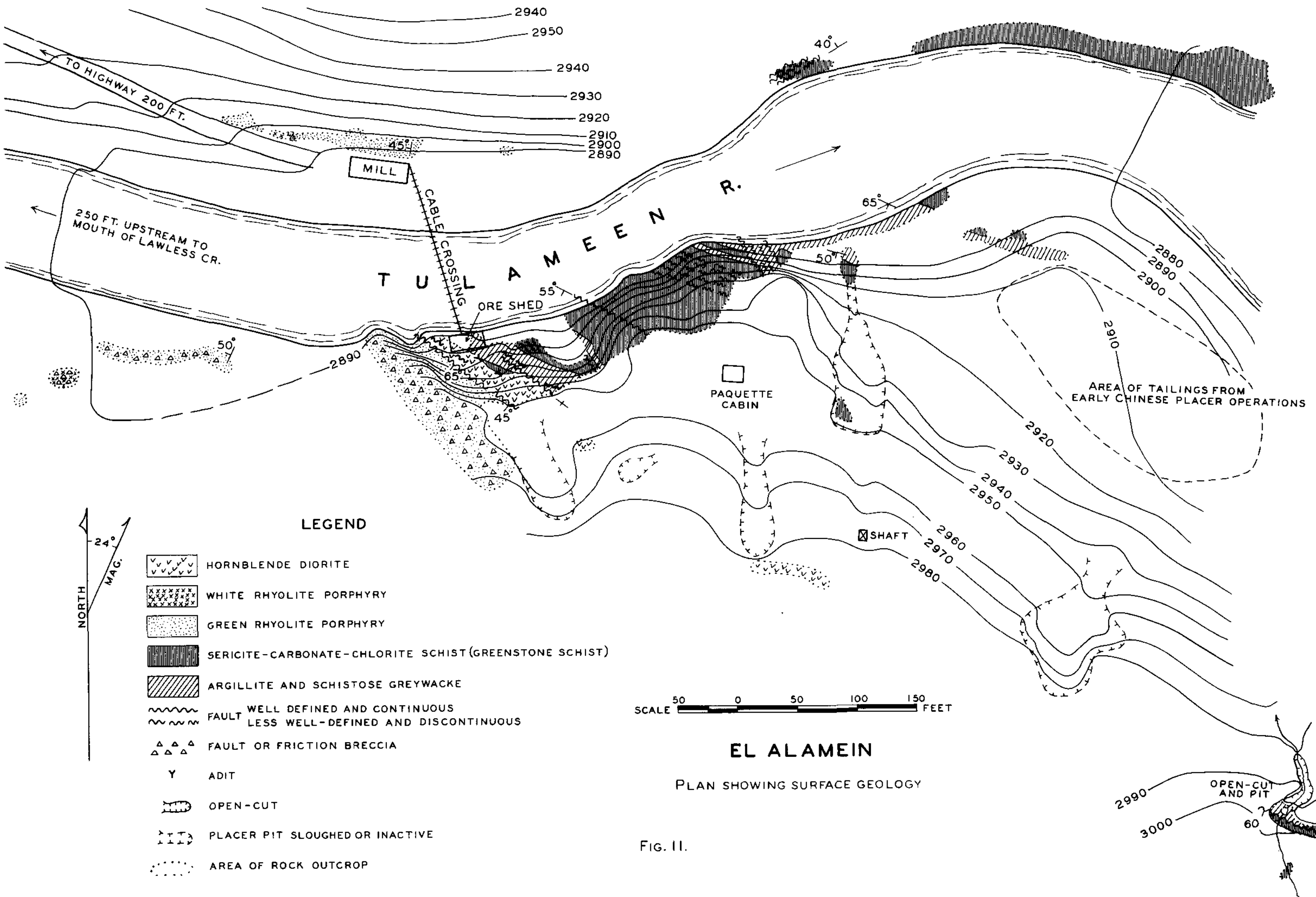
The property was examined for the Department of Mines by J. H. Bennett in June, 1949, and in detail by the present writer from July 9th to 15th, inclusive, 1949.

The workings are on a southeasterly trending shear zone that from a point, elevation 2,880 feet, on the south bank of the Tulameen River, 660 feet downstream from the mouth of Lawless (Bear) Creek, is traceable southeasterly for possibly 2,800 feet diagonally up the mountainside to elevation 3,500 feet. The principal workings are on the Wildcat claim and consist of three adits (Fig. 11) in the steep rock bluffs, 70 feet high, on the south side of the river. The mill building is directly across the river from these workings and is connected to them by a cable crossing. Additional workings include an open-cut on the El Ora claim, 750 feet southeasterly from the adits (Fig. 11), and a group of several cuts and strippings, now badly sloughed, on the Jeanette claim, about 2,800 feet southeasterly from the cuts and at about 3,500 feet elevation. The camp buildings and the mill are on the north side of the Tulameen River, less than 500 feet downstream from the mouth of Lawless (Bear) Creek.

From the top of the rock bluffs along the river the mountainside rises in a series of gravel benches, of which one, from 50 to 100 feet wide, is at the top of the bluffs, elevation 2,950 feet, a second bench at elevation 2,980 feet is about 200 feet wide, and a third at elevation 3,100 feet is of similar width.

The Wildcat claim, on which the principal showing and the adits are situated, was located in 1904, but little interest was shown in the property until 1937, when it is reported that a slide exposed the showings of free gold on the river bank near the site

* By J. S. Stevenson.



EL ALAMEIN

PLAN SHOWING SURFACE GEOLOGY

FIG. 11.

of the present work. Despite this report, very little work was done until 1947. In that year W. A. Livingstone obtained an option on the Wildcat and adjacent claims and began work on the property. In April, 1948, he incorporated the present company and continues to direct all work.

During the spring and summer of 1949 a 10-ton pilot mill was built. After a few tons of ore had been milled, the mill was closed because too much of the gold was being lost in the tailings. The machinery used in the mill is reported to consist of:—

"Jaw crusher, ore feeder, Straub Prospector 5–9 ton ball mill with internal classifier; Denver mineral jig, 9 inches x 12 inches; Straub barrel amalgamator, 24 inches x 42 inches; Copper amalgam table, 30 inches x 108 inches; two blanket tables, 30 inches x 120 inches each; bullion furnace and mercury retort. These machines are driven by individual 3-phase 60 cycle 220 volt motors. Current is generated by a 25-horsepower generator powered by an Atlas-Imperial diesel engine."*

It is reported that operations on the property were suspended on October 28th, 1949.

Recorded production from this property in 1949 was 40 ounces of gold.

The principal showings consist of a shear zone containing narrow stringers of calcite and quartz erratically mineralized with free gold. The shear zone strikes north 60 degrees west, dips 60 to 65 degrees southwestward, and is 30 feet wide. The gold-bearing stringers have been found only in a section of the shear zone that extends for about 75 feet southeasterly from the edge of the river. The shear zone continues southeasterly up the face of the rock bluffs. A shear in an open-cut 750 feet southeast of the river (Fig. 11) is well alined with the shear in the rock bluffs. It also appears to be on the strike of a zone of shearing exposed in the open-cuts on the mountainside 2,800 feet southeasterly of the adits. The shear zone approximately follows the contact between northwesterly trending rhyolite porphyry on the southwest and similarly trending argillites on the northeast. Near the workings it intersects a northwesterly trending diorite dyke about 20 feet wide. The distribution of the several rock types is shown in Figure 11.

The rocks in the neighbourhood of the showings include argillite with interbedded greywacke; green sericite-carbonate schist, occasionally interbedded with the argillite; green and white schistose rhyolite porphyries and hornblende diorite. These rocks, all somewhat similar in general appearance, have been mapped in detail in order to bring out the structural features of the geology and in an attempt to bring out the factors that may control the occurrence of the gold-bearing quartz veins.

The argillites, strike north 65 to 70 degrees west and dip 50 to 65 degrees southwestward, are black, somewhat schistose rocks that are principally homogeneous argillite but in places contain greywacke in beds 6 inches to 2 feet thick. The greywacke is blocky in outcrop but schistose when seen under the microscope. These rocks outcrop on the south side of the river downstream from the adits, in the footwall of the shear zone, and southeasterly up the hillside, where they are also in the footwall of the shear zone.

The green sericite-carbonate schist or greenstone schist is conformable with the argillite. It outcrops on the south side of the river downstream from the adits in the footwall of the shear zone and on the north side of the river, 450 feet downstream from the mill. This schist, containing only small amounts of chlorite, is light green, lighter than the usual green of greenstone schists. It is distinctly green when compared with the grey, somewhat schistose greywacke in the adjacent sediments and appears to be derived from a lava. Under the microscope the greenstone schist is seen to consist principally of alternating layers of carbonate and sericite interspersed with minor amounts of chlorite, actinolite, and clinozoisite. Although the extensive recrystallization of the original minerals has destroyed most of the original textures, the presence

* Livingstone, W. A., personal communication, November 12th, 1949.

of an occasional amygdule, filled with calcite, and the mineral composition indicate that it was derived from a lava, probably of andesitic or basaltic composition.

The green rhyolite porphyry, strike northwesterly and dip 60 degrees southwestward, is apparently conformable with and stratigraphically above the argillite and greenstone schist. It outcrops on the south side of the river upstream from the ore-shed, in the hangingwall of the shear zone. It also outcrops on the north side of the river at the mill, directly on the strike of the greenstone schist and argillite, a position that is probably explainable by an offset along an easterly trending fault in the river bed; this feature will be discussed later. From the mill the rhyolite porphyry extends up the Tulameen River to and up Lawless (Bear) Creek.

The green rhyolite porphyry is in general a massive rock, but some outcrops are cut by numerous closely spaced, parallel joints, which at the mill strike northerly and dip 45 degrees west, and in Lawless Creek strike northeasterly and dip 50 degrees southeastward. The phenocrysts in this porphyry are widely spaced and therefore are not conspicuous in a hand specimen. Under the microscope, however, the phenocrysts are seen to be well-shaped, though occasionally fractured, crystals of albite-oligoclase feldspar, and elliptical-shaped grains of quartz, all set in a schistose, fine-grained groundmass of recrystallized quartz and albite. Sericite, carbonate, clinozoisite, and a little chlorite are developed in varying amounts in different phases of the porphyry.

White rhyolite porphyry outcrops 60 feet west of the mill, adjacent to outcrops of the green rhyolite porphyry. The white porphyry, 15 feet wide, is bordered by, although not in actual contact with, green porphyry on both sides and appears to be a northwesterly trending dyke or sill in the green porphyry. The white porphyry is similar mineralogically to the green porphyry but is slightly more schistose, contains more sericite and less chlorite, and has feldspar that is slightly closer to pure albite in composition than is the feldspar in the green porphyry. A somewhat similar light-coloured porphyry of comparable width occurs on the south side of the river and may represent the offset, southeasterly continuation of the white porphyry found at the mill.

The hornblende diorite outcrops only on the south side of the river, where it may be traced from the adits southeasterly for 400 feet before becoming completely obscured by overburden. At the adits the diorite is entirely in the shear zone, but southeasterly up the hillside it appears to be in the hangingwall of the zone. Judging from the distribution of the outcrops, it appears to be a dyke, which is about 20 feet wide, and which trends southeasterly up the hillside, cutting the argillite and porphyry at a small angle. The rock is green, medium grained, and somewhat porphyritic in texture; some phases show long brown crystals of hornblende. Under the microscope the diorite is seen to consist of the brown hornblende crystals in a medium-grained groundmass of completely recrystallized quartz and albite-oligoclase. Alternation minerals such as chlorite, sericite, and clinozoisite are present in varying amounts.

The principal structural feature of the deposit is the shear zone, strike north 60 degrees west, dip 60 to 65 degrees southwestward, in which the gold-bearing stringers occur. In the stripping along the south bank of the river, the shear zone is about 30 feet wide. The material within this width is cut by slips more or less paralleling the direction of the shear with moderately sheared rock between them. Where followed by the adits, the rock in the zone is intensely sheared over a width of a few inches to 3 feet. Several prominent diagonal slips, strike northeasterly and dip about 60 degrees northwestward, cut the shear zone and offset the slips of the shear zone, from 1 to 5 feet to the left. The footwall rock, beyond the main zone of shearing contains several parallel shears in the 300 feet downstream. The hangingwall rock lacks such shears but, for about 300 feet upstream from the shear zone, consists of friction-breccia.

The argillite in the footwall of the more prominent shears within the shear zone has been dragfolded by movement along the shear into small folds that are overturned to the northeast and plunge steeply to the southeast. The form and orientation of the dragfolds indicate that the hangingwall of the shear zone moved down and to the northwest with respect to the footwall, and the attitude of tension fractures, strike northeasterly and dip 60 degrees southeastward, within the shear zone occupied by quartz stringers confirms this deduction.

The rocks within the shear zone have been varyingly altered, the argillites and greywackes only slightly, but the hornblende diorite and green rhyolite porphyry considerably. Where only moderately sheared, these rocks contain sericite, carbonate, and chlorite, but intensely sheared material consists entirely of actinolite.

Three other northwesterly trending shears are reported to outcrop in a watercourse approximately 800 feet southwesterly up the hillside from the adits; these contain a little quartz, but no work has been done on them.

A second important structural feature is a strong shear that may be seen along the northwestern side of an outcrop of completely carbonatized lava in the north bank of the river, 340 feet downstream from the mill. This shear strikes north 60 degrees east, dips 40 degrees northwestward, and consists of strongly sheared rust-coloured carbonate rock over a width of 1 foot. The southwesterly projection of this shear would extend upstream between the mill and the workings and into the south bank of the river at a small angle, about 300 feet upstream from the adits. This shear, though not observable between the mill and the adits because of the river, may explain the occurrence of greenstone schist and argillite southeasterly across the river on the strike of the rhyolite porphyry at the mill. An offset of about 350 feet would account for the occurrence of green rhyolite porphyry and white rhyolite porphyry at the mill on the north side of the river, and upstream from the mill on the south side of the river. Extensive overburden northerly from the outcrop of this shear prevents the further testing of this hypothesis.

The principal feature of economic interest on the property is the occurrence of gold-bearing calcite-quartz stringers within the shear zone. They usually range in thickness from an inch to 6 inches and in length from a foot to several feet. Mr. Livingstone reports having intersected lenses 3 feet thick by several feet long in the course of development work on the property. These stringers may be grouped into two sets, one of which strikes northeasterly and dips 60 degrees southeastward, and the other strikes northwesterly and dips 45 degrees northeastward. In addition to the larger stringers of both sets, many parallel hair-like stringers cut the argillite and adjacent diorite. So far the gold-bearing stringers have been found only in the part of the shear zone that is exposed in the bluffs at the river. Although no gold is easily visible in the vein matter from the cuts to the southeast, it is reported that mortaring and panning of vein matter from a cut on the shear zone about 2,800 feet to the southeastward revealed particles of fine gold. Vein matter is much less abundant in these cuts than at the river, only a few lenses, 1 inch by 1 foot, being seen in the cut 750 feet to the southeast and even less in the cuts 2,800 feet southeasterly up the mountainside.

The gold, associated with widely scattered grains of pyrite, occurs as crenulated layers and as disconnected wisps that are roughly alined with the more continuous crenulated layers. The gold may be found well within the white calcite-quartz vein matter; or along partings of wallrock, altered largely to sericite schist, that are enclosed by the vein matter; or along the walls of the calcite-quartz stringers. Mr. Livingstone reports that the veins contain some platinum; samples containing up to 2.82 ounces of gold per ton, taken by Mr. Bennett and the writer, were assayed for platinum, but found to contain none.

Many of the stringers do not carry gold, and the distribution of the gold-bearing zones is erratic. It is only by chance that it is possible to observe and study a stringer or group of stringers of gold-bearing vein matter at a single visit during development work on the property. The writer was shown gold-bearing vein matter in the face of the upper adit at the time of his visit but had to rely on descriptions of the occurrence of free gold found elsewhere in the workings.

The localization of a great number of stringers at the river bluff exposures rather than in cuts to the southeast up the mountainside is probably because at this point the shear zone cuts not only the contact of the argillite with the diorite, but also the full width of the diorite. This combination of argillite-diorite contact and the full width of diorite dyke appears to have been more favourable to the formation of fractures of the type occupied by the stringers than was the contact of argillite with greenstone schist such as is found farther southeasterly along the shear zone.

Description of Principal Workings.—The principal workings consist of three adits driven in the rock bluffs on the south side of the river. A lower adit 20 feet above the river and an upper adit 13 feet higher are shown in Figure 11.

The following descriptions record features seen by the writer at the workings as they were at the time of the examination. A brief statement on page 129 records reported subsequent extensions to the workings.

The lower adit has been driven southeasterly for 50 feet along a shear that follows the contact between argillite on the northeast and diorite on the southwest. The adit is driven in ground that is in general sheared and badly broken. However, it follows the contact between argillite and diorite, which is a well-defined slip occasionally accompanied by a few inches of intensely sheared rock. The slip dips steeply southwestward. Lagging prevented the complete inspection of the adit. The only mineralization seen in it by the writer was a quartz-calcite stringer, 1 inch wide, in the footwall argillite at the face and several hair-like stringers of quartz, also in the footwall. A well-developed group of diagonal quartz stringers half an inch to 3 inches wide is exposed in the diorite on the bluff immediately above the portal of this adit.

The upper adit, 25 feet long, followed the shear southeasterly from the end of an open-cut 15 feet long.

The floor and walls of this adit are largely in diorite, but because of a roll in the argillite-diorite contact, the back is also partly in argillite. Between a point 17 feet in from the portal and the face, a slashing 3 feet deep has been made in the northeast wall, across the diorite-argillite contact. Although several slips and small shears of varying strikes and dips occur in the working, the principal slips and shears strike northwesterly and dip southwestward. A strong shear along the southwest wall of the adit marks the wall between diorite on the southwest and actinolite rock on the northeast. The actinolite rock replacing sheared rock within the zone occupies the southwestern half of the face. Other slips and shears mark the contact between the actinolite rock and argillite and also occur in the argillite. Occasionally a diagonal slip, striking northeasterly and standing vertical, offsets the continuation of the principal shears, from 1 to 5 feet to the left.

Calcite-quartz stringers belonging to both strike-sets are found in the portion of the shear zone explored by this adit. The set of stringers paralleling the strike of the shear zone and dipping at 45 degrees northeasterly is exposed in the southeast wall at the portal and in the argillite at the face. The diagonal set, strike northeasterly and dip 60 degrees southeastward, occurs in the back and in the face. In addition to the larger stringers of both sets, many parallel hair-like stringers cut the argillite and adjacent diorite.

The writer took seventeen samples underground and on the surface, some of which were of stringers only, and some were of stringers and intervening rock, both diorite and argillite. Gold was recognized only in a stringer in the face of the upper adit, and that stringer was not sampled. One sample assayed: Gold, 0.8 oz. per ton; platinum, *nil*. The other samples assayed from 0.15 oz. gold per ton to *nil*, and platinum, *nil*. The sample that assayed 0.8 ounces per ton was taken across 18 inches of actinolite rock within the shear in the upper adit and included a 3-inch stringer of quartz. A sample taken by Mr. Bennett from the face of the upper adit across 4 feet assayed: Gold, 2.82 oz. per ton; silver, 0.6 oz. per ton; platinum, *nil*. This sampling can only give an indication of the amount of gold in faces and workings as they were when sampled, July 15th, 1949, and cannot indicate the amount of gold in veins in general.

The following data record extensions to the workings in the period from the end of the writer's examination on July 15th to October 31st, when work on the property was suspended.

The lower adit was extended 9 feet and the upper adit 70 feet, and "two cross-cuts from the upper tunnel were driven towards the hangingwall from the 50- and 100-foot marks, distances of about 16 and about 20 feet respectively," and "an adit tunnel was driven to intersect the upper tunnel about 70 feet from the portal. This adit tunnel prospected about 30 feet of ground adjacent to the foot-wall of the fault zone, supplied improved ventilation, and gave additional dump space."*

Kirby (Britton). Luke Kirby, of Copper Mountain P.O., owns the Enniskillen, Enniskillen No. 1, and Mint claims, staked in 1939, on the Tulameen River a short distance upstream from the mouth of Lawless (Bear) Creek and extending northerly from the river and easterly to and across Lawless Creek. Part of the ground covered by these claims was previously held by W. Britton, of Tulameen.

The principal working is an open-cut on the north bank of the Tulameen River on the Enniskillen No. 1 claim. It may be reached by a trail that leaves the motor-road 850 feet westerly from the bridge across Lawless (Bear) Creek.

The working is a combined stripping and open-cut 30 feet in diameter that extends from the water's edge northerly up the river bank. This work exposes a strong shear, strike north 40 degrees west and dip 75 degrees southwest, that consists of 1 foot of gouge and intensely sheared rock. Mineralization in the shear consists of widely scattered lenses of calcite measuring about 1 inch by 2 inches. The shear is accompanied on the hangingwall side by about 10 feet of less intensely sheared rock. Black argillite occurs in the shear and for 5 feet westerly, or upstream, and then is succeeded by green schistose andesite. Downstream from the cut, argillite and some andesite extend for about 300 feet, followed by greenstone without argillite to Lawless Creek and beyond.

At a point 15 feet upstream from the cut, three quartz veins, a few feet long and from an inch to 6 inches wide, strike north 60 degrees west and dip vertical, cut the greenstone within a width of 6 feet. No minerals other than quartz were seen in the vein and no work has been done on them.

Paquette. Joe Paquette, of Tulameen, owns the Audrey claim, which he staked in 1944, on the Tulameen River about 1 mile upstream from the mouth of Lawless (Bear) Creek. The workings on this claim consist of two strippings along the south bank of the river about 40 feet apart. They are reached by a trail that follows the south side of the river upstream from the El Alamein adits (*see* El Alamein, p. 124).

The downstream stripping extends upstream from northwesterly trending amygdaloidal andesite, across a shear zone 10 feet wide in argillite, strike north 20 degrees west and dip 85 degrees southwestward, and then extends for 40 feet across drag-folded argillite, interbedded with a few 6-inch beds of carbonate rock. These beds are massive and are cut by short gash veins of quartz that do not extend into the adjacent argillite. The shear itself contains many stringers of calcite, half an inch wide. The quartz stringers in the argillite and the calcite stringers in the massive carbonate rock contain disseminated pyrite but appear to contain little gold. The

* Livingstone, W. A., personal communication, November 12th, 1949.

owner reports that he has panned the broken rock and muck from the stripping but has not been able to obtain any gold.

The upstream stripping extends for 25 feet along the river bank across argillite that contains beds of carbonate rock similar to those in the downstream stripping. The argillite in the stripping is overlain by several feet of massive carbonate rock that outcrops at the top of the river bank. It may be noted that a carbonate dyke 15 feet wide, strike northwesterly and dip about vertical, occurs between the two strippings. No values are reported from this stripping.

COPPER MOUNTAIN (49° 120° S.W.).*

Copper.

The Granby Consolidated Mining, Smelting and Power Company, Limited.

A. S. Baillie, president, Copper Mountain; J. C. Dumbrille, assistant to the president, Copper Mountain; W. I. Nelson, general manager, Allenby; R. S. Douglas, mine superintendent, Copper Mountain; J. A. C. Ross, assistant mine superintendent, Copper Mountain; L. H. McKay, mill superintendent, Allenby; A. R. Eastcott, power plant superintendent, Princeton. Capital: 600,000 shares, $5 par value. This company operates the Copper Mountain mine at Copper Mountain, 12 miles south of Princeton. The company's steam-electric power plant in Princeton supplies power to the concentrator at Allenby, 3½ miles south of Princeton, and to the mine. A branch line of the Kettle Valley Railway from Princeton serves the power plant, mine, and concentrator.

Surface elevation at the mine is about 4,000 feet. The main development of the mine is from an adit level, No. 6, and two vertical shafts. No. 2 adit level is not used as a mine entrance but still serves as a ventilation outlet. The No. 1 shaft, handling all men and supplies for the upper part of the mine, extends from the surface to the No. 6, or main haulage, level. No. 2 shaft services No. 7 and No. 8 levels and is an internal shaft, with the hoist on No. 5 level. All ore is passed to No. 6 level, on which it is taken out of the mine in Granby-type cars, hauled by electric-trolley locomotives. After it is crushed in the coarse-crushing plant, on the surface near the portal of No. 6 level, the ore is hauled by rail to the concentrator at Allenby, 8 miles distant.

Compressed air for the mine is supplied by three Ingersoll-Rand compressors and one Sullivan compressor, the four units having a total capacity of 8,600 cubic feet of air per minute.

Improvements are being continued in underground mechanization and most slusher-drifts are now reinforced with a concrete lining. All ore is mined from diamond-drill shrinkage stopes and is then transferred from slusher-drift draw-points to grizzlies by electrically operated slusher-hoists. This practice has resulted in decreased costs, increased safety to workmen, and a greatly reduced amount of dust from drilling and transfer of ore. Ventilation raises, equipped with auxiliary fans, ensure that each slusher unit is provided with fresh air, so that the dust and smoke from scraping and blasting are carried away quickly. A total of 26,266 feet of diamond drilling was done during the year.

An abandoned tunnel on the old Voight property, 1½ miles northeast of Copper Mountain, was cleaned out so that a geological examination could be made; after completing this work the tunnel portal was again fenced off. Considerable geological work and surface diamond drilling was done in the area adjacent to Copper Mountain.

The mining of the 122 East ore-block has caused the subsidence of an area north of the No. 1 shaft. The possibility of this subsidence engulfing the No. 1 shaft caused the company to drive a new service raise that could be used in place of the shaft if necessary. The driving of the new raise was completed in the fall of 1948.

* By E. R. Hughes.

During 1949 work was done on equipping the raise with a manway and skipway. The new raise connects the No. 6 level with the surface at a point 350 feet southwest of the collar of No. 1 shaft.

Increased activity continued in No. 7 and No. 8 levels, the lowest levels in the mine. These levels are serviced by the underground No. 2 shaft, through which the ore is raised to No. 6 level, where it is taken out of the mine on the main transportation system. Ore from the No. 2 shaft workings is hoisted by a Nordberg 54- by 84-inch double-drum electric hoist with fully automatic controls. This hoist was installed in 1947 and is capable of handling 3,000 tons daily.

Safety committees make regular tours of inspection of all surface and underground workings, and their recommendations are discussed at subsequent meetings. The company employs a safety engineer. An emergency hospital with the customary equipment and supplies, including a supply of blood plasma, is maintained at the mine for the treatment of injured workmen. A trained nurse and industrial first-aid attendants are on hand at all times. Aluminium-dust therapy is available for employees. A doctor visits the Copper Mountain camp twice a week and is available in emergencies. An ambulance is maintained for transporting sick or injured persons to the Princeton General Hospital, 12 miles from the mine. Two trained mine-rescue teams competed in the Similkameen Valley Mine Safety Association's annual competition, held in Princeton on June 11th.

The mine was worked continuously throughout the year. The crew at Copper Mountain averaged 496, of whom 276 were employed underground. The total payroll for Copper Mountain, Allenby, and Princeton was 764 on November 30th.

Production: Ore mined, 1,803,916 tons; ore milled, 1,734,269 tons. Gross contents: Gold, 11,904 oz.; silver, 255,931 oz.; copper, 35,694,011 lb.

HEDLEY (49° 120° S.E.).*

Gold.

Nickel Plate (Kelowna Exploration Company, Limited). Company office, 75 West Street, New York, N.Y.; mine office, Hedley. F. A. McGonigle, manager; George Mill, acting manager; Alex Shaak, mine superintendent; E. W. Johnson, mill superintendent; J. Biggs, mechanical superintendent. This is a private company operating the Nickel Plate mine. Full descriptions of the operation have appeared in previous Annual Reports. Operation was continuous throughout the year, except for a one-week strike of employees in October. The number of men employed underground averaged 83 and on the surface 111. Average daily production was about 335 tons. No major additions to plant or equipment were made during the year and only routine development work was done underground.

The company took an option on the Oregon Mineral Claim, owned by F. H. French and associates, and some exploratory diamond drilling was done. This claim is between Sixteen Mile and Eighteen Mile Creeks and about 3 miles east of Hedley.

Production: Ore milled, 121,732 tons. Gross contents: Gold, 43,026 oz.; silver, 6,907 oz.; copper, 208,633 lb.

Hedley Mascot Gold Mines, Limited. Company office, 908 Royal Bank Building, Vancouver; mine office, Hedley. C. W. S. Tremaine, general manager; J. C. S. Moore, mine foreman. The company operated the Mascot mine until the middle of April, when it was shut down and all equipment was taken from underground. All ore produced at this mine came from the Mascot Fraction. During fifteen years of operation approximately 700,000 tons of ore was produced, having a total value of approximately $8,000,000. Dividends paid amounted to approximately $1,250,000. No work was done at the Good Hope mine or at the Horsefly Mineral Claim.

* By E. R. Hughes.

Production: Ore milled, 13,760 tons. Gross contents: Gold, 5,164 oz.; silver, 1,313 oz.; copper, 36,258 lb.

Hedley Amalgamated Gold Mines, Limited.—Company office, 535 Homer Street, Vancouver. The only work done at this property in 1949 was the drilling of thirteen X-ray drill holes, totalling 291 feet on the Cyclone Mineral Claim, Hedley. H. L. Hill was in charge of the drilling programme and two men were employed.

OLALLA (49° 119° S.W.).*

Manganese.

Iron King. Iron King No. 1 and Iron King No. 2, staked May 6th, 1949, by S. J. Fairclough, of Chilliwack, are on the south side of the ridge separating the north and middle forks of Olalla Creek, about 3½ miles by trail from the highway at Ollala. Elevations range from 3,800 to 5,300 feet.

The principal types of rock exposed on the claims include both finely laminated and massive beds of chert and some beds of pebble conglomerate, of which both pebbles and matrix appear to be chert. The beds are black, red, white, or mottled. Old cuts, which have been partly cleaned out recently, prospect a bedded deposit of manganiferous chert on the Iron King No. 2 claim. The beds strike north 30 degrees west and dip about 65 degrees northeastward. In a horizontal distance of 380 feet and a vertical range of 200 feet, seven cuts prospect this bedded zone. Drift obscures the immediate extensions of the zone, and it is not exposed in the chert bluffs 2,000 feet northwest of the cuts. In the 380-foot length explored in the cuts, the zone is offset a few feet to the right at each of several northeasterly striking faults.

The zone consists of bright red chert traversed by a network of minute veins containing rhodonite, which merge laterally into zones of hard black siliceous manganese ore containing small irregular masses of rhodonite and chert. The red chert zone is about 30 feet wide, but the zones containing manganese in fair amount range in width from 12 inches to about 10 feet. The assays of seven channel samples and one specimen are given below. The samples were taken from the most heavily mineralized parts and are not representative of the zone as a whole.

Location.	Width.	Manganese.	Silica.
	Ft. In.	Per Cent.	Per Cent.
No. 1 cut—			
Central section	2 2	16.8	53.5
Combined sections on either side	5 0	13.8	57.4
No. 2 cut—50 feet northerly	1 7	34.2	21.4
No. 3 cut (small pit)—30 feet northwesterly	1 11	48.3	15.3
No. 5 cut—190 feet northwesterly, southwest side	5 0	18.5	55.3
No. 6 cut (small pit)—75 feet northwesterly	*	49.2	14.5
No. 7 cut—45 feet northwesterly—			
Southwest side	6 4	7.1	68.0
Northeast side	5 0	18.5	55.5

* Specimen.

ADAMS PLATEAU AREA (51° 119° S.W.).†

Silver-Lead-Zinc.

As far back as 1893, mineralized bodies were explored near Agate Bay, on the west shore of Adams Lake, but it was not until 1927 that the first recorded discovery of mineral was made on the high plateau area to the east of the lake.

One of the first discoveries on Adams Plateau, the Lucky Coon, was optioned to The Granby Mining, Smelting and Power Company, Limited, in 1928. After 3,420 feet

* By W. H. White.
† By W. R. Bacon.

of trenching, 694 feet of diamond drilling, and 52 feet of drifting had been done, the option was dropped, and it was not until 1948 that another established mining company became interested in the area. In that year Pioneer Gold Mines of B.C., Limited, sent a party into the area to prospect systematically for base-metal deposits. During 1949 interest in the area heightened with the optioning and drilling of the Mosquito King property by The Consolidated Mining and Smelting Company.

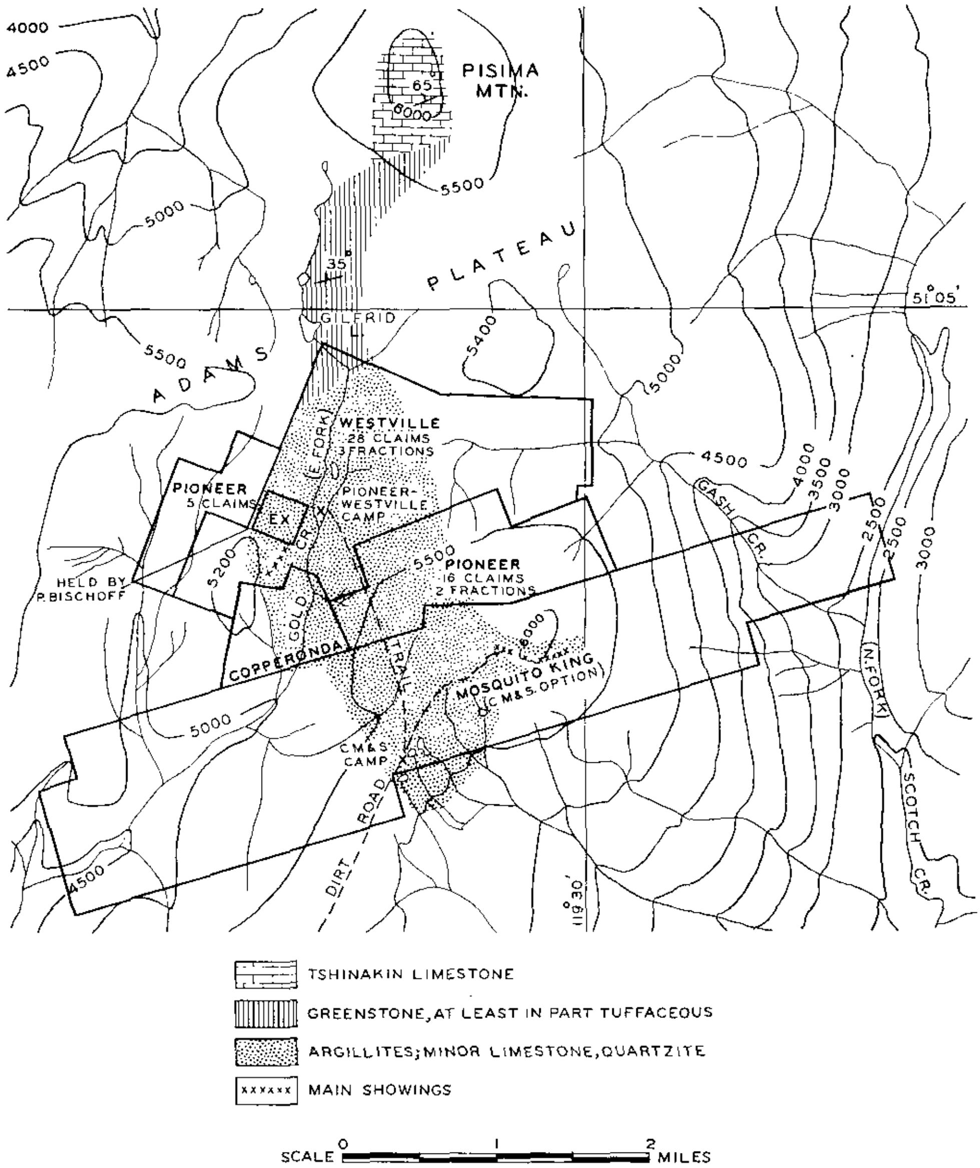


Fig. 12. Plan showing approximate location of principal claim groups on southern half of Adams Plateau.

In the Annual Report of the Minister of Mines, 1936 (pp. D 39–D 43), J. S. Stevenson described in detail the properties located in the northern portion of the plateau.

The present report, resulting from three and one-half days' field work, is confined to the southern portion, the area of current interest. Together, the two reports contain descriptions of all the known mineral occurrences of any importance on Adams Plateau.

The properties examined by the writer were the Mosquito King and those controlled by the Westville Mining Company, of Toronto, and Pioneer Gold Mines of B.C., Limited.

Location and Accessibility.—Squilax, 41 miles east of Kamloops on the main line of the Canadian Pacific Railway, is the rail point nearest the properties. The Trans-Canada Highway (Highway No. 1) also passes through this point. From here an all-weather road strikes north across Indian Reserve territory, thence easterly to the west end of Shuswap Lake to the mouth of Corning (Lee) Creek, the distance to this point from Squilax being approximately 5 miles. From here a narrow logging-road leads north following the east bank of Corning Creek for 8 miles to the logging camp operated by the Saskatchewan Federated Co-operatives, Limited, of Canoe. From this camp a road 6½ miles long, passable by jeep or light truck, leads into The Consolidated Mining and Smelting Company camp on the Mosquito King property. The combined Pioneer-Westville tent camp is approximately 2 miles to the north and was reached by a good bush trail.

General Features.—Adams Plateau, lying between Adams Lake and the north fork of Scotch Creek, attains an elevation of 6,000 feet. The area is characterized by low hills and ridges covered by extensive stands of spruce and balsam. Ponds, muskegs, and meadows are common.

Outcrops are scarce, and present knowledge of the bedrock geology is sketchy.

General Geology.—The plateau is underlain by a thick series of sediments composed of argillites and limy argillites with local thin beds of limestone, and quartzites. Overlying these rocks in apparent conformity is a series of greenstones, at least in part tuffaceous. In turn the greenstones are overlain by the Tshinakin limestone,* which caps Mount Pisima, the highest point in this area.

These stratified rocks are all considered to be part of the Eagle Bay formation of Proterozoic or Early Paleozoic age.† They nearly always dip gently northward.

Igneous float ranging in composition from acidic to basic and in texture from fine to coarse grained was noted, but none was seen in place.

Properties.

Mosquito King. (Figs. 12 and 13.) This property is under option to The Consolidated Mining and Smelting Company from I. W. C. Solloway and associates, of Vancouver. At the time of the examination the season's work had been completed and all personnel had withdrawn from the area. Trenches and open-cuts A to Q, inclusive, were carefully examined. They expose bedrock at irregular intervals over a lateral distance in excess of 2,500 feet in an easterly direction. The principal rock found in these trenches is a thinly bedded argillite, which varies in lime content and in degree of silicification. Thin beds of quartz-sericite rock, in places moderately schistose, were also noted.

Certain of these beds have been intensely silicified and have been mineralized with pyrrhotite and, in places, pyrite, sphalerite, and galena. Chalcopyrite was noted in one or two spots. Quartz is a minor constituent.

The mineralization is fine grained in the extreme. The sphalerite is darkish to jet black and, judging by colour alone, could be termed marmatite.

Although the mineralization is concordant with the gently north dipping (0 to 25 degrees) sediments, it has probably been localized by fracturing and possibly by minor folding, which was noted in one or two of the trenches. Steeply dipping to vertical fractures of northerly strike are seen in several of the trenches. Evidence that they

* Daly, 1915, p. 20.

† Rice and Jones, 1948, p. 3.

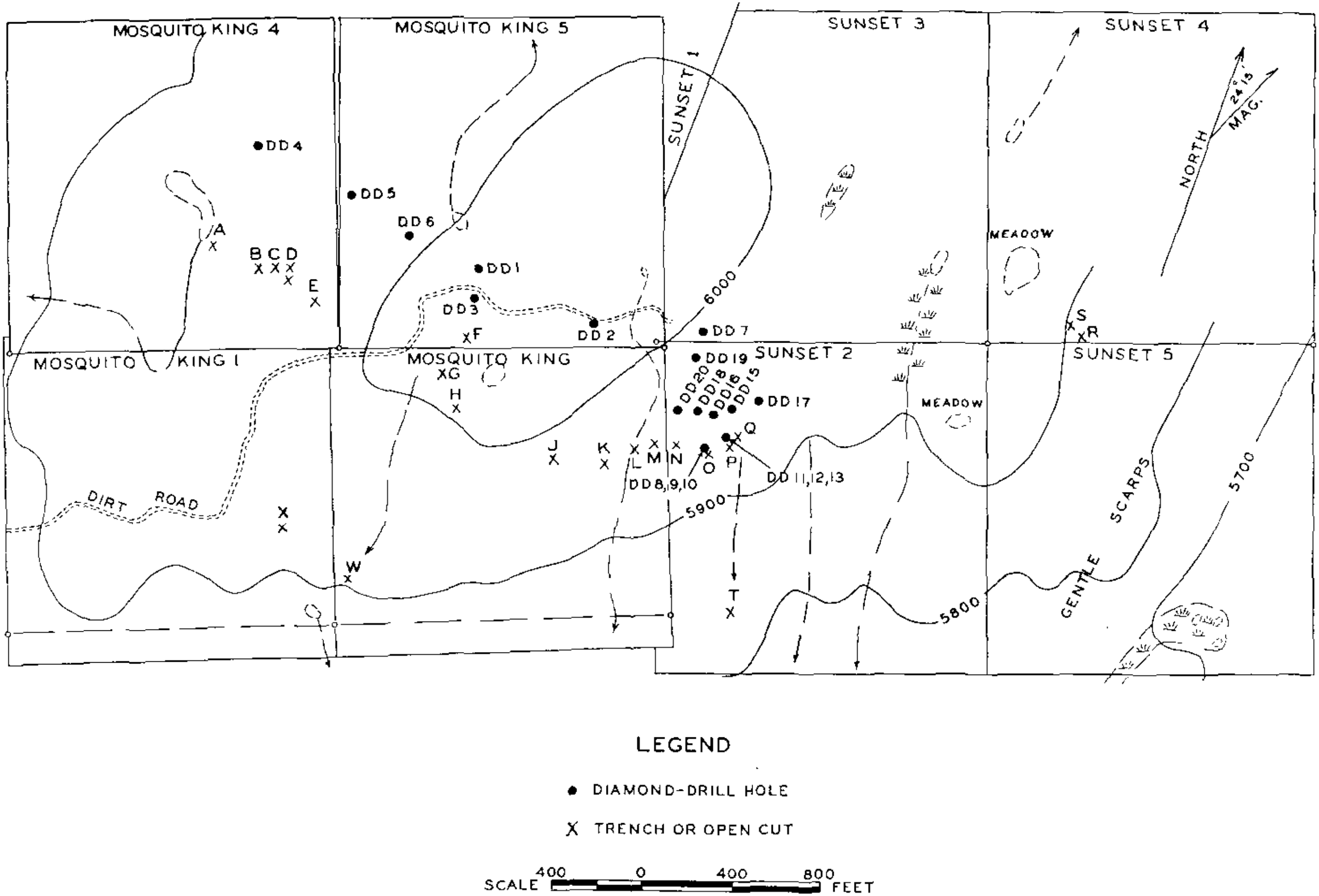


Fig. 13. Mosquito King—plan showing workings and diamond-drill holes.

are in effect fault planes was obtained in Trench B, where there is a pronounced dragging on either side of a vertical, north 10 degrees west fracture. Here the vertical movement has been west side down. The beds immediately on either side of the fault are heavily mineralized with sphalerite and galena.

Some mineralization was noted in every trench but, as bedrock is exposed only in widely spaced trenches and as the fractures that are believed to have controlled the mineralization strike across the general alinement of the trenches, continuous mineralization between trenches cannot be assumed.

Samples were taken in several of the trenches and are tabulated below. Because of the gentle dip, many of the trenches expose the mineralization for considerable distances down the dip. The widths in the following table are measured at right angles to the dip.

Trench.	Width.	Assay.			
		Gold.	Silver.	Lead.	Zinc.
	Feet.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
C	1.5	Trace	1.1	3.2	1.4
D	4.0	Trace	0.7	0.9	*
D	3.0	*Nil*	0.3	1.3	*
F	4.1	Trace	0.9	1.3	1.5
I	2.3	Trace	0.1	0.2	1.1
I	1.2	0.01	1.8	4.1	3.8
J	5.0	*Nil*	1.4	3.8	3.2
L	1.0	Trace	3.5	9.7	9.0
M	1.5	Trace	1.5	7.2	8.1
P	1.0	0.01	5.8	19.5	7.5

* Less than 0.3 per cent.

In all, twenty diamond-drill holes with a total footage of 2,861.5 feet were drilled to test the flat-lying strata for possible replacement deposits. With the exception of Hole No. 14, the locations of these holes are shown on Figure 13. Hole No. 14 was drilled to the southwest of the area depicted in this figure.

Argillite, limestone, and quartzite are the principal rocks that were intersected in the holes. The bedding is well defined in many sections of core and, in most places, is not appreciably contorted. Epidote is a common secondary mineral. Narrow basic and acidic sills were cut in many holes.

Certain sections of drill core were missing, presumably taken for assaying purposes.

Westville Mining Company.

This company has had a small energetic crew doing intelligent prospecting work all summer. Some interesting showings have been uncovered on the Elk 5 claim and the Elk 8 Fraction. The showings are similar in type and environment to those found on the Mosquito King. Over a lateral distance of 1,200 feet, sphalerite and lesser amounts of galena have been found associated with pyrite, pyrrhotite, and quartz. The mineralization occurs at more than one horizon, and additional work will be required to prove continuity.

The sulphides are fine grained, except in the Main Cut, where coarse galena is found. A sample of this galena assayed 50.8 ounces silver per ton. Silicification with a little epidote comprises the alteration.

The argillaceous beds containing these deposits average north 40 degrees east in strike and 30 degrees northwestward in dip. Here again it is probable that the mineralization has been localized by fractures, in this case striking easterly and dipping steeply to vertically. It is noteworthy that the coarse galena mentioned above appears to be associated with minor folding as well as with fracturing.

Two of the northernmost pits, spaced 75 feet apart, expose a mineralized band that is 8 feet wide in the more northerly pit and 7 feet wide in the other. In the latter pit two samples were taken, which assayed as follows:—

Location.	Width.	Silver.	Lead.	Zinc.
	Inches.	Oz. per Ton.	Per Cent.	Per Cent.
Hangingwall	14	1.9	2.6	5.4
Footwall	70	Trace	*	1.0

* Less than 0.3 per cent.

Pioneer Gold Mines of B.C., Limited.—In spite of systematic prospecting, nothing of interest has been found to date on the ground held by this company.

[References: Daly, R. A., A geological reconnaissance between Golden and Kamloops, B.C., along the Canadian Pacific Railway, *Geol. Surv., Canada,* Mem. 68, p. 20, 1915. Rice, H. M. A., and Jones, A. G., Salmon Arm map-area, British Columbia, *Geol. Surv., Canada,* Paper 48-4, p. 3, 1948.]

LUMBY (50° 119° S.W.).

Gold.

Bluebird.* This claim is on the northeast side of Harris Creek, about 3½ miles from its junction with Bessette Creek and about 4 miles air line south of Lumby, from where it is reached by a dirt road. Sedimentary rocks of the Cache Creek series and plutonic rocks underlie the claim. Several small quartz veins occurring in both formations have been explored by shallow open-cuts. The width of these veins is usually not more than 6 inches but locally may be as much as 2 feet. They are quite ragged and contain horses of wallrock, but the walls are free and the adjoining wallrock is much altered and decomposed. The veins are about vertical and strike in a general northeasterly direction.

Samples taken yielded assays as follows:—

6 inches rusty quartz 5 feet below surface of open-cut: Gold, 1.02 oz. per ton; silver, 0.1 oz. per ton.
7½ inches white quartz: Gold, trace; silver, *nil.*
3 inches quartz: Gold, 0.41 oz. per ton; silver, *nil.*
Grab of rusty quartz, bottom of cut: Gold, *nil;* silver, *nil.*
6 inches rusty quartz: Gold, 0.02 oz. per ton; silver, *nil.*
31 inches quartz: Gold, trace; silver, *nil.*

Silver-Lead-Zinc.

Silver Star.† (50° 119° S.E.) A brief reference to the Silver Star silver-lead discovery was included in the Annual Report of the Minister of Mines, 1926 (p. 200). This modest prospect is half a mile to the northeast of the summit of Aberdeen Mountain at an elevation of 6,000 feet. The summit is 12 miles northeast of Vernon and can be reached by 18 miles of narrow road from the latter point.

Aberdeen Mountain is composed of calcareous quartzites, limestone, and argillite of the Chase formation.‡ The general trend of these rocks is north 40 degrees west with an easterly dip of 35 to 45 degrees, but there is considerable minor folding and local contortion.

Former work consists of two shafts, both now caved. The main shaft was sunk on a quartz vein, 3 to 4 feet wide, striking north 70 degrees east and dipping 50 degrees

* By J. A. Mitchell.
† By W. R. Bacon.
‡ Rice, H. M. A., and Jones, A. G., *Geol. Surv., Canada,* Paper 48-4.

south. This vein appears to occupy the axial plane of a minor fold in argillite. From dump specimens, the mineralization consists of galena with minor sphalerite and pyrite.

During the summer of 1949 several local residents became interested in the area and prospected near the former workings. One transverse stringer, 4 inches wide and carrying argentiferous galena, was found in a band of quartzite. The stringer, however, does not persist beyond the boundaries of this competent quartzite, which has a width of 7 feet.

MONASHEE PEAK (50° 118° S.E.).*

Gold.

St. Paul Group. This property is owned by O. N. Sheppard and associates, who are operating under the name of St. Paul Mines, Limited. In the past, several tunnels were driven on a narrow high-grade stringer and several shipments of high-grade silver ore were made. A small mill was also operated, but this has been dismantled and only the frame of the building is now standing.

During 1949 the present owners bulldozed a jeep-road from the mill to the mine to replace the old tram-line.

LIGHTNING PEAK (49° 118° N.E.).†

Silver-Lead-Zinc.

Paycheck Mining and Development Company, Limited. Company office, 804 Silica Street, Nelson. H. A. McKen, president and managing director. Capital: 4,000,000 shares, no par value. This company controls a group of claims on Lightning Peak, including the Director, Paycheck, Dictator, and Waterloo claims. Work in 1949 was concentrated on improving the 19 miles of road from the Monashee Highway. Some raising and winzing were done underground from the bottom level of the Waterloo. A small shipment of dump ore was made in March. Operations ceased in December.

Production: Ore shipped, 2½ tons. Gross contents: Silver, 20 oz.; lead, 2,609 lb.; zinc, 376 lb.

FAIRVIEW CAMP (49° 119° S.W.).‡

Silica-Gold.

Fairview. The Consolidated Mining and Smelting Company of Canada, Limited. G. E. Clayton, mine superintendent. This mine is about 5 miles west of Oliver. The property was formerly operated by the Fairview Amalgamated Gold Mines, Limited, but was idle for several years until reopened by the present operators in 1946. The No. 6 adit is the haulage level. Shrinkage stoping is being done between this level and the No. 5 adit, 135 feet above. No work is being done on any of the other levels. Electrical power is obtained from the West Kootenay Power and Light Company, Limited. The mined quartz is shipped to Trail for use as flux in the smelter. The quartz contains a small amount of gold. Eleven men were employed underground, and six on the surface. Operations were continuous throughout the year.

BEAVERDELL (49° 119° S.E.).§

Silver-Lead-Zinc.

The Beaverdell Silver Camp. Beaverdell, 51 miles northerly from Greenwood, on the Kettle Valley Railway, has been a centre of silver mining for about fifty years. Most of the productive mines are in a belt 1½ miles long and half a mile wide on Wallace Mountain, immediately east of the town of

* By J. A. Mitchell.

† By J. W. Peck.

‡ By E. R. Hughes.

§ By W. H. White, except as noted.

Beaverdell. The principal mines within this belt, from west to east, are on the Wellington, Sally, Rob Roy, Beaver, Bell, Highland Lass, and Idaho claims. Figure 14 shows the main claims on Wallace Mountain. Production statistics to the end of 1949 are tabulated below:—

Mine.	Period.	Ore shipped.	Gold.	Silver.	Lead.	Zinc.
		Tons.	Oz.	Oz.	Lb.	Lb.
Beaver	1925, 1926, 1928, 1929, 1933–1939	1,112	35	169,955	121,550	188,005*
Bell	1913, 1916 to May, 1936	19,189	703	3,537,667	1,966,283	1,711,825†
Highland Lass	1922, 1928 to May, 1936	5,219	191	994,278	690,865	1,074,820‡
Highland Bell	June, 1936, to 1949	59,776	2,183	8,555,375	5,062,233	7,143,430
Sally and Rob Roy	1901, 1904–10, 1913–41	11,475	164	1,960,150	1,071,356	474,826†
Wellington	1920–41	7,752	354	1,479,585	1,027,750	1,552,860†
Total		104,523	3,630	16,697,010	9,940,037	12,145,766
			Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Average grade			0.03	159.84	4.75	7.16§

* Zinc content from 1933 onward. † Zinc content in 1928 and from 1930 onward. ‡ Zinc content from 1928 onward. § Based on quantity of ore in years for which zinc was reported.

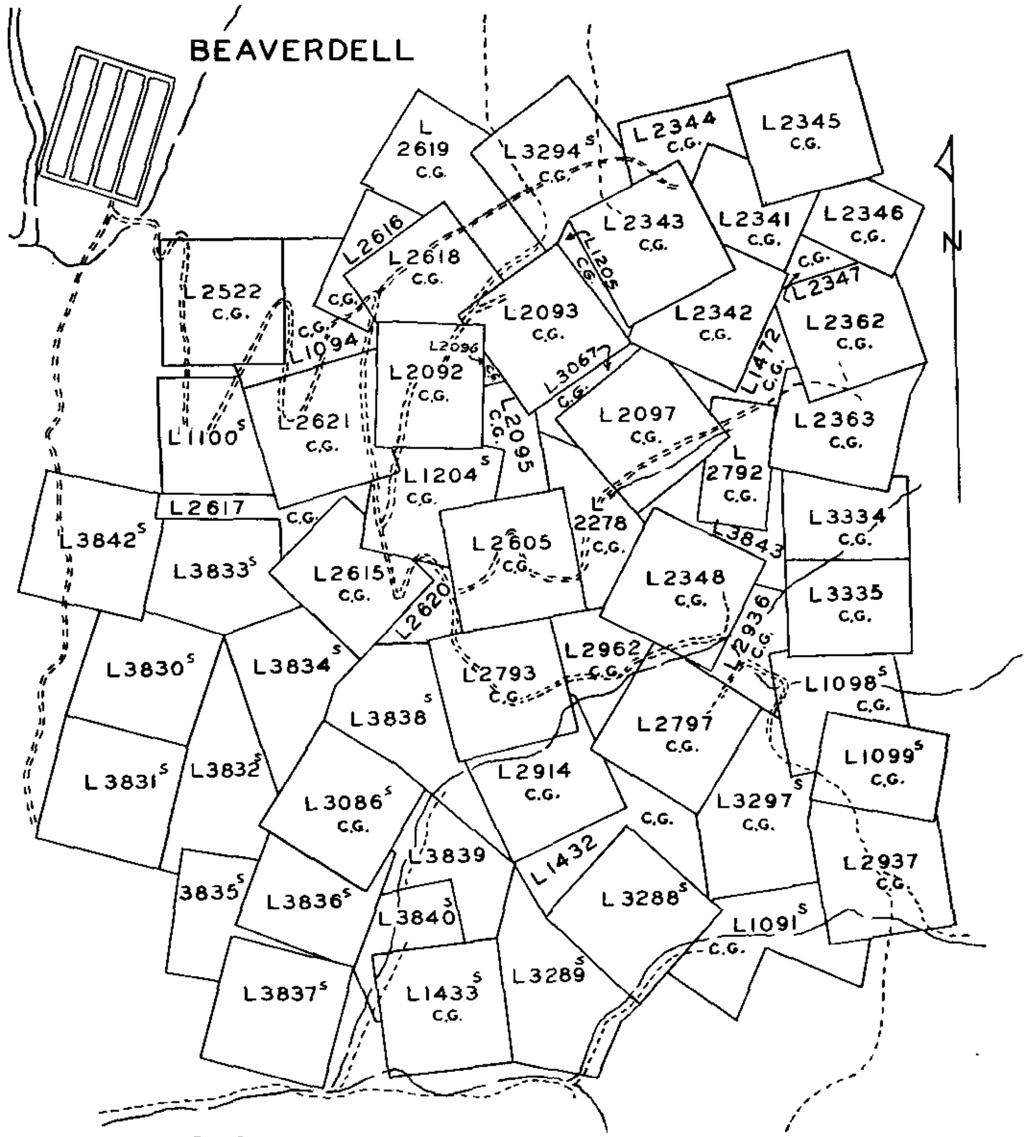
Small quantities of rich silver ore, not recorded in the table, have been mined from time to time from claims lying south of the main productive belt, notably from the Kokomo Fraction, Excelsior, Bounty, Bounty Fraction, Rambler, Nodaway, and Standard Fraction.

The first production from the Sally was recorded in 1901. Except for the years 1911 and 1912, the record for the Sally and the Rob Roy includes shipments in every year from 1904 to 1941.

Recorded production for the Bell begins with 1913, and from 1916 on there was production each year. Production exceeded 1,000 tons in 1926 and in subsequent years. Production of 15 tons from the Highland Lass was recorded in 1922, and beginning with 1928 production was recorded for each year. In 1930 R. B. and F. Staples and associates, of Vancouver and Creston, obtained control of the Bell and the Highland Lass. The two properties were under the same management, but production was recorded separately until May 31st, 1936, when the purchases were completed. Since then operation of the properties has been continued under the company name "Highland Bell, Limited," and the combined production has been recorded. In 1938 Highland Bell, Limited, obtained control of the Beaver. In 1946 Leitch Gold Mines, Limited, obtained control of Highland Bell, Limited, and of the Sally. The properties have been combined and operations continue as Highland Bell, Limited.

Work was done on the Wellington claim in 1901 and from time to time thereafter. Production was recorded in the years 1920, 1921, and 1925 to 1941, inclusive. The Wellington Syndicate, of Greenwood, shipped more than 700 tons from the property in 1926 and 1927. In the period 1928 to 1941 the Beaverdell-Wellington Syndicate shipped nearly 7,000 tons of ore. In 1946 the Silver Bell Mining Syndicate acquired the Wellington, Bounty, Bounty Fraction, and other claims on Wallace Mountain and did some rehabilitation. In 1947 Silver Bounty Mines, Limited, took over the holdings of the Silver Bell Syndicate and continues to operate the property.

In general the ore-bearing structures of Wallace Mountain are so complex that rarely has continuous ore been followed in any direction for more than a few tens of feet without offsetting or other interruption. However, as noted later, some oreshoots, although cut and offset by a few faults, have been fairly continuous for horizontal distances ranging up to 500 feet. The complexity is reflected in the policy of current operators to omit from their annual reports estimates of ore reserves. No final terminating structures are known and no downward changes in either mineralogy or values suggest bottoming of the general zone of the ore formation. In consequence, the chances of finding more ore in abandoned mines, such as the Sally, Bell, Beaver, Kokomo, Bounty, and Wellington, cannot be regarded as exhausted.



Claim.	Lot No.	Claim.	Lot No.	Claim.	Lot No.
Beaver	2342	Gem Fr.	2347	Rambler	2797
Bell	2343	Highland Chief	2345	Rob Roy	2093
Bounty	2348	Highland Lass	2341	Sally	2092
Bounty Fr.	2962	Idaho	2362	Standard Fr.	3297S.
Buster	2937	Kokomo Fr.	3067	Tiger	2097
Excelsior	1204S.	Nodaway	2615	Wellington	2621

Fig. 14. Surveyed claims on Wallace Mountain. Crown-granted claims marked " C.G."

No milling has ever been done on Wallace Mountain, but crude ore, after sorting either underground or on the surface, has been shipped to a smelter. This practice has resulted in the accumulation of numerous large dumps of lower-grade material, more or less admixed with waste from development headings. Other large quantities of waste and of low-grade ore sorted out underground remain in the mines, where it was used as pack walls in place of timber.

Highland Bell, Limited, is the assessed owner of twenty Crown-granted claims and is understood to own or to have options on several other claims. It is understood that Silver Bounty Mines, Limited, owns or controls twenty-seven claims. Highland Silver Mines, Limited, is the assessed owner of the Rambler and several other claims. Figure 14 shows the surveyed claims in and adjoining the known productive area on Wallace Mountain. Most of the claims are understood to be owned or controlled by the three companies mentioned, although about half the claims are still assessed in the names of the individual owners or of small groups of owners.

General Geology.

The veins of the Beaverdell camp are in an area of moderate westward slope west of the summit of Wallace Mountain. The geology of Wallace Mountain is described in some detail by L. Reineke in Memoir 79,* *Geological Survey, Canada.* The western half of Wallace Mountain is an intrusive mass mapped by Reineke as part of a larger, very irregular body known as the "Westkettle batholith." East of the sinuous contact that trends northerly and dips gently eastward lie metamorphosed sedimentary and volcanic rocks of the Wallace formation that partly "roof" the intrusive mass. Reineke mapped as "Beaverdell batholith," intruding the Westkettle batholith, a stock-like mass about 1 mile in diameter found at Beaverdell and apparently extending westward across the valley beneath the valley fill. Large exposures of the Beaverdell batholith occur elsewhere in the district.

The present report is based principally on data collected in ten days in June, 1949, devoted to mapping and studying the surface and underground workings. Additional data were obtained from maps and other records of Highland Bell, Limited, with the assistance of officers of that company.

The Westkettle batholith, as seen in the productive belt on Wallace Mountain, is composed of an even-grained granitic rock having an average grain size of about 1½ millimetres. It has a speckled grey appearance, due to approximately equal amounts of dark- and light-coloured grains. Some of the feldspar has a pinkish tint, and this coloration is more noticeable in the Sally and Wellington mines toward the west end of the productive belt. The Beaverdell stock, as seen in only one weathered outcrop on the road between Beaverdell and the Wellington mine, is light-coloured pinkish rock resembling granite, having a grain size of about 5 millimetres. Rock of similar appearance in hand specimens, locally termed "aplite," is fairly common in the mine workings as discontinuous lenses and dykes.

The productive veins of the camp are found only in the rocks of the Westkettle batholith. Specimens from the typical granitic rock found on 7 and 8 levels of the Highland Lass mine consist of 22 to 25 per cent. quartz, 23 to 31 per cent. alkali feldspar (microcline), 31 to 34 per cent. plagioclase (oligoclase, An 33 to 35). This rock, according to the classification used by the Department of Mines, is granodiorite. The rock from the Wellington No. 5 level appears to be a sodic granite and the "aplite" dykes of the Highland Lass are also of sodic granite.†

Minor intrusives in the productive belt of Wallace Mountain include dykes of at least three different ages. The oldest are the discontinuous pink aplite dykes, mentioned above, which have various strikes and commonly have gentle dips. The next oldest is a very fine-grained chocolate-brown dyke seen in the Wellington No. 5 level near the shaft. It cuts an aplite dyke and in turn is cut by a dark-green dyke, which is somewhat amygdaloidal and has phenocrysts of augite and plagioclase. A similar dark-green amygdaloidal dyke, about 30 feet wide, known as the "Idaho dyke," occurs

* Reineke, L. (1915): Ore deposits of the Beaverdell map area, *Geol. Surv., Canada*, Mem. 79.

† Mineralogic compositions were determined in thin sections not less than 3 square centimeters in area, using a 6-spindle integrating stage. Plagioclase determinations were made by L. Dolar-Mantuani by the Universal stage method.

in the Highland Lass mine, where it is subparallel to the vein. The Idaho dyke has chilled borders against both fresh and highly altered granodiorite. On the other hand, in one place on 8 level of the Highland Lass mine the dyke is penetrated by irregular calcite veinlets containing galena, chalcopyrite, and pyrite. Apparently the Idaho dyke was emplaced during the period of mineralization.

The most striking geologic feature of Wallace Mountain is the multiplicity of the faults; some are pre-mineralization in age, some are mineralized, and many occurred later than the mineralization. Some later movement has occurred on nearly all faults and may obscure the time relations.

In the Wellington and Sally mines the veins are mineralized faults or fractures that strike easterly and dip moderately to steeply southward. To the east in the Bell mine, according to old mine plans, ore was mined from an easterly striking set of veins and from a northeasterly striking set that dipped moderately to the southeast. Still farther east, in the Highland Lass mine, the orebodies being mined are in the northeasterly striking set of veins, which is the only well-developed set.

The fault pattern is complex, and as the faults cut and displace the ore-bearing parts of the veins, consequently knowledge of the fault pattern is of great importance in searching for and in mining ore. The faults have been classified in five types on the basis of their attitudes. Each type consists of faults having common orientation, kind of movement, and age relationship. Each of the five types is discussed briefly in the following paragraphs.

High-angle, Northerly Striking, Normal Faults, Type 1.—These faults strike from north to north 20 degrees east and dip from 85 to 50 degrees eastward. All appear to be younger than the ore. Several such faults, on which the movement probably amounts to hundreds of feet, cut the productive belt of Wallace Mountain into several large blocks. As these are normal faults dipping eastward, progressively lower horizons in the granodiorite are exposed toward the west end of the productive belt.

Low-angle, Northerly Trending, Strike-slip Faults, Type 2.—These faults are prominent in the Wellington and Sally mines but are unknown in the Highland Lass mine to the east. Dips range from 18 degrees to as much as 50 degrees westward. Striations on the fault surfaces are essentially horizontal. Near the Wellington shaft on No. 5 level (Fig. 15), a vertical aplite dyke cut by a low-angle fault shows that the east side moved relatively southward 25 feet. Although late movement has occurred on most of these low-angle faults, it is thought that they originated prior to the period of mineralization. For example, the small oreshoot recently mined on Wellington No. 5 level had a flat rake to the west between two low-angle faults. The upper fault contains veinlets of ore minerals, and the lower fault is occupied by a dyke of a type similar to the Idaho, which apparently antedates, in part at least, the period of mineralization in the Highland Lass mine (*see* Fig. 16).

Northeasterly Striking, High-angle, Normal Faults, Type 3.—Faults of this set, dipping at moderate angles to the northwest, are numerous and constitute the most serious obstacle to systematic mining and exploration. In many places these faults are spaced but a few feet apart, chopping the veins into short segments, each of which has moved downward to the northwest. In the Highland Lass mine the aggregate effect of these normal faults has been to flatten the dip of the general ore zone from 50 degrees or more to 34 degrees (*see* Fig. 16). Usually the displacement on these faults is only a few feet. The relative age of these faults is not everywhere evident. In most places the veins are cut by the normal faults and drag ore can be seen in the fault plane. On the other hand, there is some evidence that original movement on these faults antedated the period of mineralization. For example, in one stope in the Highland Lass mine, the oreshoot on the footwall side of a normal fault widened at the immediate fault surface, and a miniature stringer lode extended down the fault plane to connect with the oreshoot on the hangingwall side of the fault.

Northeasterly Trending "Slice" Faults, Type 4.—Further complications arise from the presence of faults which cut across the veins, making very acute angles with them in both strike and dip. The dip of the "slice" faults is in the same direction as that of the veins. Where the dip of such a fault is a little less than that of the vein, the effect is to repeat the vein; but where the dip of the "slice" fault is a little greater, the effect is to cause a gap in the vein. Many of these fault surfaces have one or more sets of striations pitching gently either to the northeast or southwest. It is probable that the "slice" faults have a relatively large component of this movement parallel to the strike. The ore appears to pinch out gradually along some "slice" faults, but others simply cut the ore. Furthermore, it is not uncommon to find that the ores on the two sides of a "slice" fault are dissimilar in mineralogy, values, and internal structure. It appears that the slice faults are in part pre-ore in age and may have had some effect on the distribution of mineralization.

Cross-faults, Type 5.—These northerly striking faults, dipping in either direction, cause either small normal or reverse displacements of the orebodies.

Mineralization.

The veins are in zones of altered granodiorite or sodic granite up to 50 feet wide, locally known as "ore ground." These zones are easily recognized and are important guides in exploration. While still retaining its granitic texture, the altered rock is soft and appears speckled with small purplish blotches. The mineralogic changes include abundant development of sericite and clay minerals, chlorite, calcite, epidote, and hematite.

The ore occurs in simple veins, composite branching veins, and stringer lodes. The oreshoots generally range in width from a few inches to several feet and average about 12 inches, but massive ore several feet wide and stringer lodes as much as 15 feet wide have been mined. The vein matter includes abundant medium-grained pyrite, sphalerite and galena, with some arsenopyrite, and some chalcopyrite, in a gangue of quartz, calcite, and sericitic remnants of the wallrock. Commonly the veins have a banded structure produced by the rude parallelism of sulphide stringers. Undulating fault surfaces bound the veins. The walls for distances of 1 to 5 feet from the veins are soft, brecciated or sheared rock, highly altered and containing much clayey mud or gouge. Some veins and parts of veins, characterized by abundant sphalerite and pyrite in massive glassy quartz, contain only small amounts of silver. The parts of the vein that constitute oreshoots contain, in addition to the common sulphides, visible amounts of silver-bearing minerals such as tetrahedrite, pyrargyrite (ruby silver), polybasite, argentite, and native silver.*

Native silver occurs as flakes and small hackly masses in the vein walls; as tangled hair-like wires intimately associated with crystals of calcite, fluorite, and argentite in vugs both in the vein walls and in the solid vein matter; and also as microscopic grains intimately intergrown with galena and other ore minerals. Evidently the native silver is of primary origin and is found throughout a vertical range of at least 1,000 feet. Considering that the productive belt has been down-faulted progressively toward the east, it is probable that native silver was originally deposited through a vertical range of much more than 1,000 feet.

Silver Bounty Mines, Limited. Company office, 744 Hastings Street West, Vancouver. G. S. Eldridge, president; John Broatch, mine manager. The company is reported to own twenty-seven Crown-granted claims, including Wellington, Bounty, and Bounty Fraction, and to have the Tiger claim under option. The Silver Bell Mining Syndicate began work on this property in 1946. Silver Bounty

* The mineralogy of the Beaverdell ores has been described in some detail by Staples, A. B., and Warren, H. V. (1946): Mineralogy of the ores of the Highland-Bell mine, *Western Miner*, May, 1946, pp. 38–43, and June, 1946, pp. 54–58.

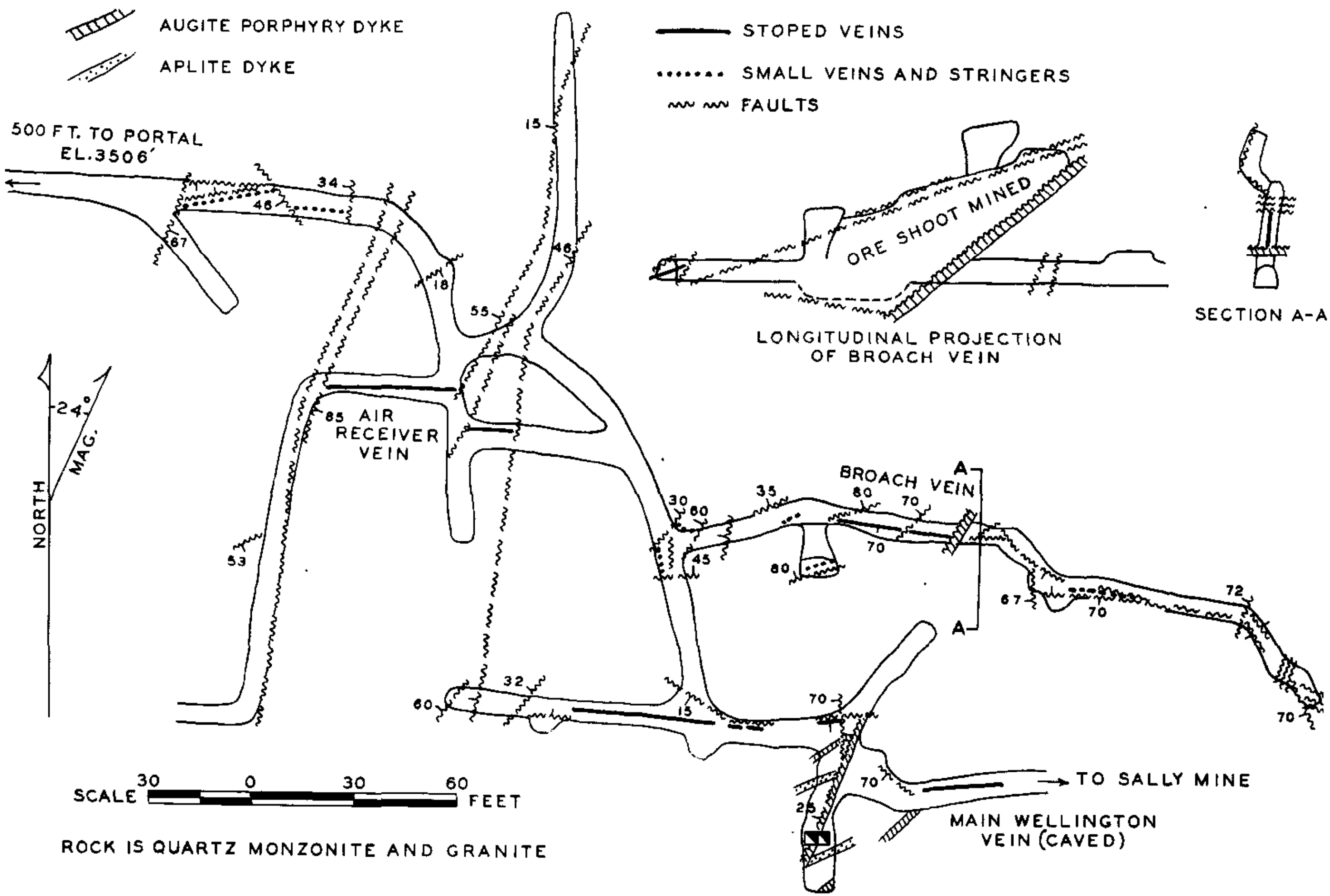


Fig. 15. Part of No. 5 level, Wellington mine.

Mines, Limited, with the same president and manager, took over the property in 1947 and has continued exploratory work with incidental production. Two small oreshoots on Wellington No. 5 level have been mined in the past two years. A small tonnage of ore was mined from the Air Receiver vein (*see* Fig. 15) in the early part of 1949. After sorting of waste at the surface, 48 tons of ore was shipped to the smelter at Trail. The three lower levels of the Wellington mine were unwatered in 1949 in contemplation of further exploration, and arrangements were made for the use of No. 5 level by the Highland Bell, Limited, as an entry into the adjoining Sally ground. Some work was done in 1949 by two lessees in the extensive workings on the Bounty Fraction, who shipped 8 tons of ore to the Trail smelter.

Production for 1949: 56 tons shipped. Gross contents: Gold, 3 oz.; silver, 8,338 oz.; lead, 6,434 lb.; and zinc, 10,142 lb.

The area on Wellington mine No. 5 level where work was done in 1948 and 1949, the position of the main Wellington vein, mined many years ago, and of two vein segments discovered and mined during the current work are indicated in Figure 15. The Air Receiver vein was followed westward about 30 feet, where it was cut off by a gougy fault zone. Drag ore in the fault zone indicated displacement to the left, but a drift turned southerly along the fault zone for a distance of 100 feet failed to expose the continuation of the vein.

The Broatch vein was mined in 1948 and early in 1949. This vein illustrates a combination of structures typical of other oreshoots in the western part of the productive belt. The vein strikes easterly and dips steeply southward. The pronounced westerly rake of the oreshoot mined is due to two transverse faults of the strike-slip type, which dip gently westward and converge up the dip. Minute veinlets contain ore minerals in the upper fault zone, and the lower bounding fault is occupied by an augite porphyry dyke similar to the Idaho dyke of the Highland Lass mine. It is probable, therefore, that the bounding faults are pre-ore and helped to localize the oreshoot in the obtuse triangular-shaped area between them. The vein was mined a few feet below the floor of the drift, and the opening was filled with waste. Apparently the vein terminated against, or was cut off by, a third fault of unknown attitude.

In workings on the Bounty Fraction some oreshoots were found in a fracture that strikes north 70 degrees east and dips 68 degrees northwestward. A few feet of drifting on this fracture from the face of one of the old stopes disclosed isolated lenses of ore a few feet long and from 2 to 6 inches wide. A sample 2 inches wide from this place assayed: Gold, 0.01 oz. per ton; silver, 120.8 oz. per ton; lead, 8.5 per cent.; and zinc, 24.1 per cent.

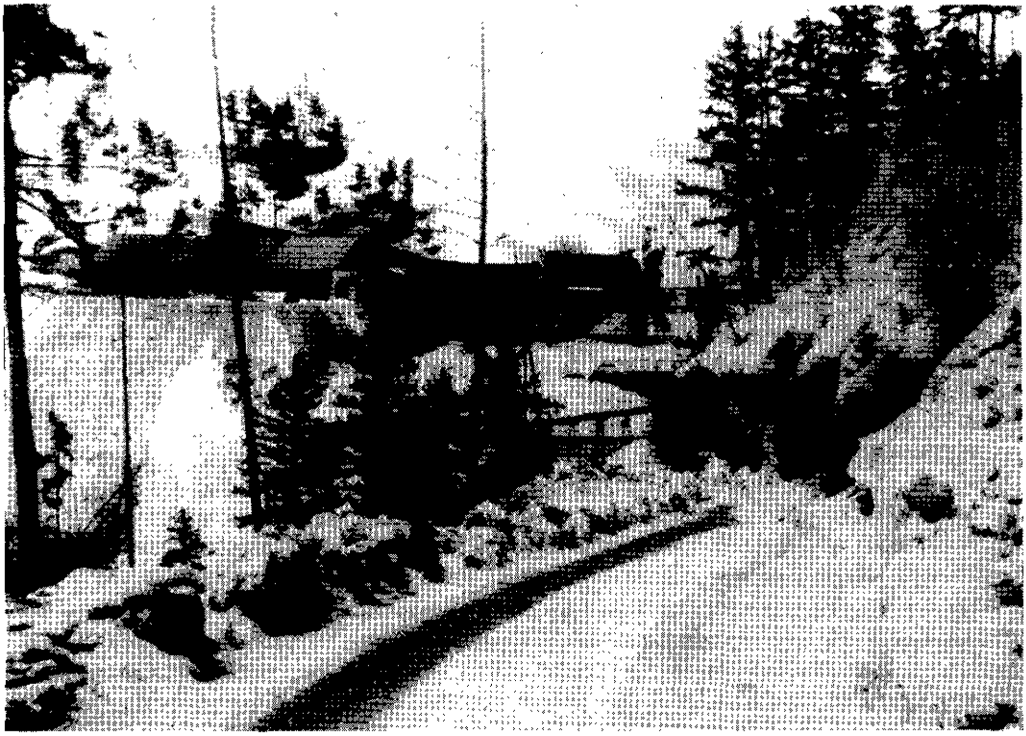
Highland Bell, Limited.

Company office, 844 Hastings Street West, Vancouver; mine office, Beaverdell. K. J. Springer, president; P. L. Clark, manager. The company is the assessed owner of twenty Crown-granted claims, including the Sally, Rob Roy, Bell, Beaver, and Highland Lass. The company is understood to own several additional Crown-granted claims and to have options on Idaho and Highland Chief, and holds by location three claims east and northeast of the Highland Chief. The extensive workings on the Sally, Rob Roy, Beaver, and Bell claims are abandoned and partly caved, but during the summer of 1949 geological work and diamond drilling were done in some of these workings. The principal mining operations are carried on by the company in the Highland Lass mine, the workings of which are on the Highland Lass claim, Gem Fraction, and Idaho claim.

At the Sally mine the No. 2 level was reopened and a diamond-drill programme was started. An agreement was made with the Silver Bounty Mines, Limited, to use the Wellington No. 5 adit, which extends into Sally ground, to pump out the winze to the Wellington No. 7 level and then the winze to the Sally No. 8 level, so that exploration work could be done on the Sally.

At the old Beaver mine the shaft was rehabilitated and diamond drilling was done on the bottom or No. 3 level.

The Highland Lass mine is developed by nine levels between elevations of 4,130 feet and 3,680 feet. No. 4 level, elevation 3,980 feet, is the main haulage adit. All the other levels down to and including part of 7 level are abandoned. The compressor and power plant, steel-shop, change-house, and sorting plant are at the portal of No. 4 level. The 34-degree main winze connects 4 level with 7 and 8 levels and another winze continues to 9 level. Daily production is about 25 tons net after rejecting 15 tons as waste in the sorting plant. The lump ore and dewatered fines from the sorting plant are shipped to the Trail smelter.



Highland Bell mine, March, 1949.

When the mine was visited in June, mining and exploration were being done by three mining crews of two or three men each and one diamond-drilling crew on one shift per day. One mining crew was engaged in ore production and the other two in exploration. On 7 level, work was proceeding in 716 drift, 706 stope, and 708 stope; and on 8 and 9 levels, 802 stope and 902 stope were being worked intermittently. At the end of the year plans were made to deepen the lower winze and establish another level below No. 9. The scale of operations in the Highland Lass mine is restricted to the limited capacity of the single-tracked winzes which must be used both for service and haulage of ore and waste. During the year the crew averaged forty-two.

Production for 1949: 6,530 tons shipped. Gross contents: Gold, 246 oz.; silver, 838,785 oz.; lead, 431,230 lb.; and zinc, 504,720 lb.

Figure 16 is a vertical projection of the Highland Lass mine, with the complex structure somewhat generalized. It should be noted that 9 level, being at an angle to the projection plane, appears foreshortened and the oreshoots appear closer to the Idaho dyke than they actually are. The workings are in granodiorite overlain by a

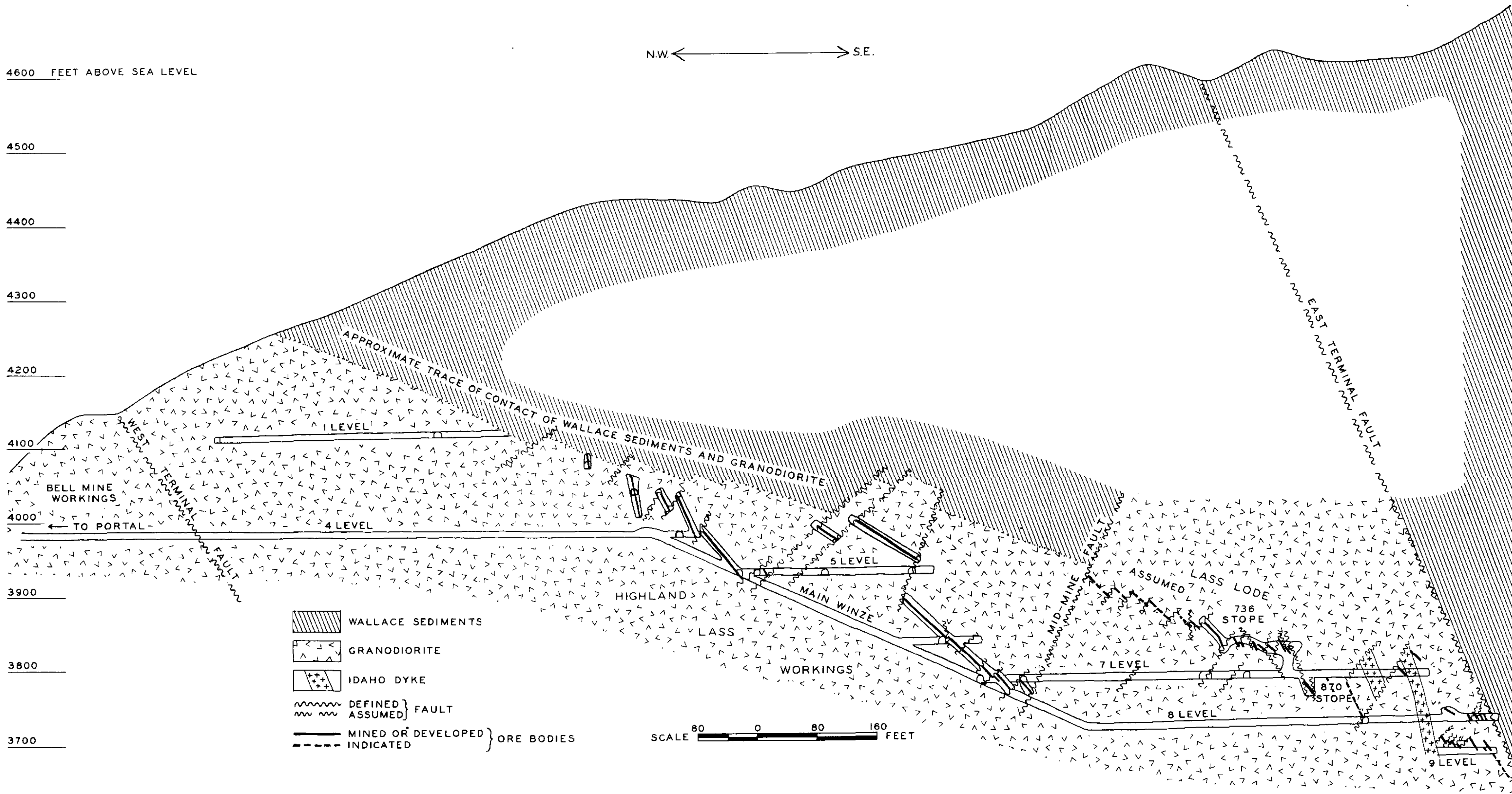


FIG. 16. HIGHLAND BELL LIMITED. GENERALIZED VERTICAL PROJECTION ON PLANE BEARING SOUTHEAST THROUGH MAIN WORKINGS. MODIFIED FROM COMPANY DRAWINGS

gently sloping roof of the Wallace formation. The Idaho dyke cuts the granodiorite and the Wallace rocks.

The mine is in a fault block some 1,300 feet wide in an east-west direction, bounded by Type 1 faults, known respectively as the West and East Terminal faults. These are not final terminating structures because they are clearly younger than the ore deposits. However, the West Terminal fault effectively isolates the orebodies of the Highland Lass mine from those of the adjoining Bell mine, and on the East Terminal fault the contact of the granodiorite and the overlying Wallace rocks is down-faulted an undetermined distance below explored horizons. The contact of Wallace rocks and granodiorite constitutes a third terminating structure, in this instance of a final nature because the veins pinch out in the Wallace sediments within a few feet of the contact.

The main veins, or vein segments, referred to collectively as "the Lass lode," are restricted to a zone of highly altered granodiorite some 25 feet wide which grades laterally into fresh rock. The altered zone is cut by numerous subparallel fault surfaces and by quartz-calcite veins and stringer lodes which in places contain abundant sulphides and silver-bearing minerals. In former operations the Lass lode was extensively developed on all levels down to and including part of 7 level. Most of these workings are no longer accessible, but mine plans indicate that the oreshoots mined were fairly continuous for horizontal distances ranging up to 500 feet, disrupted by only a few faults. On nearly all levels the lode was followed northeasterly to the Wallace contact, and many of the largest and richest stopes were within 400 feet of this contact. The southwesterly part of the mineralized zone has been incompletely explored. It is reported that toward the West Terminal fault the veins in general tended to become "quartzy" and low grade, and the few oreshoots in them were relatively small. A short distance below 7 level the Lass lode is cut off by the Mid-Mine fault, which strikes north 30 degrees east and dips from 55 to 60 degrees northwestward. This is a normal fault having a dip slip of about 160 feet, which is very much greater than that of any other fault of this type known in the mine.

Current development of the Lass lode is in the section southeast of the Mid-Mine fault, and the bulk of the production for the past two years has come from this area. The structure is far more complex here than in the upper parts of the lode. Type 4 normal faults and Type 5 slice faults are more numerous and individual vein segments more limited in extent. However, in places the structural complexity contributes to greater stoping widths because narrow oreshoots are repeated several times by closely spaced slice faults. The main stope in this area, known as 736 stope, has been developed for 220 feet on the strike and about 100 feet up the dip. Diamond drilling indicates that the lode may continue to be ore-bearing up the dip to the Mid-Mine fault at about the elevation of 5 level. Current operations on 7 level are directed toward finding the ore-bearing section of the lode in either direction from 736 stope. When the mine was visited in June, 1949, oreshoots had been developed in 716 drift for a distance of 120 feet southwesterly from the end of 736 stope, and to the northeast beyond a prominent slice fault, some 50 feet of ore had been mined in 706 stope. Therefore, at that time the known total length of the Lass lode on 7 level, essentially of ore grade, was about 400 feet. The structures which will probably terminate the Lass lode along strike at the elevation of 7 level are the Mid-Mine fault to the southwest and the East Terminal fault to the northeast. The distance between these terminal faults along the general strike of the lode is about 750 feet.

Apparently the Lass lode is seriously disrupted again below 7 level, and its position and extent at the elevation of 8 level are uncertain. One small stope in the northeasterly end of 8 level, known as 802 stope, which is being developed at the present time, may eventually prove to be the faulted continuation of the lode down dip from 706 stope.

The Idaho dyke zone, in reality a zone of numerous subparallel slice faults and faulted segments of one or more dykes, is well exposed on 8 level. The strike is northeasterly and the zone as a whole dips southeastward somewhat more steeply than the Lass lode. In part at least it is a pre-ore structure and may have had an important effect on the distribution of mineralization. A group of veins known as the " Idaho lode " is in " ore ground " southeast of the Idaho dyke zone. This " lode " has a general mineralogic similarity to the Lass lode, yet is sufficiently different in its structural features to suggest that it is a distinct lode rather than the faulted continuation of the Lass lode.

In the Idaho lode the main northeasterly striking veins and stringer lodes are linked by numerous easterly striking stringers and small veins. Veins have been developed on 9 level in 902 and 903 stopes for a length of about 120 feet and some have been followed in a raise to 8 level. The ore in this part of the Idaho lode is similar in mineralogy and grade to that of the Lass lode, and native silver is particularly prominent on 9 level. The developed section of the Idaho lode is adjacent to the East Terminal fault, and its extension to the west and southwest has yet to be explored.

Highland Silver Mines, Limited.* Company office, Room 404, 470 Granville Street, Vancouver. Dr. W. Rutledge, president. Capital: 2,000,000 shares, 50 cents par value. This company owns a group of claims on Wallace Mountain adjacent to Highland Bell and Silver Bounty properties. The camp and most of the workings are reached by road from Beaverdell.

Shipments to the Trail smelter were in the name of the Cranberry Creek Gold Mining Co., Ltd. A. E. Horne, of this company, obtained an option on the property from the Highland Silver Mines, Limited. Some diamond drilling was done from a set-up in a caved adit near the main campsite on the Standard Fraction.

Production: Ore shipped, 13 tons. Gross contents: Silver, 867 oz.; lead, 1,685 lb.; zinc, 2,222 lb.

Cobalt.* A. E. Horne obtained an option on the Cobalt fractional claims, which are owned by D. C. Rodgers, of Greenwood, and which lie on the east side of the Standard and Buster Crown-granted mineral claims. Five holes, totalling about 350 feet in depth, were drilled from a short adit.

Two small shipments of clean-up ore were made late in the year.

WESTBRIDGE (49° 118° S.W.).*

Silver-Lead-Zinc.

Zamora (Crown Point and Maybe). This property, comprising the Crown Point Crown-granted claim and ten other claims, is on James Creek about 3 miles by road from the Rock Creek–Beaverdell Road. The workings, at an approximate elevation of 3,000 feet, consist of a shaft and one large open-cut 100 feet to the south. The shaft is reported to be 25 feet deep, with short workings near the bottom. The open-cut was made in 1948, and when work ceased early in 1949 it had been enlarged to 100 feet in length, 12 feet in width, and up to 20 feet in depth. The material mined was a large quartz body containing stringers of galena, sphalerite, and pyrite. Greenstone and limestone are visible on the walls of the cut. Air for mining was provided by a portable compressor, and the ore was scraped into a loading-bin by a dragline scraper. No sorting was attempted, and it is understood that the results obtained by this method were disappointing. This work was done by O. D. Fieth, who had three men working for him. They stopped work early in the year.

Later, after the claim had reverted to the owner, G. E. White, of Oliver, a lease was given to O. Johnson and E. Wanke, of Greenwood. These men, operating under what was known as the " Maybe " lease, obtained two carloads of ore, of which all but

* By J. W. Peck.

6 tons came from the shaft workings of the Crown Point. The other 6 tons were obtained from the Maybe claims, which adjoin the Crown Point claim on the northeast side.

Production: Ore shipped, Zamora, 367 tons. Gross contents: Silver, 868 oz.; lead, 16,963 lb.; zinc, 21,046 lb. Ore shipped, Maybe lease, 121 tons. Gross contents: Gold, 5 oz.; silver, 935 oz.; lead, 19,591 lb.; zinc, 16,880 lb.

ROCK CREEK (49° 118° S.W.).*

Gold-Silver-Lead-Zinc.

Imperial. This group, consisting of the Imperial, Imperial Nos. 1 and 2, Badger, Badger Nos. 1 and 2, Emma, and Lancashire, is situated 3.7 miles by road north of Rock Creek. It was purchased in 1949 by J. Powelson and W. R. Bullock.

The property has been idle since the late 1920's, except for shipments in 1934 and 1936. The main workings consist of an adit driven southeasterly at an elevation about 25 feet above the road to Rock Creek with a 17-foot crosscut to the southwest 65 feet from the portal. At 120 feet from the portal a crosscut has been driven to the northeast for 50 feet, and from the end of this crosscut about 375 feet of irregular drifting and crosscutting have been driven in a southeasterly direction. In this latter section several winzes have been sunk in the north side of a fault. The bulk of the ore shipments in the past appear to have come from a stoped-out section which is entered by a raise in the main adit 95 feet from the portal.

On the surface several open-cuts have been made in the vicinity of the main adit. One open-cut, about 20 feet above the portal, exposed a mineralized zone, and it was from this exposure that a shipment was made in 1949. Four men were employed for a brief period. Ore was trucked to the smelter at Trail.

Production: Ore shipped, 59 tons. Gross contents: Gold, 9 oz.; silver, 682 oz.; lead, 1,031 lb.; zinc, 2,001 lb.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1926, p. 211.]

GREENWOOD (49° 118° S.W.).*

Lead-Silver.

Dynamo Syndicate. The Dynamo group, located just south of the city of Greenwood, is controlled by M. Butorac and associates, of Trail. The property remained idle from January until November, when J. McDonell undertook further underground work. This work was in the Mamont adit, which follows a vein and its split for over 150 feet in a direction south 10 degrees east. In 1949 most of the work was done in a sublevel off a raise located 110 feet in from the portal. This sublevel was advanced 50 feet. The main adit was also advanced on the hangingwall split, and when visited on November 23rd an 18-inch quartz vein mineralized with galena was visible at the face. Ore obtained was shipped to the smelter at Trail. The drilling was done with hand-steel.

Production: Ore shipped, 29 tons. Gross contents: Silver, 193 oz.; lead, 9,092 lb.; zinc, 2,474 lb.

PHOENIX CAMP.†

Copper-Gold.

Brooklyn-Stemwinder Gold Mines, Ltd. Company office, 470 Granville Street, Vancouver. E. H. Kellner, managing director; J. A. Hanna, manager. The company owns the Stemwinder, Standard Fraction, Joker, Montezuma, New York, and Brooklyn Crown-granted claims near the ruins of the old mining town of Phoenix. Most of the mines of the Phoenix camp were on the south

* By J. W. Peck.
† By W. H. White.

side of Twin Creek, south and southwest of the town, Brooklyn and Stemwinder being the only mines on the north side of the broad, shallow valley of Twin Creek.

The Stemwinder was located by James Attwood and James Schofield in 1891, and in the same year Joseph Taylor and Stephen Mangott located the Brooklyn. In 1893 Robert Dengler, D. McInnes, and William Gibbs located the Rawhide. The three claims mentioned and other claims were held at various times by the same owners or operators. The Brooklyn and the Rawhide were large producers. Production from the Brooklyn was principally in the period 1901 to 1908. Much of the ore produced in that period was shipped to the smelter at Boundary Falls, but some of the ore was shipped to the smelter at Greenwood, owned by the British Columbia Copper Company. After several reorganizations, the New Dominion Copper Company was formed in 1909. This company was controlled by the British Columbia Copper Company; its assets included the Brooklyn and Stemwinder mines, but they were not operated. Production by that company from the Phoenix camp came principally from the Rawhide property.

A trial shipment of 5 tons from the Stemwinder was made in 1895. A shipment of 120 tons was made from the Brooklyn in 1898. Production was not continuous in the period 1901 to 1908 but amounted to a substantial tonnage. The total production credited to the Brooklyn to the end of 1908 was: Ore shipped, 250,293 tons. Gross contents: Gold, 17,123 oz.; silver, 87,388 oz.; copper, 6,168,078 lb. To the end of 1908, production credited to the Stemwinder was: Ore shipped, 33,129 tons. Gross contents: Gold, 3,175 oz.; silver, 12,793 oz.; copper, 951,252 lb.

Since the operators of the Brooklyn and Stemwinder, during parts of the period 1900 to 1908, also operated other properties, it may be that the production was not all allocated to the proper property. LeRoy in 1912* cast doubt on the figures then available; his "best approximation" indicates a production of about 170,000 tons of ore from the Brooklyn and Stemwinder, of which nearly 35,000 tons is assumed to have been from the Stemwinder.

Shipments of crude ore from the dumps or mined underground were made in the years 1918, 1919, 1926, 1928, and 1932. In 1936 the Brooklyn mine was operated by four lessees, and in the period 1937 to 1940 the property was leased to W. E. McArthur, of Greenwood. Most of the ore mined in this five-year period was trucked to the Providence mill and the concentrates were shipped to the Tacoma smelter, but shipments totalling 659 tons of crude ore were also recorded. Production recorded for the period 1936 to 1940 was: Ore mined, 34,250 tons. Gross contents of concentrates and of ore shipped crude: Gold, 6,716 oz.; silver, 8,341 oz.; copper, 588,524 lb.

The production for the period 1936 to 1940 is believed to have been entirely from the Brooklyn, except for a small quantity of ore from the Granby (Old Ironsides) mine, milled with the Brooklyn ore in 1939. McArthur was operating the Granby mine during most of the period from 1936 to 1940.

The total production credited to the Brooklyn, including shipments in the period ended in 1908, including 174 tons of ore shipped crude in 1918, 1926, and 1928, and the 1936–40 production, is 284,717 tons. Gross contents: Gold, 23,861 oz.; silver, 95,890 oz.; copper, 6,764,148 lb.

The total production recorded from the Stemwinder, including 61 tons in 1919 and 1932 and ore milled and shipped crude in 1949, is: Ore mined, 35,290 tons. Gross contents of concentrates shipped and of ore shipped crude: Gold, 3,309 oz.; silver, 13,527 oz.; copper, 1,011,758 lb.

The Stemwinder mine was developed by a shaft inclined at 67 degrees with a level 106 feet and another 200 feet lower in elevation than the shaft collar. Most of the ore was mined near the shaft from a glory-hole and an open stope. The glory-hole is about

* LeRoy, O. E. (1912): The geology and ore deposits of Phoenix, boundary district, British Columbia, *Geol. Surv., Canada*, Mem. 21.

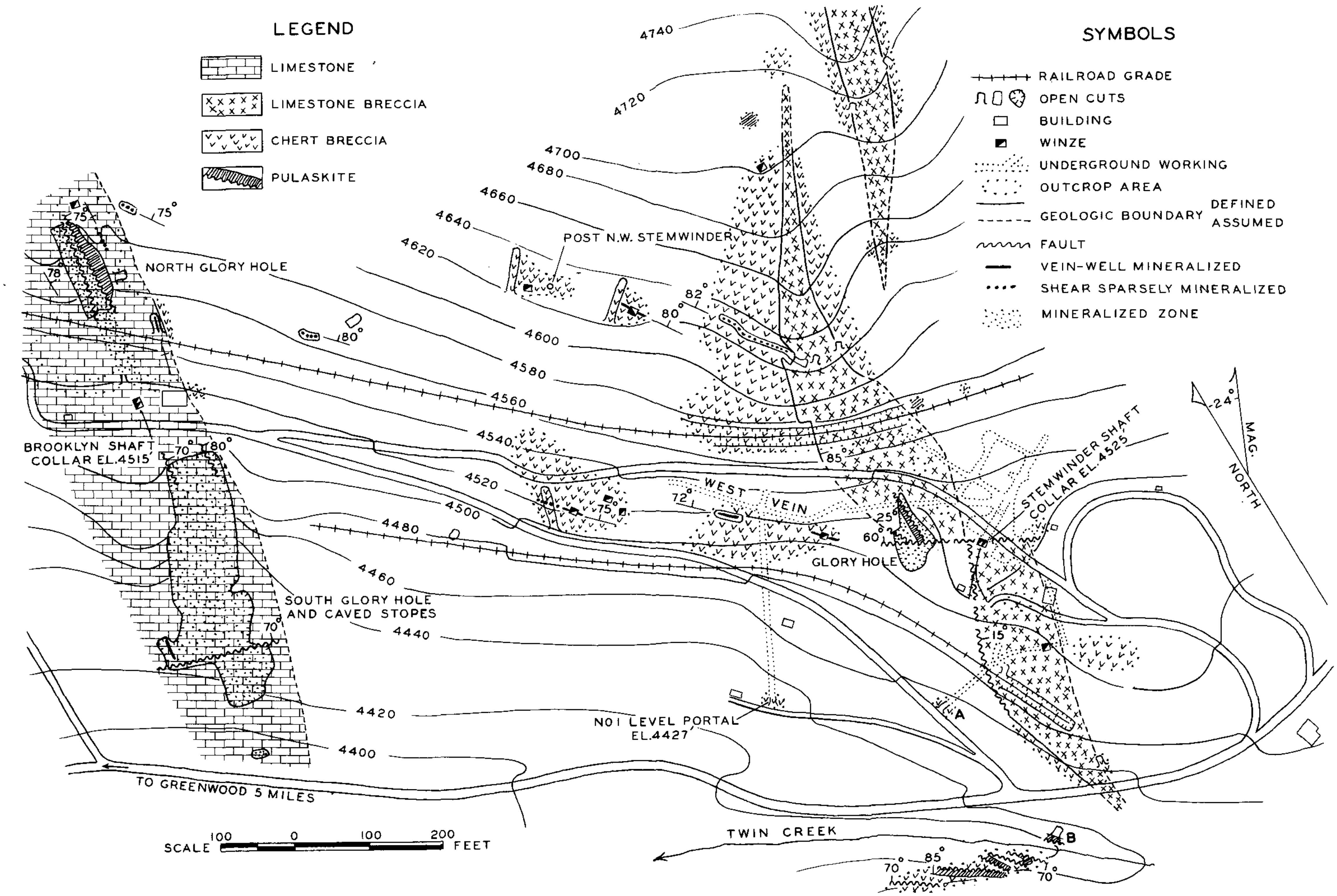


FIG.17. BROOKLYN-STEMWINDER — SURFACE GEOLOGY.

100 feet long, 50 feet wide, and 30 feet deep, and the stope is about 110 feet long, and averages 30 feet wide and 20 feet high.

Other workings on the Stemwinder claim include an old adit at "A," Figure 17. This adit, although partly caved, was entered and surveyed in 1949. It was apparently driven for exploration many years ago. A cut at "B," Figure 17, may be the caved portal of a 100-foot adit mentioned in the Annual Reports of the Minister of Mines 1929, page 257, and 1930, page 323.

The present company began a programme of diamond drilling in 1946 and continued it in 1947. Subsequent operations have been restricted to the Stemwinder mine. Late in 1947 an adit crosscut was begun at a point 360 feet westerly of and 98 feet lower than the shaft collar. The adit was driven north 24 degrees east, 265 feet, where it cut a northwesterly striking vein, referred to as the West vein. A drift was driven 125 feet northwesterly along this vein and another drift, driven southeasterly, broke into the old part of the mine, making a connection with the old upper level. During 1948 a section of the West vein, about 110 feet long, was stoped above the track to an average height of 25 feet.

The new adit and the old level with which it is connected are referred to as No. 1 level, and the old lower level as No. 2 level.

During the summer of 1949 about 2,000 tons of ore was mined from old pillars and other small isolated bodies near the shaft on No. 1 level. Twenty-two diamond-drill holes, totalling 1,170 feet, were drilled in the area near the shaft, and scattered values were obtained in several of these holes, mainly below No. 1 level, south of the shaft. A crosscut being driven southerly from the shaft on No. 2 level was 140 feet long when examined by the writer. The object of the work on No. 2 level was to investigate the diamond-drill intersections. However, this work had not reached its objective when the mine was closed in November.

The former Providence mill at Greenwood was acquired from the Greenwood Ore Concentrating Company, and after rehabilitation milling was begun on May 16th, 1949. Some ore mined in 1948 and the ore mined in 1949 was trucked 5 miles to the mill, which was operated for thirty-nine shifts. The 205 tons of concentrates produced in milling about 2,000 tons of ore and one trial shipment of 59 tons of crude ore from the West vein were shipped to the Tacoma smelter.

Gross content of crude ore and concentrates shipped: Gold, 118 oz.; silver, 677 oz.; and copper, 56,691 lb.

The Brooklyn mine, 1,200 feet northwesterly of the Stemwinder, was developed by a shaft, several levels and stopes, and by two glory-holes, which are the only workings still accessible. The North glory-hole is 130 feet long, 30 feet wide, and ranges in depth from 30 to 80 feet. The South glory-hole, part of which includes caved stopes, is 340 feet long, ranges in width from 70 to 120 feet, and in depth from 30 to 100 feet. The Brooklyn mine has not been worked since about 1908. Some features of its geology and mineralization are noted briefly in later paragraphs.

The geology of the Phoenix camp was studied in detail by LeRoy in 1911, when most of the large mines were operating.* In 1936 McNaughton investigated a larger part of the Phoenix-Greenwood area.† The main rocks of the Phoenix area include a diverse group of limestone, argillite, andesite, and latite, all of which have been altered locally to cherty rocks, referred to by LeRoy as "jasperoid." This group of rocks is overlain unconformably by Tertiary arkose, sandstone, and volcanic flows. The youngest rock in the Phoenix area, an intrusive rock called pulaskite porphyry, occurs as sills, dykes, and small irregular stocks.

* LeRoy, O. E. (1912): The geology and ore deposits of Phoenix, boundary district, British Columbia, *Geol. Surv., Canada*, Mem. 21.

† McNaughton, D. H. (1945): Greenwood-Phoenix area, British Columbia, *Geol. Surv., Canada*, Preliminary Paper 45-20.

In July, 1949, the writer devoted nine days to mapping the Brooklyn-Stemwinder section of the Phoenix camp. Figure 17 is a plane-table map of that section showing the geology and the principal workings. The most widespread rock in this part of the Phoenix camp is a peculiar aggregate of subangular to subrounded fragments of white, red, and green chert; various types of volcanic and coarse-grained granitic rock; and, occasionally, finely crystalline limestone. The rock may be called chert breccia. It is one type of cherty material included in LeRoy's "zone of jasperoids." Two northerly trending, curved, lenticular bodies of another peculiar rock, which will be referred to as limestone breccia, occur near and in the Stemwinder mine. It consists of subangular fragments of greyish-white finely crystalline limestone ranging in size from half an inch to 6 inches, together with a few smaller fragments of chert, set in a fine-grained matrix of carbonate, chlorite, quartz, and clay minerals. Where faults are absent, the contact with the chert breccia is abrupt rather than gradational. Westward, near the Brooklyn mine, the chert breccia is in sharp contact along a northerly trending line with finely crystalline, thin-bedded, siliceous or argillaceous limestone. The distinct and regular bedding of the latter strikes north and dips 75 to 80 degrees eastward. Although the bedded limestone is more than 1,000 feet thick on the north side of Twin Creek, it appears to be absent a short distance to the south, on the opposite side of the drift-filled valley bottom.

Irregular tabular bodies of pulaskite porphyry in the Brooklyn-Stemwinder area will be mentioned in later paragraphs.

Several mineralized zones exposed in old open-cuts and shallow winzes are indicated on Figure 17. A vertical, northerly striking fault zone consisting of about 6 feet of crushed limestone sparsely mineralized with pyrite and chalcopyrite occurs a few feet east of the Brooklyn North glory-hole. An old cut on the railroad grade 50 feet southeast of the glory-hole contains a northerly striking vein-like body of lime-silicate rock in which pyrite and chalcopyrite are sparsely disseminated. The west side of this cut is in limestone; the east side, in chert breccia. Two other old cuts in chert breccia near the North glory-hole expose fault zones that strike northwesterly and dip steeply to the northeast. These zones are rusty and slightly copper stained.

The West vein of the Stemwinder mine is exposed intermittently by open-cuts and shallow winzes for a total distance of 360 feet along the outcrop. This vein strikes north 40 degrees west and dips about 75 degrees northeastward. In general it is somewhat narrower in the outcrops than in the drift about 80 feet below. A channel sample across 4 inches of quartz and pyrite taken in a cut 350 feet northwest of the Stemwinder shaft assayed: Gold, 0.68 oz. per ton; silver, 1.1 oz. per ton; and copper, 3.8 per cent.

Several caved pits and trenches and two winzes filled with water, about 300 feet north of the West vein outcrops, explore one or more zones of quartz stringers and lenses. The zones are subparallel to the West vein. They are in chert breccia and terminate at the contact with limestone breccia. The vein matter in them contains disseminated pyrite and is slightly copper stained. These exposures were not sampled, but apparently some ore has been mined from the winzes.

A zone of unmineralized, slickensided fault planes, roughly parallel to the West vein, may be seen in a small outcrop of chert breccia in the bed of Twin Creek, southwest of the Stemwinder mine. Adjacent fault planes are a few feet apart. Irregular, tabular bodies of pulaskite porphyry follow fault planes and in places bridge from one fault plane to the next. This fault zone may be an important structural feature separating the Brooklyn-Stemwinder area from the main part of the Phoenix camp south of Twin Creek.

Three different types of copper-gold ore occur on the Brooklyn-Stemwinder property—the lime-silicate ore of the Brooklyn mine, the lime-carbonate ore of the old part of the Stemwinder mine, and the siliceous ore of the West vein. The orebodies of the

Brooklyn mine were in a zone of lime-silicate rock, characterized by abundant epidote and by white lime silicates, with some specularite, garnet, calcite, and quartz. This zone is from 20 to 150 feet wide. It lies within the thin-bedded limestone near its contact with chert breccia, being essentially parallel to the bedding of the limestone. Several northerly striking faults and numerous joint planes parallel to the bedding of the limestone may be seen in the ends of the North glory-hole, and it is within this zone of faults that the lime-silicate rock is mineralized with pyrite and chalcopyrite. Mineralization that also appears to be spatially related to faults may be examined in the bottom of the large caved stope south of the shaft. A specimen of well-mineralized material from this place assayed: Gold, 0.37 oz. per ton; silver, 2 oz. per ton; and copper, 5.4 per cent.

A sheet of pulaskite porphyry exposed on the east wall of the Brooklyn North glory-hole lies upon a gently dipping fault plane and shows a chilled margin. The sheet of pulaskite is about 8 feet thick; it strikes north 30 degrees east and dips 35 degrees to the southeast. Lime-silicate rock containing seams filled with calcite and grains of chalcopyrite underlies the sheet of pulaskite which, however, is immediately overlain by unaltered thin-bedded limestone. In the north face of the glory-hole the pulaskite porphyry sheet is crushed and cut off by the fault which forms the hangingwall of the mineralized zone.

In the old part of the Stemwinder mine, faults are the most conspicuous feature. Two important fault sets strike variably west of north. Faults of one set dip moderately to steeply east, and faults of the other set dip 25 to 40 degrees westward. Faults of a third set appear to cut those of the other two sets. The third set strikes northeasterly and dips moderately or steeply to the northwest or to the southeast. They are characterized by much gouge and by fluting that is close to horizontal. Although on the surface the limestone breccia body appears to be fairly continuous, in the workings it is found to be cut into isolated blocks by the numerous faults. The blocks, ranging in size from a few feet to a few tens of feet, are in fault contact with chert breccia on all sides. On No. 1 level the segmentation occurs in a northerly trending belt roughly 200 feet wide. This belt is bounded on the west, almost directly below the glory-hole, by a fault, beyond which the rock is all chert breccia.

All the ore of the old part of the Stemwinder mine occurs in this belt. The orebodies are fault blocks of limestone breccia which have been partly recrystallized as coarse-grained grey calcite containing irregular veinlets and larger masses of chalcopyrite and pyrite. Usually the mineralization ends at the faults bounding the limestone breccia blocks, but in a few places the chert breccia for a few feet beyond such a fault is brecciated and moderately well mineralized. The ore is strikingly different to that of the Brooklyn mine. It contains no garnet or other lime-silicate gangue minerals, no specularite, and no quartz. However, it is similar to the Brooklyn ore in its virtual restriction to carbonate rocks and in its relation to faults which may well be pre-ore in age. The orebody mined in the Stemwinder glory-hole was a block of mineralized limestone breccia bounded on both sides and below by faults. The lower bounding fault dips 25 degrees westward and contains a thin sheet of pulaskite porphyry. The intensity of mineralization of the limestone breccia shows a marked increase near this fault.

The West vein is in chert breccia in a shear zone that strikes northwesterly and dips steeply to the northeast. The vein is a series of quartz-calcite lenses and stringer lodes distributed along the main shear zone. In the drift vein, widths range from 1 to 20 inches, averaging about 12 inches. Widths in the roof of the stope are somewhat less. Pyrite and chalcopyrite are irregularly distributed in the veins. This ore differs from that of the old part of the mine in that quartz constitutes a large part of the gangue.

A plan of part of No. 1 level (Fig. 18) shows the geology as mapped along the drifts on the West vein. Thirty feet southeast of the main crosscut the shear zone is

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cut off by a wide gougy zone of fault breccia. Drag ore indicates a relative fault movement to the left. A short, faulted vein segment 110 feet farther southeast has an attitude similar to the West vein.

The positions from which samples were taken in the West vein drifts and the assays of the samples are shown on the plan of the level. These are channel samples; most of them were cut across the vein only, but where vein matter was absent or more widely distributed in stringers, the samples were taken across the width of the whole shear zone. One sample taken of unmineralized sheared material was barren or contained only traces of metals.

Another vein parallel to the West vein is exposed in the adit near the portal. A 10-inch sample assayed: Gold, 0.01 oz. per ton; silver, 0.3 oz. per ton; and copper, 3 per cent.

CHANNEL SAMPLES.

Sample No.	Width.	Gold.	Silver.	Copper.
	Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.
1	14	Trace	0.2	1.2
2	11	0.01	0.3	6.2
3	15	0.03	0.2	0.32
4	20	*Nil*	*Nil*	Trace
5	36	0.02	*Nil*	0.23
6	24	Trace	*Nil*	Trace
7	4	0.44	0.4	2.8
8	26	Trace	*Nil*	Trace
9	6	0.99	1.6	4.2
10	14	0.31	0.2	0.8
11	4	0.55	0.3	1.9
12	36	*Nil*	*Nil*	Trace
13	6	0.17	0.6	4.6
14	6	0.04	0.6	3.0
15	9	0.01	0.8	7.7
16	4	0.04	0.3	3.0
17	14	0.07	0.7	3.0
18	13	0.06	0.7	4.9
19	11	0.21	0.2	5.9
20	12	0.18	Trace	7.9
21	11	0.07	0.4	3.1
22	16	0.16	0.8	5.9
23	13	0.09	*Nil*	7.6
24	10	0.38	1.8	8.9
25	5	0.16	1.3	4.9
26	4	0.27	0.8	2.7
27	9	0.14	1.5	8.1
28	16	*Nil*	1.3	5.5
29	6	0.10	1.4	6.0
30	9	1.96	2.0	5.5
31	7	0.31	0.3	1.0

FRANKLIN CAMP (49° 118° N.E.).*

Silver-Lead-Zinc.

McKinley. This property, operated under lease by W. E. McArthur, of Greenwood, is 44 miles by road north of Grand Forks. Work ceased in December, 1948, because of snow, and operations did not begin until May, 1949. Surface stripping exposed short faulted segments of a vein mineralized with chalcopyrite, galena, and sphalerite. The ore was mined out, and no more was found by diamond drilling. Work ceased in late summer after all broken ore, including 40 tons broken in 1948, was shipped to the smelter at Trail. According to Mr. McArthur the ore assays

* By J. W. Peck.

over 3 per cent. copper, but no reward is obtained for this at the Trail smelter. Four men were employed.

Production: Ore shipped, 145 tons. Gross contents: Gold, 2 oz.; silver, 913 oz.; lead, 32,489 lb.; zinc, 49,654 lb.

BURNT BASIN (49° 118° S.E.).*

Silver-Lead-Zinc.

W.S. Five recorded claims—the W.S., the W.S. 1, 2, 3, and 4—are 1 mile northwest of Coryell, a flag stop on the Canadian Pacific Railway Kettle Valley line, 18 miles by road northeast of Christina Lake. They are owned by the W.S. Mines, a partnership between W. Schwartzenhauer, H. M. Sequin, and J. A. Garneau. The main workings are about one claim length southeast of the Hastings Crown-granted claim and consist chiefly of a 400-foot adit driven in a northwesterly direction. Two short crosscuts have been driven to the southwest and one to the northeast. Near the face of the adit a winze has been sunk 15 feet and a 20-foot raise driven. It was from this raise that ore was obtained in 1949. Galena and sphalerite in narrow bands are visible in several places in the adit. The country rock is chiefly limestone. Hand-steel had to be used; the ore was sacked, moved by horses down a mile of trail, and then trucked to the smelter at Trail. It is reported that the late Hugh Breakell, of Grand Forks, worked this property about twenty-five years previously and made at least one shipment.

Production: Ore shipped, 6 tons. Gross contents: Silver, 160 oz.; lead, 5,125 lb.; zinc, 2,148 lb.

Halifax. This Crown-granted claim in the Burnt Basin area was worked late in 1948 by W. Schwartzenhauer and associates. Work in 1949 was restricted to one ore shipment in February. Production: Ore shipped, 14 tons. Gross contents: Silver, 125 oz.; lead, 3,562 lb.; zinc, 4,106 lb.

ROSSLAND (49° 117° S.W.).†

Gold.

Midnight and I.X.L. (Kootenay Central Mines, Limited). Head office, Room 2, 815 Victoria Street, Trail. E. R. Haynes, president; J. A. Cooper, vice-president and manager. Capital: 500 shares, $100 par value. This company owns the adjoining Midnight and I.X.L. mines, 1 mile south of Rossland. In the Midnight mine no mining was done other than driving a raise from the sublevel 75 feet below the main adit to connect with this adit. This will make it possible to mine a block of ore to the north of the main winze. In the I.X.L. mine a sublevel half-way between the No. 5 and No. 4 levels was worked. A remnant of ore extending 70 feet to the west of the main raise and extending presumably 70 feet to the level above was mined, although it was left by previous operators presumably because it was of too low a grade.

Seven men were employed until work ceased in April. In May the main compressor was removed to the Spokane mine, which was optioned by the company. Late in the year, operations commenced again on a reduced scale.

Production: Ore mined, 119 tons. Gross contents: Gold, 15 oz.; silver, 93 oz.

Nature Boy. This is a recorded claim staked in 1948 about 2 miles from Rossland on the Rossland–Trail Highway. A few tons were mined from surface stripping by the owner, James Pearson. Production: Ore shipped, 4 tons. Gross contents: Silver, 31 oz.; lead, 118 lb.; zinc, 90 lb.

* By J. W. Peck.

† By J. W. Peck, except as noted.

South Belt.* The basin-shaped area immediately south of Rossland, rimmed by hills rising some 2,000 feet above the valley of Trail Creek, is referred to as the South Belt. It was in this area in 1897 that the first discovery of the Rossland camp was staked as the Lilly May. Some 2 miles northward, gossans along the base of Red Mountain attracted attention, and in 1890 the Le Roi, Centre Star, and War Eagle claims were staked, and the Josie, together with many others, was located the following year. In subsequent years this area became the heart of the Rossland mining camp. The South Belt has received attention from time to time, but production has been small. The most recent activity centred about the Mayflower and began in 1946. Exploration has been hindered by much drift, which is deeper and more continuous in the lower parts of the basin.

The geology of the South Belt is shown on Map No. 1004, which accompanies Memoir 77,† and is described in that publication and elsewhere.‡ The elongated mass of monzonite extending easterly across the northern part of the area intrudes a rock complex referred to as augite porphyrite and remnants of slaty rock of the still older Mount Roberts formation. The contacts of the monzonite mass are irregular, and the southern boundary curves distinctly to the north so that, in the part of the area directly south of Rossland, the other rocks occupy a marked embayment in the monzonite.

The deposits of greater relative importance in the South Belt are in the older rocks in this embayment. Northerly striking lamprophyre dykes dipping moderately eastward, distinctive not only of the South Belt but of the Rossland camp as a whole, appear to be more numerous in the embayment than in areas on either side. From near the centre of the embayment eastward for at least 2 miles innumerable light-coloured dykes of granite porphyry are a distinctive feature. For the most part these dykes strike a few degrees east of north and dip moderately eastward. Several granite porphyry dykes, identical in megascopic and microscopic features to those just mentioned, occur to the north and west of the area and in the Le Roi and Centre Star mines north of Rossland. However, these dykes have an easterly rather than northerly trend and dip almost vertically.

A moderate amount of development work has been done on mineral deposits of the South Belt, most of it many years ago. Data concerning properties, gleaned from published and unpublished sources and from examination of the old dumps and the few workings still partly accessible, are summarized below. In describing the ores the terms "Rossland type," "South Belt type," and "Transitional type" are used for brevity. The Rossland type is heavy sulphide ore, predominantly pyrite and pyrrhotite with a little chalcopyrite, and yields gold and copper. The South Belt type contains pyrite, pyrrhotite, arsenopyrite, sphalerite, galena, and, locally, boulangerite.§ A large part of the value is due to silver, lead, zinc, and gold, but the gold content is low. The Transitional type is gradational in mineralogy and metal content between the Rossland and South Belt types. Usually it contains abundant sphalerite, little or no galena, and is low in silver.

* By W. H. White.

† Drysdale, C. W. (1915): Geology and ore deposits of Rossland, *Geol. Surv., Canada*, Mem. 77.

‡ Bruce, E. L. (1916): Geology and ore deposits of Rossland, *Minister of Mines, B.C.*, Ann. Rept., pp. 214–244.

§ A soft grey metallic mineral of accicular habit (possibly mistaken in the past for stibnite) has been identified as boulangerite by R. M. Thompson, Department of Geology and Geography, University of British Columbia. The mineral is locally abundant in South Belt ores.

Property.	Location.	Strike of Deposit.	Total Tonnage mined.	Country Rock.	Ore Type.
Phoenix	2,000 ft. southwest of city centre	N. 80° W.	117	Monzonite	Rossland.
Abe Lincoln	1,000 ft. west of Phoenix	W. (?)	*Nil*	Monzonite	Rossland.
Sunset	1,300 ft. south of Phoenix	(?)	19	Monzonite	Rossland.
Nest Egg	1,500 ft. east of Sunset	(?)	?	Monzonite	Rossland.
Monday	1,200 ft. south of Nest Egg	N. to N.E.	?	Slate	Transitional.
Homestake	1,000 ft. east of Monday	N. 80° W.	377	Porphyrite	Transitional.
Gopher	1,200 ft. east of Homestake	(?)	?	Porphyrite	Transitional.
Maid of Erin	1,800 ft. east of Gopher	W. (?)	12	Porphyrite	Transitional.
Celtic Queen	4,500 ft. east of Maid of Erin	N. to E.	*Nil*	Slate and porphyrite	Transitional.
Crown Point	2,600 ft. east of Celtic Queen	N. 30° E.	400	Porphyrite, near monzonite	Rossland.
Blue Bird	1,200 ft. south of Homestake	W.	538	Slate	South Belt.
Mayflower	1,000 ft. east of Blue Bird	N. 70° W.	626	Porphyrite	South Belt.
Hattie	3,600 ft. west of Blue Bird	W.	9	Monzonite	Rossland.
Deer Park	2,800 ft. west of Hattie	Irreg. N.	?	Monzonite	Rossland.
Lilly May	1,000 ft. south of Hattie	W. and N.W.	50	Slate	South Belt.

Regarding the distribution of these deposits in the South Belt, the following generalizations can be made:—

(1) Deposits with Rossland type ores occur either in or near the monzonite.

(2) The most common trend of the deposits is westerly, but anomalous trends are found on the outskirts, both east and west of the central part of the area.

(3) Deposits with South Belt type or Transitional type ores are most common in the embayment of older rocks directly south of Rossland.

(4) The total recorded output of the South Belt is 2,100 tons. More than half this ore was mined from the Blue Bird and Mayflower. They appear to be on a structure or on two subparallel structures constituting the most persistent ore-bearing zone so far discovered in the South Belt.

Rossland Mines, Limited (Mayflower, etc.).—Company office, 675 Hastings Street West, Vancouver. W. B. Burnett, president; E. H. Lovitt, manager. In 1946, 1947, 1948, and the early part of 1949 this company carried on exploration in the South Belt of Rossland. Geological and geophysical surveys were made in an area roughly 3 miles long in an east-west direction and 1½ miles wide. Possible westerly extensions of the ore-bearing structure of the Mayflower deposit and some of the geophysical anomalies were tested by seventeen diamond-drill holes, totalling 2,342 feet of drilling. Ore was mined in the Mayflower adit in 1948 and 1949 and trucked to Retallack, where it was milled in the Whitewater mill. The 1948 Annual Report of the Minister of Mines states that the ore milled that year amounted to 250 tons and that 295 tons remained in the stockpile. The 1949 production return indicates that an additional quantity of ore, amounting to 136 tons, was trucked to the Whitewater mill. The total quantity of ore milled in the two years amounted to 681 tons, and the gross contents of the concentrates shipped in the two years amounted to: Gold, 55 oz.; silver, 5,254 oz.; lead, 32,053 lb.; zinc, 86,958 lb.; and cadmium, 297 lb.

The workings usually referred to as the Mayflower are on the Crown-granted Olla Podrida claim, 7,200 feet due south of the centre of Rossland. Located in 1899, the property was developed intermittently until about 1911. The earliest work was done on the South vein, on which old caved workings are east of the railroad, about 300 feet southeasterly from the main adit. The North or Main vein was discovered later and explored at shallow depth by two winzes and other workings both east and west of the railroad. In 1939 the main adit (Figs. 19 and 20) was started from the bottom of the valley of Gopher Creek. This level includes a drift on the Main vein and a crosscut

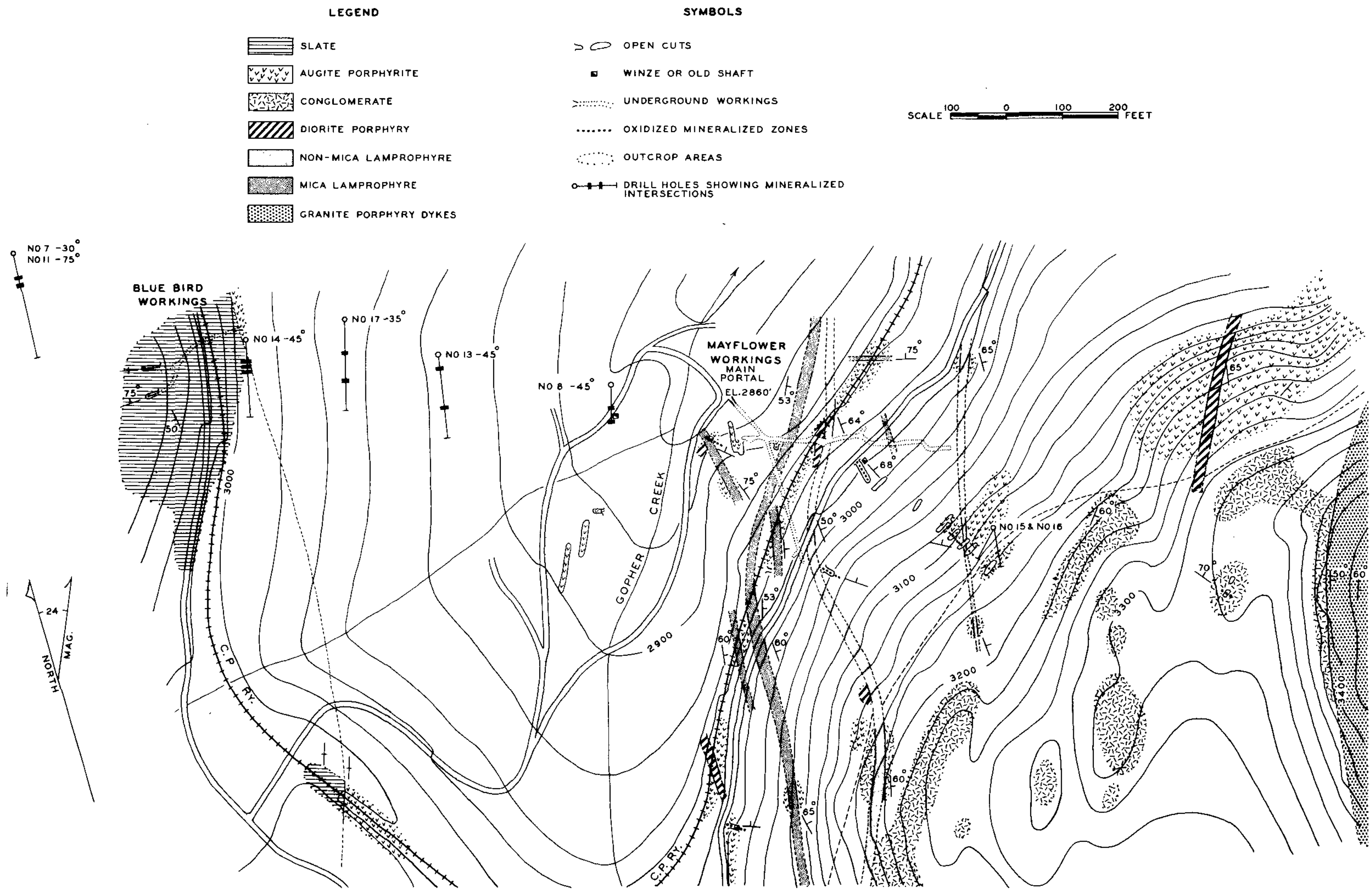

FIG. 19. SURFACE GEOLOGY NEAR MAYFLOWER WORKINGS.

driven southerly in search of the continuation of the South vein, mined in the old workings about 80 feet above.

The predominant rock near the workings is a variation of the type called "augite porphyrite" in Memoir 77, which here is characterized by prominent dark-green crystals of altered augite and is markedly brecciated. The angular fragments are recognizable only on weathered surfaces and are embedded in a matrix somewhat finer in grain but apparently of the same composition as the fragments. The fragments range from 1 to 12 inches across. The prominent augite crystals are scattered evenly throughout both fragments and matrix, and some crystals of augite extend from a fragment across the boundary into the matrix. Near the southeastern border of the augite porphyrite area the outcrops are more severely weathered and coloured red and white by oxidation of iron and kaolinization of the feldspars. In one outcrop 950 feet east of the main adit the augite porphyrite breccia grades first into volcanic agglomerate and finally into thin-bedded reddish material resembling tuff, which strikes north 60 degrees east and dips steeply southeastward.

The augite porphyrite breccia gives place southeastward to conglomerate composed of subrounded and rounded pebbles of augite porphyrite, granite, diorite, and quartz in a matrix of very fine-grained dark-coloured silt-like material. The matrix weathers out readily, leaving the pebbles protruding from the surface. Most of the pebbles range in size from 1 to 3 inches, but in places pea-size pebbles and coarse sand occur in stratified lenses that strike about north 40 degrees east and dip about 60 degrees to the southeast. Grain-size gradations in the stratified beds indicate that the beds are right-side up. Preferential replacement of the matrix and of certain of the pebbles by epidote is a common feature. The contact of the augite porphyrite and conglomerate was nowhere observed, but it would appear to be abrupt. Evidently it represents an erosion surface separating the augite porphyrite and the overlying conglomerate.

One thousand feet southwesterly from the Mayflower workings, across the drift-filled valley of Gopher Creek, the contact of augite porphyrite and thin-bedded siliceous slate of the Mount Roberts formation is exposed in a railroad cut. The augite porphyrite near the contact is massive, fine grained, and not porphyritic, and the slate is indurated and pyritic. The contact strikes north 20 degrees east and is vertical. In the railroad cut the bedding of the slate is parallel to the contact, but 850 feet farther north the slate in the Blue Bird workings strikes north 15 degrees west and dips 50 degrees westward.

Intrusive into these older rocks are diorite porphyry, granite porphyry, and both mica lamprophyre and non-mica lamprophyre dykes. The oldest are dykes and irregular masses and tongues of fine-grained diorite porphyry with distinctive accicular hornblende crystals. The zone of granite porphyry dykes begins near the eastern edge of the area mapped. The granite porphyry is easily distinguished by its subspheroidal crystals of clear quartz about 1 millimetre in diameter, in a fine-grained feldspathic groundmass. The dykes strike north 15 degrees east and dip regularly 50 to 60 degrees eastward. On a railroad cut north of the area a granite porphyry dyke is cut by a lamprophyre dyke.

The lamprophyre dykes of both types are numerous and are a distinctive feature of considerable economic significance. Probably they are more numerous than suggested by Figure 19. Although some of the dykes branch and vary in attitude, the swarm as a whole trends a few degrees west of north and dips moderately to the east. The dykes range in width from 4 to as much as 25 feet. In field mapping, the lamprophyre dykes were divided into mica and non-mica types, depending on whether or not biotite was visible with a hand-lens. These names, based on megascopic characteristics, are retained as a convenient way of distinguishing between the two types of lamprophyre dyke. Microscopic examination shows that both types contain about 15 per cent. biotite, the only difference being one of grain size; both types also contain much hornblende, some calcite, and a feldspar near oligoclase in composition. Small white ellipsoidal bodies composed of both plagioclase and calcite are usually, but not always, present in the non-mica lamprophyres.

The cuts and old caved workings, shown on Figure 19, mark the positions of thoroughly weathered and oxidized mineralized zones. The exposures suggest one main zone and several subsidiary zones, all trending westerly and dipping steeply to the north. The main zone, marked by a series of cuts and an old shaft east of the road, narrows eastward and appears to die out a short distance beyond the conglomerate contact. Diamond-drill holes, numbered 15 and 16, intersected only a few inches of sparsely mineralized material. The continuation of the main zone to the west may be represented by the old shaft 70 feet south of the main adit portal and by a shallow winze 170 feet farther to the west across Gopher Creek. A channel sample across 18 inches of disseminated sulphides in this winze assayed: Gold, 0.01 oz. per ton; silver, 1.6 oz. per ton; lead, 0.5 per cent.; zinc, trace. These surface workings may represent the mineralized zone developed in the main adit, but neither the surface position nor the attitude correlate satisfactorily with the workings. The subsidiary zones appear to be narrow and discontinuous.

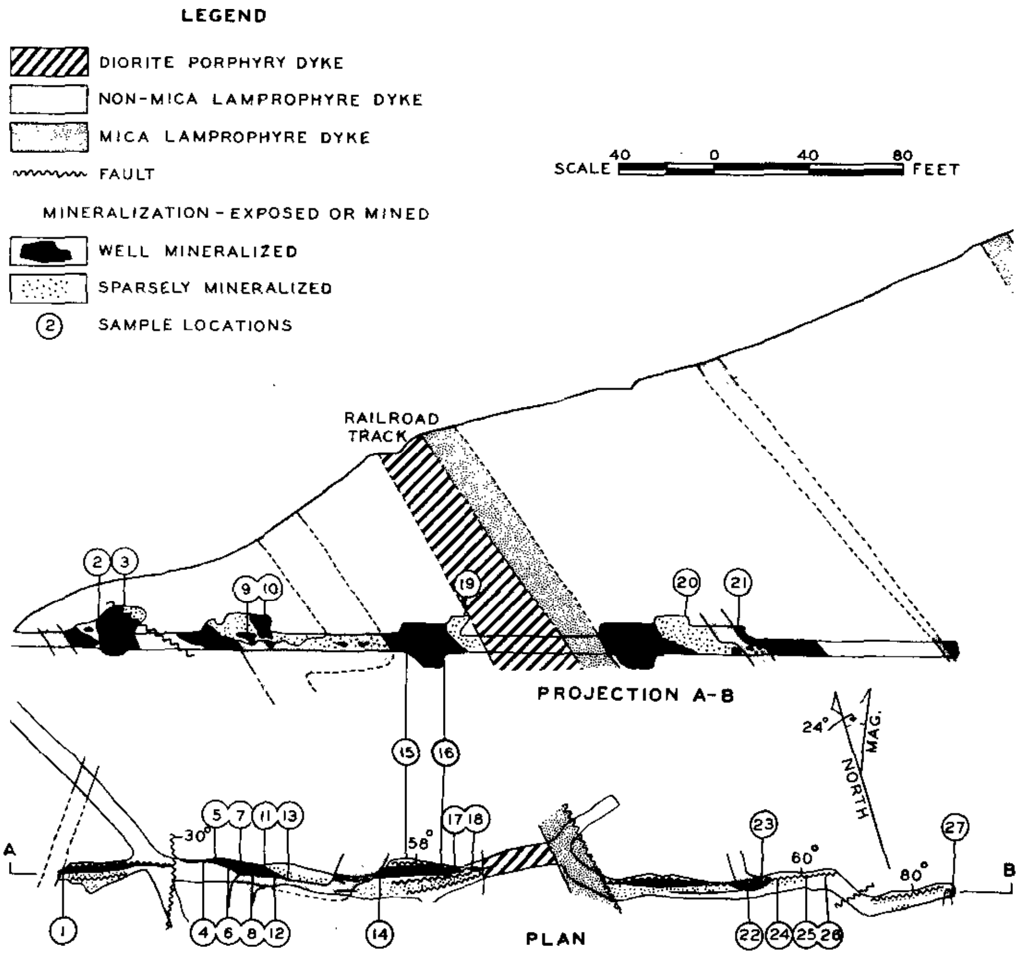

Fig. 20. Mayflower workings—main adit.

The main level (Fig. 20) was driven 90 feet southeasterly from the portal, to the point where it cut the main zone. From this point, drifts follow the shear zone westerly for 40 feet and easterly for 335 feet. From the same point a crosscut was driven 230 feet southerly in search of the South vein, mined in old workings 80 feet higher, but the South vein was not found in this working.

The rock in the main adit is augite porphyrite breccia cut by one dyke of diorite porphyry and five lamprophyre dykes. The projection shows the correlation of underground and surface exposures. The drift follows a shear zone with poorly defined walls. Discontinuous fault planes occur along the zone in subparallel, en echelon, and branching patterns. The augite porphyrite along this zone and for several feet laterally is altered to a matted aggregate of fine-grained biotite and sericite containing abundant ragged particles of pyrrhotite. The diorite porphyry is altered to a lesser degree, but the lamprophyre dykes appear to be unaffected. Figure 20 illustrates the manner in which the lamprophyre dykes cross the shear zone. Some extend across without deflection, but others turn along the shear zone as irregularly constricted sheets that finally cross to the opposite side. The lamprophyre dykes have been intruded subsequent to the formation of the shear zone and probably subsequent also to the period of alteration of the other rocks.

Sample No.	Description.	Width.	Gold.	Silver.	Lead.	Zinc.
		Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
1	Massive sulphide ore	12	0.19	19.1	5.1	8.2
2	Sheared rock—small masses of sulphide	22	0.07	9.5	3.0	5.4
3	Sheared rock—small masses of sulphide	22	0.08	10.0	2.8	8.6
4	Massive sulphides	5	0.08	11.4	4.1	8.8
5	Massive sulphides	8	0.18	7.6	2.8	8.9
6	Siliceous rock with disseminated sulphide	10	0.17	16.6	6.0	8.2
7	Massive sulphides	11	0.22	10.4	3.6	7.0
8	Massive sulphides	10	0.08	3.7	1.2	8.4
9	Specimen from dyke contact—massive sulphide ore	....	0.35	3.1	0.6	18.0
10	Massive pyritic ore	15	0.42	6.8	2.0	8.3
11	With fairly abundant galena	9	0.22	22.7	7.4	8.4
12	Massive sulphides	9	0.26	5.4	1.6	8.7
13	Sheared rock with sulphide stringers	14	0.08	1.1	0.2	1.7
14	Massive pyritic ore	12	0.18	1.1	0.2	8.4
15	Massive ore with some galena	38	0.18	19.6	6.3	9.6
16	Siliceous rock with sulphide masses	9	0.13	8.1	3.0	2.9
17	Massive sulphides with much sphalerite	16	0.14	5.8	2.3	13.0
18	Massive sulphide ore	12	0.22	25.1	7.9	7.9
19	Disseminated sulphides	12	0.01	Trace	1.9	4.4
20	Sheared rock slightly mineralized	12	0.01	0.7	0.2	Trace
21	Massive pyritic ore	16	0.12	2.8	0.8	4.6
22	Galena and sphalerite fairly abundant	20	0.21	17.7	5.1	10.4
23	Patchy sulphide mineralization	14	0.18	13.3	3.0	7.0
24	Disseminated sulphides	10	0.02	1.8	0.9	1.4
25	Disseminated sulphides in patches	7	0.06	7.7	4.0	5.6
26	Pyrite with stringers of sphalerite	12	0.36	1.0	0.9	13.6
27	Patches of sulphides	12	0.23	2.3	0.7	5.2

In the drift length of 375 feet there are five oreshoots having an aggregate length of 185 feet. In 1948 and 1949 ore was mined from stopes extending short distances above the roof of the drift, and downward under three of these stopes to a depth of a few feet below the floor of the drift. The width in present exposures at the tops of stopes and in the roof of unstoped parts of the drift averages about 15 inches. In detail the oreshoots are irregular, with bulges and vein-like masses extending into the walls.

Widths indicated in the drift before the stopes were mined are reported to have been 4 feet and more. At some points the drift is as much as 10 feet wide. The oreshoots are distributed along the main shear zone immediately adjacent to the hangingwall sides of dykes. They rake to the east, parallel to the dip of the dykes. In mining these shoots the greatest widths and the best ore were found close to the dyke contacts. In some places, dykes in contact with ore are found to be fractured and mineralized, and small stringers of ore minerals may be observed extending through dykes. Limited replacement of the dyke material by ore minerals is apparent in thin sections. The lamprophyre dykes are older than the ore minerals, with the possible exception of pyrrhotite, and consequently played an important part in localizing deposition of ore minerals within the still older shear zone.

The ore is composed of fine-grained, disseminated, or rudely banded, massive sulphides in a gangue consisting of thoroughly sericitized rock, a little carbonate, and some quartz. The metallic minerals in their general order of relative abundance include pyrite, pyrrhotite, sphalerite, arsenopyrite, galena, and boulangerite. Locally the relative proportions may vary a good deal. Microscopic examination of polished sections suggests that pyrrhotite was the earliest mineral to form, followed and partly replaced by pyrite and arsenopyrite. The numbered locations of samples taken are shown in Figure 20. All but one are channel samples. Assay data relating to these samples appear opposite corresponding numbers in the table on page 161.

Rossland Mines, Limited, carried out extensive geophysical surveys, employing both magnetic and self-potential methods. The latter proved the more satisfactory. Self-potential contour maps showed broad, irregular, and apparently meaningless areas of high self-potential, also sharply defined ridges and elongated domes, many of which correspond in position and direction to known mineral deposits. The Mayflower anomaly, for example, with self-potential ranging from 100 to 350 millivolts, may be traced for 3,000 feet westerly from the Mayflower workings. The Blue Bird and Monday workings are on this part of the anomaly. It does not, however, extend far easterly from the Mayflower workings. A test-pit on the anomaly about 2,900 feet westerly from the Mayflower workings exposed nearly 10 feet of sparingly mineralized material containing some sphalerite. Some of the diamond-drill holes put down to test the anomaly are plotted on Figure 19. Data concerning the mineralized intersections in these drill holes based on examination of cores are summarized below:—

Hole No.	Core Length of Intersections.	Mineralization.
8	30 inches, and 7 feet	Irregular areas of massive sulphides, mainly pyrite and pyrrhotite.
13	4 feet, and 18 inches	Sparsely mineralized; some sphalerite.
17	5 inches, and 15 inches	Massive sulphides with galena and sphalerite.
14	12 inches, 10 inches, and 6 inches	Massive sulphides with galena, sphalerite, and boulangerite.
7	3 feet and 4 feet	Massive sulphides with galena, sphalerite, and boulangerite.
11*	No intersections.	
6†	2 feet	Massive sulphides.

* Directly below Hole No. 7. † Three hundred and seventy feet westerly from Hole No. 7.

The frequent occurrence of lamprophyre in the drill cores indicates that these important dykes may be as numerous in the drift-covered valley bottom west of Gopher Creek as they are in the Mayflower area. The drill intersections suggest, but do not prove, that the general ore-bearing structure of the Mayflower may continue westerly for 1,500 feet or more. Probably these intersections are in several subparallel zones. Holes spaced so far apart might well miss oreshoots similar in size to those in the Mayflower workings.

NELSON.*

Kokanee Creek (49° 117° N.E.).

Silver-Lead.

Molly Gibson. This mine is at the head of Kokanee Creek and is owned by The Consolidated Mining and Smelting Company of Canada, Limited. In 1949 R. J. Johnstone made a shipment of dump material. Production: Ore shipped, 10 tons. Gross contents: Silver, 297 oz.; lead, 2,064 lb.; zinc, 895 lb.

Eagle Creek (49° 117° S.E.).

Gold.

Granite-Poorman (Kenville Gold Mines, Limited). British Columbia office, Royal Bank Building, 675 Hastings Street West, Vancouver; mine office, Box 390, Nelson. G. H. Rainville, president; W. B. Montgomery, manager. Capital: 3,500,000 shares, $1 par value. This company is controlled by Quebec Gold Mining Corporation and Noranda Mines. Production was maintained during the first half of the year, with the Midway vein producing 75 per cent. of the ore and the Flat, Hardscrabble, and Yule veins following in that order.

On August 12th the company ceased operating the mine but gave leases on parts of it. Six groups of lessees leased sections of the mine, as follows:—

(1) Kootenay Hard Rock Mining & Development Co. (H. Maxwell, H. Peters, S. Hill, plus one employee) : Hardscrabble and 220 Yule, 2570 level.

(2) H. Cooper and A. Jmaeff, plus one employee: Midway vein above 2750 level.

(3) H. Henry, J. Logan, and H. R. Sage: Poorman, 2750 level.

(4) C. Johnson, A. Johnson, and W. Johnson: 219 and 220 Yule, 2750 level.

(5) M. Arishenko: Flat vein, 2570 level.

(6) H. R. Smith plus two employees: Granite.

Operation of the mill was continued to treat ore mined by the lessees and ore from the Arlington, owned by the same company. Ore was purchased from the Venango, and ore from the Van Roi was milled on a custom basis. To treat the Van Roi ore, it was necessary to install a flotation circuit; the change-over was completed in July. Before August the crew averaged seventy-five, but was reduced to twenty-five after that date.

Production: From the Granite-Poorman, mined by the company, 24,004 tons; mined by lessees, 1,815 tons; total, 25,819 tons; from the Arlington (p. 167), 124 tons; from the Venango, 247 tons; total ore milled for the company, 26,190 tons. The lessees shipped 5.3 tons of crude ore to the smelter. Metals recovered: Gold, 6,409 oz.; silver, 4,027 oz.; lead, 15,191 lb.; zinc, 14,315 lb.

Venango. This mine adjoins the Kenville property to the west. A. G. and D. H. Norcross obtained a lease from Venango Gold Mines, Limited, and shipped 247 tons of ore to the Kenville mill. A road 200 yards long was made to improve trucking facilities. Air for mining was purchased from the Kenville Gold Mines, Limited.

* By J. W. Peck.

TOAD MOUNTAIN (49° 117° S.E.).

Lead-Zinc-Silver.

Silver King. O. W. Gowing continued to work intermittently on this property on a lease from The Consolidated Mining and Smelting Company. Dump ore from the level above the Dandy level was first trucked to the Kenville mill, but it was not treated there and had to be sent to the smelter at Trail.

Copper-Gold-Silver.

Victoria-Jessie. This property was operated under lease by the Rollick brothers, of Nelson. It is on Toad Mountain, about 9 miles by road from Nelson. The Rollick brothers set up a portable compressor and removed ore by overhand and underhand stoping in the main Victoria adit, about 400 feet in from the portal.

Production: Ore shipped, 30 tons. Gross contents: Gold, 23 oz.; silver, 9 oz.

Gold-Silver.

Daylight. This property, lying above the Victoria-Jessie mine, was also operated for a short time by the Rollick brothers, of Nelson. A few tons of ore was removed from the vicinity of the shaft. Production: Ore shipped, 4 tons. Gross contents: Gold, 3 oz.; silver, 3 oz.

HALL CREEK (49° 117° S.E.).

Gold.

Canadian Belle Mining Co., Inc. R. E. Linquist, president and general manager. Capital: 1,500,000 shares, 1 cent par value. This Washington company was formed to develop the Canadian Belle, 3 miles by road from Hall Creek Siding, south of Nelson. J. McLellan, of Nelson, obtained a contract to drive a 1,000-foot crosscut to investigate diamond-drill results obtained in 1948. The portal was collared on the bank of Keno Creek 100 feet above the main campsite, but as soon as this was completed, the project was abandoned.

Golden Eagle and T.S. Groups. These groups are owned by W. Rozan and associates, of Nelson. The claims are located at the summit between Fortynine and Hall Creeks. Access is by way of Fortynine Creek. Mr. Rozan worked alone during 1949 and made a shipment from the Sun Fraction. Production: Ore shipped, 3 tons. Gross contents: Gold, 2 oz.; silver, 5 oz.; lead, 97 lb.

YMIR (49° 117° S.E.).*

Gold-Silver-Lead-Zinc.

Goodenough (Protection). This mine, on the north slope of Ymir Creek, 5½ miles by road from Ymir, was operated under a purchase agreement by J. Turk, A. Fata, and F. Patula. Most of the ore came from No. 2 level. Here, after considerable " dead " work, a 20-foot section of a vein 3 feet wide was opened about 200 feet east of the main raise to No. 4 level. This ore section, missed by previous operators, is at right angles to the main vein. On the surface the No. 5 portal was stripped, and a vein was exposed which is about 10 feet south of, and parallel to, the old adit. Hand-steel is used, and ore obtained is trucked to the smelter at Trail.

Production: Ore shipped, 341 tons. Gross contents: Gold, 190 oz.; silver, 2,052 oz.; lead, 46,763 lb.; zinc, 48,464 lb.

* By J. W. Peck, except as noted.

Centre Star (Wesko). T. Wilkinson and S. Wasney operated this mine on a lease from Wesko Mines, Limited. The mine is 2½ miles by road southeast of Ymir. Since acquiring their lease in the latter part of 1948, a shipment was made by hand-sorting the 300 level dump. Underground work was concentrated on the second sublevel above the bottom, or 560, level. Small remnants of ore near the main raise were removed, but it is understood the results were disappointing. The ore was removed with hand-steel, and a tram of 1,000 feet with a wheelbarrow was required to bring the ore to surface. Work was stopped at the end of June.

Production: Ore shipped, 17 tons. Gross contents: Gold, 4 oz.; silver, 59 oz.; lead, 1,396 lb.; zinc, 1,805 lb.

Dundee. The Dundee mine is on the north side of Bear (Oscar) Creek valley, 2 miles by road from Ymir. The property consists of the Old Bill, White Pine, Parker, Lightheart, and Annie Fractional Crown-granted mineral claims. These were at one time controlled by the old Ymir Yankee Girl Gold Mines, Limited, but were acquired in 1949 by A. Burgess and associates.

The portal site and a portion of the 1235 adit of the Yankee Girl mine are on the Old Bill claim. The main Dundee adit is several hundred feet down the hill. It is connected to the 1235 level of the Ymir Yankee Girl by a raise.

This lower level was reopened with some difficulty, and track and pipe were removed to rehabilitate the 1235 level above.

From the portal the 1235 level runs northeasterly. The first 1,200 feet or so is in Dundee ground, but at the boundary the adit splits. The northeast branch is in Ymir Yankee Girl ground and the south branch in Dundee ground.

Ore was removed from ore remnants previously left on the footwall side of a stope off the south branch about 2,000 feet from the portal. This ore was shipped to the Trail smelter. Three men were employed.

Production: Ore shipped, 550 tons. Gross contents: Gold, 113 oz.; silver, 3,976 oz.; lead, 121,786 lb.; zinc, 113,622 lb.

Zinc.

Last Chance. New Jersey Zinc Explorations, Limited, holds an option on the Last Chance property, north of Oscar (Bear) Creek, about 3½ miles easterly from Ymir. Under the direction of E. P. Haukedahl, of Ymir, three short adits were driven by hand-steel.

Jack Pot.* This property, southeast of Ymir, on the crest and northern slope of the ridge separating Porcupine and Hidden Creeks, is under option to New Jersey Zinc Explorations, Limited. Some of the showings were described in the Annual Report of the Minister of Mines, 1948 (pp. A 132 and A 133). During 1949 further geological mapping and stripping were done by New Jersey Zinc Explorations, Limited, and twenty-one diamond-drill holes, totalling 6,819 feet, were drilled. A road 4 miles long was built by the company from Porcupine Creek valley to the crest of this ridge. Six men were employed under the direction of R. C. Macdonald.

The local stratigraphic succession begins with micaceous quartzite, succeeded upward by a bed of crystalline limestone about 250 feet thick, overlain by about 150 feet of quartzite and granitized quartzite, and above this a second limestone stratum about 200 feet thick. Contorted, thin-bedded siliceous slate or argillite exposed on top of the ridge may represent the uppermost member of the succession.

The strata lie in broad flexures dipping at low angles southward, but locally the structure is complicated by close folds plunging for the most part south-southwestward. Tabular, sill-like granitic and aplitic masses, probably related to a granitic stock exposed a short distance south of the showings, complicate the structure further.

* By W. H. White.

In both limestone members, certain zones parallel to the bedding have been extensively dolomitized and locally contain small irregular masses and bands of yellowish-green serpentine. The mineral dolomite has been developed in the limestone in varying degrees, ranging from the presence of a few scattered crystals to the complete or almost complete dolomitization of a bed. Dolomite,* being less readily dissolved, protrudes from the surface of weathered limestone at some points. Other zones, chiefly lying above the dolomitized zones, are characterized by white lime silicates. The dolomitized zones contain pyrite and dark-brown sphalerite, both widely disseminated and in well-mineralized beds. No chalcopyrite was observed, but pyrrhotite and occasional grains of galena are present locally. The total quantity of sphalerite in the calcareous strata of this area is large. The current work is an effort to find concentrations of commercial size and grade in the several zones being investigated.

The Main zone is in the lower limestone member, on the Jack Pot claim. The zone is explored in a series of about twenty open-cuts for a horizontal distance of about 400 feet. The cuts are oblique to the average strike. The thickness of moderately well-mineralized material ranges from 5 feet to as much as 50 feet. Some of the fourteen holes drilled to prospect this zone encountered mineralization several hundred feet down dip from the outcrops.

The West zone is on the Jamesonite claim, 750 feet southwesterly from the Main zone and not far below the top of the ridge. This zone appears to be in the upper limestone member. It is exposed at frequent intervals by open-cuts for a horizontal distance of 450 feet along the strike. Although the thickness of mineralized material ranges only from 3 to 10 feet, it appears to be a better grade than that of the Main zone. A sample taken across 8 feet in this area in 1948 assayed 8.9 per cent. zinc. Intersections in each of five holes drilled to prospect this zone at fairly shallow depth indicate persistence of the mineralization 250 feet down dip from the outcrops.

The Lerwick zone is on the Ink Spot claim, about 1,400 feet southeasterly from the Main zone. It is exposed in a small area stripped by bulldozer in fairly deep drift. Probably this zone is in the lower limestone member. Apparently there are two beds of sparsely mineralized dolomite and dolomitic limestone, each about 25 feet thick, separated by a few feet of barren dolomite. Pyrrhotite is more prominent here than in the other zones. A single drill-hole gave poor recovery of oxidized material but did indicate the presence of mineralization about 250 feet down the dip.

Several isolated open-cuts on the northward slope of the ridge, some 2,400 feet northeasterly from the Lerwick zone and about 800 feet below the top of the ridge, comprise the East showings. Although correlation is not yet assured, these exposures may represent one or more mineralized zones in the lower limestone member. Crystalline limestone strata in this area dip moderately to steeply eastward, and the surface approximates a dip slope. In contrast to the fresh material in cuts near the top of the ridge, the material in cuts on the East showings is deeply oxidized.

Gold-Silver-Lead-Zinc.

Dewey. This mine is on Porcupine Creek, 1 mile from the Nelson–Nelway Highway. Henry Erickson made a shipment to the smelter at Trail, obtaining ore from underground and from a surface dump. Production: Ore shipped, 31 tons. Gross contents: Gold, 5 oz.; silver, 114 oz.; lead, 2,223 lb.; zinc, 2,706 lb.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1926, p. 276. *Geol. Surv., Canada,* Mem. 191, p. 17.]

* Identification of the mineral dolomite was confirmed by testing it with hydrochloric acid (2N HCl).

SALMO (49° 117° S.E.).*

ERIE CREEK.

Gold-Silver-Lead-Zinc.

Arlington. This mine, 7 miles by road from Salmo, was operated by Kenville Gold Mines, Limited under an agreement with F. C. Buckland, who optioned the property in 1948. The bulk of the ore shipped in 1949 came from the 60 and 80 level dumps. It was handled with a Mobil-loader and then trucked to the Kenville mill at Nelson. Underground, some backfill from the flat-lying stopes was removed and trucked to Kenville. This fill came chiefly from the 260 stope, on the 60 level in the north end of the mine. Some of the backfill and ore from remnants mined 90 feet inside the 60 portal was trucked to the smelter at Trail.

On the surface a large stripping and trenching programme was carried out northwest of the Arlington mine. Three narrow stringers reportedly carrying gold were exposed, cutting the flat-lying argillite beds. These stringers, when sunk on for distances varying from 5 to 20 feet, were found to be offshoots from veins between 2 and 3 feet wide that lie with the bedding. The main exploration centred around a shaft sunk 700 feet west and 900 feet north of the 60 level portal of the Arlington mine. Ore obtained here was trucked to Trail. Ten men were employed, under the direction of W. Baker.

Production: Ore shipped to Trail, 646 tons. Gross contents: Gold, 254 oz.; silver, 1,023 oz.; lead, 14,691 lb.; zinc, 14,123 lb. Ore shipped to Kenville mill, 124 tons; contents included with other company ore treated in the Kenville mill.

[Reference: *Geol. Surv., Canada,* Mem. 172, p. 75.]

SHEEP CREEK.

Gold.

Sheep Creek Gold Mines, Limited. Company office, 616 Stock Exchange Building, Vancouver; mine office, Sheep Creek. A. E. Jukes, president; H. E. Doelle, managing director; F. R. Thompson, mine superintendent. Capital: 2,000,000 shares, 50 cents par value. The mill, reopened November 3rd, 1948, was operated until June 23rd, 1949, at which time all broken ore had been milled. Mining, however, continued throughout the year, and on October 5th enough ore had been accumulated to start the mill again. Ore was broken on all levels from No. 2 to No. 7, with production by veins as follows: 92, 950 tons; 85, 1,004 tons; 83, 7,692 tons; 81, 600 tons; 75, 8,308 tons; 68, 4,273 tons; 64, 276 tons; 57, 5,874 tons. The main development was the completion of the long drive on No. 9 level to the 57 vein and the raising on this vein to No. 7 level. This connection materially improved the ventilation of the lower levels. Development footages were as follows: Drifting and crosscutting, 1,229 feet; raising, 360 feet; diamond drilling, 418 feet. The number of man-shifts totalled 14,925; the number of men employed per day averaged sixty-seven.

At the Udiville group, which lies south of Sheep Creek along Bennett Creek, surface stripping by bulldozer and 654 feet of diamond drilling were done.

Production: Ore milled, 27,992 tons. Gross contents: Gold, 10,853 oz.; silver, 4,264 oz.

Gold Belt Mining Company, Limited. This mine remained closed throughout 1949. On February 22nd a snowslide totally demolished the mill building, from which most of the equipment had been removed in 1948. A small crew was employed by the Keno Hill Company to salvage what remained after the slide. Some dump ore at the mill level portal, reported to have been saved during the development drive on the 6600 vein, was trucked to Trail.

Production: Ore shipped, 154 tons. Gross contents: Gold, 45 oz.; silver, 76 oz.

* By J. W. Peck.

Kootenay Belle.—R. Thompson, lessee. Production: Ore shipped, 390 tons. Gross contents: Gold, 304 oz.; silver, 390 oz.

Nugget.—A. Endersby, Fruitvale, owner and operator. Production: Ore shipped, 91 tons. Gross contents: Gold, 87 oz.; silver, 135 oz.

Zinc-Lead.

H.B. The H.B. mine, owned by The Consolidated Mining and Smelting Company of Canada, Limited, is on the west side of Aspen Creek, 8½ miles by road from Salmo. The main workings consist of the No. 2, No. 4, and No. 7 adit levels respectively, 300 feet and 280 feet apart vertically. Sublevels exist at the No. 1 and No. 3 level horizons. Most of the ore mined in the past came from above the No. 2 level.

The diamond drilling commenced in 1948 was continued throughout the winter. Drilling was done from the Benson Fraction into the Zincton claim, on the Garnet claim, and on ground to the north of the H.B. claim. In June, 1949, an underground development programme was started to investigate the drill results. The No. 4 level was rehabilitated and a drive started due south from the southernmost part of the workings. By the end of 1949 this drift had been advanced nearly 1,000 feet, exposing sections of sphalerite, galena, and pyrite replacement in limestone. In December a raise was started, toward No. 3 level, to be used as an ore-pass to handle oxidized ore on that level and above.

On the surface a dragline scraper was installed at the foot of the No. 2 level dump and was operated from June 13th to November 9th. Almost 9,000 tons of ore was reclaimed from the dump and was trucked to the smelter at Trail.

A modern mining camp was erected at and south of the No. 4 level portal. A blacksmith-shop, a compressor-house, an office, a change-house, a cook-house, four bunk-houses, a wash-house, and five dwellings were constructed. Air for mining was supplied by a 1,350-cubic-feet-per-minute Sullivan compressor driven by a 260-horsepower electric motor. J. E. McMynn was in charge. The crew averaged about thirty-seven men.

Development: Drifting and crosscutting, 1,114 feet; raising, 67 feet.

Production: Ore shipped, 8,910 tons. Gross contents: Silver, 11,185 oz.; lead, 618,583 lb.; zinc, 1,410,143 lb.

[Reference: *Geol. Surv., Canada,* Mem. 172, p. 47.]

Iron Mountain.

Lead-Zinc.

Canadian Exploration, Limited (Emerald, Jersey). Head office, Royal Bank Building, Vancouver; mine office, Salmo. R. E. Legg, general manager; J. B. Magee, mine superintendent; G. H. Grimwood, mill superintendent. Capital: 1,000,000 shares, $1 par value. The mine camp is on the summit between Sheep Creek and Lost Creek, 8 miles by road from Salmo, and the mill, served by a tramline from the mine, is on the Nelson–Nelway Highway, 5 miles south of Salmo.

The Emerald tungsten workings were closed at the end of 1948, and the last tungsten ore was run through the mill on January 12th, 1949. Efforts were then concentrated on the Jersey lead-zinc property, which had been extensively drilled in 1948. A road was constructed to a good surface showing overlooking Lost Creek, approximately 4,000 feet south of the Emerald tungsten mine. The surface was stripped and a scraper set-up built for loading ore into bins, from which it was trucked to the head of the tramline to the mill. A compressor-house was built near by, and the compressors moved from the Emerald site. Power was also extended. In the mill the necessary flotation cells, filters, bins, and other equipment were installed, and by March, 1949, the mill was handling over 300 tons per day.

The orebody is a flat-lying replacement of the dolomite country rock. Because the open-pit method was limited by the hillside, an adit was driven under the orebody and draw points were established. Over half a mile of this development had been completed by the end of the year. Near the portal, maintenance-shops were established and a large ore-bin was constructed. For 1949, however, the large open pit established at the beginning of the year accounted for more than 85 per cent. of the tonnage.

Jersey mine, open pit, March, 1949.

At the end of November, operations were suspended until changes required to provide for greater capacity in the mill were completed. New ropes were also placed on the tramline. It was expected that milling would be started again by January, 1950. The number of men employed averaged 120.

Development: Drifting, 1,581 feet; crosscutting, 592 feet; raising, 459 feet; diamond drilling, 18,870 feet.

Production: Ore milled, 81,786 tons. Gross contents: Silver, 5,601 oz.; lead, 3,730,882 lb.; zinc, 8,452,246 lb.; cadmium, 63,524 lb.

NELWAY (49° 117° S.E.).*

Lead-Zinc.

Reeves MacDonald Mines, Limited. Company office, 626 Pender Street West, Vancouver. R. F. Jones, superintendent. This company operates the Reeves MacDonald mine, which is on the Pend d'Oreille River about 4 miles west of Nelway. The property is understood to include sixty-four Crown-granted mineral claims and fractions covering ground between the Pend d'Oreille and Salmo Rivers. Replacement deposits that contain zinc, lead, and silver were discovered in

* By W. H. White, except as noted.

1918. They were explored extensively between 1925 and 1929 by diamond drilling and by underground workings. Pend Oreille Mines and Metals Company, of Metaline Falls, Wash., acquired control of the property in 1929. Following a period of inactivity, operations were resumed in 1947. By August, 1949, the main part of the surface plant had been completed. The mill, designed to have an ultimate capacity of 1,000 tons per day, was treating about 400 tons per day on a two-shift basis. The lead and zinc concentrates produced were trucked to the Trail smelter. During August the crew amounted to 124 men. Thirty-six were employed underground, seven in the mill, and the remainder on surface construction.

Compressed air is supplied by a 2,500-cubic-feet-per-minute Belliss & Morcom compressor driven by a 550-horsepower General Electric synchronous motor. The old compressor, a 360-cubic-feet-per-minute Ingersoll-Rand diesel-driven machine, is used as a stand-by. Haulage equipment includes a trolley locomotive, Granby-type cars of 64-cubic-foot capacity, and a small battery locomotive. An Eimco mucking-machine, a Joy jumbo, and eight 20-horsepower Ingersoll-Rand electric slushers are used in mining operations.

A twin raise inclined at 55 degrees, completed early in 1949, connects the River adit, elevation 1,910* feet, with the Reeves adit, elevation 2,676 feet. This serves both as an ore-pass and a manway. The workings are shown in outline in Figure 21. The plan of mining is to slash horizontal slots to assay walls at 50-foot vertical intervals. The horizontal pillars, about 26 feet thick, to be left for support between the slots, will be drilled and blasted after the slots are completed. By the end of August the main ore zone in the Reeves adit (2650 level) had been slashed to its assay walls, and slots were in various stages of development on the 2750, 2700, 2600, and 2550 sublevels. A haulage drift was being driven in the footwall of the main ore zone on the River adit to connect with the bottom of the main ore-pass. A subsidiary ore zone on the River level was being explored in a raise extending 100 feet above the level.

The property of Reeves MacDonald Mines, Limited, includes some 2,000 acres of Crown-granted claims extending from the Pend d'Oreille River about 3 miles easterly along the low ridge which separates the Pend d'Oreille River from its tributary, the Salmo River. Underbrush is thick and, except along the rivers and road cuts, bedrock is seldom found.

The general geology of the Pend d'Oreille River area on either side of the International Boundary has been dealt with by several investigators,† who have subdivided and correlated the Precambrian and Cambrian sedimentary rocks of the area in various ways. The rocks are a sedimentary group, now metamorphosed to quartzite, phyllite, various kinds of schist, and crystalline limestone. They are members of the Pend d'Oreille series, as mapped by Walker (Mem. 172, p. 9). Lamprophyre dykes are the only intrusive rocks in the area, the nearest mapped body of granitic rock being some 8 miles north of the mine.

The writer spent fifteen days in August at Reeves MacDonald. During this time a 2½-mile length of the Pend d'Oreille River, from the International Boundary to the mouth of the Salmo River, was traversed; the surface geology near the mine was mapped in some detail by plane-table. A preliminary study was made of the main ore zones indicated in surface workings and in the Reeves and River (2650 and 1900) adit levels. The MacDonald adit level north of the River adit portal and old workings

* Elevations have recently been adjusted to agree with the geodetic base. The River adit is being called the 1900 level and the Reeves adit the 2650 level.

† Walker, J. F.: Geology and mineral deposits of Salmo map-area, British Columbia, *Geol. Surv., Canada*, Mem. 172 (1934).

† Little, H. W.: Preliminary map of Nelson (west half), British Columbia, *Geol. Surv., Canada*, Paper 49-22 (1949).

† Park, C. F., and Cannon, R. S.: Geology and ore deposits of the Metaline quadrangle, Washington, U.S.G.S. Prof. Paper 202 (1943).

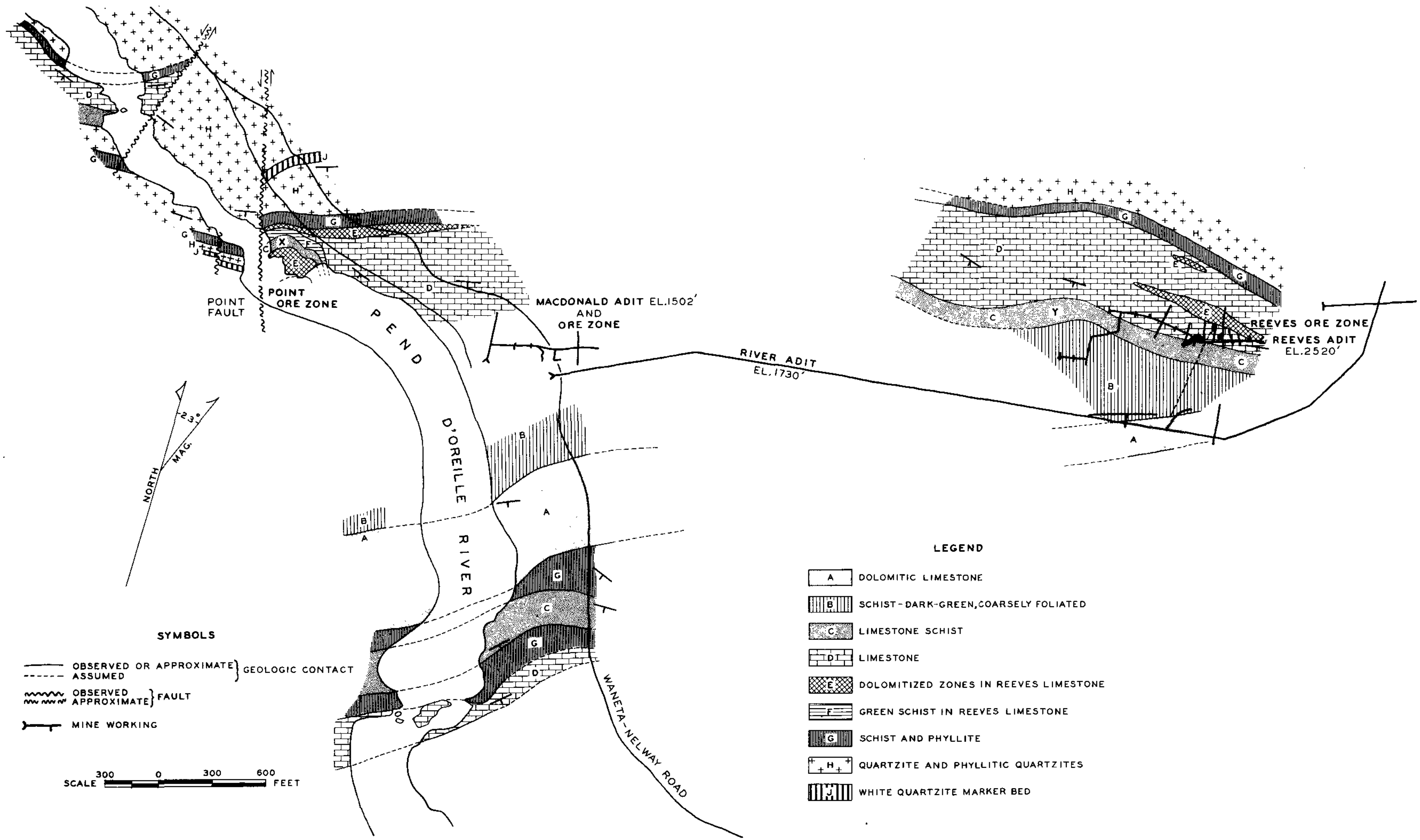

FIG.21. GENERAL SURFACE GEOLOGY. REEVES-MACDONALD MINE AREA.

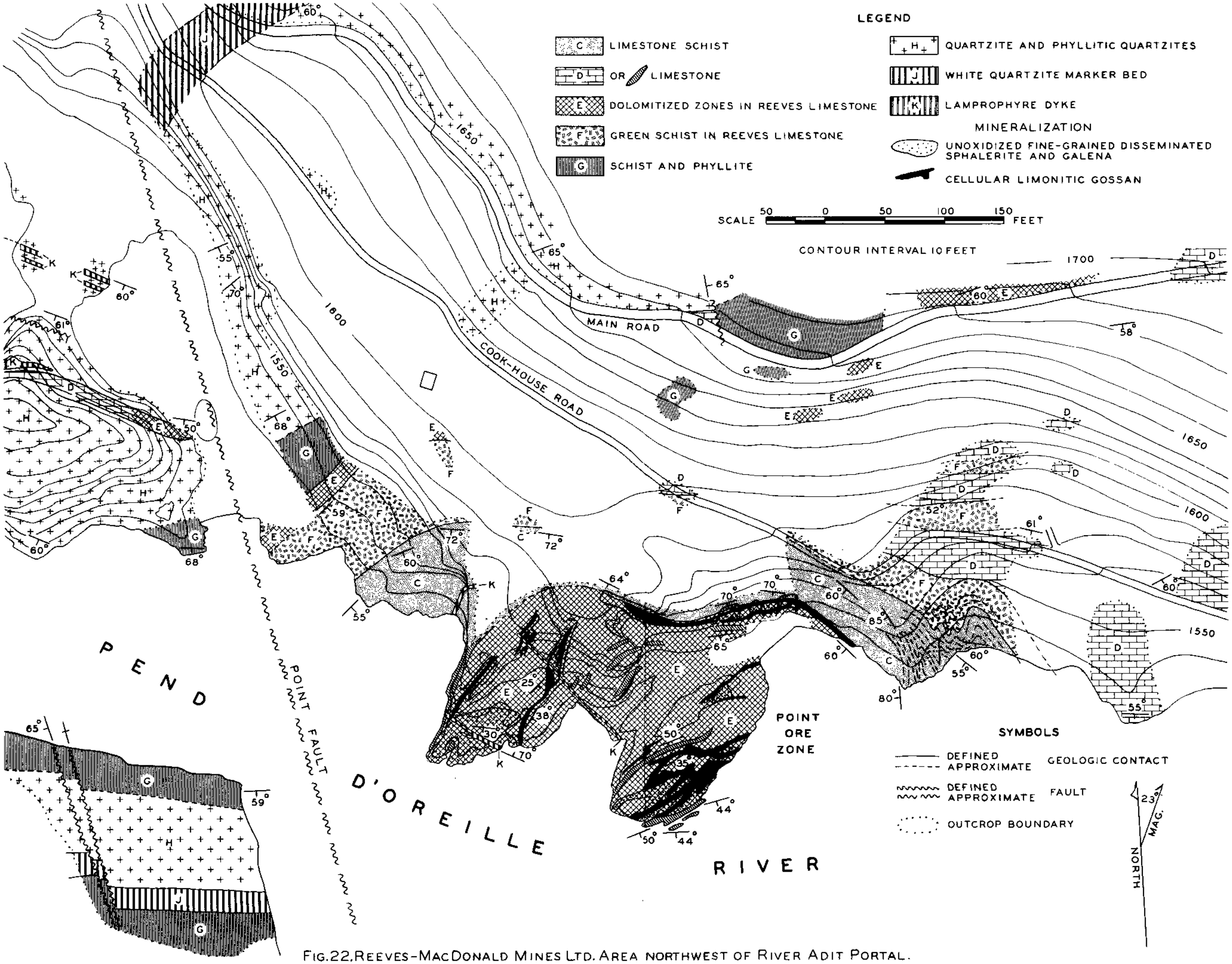

FIG. 22. REEVES-MACDONALD MINES LTD. AREA NORTHWEST OF RIVER ADIT PORTAL.

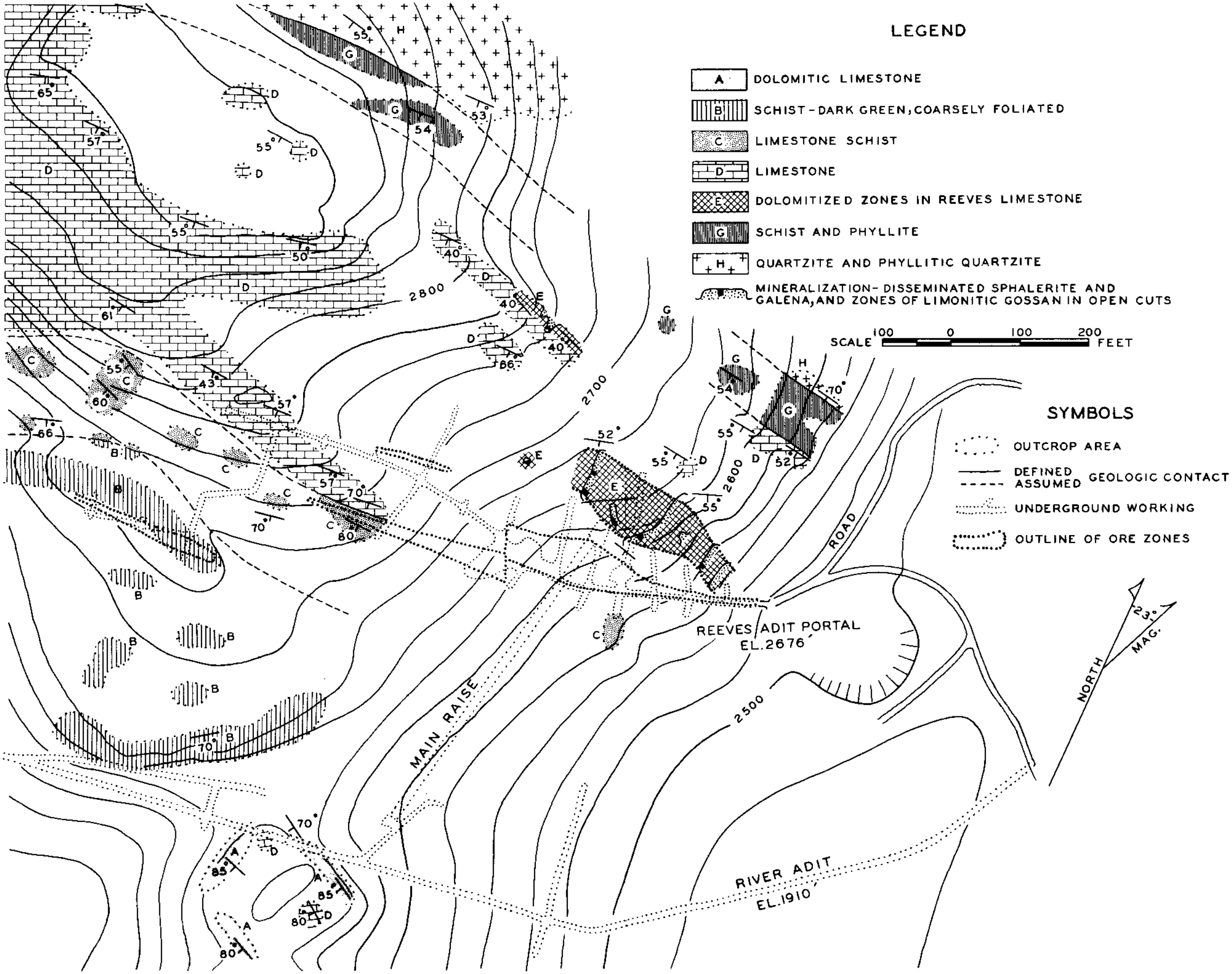

FIG. 23. REEVES MACDONALD MINES LTD. AREA NEAR REEVES WORKINGS.

east of the Reeves adit were not visited. These are described briefly by Walker (Mem. 172, pp. 59, 60).

The present report deals mainly with the stratigraphy and structure of the metamorphosed sedimentary rocks near the main workings, and with what appear to be the principal controls of ore deposition.

Local Stratigraphy and Structure.—Figure 21 is a general map of the area near the Reeves MacDonald mine showing the distribution and lithology of the sedimentary strata comprising the lower 3,000 feet of the Pend d'Oreille series. This will be referred to as the Reeves MacDonald formation. Its base is selected arbitrarily at the base of the lowest calcareous member, the strata below being quartzite and phyllitic quartzite similar to the Reno formation of Walker and the Gypsy quartzite formation of Park and Cannon. The top of the Reeves MacDonald formation is taken at the base of a thick formation of intensely deformed black siliceous and calcareous slate and phyllite, for which the name Creggan Creek formation* has been proposed. Material variations in thickness now apparent in some of the members may be attributed mainly to intense deformation. The stratigraphic section of the Reeves MacDonald formation given below was measured on the exposures shown on the map, and in the eastern part of the River adit level. The thickness given must be considered as approximate, some beds having been thickened or thinned by isoclinal folding, strike-faulting of unknown magnitude, or by rock flowage. As the structure is not known in complete detail, the thickness or the range in thickness given for any member is not necessarily the thickness of the member as laid down nor the complete range in thickness of the member after deformation.

	Thickness. (Feet.)
Creggan Creek formation—black siliceous and calcareous slate and phyllite, intensely crumpled	....
Reeves MacDonald formation.	
Top.	
1. Limestone—alternating thin beds of light and dark colour	160
2. Schist—green, finely laminated	120
3. Limestone schist—finely laminated with glistening cleavage surfaces due to layers of fine-grained sericite. Few thin beds of crystalline limestone	150
4. Schist — light-green to buff colour. Paper-thin laminæ	70–180
5. Dolomitic limestone—dark-buff to black, variegated colours. Very fine grained	220–440
6. Schist — black to dark olive-green; coarse grained with contorted foliation and somewhat garnetiferous	250–350
7. Limestone schist—similar to 3, and a very useful marker bed	50–90
8. Reeves limestone—alternating thin beds of light and dark colour; finely crystalline. It has several discontinuous beds of green schist near the base. A distinctive bed of greenish finely laminated limestone occurs about 80 feet above the base in the River adit	270–550
9. Schist—light-green colour, in places quartzitic	10–60
10. Phyllite and phyllitic quartzite	150–210
11. Quartzite—light green to white with very fine laminations. This is a useful marker bed in the footwall of the Reeves limestone. It can be recognized both on the surface and in the River adit	100

* Okulich, V. J., personal communication, 1949.

	Thickness. (Feet.)
12. Phyllite and phyllitic quartzite, and schist	130
13. Limestone—alternating thin beds of light and dark colour. Explored by the footwall drift in the River adit	40
14. Quartzite, phyllite with thin beds of green schist	290
15. Limestone schist — similar to Member 3. Present only west of the river, having been cut out by a fault on the east bank	80
16. Limestone—alternating thin beds of light and dark colour	110
17. Slate and schist—black, closely dragfolded	40
Base.	
Reno formation—phyllite grading downward into phyllitic quartzite and quartzite	
Total thickness	2,240–3,050

The Reeves limestone is the thickest member in the formation. Although mineral deposits may occur in other calcareous members elsewhere on the property, all those examined are in the Reeves limestone. Individual limestone members cannot be identified lithologically. Consequently, success in tracing the Reeves limestone farther eastward in an area of few outcrops will depend on the use of marker beds. The best marker beds for the Reeves limestone appear to be the dolomitic horizon some distance above, the limestone schist bed and the schist (member 6) immediately above, and the distinctive white quartzite horizon some distance below the Reeves limestone. Interbedded limestone and schist near its base may be characteristic of the Reeves limestone. Some idea was gained of the local structure of the Reeves limestone in the two areas mapped in some detail.

Regionally, as shown by the Geological Survey Preliminary Map 49-22, the Reeves MacDonald area is on the south limb of a major anticline, the axis of which trends southwesterly and plunges fairly gently to the southwest. Strikes in the area are, therefore, westerly, and dips are to the south. However, the strata have been deformed, and the local structure is complicated by faults and flexures.

The geology of a small area near the Pend d'Oreille River northwest of the River adit, referred to as the Point ore zone, is shown in Figure 22. An unusually low stage of the river in August provided an opportunity to examine parts normally below water. The map shows the lower part of the Reeves limestone, severely compressed and folded into a compound synclinal structure that plunges southward. Beds of finely laminated green schist have been very severely crumpled and torn apart, and the limestone, coarsely crystalline and structureless, contrasts sharply with normal evenly bedded limestone only a few hundred feet distant. The exact position of the top of the Reeves limestone in the Point area is not known. The outcrop width of the member is deceptively large because of the steep dip-slopes. Actually, the stratigraphic width exposed is not more than 200 feet. The limestone schist at X (Fig. 21) on the north boundary of the Point ore zone must represent a discontinuous stratum and not the bed of similar rock, which overlies the Reeves limestone at Y. The strata on the north side of the river are seriously warped and not continuous with the more regular strata south of the river. Probably a northerly striking fault crosses the river at this point. This northerly trending fault, marked on Figure 21 as the Point fault, was postulated first by Walker.* If it be assumed that the narrow bed of white

* Walker, Mem. 172, p. 20.

quartzite on the south side of the river is the quartzite marker bed below the Reeves limestone, then the block on the east side of the fault must have moved relatively northward about 700 feet. Four other northerly striking faults with small displacements and one strike fault were observed. Probably others exist in this area. Another major northerly trending fault crosses the river about 1,000 feet farther northwesterly (Fig. 21). It disrupts the lower limestone member, and evidently the movement on it also was east side north.

In the area near the Reeves workings (Fig. 23) where outcrops are numerous, the contacts of the Reeves limestone can be determined with fair accuracy. The structure of the limestone bed appears to be a broad anticlinal arch with gentle flexures superimposed upon it locally. The anticline plunges southward and the gentle flexures may plunge southwestward. The thickness decreases from about 370 feet at the crest of the ridge, 1,500 feet westerly from the Reeves portal, to about 270 feet at the Reeves workings. The Reeves limestone does not continue along strike across the drift-filled valley east of the Reeves portal.

Buff-coloured dolomitic limestone with narrow limestone beds outcrops on a knoll on the west side of this valley about 800 feet southwesterly of the Reeves portal. Presumably this represents member 5, page 171 (Unit A, Fig. 21), in the stratigraphic section. The northwesterly strike and the steep dip to the southwest are anomalous compared to the attitudes of the rocks to the north. A short distance to the south is a similar knoll, and the outcrops here are black finely bedded calcareous slate, unlike any other member of the Reeves MacDonald formation. The attitude differs considerably from that of the dolomitic limestone a few feet to the north, and the strata exhibit severe crumpling in outcrops close to the saddle between the two knolls. This saddle marks the position of either a tight flexure or, more probably, a northeasterly trending fault. One small outcrop of dark dolomitic limestone was found on the east side of the drift-filled valley, and near by two outcrops of the black calcareous slate were found. Outcrops farther southeast, beyond the boundary of Figure 23, are intensely crumpled black siliceous slate and phyllite, closely resembling the Creggan Creek formation. Dolomitized limestone containing pyrite, sphalerite, and a little galena, referred to as the B.L. ore zone, is exposed in a cut 800 feet northeast of the Reeves portal, and 200 feet north of this is an outcrop of phyllitic quartzite similar to that underlying the Reeves limestone.

The foregoing suggests that the drift-filled valley east of the Reeves portal marks the trace of a northerly trending fault along which the strata have been crumpled and compressed. The rocks to the east may have moved relatively northward some 500 feet. As the easterly workings in the River adit that extend beneath the valley are not disrupted, the fault would have to dip at a moderate angle eastward.

Mineral Deposits.—Some general features of the structure and mineralogy of the mineral deposits are discussed in the following paragraphs. The ore zones referred to as the Point, Reeves, and MacDonald* ore zones are shown diagrammatically on Figure 21, and the first two are shown in somewhat more detail on Figures 22 and 23 respectively. The deposits are essentially bedded replacements of pyrite, sphalerite, and galena at different stratigraphic horizons of the Reeves limestone. Both the Point and Reeves ore zones occur where the limestone is compressed and locally folded near northerly striking faults. The Point ore zone is in a marked complex synclinal structure plunging southward, and the Reeves ore zone is in a part of the Reeves limestone member which has been compressed from a thickness of more than 450 feet, indicated by holes drilled from the River adit, to only about 270 feet. Near this ore zone the limestone bed as a whole exhibits only gentle flexures, but local internal structures, such as brecciation and sharp drag or flow folds plunging southwestward,

* The MacDonald ore zone is completely weathered to limonitic clay containing secondary lead and zinc minerals. Structural features are almost completely obliterated.

are common in the underground workings. The orebodies of the Reeves zone may rake southwestward with these minor structures.

The deposits occur within irregularly tabular or pod-shaped envelopes of dolomite and partly dolomitized limestone. In some places, particularly along the hangingwall side of orebodies, the rock is completely dolomitized. The rock has a striking appearance, with its narrow alternating black and white bands of very fine-grained dolomite. The bands have the general attitude of the Reeves limestone, but in detail they can be seen to branch and cross at acute angles. Coarsely crystalline dolomite usually is present as cross-cutting veinlets and as peculiar structures resembling strings of beads parallel to the general banding. In other places, particularly near the edges of dolomitized zones, but also found to some extent within orebodies, bands of dolomite and white sugary limestone alternate. Finely brecciated dolomite is common in certain parts of the orebodies, but beyond the limits of mineralization, massive or banded dolomite predominates. Laterally, the dolomitic zones gradually split into narrower sheets which finally disappear. The dolomite may have originated by concentration of primary magnesia derived from sedimentary strata, or, alternatively, the magnesia may have come from some deep-seated magmatic source. However, as all the ore is within dolomitized zones having many times the area of the orebodies, the importance of such zones in guiding exploration is self-evident.

The Point ore zone contains two mineralized zones, each about 20 feet thick, separated by some 60 feet of unmineralized dolomite containing residual lenses of limestone. The mineralized zones are shaped like two cupped hands superimposed, and follow the synclinal structure of the strata. Disseminated, fine-grained yellow sphalerite and occasional grains of galena occur in a matrix of brecciated dolomite. Irregular tabular masses of limonitic gossan probably represent original bodies of pyrite.

The Reeves ore zone contains several mineralized zones, only the largest of which is being mined at present. This orebody, shown in dotted outline in Figure 23, is lenticular in plan, having a maximum width of 80 feet and a length of possibly 680 feet. Current development is restricted to the central section, about 450 feet long, which ranges in width from 20 to 80 feet. The grade of the ore is roughly: Zinc, 6 per cent., and lead, 1 per cent. or less. Fine-grained yellow or light-brown sphalerite occurs in discontinuous lenticles; fine-grained galena is more widely disseminated; and pyrite occurs in tabular, vein-like aggregates of small crystals. The gangue is banded and in places brecciated dolomite containing occasional small grains of calcite and fine-grained aggregates of quartz. The amount of quartz is variable, but probably averages 5 per cent.

Numerous fractures, normal to the banding of the dolomite, are found in the ore zone. The fractures contain coarsely crystalline dolomite, some calcite, and relatively coarse-grained galena, but only small amounts of sphalerite. On the footwall side of the Reeves orebody such fractures cutting alternating bands of dolomite and white sugary calcite contain galena in about the same amount as in the commercial ore, but sphalerite is almost absent.

Red Rock (Michaely Silver Lead Mines, Limited).*

Company office, Bay Avenue, Trail. Capital: 75,000 shares, 50 cents par value. This property is reached by 3 miles of steep road from a point 1½ miles west of the Reeves MacDonald mine on the Nelway–Waneta Road. Lessees continued to operate this mine and trucked the mined ore direct to the smelter at Trail. Production: Ore shipped, 136 tons. Gross contents: Silver, 1,034 oz.; lead, 34,534 lb.; zinc, 46,568 lb.

Iron.

Lomond (International).*

This property is reached by a quarter of a mile of road from a point 2 miles west of Nelway on the Nelway–Waneta Road. Shallow deposits of earthy iron oxide are exposed on the banks of Lomond Creek. This limonite ore was mined and trucked to the Lehigh Cement Works at

* By J. W. Peck.

Metaline Falls, Wash. A. Burgess, M. Burgess, and S. Lundgren operated under lease until June, shipping 1,492 tons; the owner, G. Shallenberger, continued the shipments after that date. The ore mined came from a section upstream from the place mined in 1948.

Mr. Shallenberger continued prospecting his property for base metals. He shipped 15 tons to the lead smelter at Trail from surface exposures about 400 feet upstream from the iron workings. Camp buildings and a small ore-bin were constructed on the Nelway–Waneta Road.

SOUTH KOOTENAY LAKE (49° 116° S.W.).*

SUMMIT CREEK.

Gold-Silver-Lead-Zinc.

Bayonne. D. S. MacDonald and associates, of Ymir, continued to hold their lease on this mine on Bayonne Creek, 24 miles by road from Tye. Road conditions did not allow access to the property until May. In 1949, rather than shipping the ore as in the previous year, the lessees used some of the mill machinery to make a flotation concentrate. Mining was done on a remnant left in the Main vein between No. 7 and No. 8 levels, about 2,200 feet in from the No. 8 portal.

On August 30th the warehouse at Tye, containing 25 tons of concentrates, was destroyed by fire. The concentrates were recovered from the ashes. During the early part of the year, while the property was idle, heavy snow collapsed part of the mill structure that housed the settling-tanks. Operations ceased in October.

Spokane. The Spokane mine is on Wall Mountain, 18 miles by road from Tye. The principal workings consist of five adits. No. 4 adit is the upper terminal of a tramway that extends 425 feet in vertical distance to an ore-bin below. No. 4 level is connected by a raise to No. 3 level, and most of the mining over the past few years has been in this area. No. 5 adit is an 80-foot drift on the vein but is not connected to the other workings. The vein strikes roughly east and west and dips steeply to the south. The vein filling is quartz, mineralized with sulphides, contained within granodiorite walls. It ranges in width from a few inches up to 2½ feet and often includes horses of waste.

Early in the year Kootenay Central Mines, Limited, obtained a lease and bond on this property through K. K. Laib, one of the owners. A road was built from the lower tram terminal to a new portal site also called No. 5, located at elevation 5,780 feet or 170 feet below the No. 4 level. The hand-steel method of the former owners was discarded, and a compressor was moved to the site from the company's Rossland operations. A bunk-house and cook-house were also erected at the new site. On the No. 4 level a stope was started on the vein near the junction with the adit crosscut. Ore was trucked to Tye. The new No. 5 portal was collared and had advanced 20 feet by September 1st. It is estimated 120 feet of crosscutting is required to intersect the downward extension of the vein as exposed on No. 4 level. Eight men were employed at these operations under the direction of J. A. Cooper. Snow forced a shut-down before the end of the year.

Production: Ore shipped, 289 tons. Gross contents: Gold, 67 oz.; silver, 1,672 oz.; lead, 57,219 lb.; zinc, 4,889 lb.

SANCA.

Silver-Lead-Zinc.

Lakeview. This property, near Sanca and midway on the highway between Kootenay Bay and Creston, was acquired late in 1948 by W. R. Bullock, J. Powelson, and associates. Bunk-house and cook-house buildings

* By J. W. Peck.

were erected, and a small crew was employed under the direction of E. G. Timmons, the former owner. The north drift on the lower level was cleaned up and drifting began. No ore was found, except in the bottom part of the drift. On the surface, about 600 feet north of the main shaft, a shaft was sunk 25 feet in an effort to pick up the ore shear, but this was not successful. In April the mine was turned over to lessees, H. E. Nathe, A. Bysouth, W. A. Muir, and F. J. Brady. These men worked a few months in the south end of the mine investigating a hangingwall split. Ore obtained was trucked to Trail. The mine was inactive after July.

Production: Ore shipped, 82 tons. Gross contents: Silver, 497 oz.; lead, 20,839 lb.; zinc, 58,968 lb.; cadmium, 241 lb.

PILOT BAY.

Pilot Bay Concentrator and Smelter.—This property is owned by Mr. and Mrs. H. T. Stearns, of Hope, Idaho. The programme begun in 1948 was continued, and shipments of the dumps around the old smelter were made to Trail.

Production: Ore shipped, 150 tons. Gross contents: Silver, 1,371 oz.; lead, 59,417 lb.; zinc, 18,292 lb.

CRAWFORD CREEK.

Silver Hill.

J. J. Gray, of Toronto, holds a lease on this mine from the B.C. Lead & Zinc Mines, Ltd. This company is registered in Ontario. Work in 1949 was restricted to building a 3-mile road from a point on the Crawford Creek road about 9 miles from its junction with the Kootenay Bay–Creston Highway. The road was built to the lower adit, and a 50-ton shipment made to the Kenville mill at Nelson before work was stopped in December. The shipment was not milled in 1949. Three men were employed under the direction of W. S. Hamilton.

Colorado Group (Colorado Mining & Milling Co., Ltd.).—Company office, 102 Medical Arts Building, Nelson. N. Adshead, manager. Capital: 200,000 shares, 50 cents par value. This company was formed in 1949 to develop the Colorado group in the Rose Pass at the headwaters of Crawford Creek. An option on this property was obtained by Norman Adshead from the owner, J. W. Mulholland, of Nelson. No work, other than trail improvement, was done.

NORTH KOOTENAY LAKE (49° 116° N.W.).*

RIONDEL.

Silver-Lead-Zinc.

Bluebell (The Consolidated Mining and Smelting Company of Canada, Limited).†

This property is at Riondel, on a promontory on the east shore of Kootenay Lake, about 6 miles north of Kootenay Bay. It is reached by a road that leaves the highway a short distance from the ferry landing. The ore deposits are sulphide replacement bodies in a limestone band that crosses the promontory and dips westward under the lake. Past production, from 1895 to 1927, inclusive, amounted to 540,174 tons, containing in ore and concentrates: Silver, 669,713 oz.; lead, 49,309,420 lb.; zinc, 6,260,671 lb. Much zinc was discarded.

The history of the Bluebell mine is perhaps the longest in the Province. The large surface showing was known to early fur-traders and was brought to the attention of mining capital at least as early as 1865. Claims were located in 1882, and the first serious attention of capital was directed to the ground in 1884. Partly as a result of an early quarrel over ownership, important parts of the ground were held by separate interests for a long time, to the detriment of early development.

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* By J. W. Peck, except as noted.

† By M. S. Hedley.

The Hendryx interests, under the name of Kootenay Mining and Smelting Company, developed the Bluebell claim and built a concentrator and smelting plant at Pilot Bay. In March, 1895, the smelter was blown in and 52,000 tons of ore from the Bluebell was shipped to it in that year. This enterprise came to an end in 1896.

The Bluebell was acquired in 1905 by French capital, and the Canadian Metal Company, Limited, was formed to operate it. Under the management of S. S. Fowler, a concentrator was built, water was brought in for power, and the property was operated successfully from May, 1908, to March, 1910, when financial difficulties, incurred in an ill-advised smelting plant at Frank, Alta., forced reorganization. The New Canadian Metal Company, with the same management, operated the mine from July, 1912, to March, 1921.

The gravity mill, of about 160 tons daily capacity, produced lead concentrates only. Apparently much thought was given to the recovery of zinc, but the amount of pyrrhotite in the ore made separation by existing methods difficult. An early report estimated that the ore consisted of a third sulphides of lead and zinc, a third iron sulphides, chiefly pyrrhotite, and a third limestone and quartz. By 1910 much of the sulphide ore above the adit level had been mined. The lower levels were driven later. In 1917 and subsequent years a substantial tonnage of oxidized ore, overlooked in early operations, was mined at and close to the surface. The top of the ore zone was finally glory-holed.

In 1924 S. S. Fowler and B. L. Eastman obtained a lease and option from the French owners. They installed equipment for the recovery of zinc and obtained more water for power, but capital was inadequate, and when metal prices dropped, operations were suspended in September, 1927. Further profitable operation of the Bluebell depended upon acquiring more ground.

Mr. Fowler optioned the ground owned by J. C. Ainsworth, including the Comfort to the north and Kootenay Chief to the south, and assigned the option to The Consolidated Mining and Smelting Company of Canada, Limited. Late in 1929 a shaft was sunk on the Comfort claim and an adit driven on the Kootenay Chief; this work was stopped late in 1930.

In 1930 The Consolidated Mining and Smelting Company acquired the Ainsworth and the French interests. Fowler and Eastman retained an interest in the entire property, the last part of which was bought out in 1948.

The property was diamond drilled in 1942 and again in 1947. Underground development was started in 1948.

The rocks at Riondel are members of the Lardeau series and consist of schist, quartzite, and limestone. The average dip is about 35 degrees to the west, with minor complications due to small rolls. Thin sheets of pegmatitic granite follow some bedding planes, and lamprophyre dykes are common. The ore is in a band of limestone 150 to 200 feet thick.

Production all came from the Bluebell claim which, with the Comfort and Kootenay Chief, had extra lateral rights. Some Bluebell ore adjoined the Comfort claim to the north. The following remarks all refer to the Bluebell, although it is understood that basically the conditions are the same at all three parts of the same property.

The ore is a sulphide replacement of limestone, in places consisting of almost massive sulphides. Pyrrhotite is the most abundant mineral and, with pyrite, makes up a large part of the ore. There is a little arsenopyrite and less chalcopyrite. Galena and sphalerite are the ore minerals. Patchy silicification is common, and cavities lined with quartz crystals occur in and near the ore. Replacement is controlled to an important degree by steep joints, which strike north 55 degrees to 80 degrees west across the formation. The orebodies are tabular, but they do not extend from wall to wall of the limestone, and discontinuities occur along the rake of the orebodies. Further localization is by bedding planes and minor structures, although some ore terminates for no apparent reason. The ore limits were apparently well defined in the old stopes, although pyrrhotite masses are seen at the margins of some.

The Bluebell ore zone contained three semi-continuous orebodies in a distance of about 500 feet, measured along the strike of the limestone, and extending from surface to the 375 level, a rake distance of more than 800 feet. No reason for the downward termination is known.

The mine was developed by an adit level 20 feet above lake-level and by five levels at 75-foot intervals (formerly A to E, now 75 to 375 levels) from an internal shaft. Ore was delivered from the adit to the mill, and hoisting was done from the surface through a raise continuation of the shaft. The old workings are now heavily oxidized, and many are inaccessible.

Diamond drilling in 1942 and 1947 was done along the full extent of the limestone belt, which is exposed on the promontory for a length of 5,000 feet. The results were sufficiently encouraging to warrant serious development, and in 1949 drifts were being driven north and south along formation on 225 level (formerly C). The northern objective on the Comfort involved driving at least 1,000 feet, and the southern objective on the Kootenay Chief involved driving at least 1,600 feet. The drifts were being driven in the limestone near its upper or hangingwall surface.

At the time of the writer's visit, in August, the drifts were well advanced but still short of the projective ore zones. Ground in the north drift was fractured, with some mud seams and solution cavities, and flows of water were encountered. The drive had been advanced about 1,000 feet by the end of 1949, with the objective not then in sight. In the south drift the ground was good, except in one place where the hangingwall schists had been encountered; these were later avoided. At the year's end the drive had been advanced 2,100 feet, several mineralized sections had been encountered, and it was planned to raise 180 feet to a winze in the Kootenay Chief workings.

Additional diesel power was installed at the old plant, and a new hoist was put in. For the most part, the facilities of the old camp were being used pending the results of development. An average of about forty-five men was employed, under W. R. Selby, superintendent.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1888, p. 301; 1895, p. 683; 1925, pp. 232, 233. *Geol. Surv., Canada*, Sum. Rept., 1928, Pt. A, pp. 129–134.]

Atlanta.—It is recorded that F. Sutcliffe shipped 12 tons from this claim in the Riondel camp. Gross contents: Silver, 80 oz.; lead, 3,798 lb.; zinc, 1,972 lb.

AINSWORTH.

Kootenay Florence (Ainsmore Consolidated Mines, Limited). Company office, 112 Yonge Street, Toronto; mine office, Ainsworth. A. E. Silverwood, president; W. J. Bull, manager. Capital: 100,000 shares, no par value. The Kootenay Florence mine and mill are 2 miles north of Ainsworth on the Nelson–Kaslo Highway. The mine is developed by two main adits; the lower, No. 9, is the main haulage level and is connected to the upper, No. 5, by a 400-foot raise system. As in 1948, all production came from the No. 9 level, and was maintained throughout the year on a one-shift-per-day basis. The 906 stope, above the No. 8 sublevel, produced most of the ore. Later in the year a new stope on No. 9 level, called the 908 stope, which is adjacent to and on the same vein as 906 stope, was started. The main raise to No. 5 level caved during the year, destroying the natural ventilation. A new raise was started and was about half completed at the end of the year.

In September ore was milled on a custom basis from the Woodbury Creek property of Privateer Mine, Limited. A total of 532 tons had been milled before Privateer ceased operations November 1st. The number of men employed averaged twenty-one. Production: Ore milled, 11,907 tons. Gross contents: Silver, 16,526 oz.; lead, 778,554 lb.; zinc, 622,225 lb.; cadmium, 2,891 lb.

Highlander, etc. (Yale Lead & Zinc Mines, Limited).—Company office, 525 Seymour Street, Vancouver; mine office, Ainsworth. H. W. Knight, president; R. Forman, manager. Capital: 3,500,000 shares, $1 par value. This company, incorporated in January, 1949, is reported to have acquired much of the ground in the Ainsworth camp lying between Coffee and Cedar Creeks. Fifty-three Crown-granted claims and twenty-two claims, including the Highlander, Eden, Crescent, Black Diamond, Banker, Krao, Crow Fledgling, Maestro, and Spokane, are reported to be owned or controlled by Yale Lead & Zinc Mines, Limited.

Notes on production and other activities on several of these properties follow this note on the Highlander.

During the first half of the year, clean-up work was continued in the Highlander tunnel, which extends nearly 3,000 feet to intersect the Highlander vein 1,560 feet from the portal. A few tons of ore obtained in the course of this work was trucked to the smelter at Trail.

Drifts extend north and south on the Highlander vein for 350 feet and 1,016 feet respectively. Previous mining had been done in a stope 200 to 300 feet long and up to 40 feet high just south of the intersection of the vein with the main crosscut. Diamond drilling to the extent of 5,000 feet in five holes was done, but the core recovery was poor. During the summer the property was inactive, but in the autumn a diamond-drill programme was started on the Krao claim. Also the McEwan adit on the Krao claim was opened up for geological examination and survey.

On the surface two new bunk-houses were erected in Ainsworth and a new compressor building constructed at the Highlander portal. The Ainsworth Hot Springs Hotel and townsite were purchased. Only the hotel was in use at the end of the year.

Production: Ore shipped, 11 tons. Gross contents: Silver, 187 oz.; lead, 9,638 lb.; zinc, 1,444 lb.

Crow Fledgling.—Ed Emilson operated this mine during the first part of the year on a lease from Ainsmore Consolidated Mines, Limited. The property was absorbed later in the Yale Lead & Zinc Mines, Limited, holdings. Production: Ore shipped, 18 tons. Gross contents: Silver, 158 oz.; lead, 4,735 lb.; zinc, 7,781 lb.

Black Diamond.—T. and S. Hawes obtained a lease on this property from Yale Lead & Zinc Mines, Limited. Dump ore was removed and trucked to the Highland lessees' mill, north of Ainsworth. This work was done in the fall of the year. Production: Ore shipped, 47 tons. Gross contents: Silver, 4,083 oz.; lead, 37,388 lb.; zinc, 15,682 lb.

Spokane.—W. R. Glasspoole and T. Lane, of Ainsworth, shipped a total of 48.3 tons of lead ore to the Trail smelter. Gross contents: Silver, 479 oz.; lead, 28,331 lb.; zinc, 4,803 lb.

Highland.—F. W. Robinson, J. Asher, and G. L. Green own a small mill installed in the old Highland mill building beside the Nelson–Kaslo Highway about a mile north of Ainsworth. They hold a lease from The Consolidated Mining and Smelting Company on the old Highland tailings which lie beneath the surface of Kootenay Lake. During the first five months of 1949 these tailings were scraped out of the lake by means of a dragline scraper and float set-up; operations then ceased. The mill remained idle until October, when the dump ore from the Black Diamond mine was treated on a custom basis in the mill. F. W. Robinson left the partnership during the year.

Production: Highland concentrates shipped, 151 tons. Gross contents: Silver, 828 oz.; lead, 61,842 lb.; zinc, 104,361 lb.; cadmium, 519 lb.

P. McLellan, who obtained a lease on the Highland mine workings in 1948, shipped 76 tons of lead ore.

Silver Hoard.—W. Lane operated this property under lease. Production: Ore shipped, 106 tons. Gross contents: Silver, 3,756 oz.; lead, 9,336 lb.; zinc. 12,653 lb.

Salvage at Ainsworth Dock. C. Olsen and W. Hansen, using waders, salvaged ore from below water at the Ainsworth dock. It is believed this ore accumulated from barge spillage in the past and came from mines in the vicinity that operated twenty to forty years ago. A small shipment was trucked to Trail in the spring. Production: Ore shipped, 5 tons. Gross contents: Silver, 48 oz.; lead, 3,240 lb.; zinc, 652 lb.

Neosho. S. Hallgren obtained this Crown-granted claim from the Crown in 1948. It lies about 1 mile west of Kootenay Lake and half a mile north of Copper Creek. It had been inactive since 1928, but a survey completed at that time shows an adit driven at an elevation of 3,400 feet in a direction north 20 degrees west for a distance of 200 feet. This adit has been caved and inaccessible for nearly twenty years. In 1949 the owner completed a 1½-mile road into the property from the No. 1 Mine road and made shipments from the dump at the adit. Toward the end of the year a lease was given to two men, who undertook to reopen the workings.

Production: Ore shipped, 55 tons. Gross contents: Silver, 1,741 oz.; lead, 3,296 lb.; zinc, 8,895 lb.

Star, Sunlight. These claims, about a mile west of Ainsworth, are owned by A. G. Norcross, of Nelson. Stripping was done with a bulldozer to expose a small fissure vein in limestone formation. After obtaining about 30 tons of low-grade lead-zinc ore the vein pinched out and the project was abandoned. A small tonnage for shipment was collected by hand-sorting.

Production: Ore shipped, 5 tons. Gross contents: Silver, 91 oz.; lead, 2,266 lb.; zinc, 906 lb.

Silver Hill Mines, Ltd. (No. 5). Company office, 475 Howe Street, Vancouver. E. Borup, president; E. H. Kinder, manager. Capital: 150,000 shares, $1 par value. This company began work in 1948 on the Logan McPhee group of claims on Cedar Creek, 2 miles by road northwest of Ainsworth. Work continued throughout the winter in the adit on the No. 5 claim, and by May it had been extended to over 400 feet without intersecting the vein exposed on the surface above. This work was then abandoned and the road was extended to a higher elevation in order to open up an old shaft. A road was also built to the Ayesha claim and the top adit extended 75 feet to make the face 135 feet from the portal.

It is reported the option was dropped in September. One shipment was trucked to the smelter at Trail, half from the No. 5 claim and half from the Ayesha.

Production: Ore shipped, 6 tons. Gross contents: Silver, 52 oz.; lead, 2,426 lb.; zinc, 1,864 lb.

Hector.—This Crown-granted claim, just northwest of Ainsworth, was worked by its owner, R. Sheridden. Production: Ore shipped, 11 tons. Gross contents: Silver, 99 oz.; lead, 5,187 lb.; zinc, 1,630 lb.

Laurier. This Crown-granted claim is on the south side of the south fork of Woodbury Creek and is about 2 miles by road from the Kootenay Florence campsite. It is owned by E. Emilson, who made a shipment from surface open-cuts. Production: Ore shipped, 14 tons. Gross contents: Silver, 346 oz.; lead, 10,330 lb.; zinc, 2,031 lb.

Nicolet. This claim, near the road about 1½ miles north of Ainsworth, was leased from the Ainsmore Consolidated Mines, Limited, by J. J. Isaacs, who did some work on it and made a shipment of ore to the Trail smelter. Production: Ore shipped, 19 tons. Gross contents: Silver, 65 oz.; lead, 6,026 lb.; zinc, 4,329 lb.

Twin. This claim is about 2½ miles north of Ainsworth and half a mile west of Kootenay Lake. H. Hansen leased the claim from Ainsmore Consolidated Mines, Limited, and made a shipment of ore from the dump. Production: Ore shipped, 6 tons. Gross contents: Silver, 76 oz.; lead, 4,694 lb.; zinc, 693 lb.

Early Bird. The Early Bird claim lies astride the Nelson–Kaslo Highway, about 1½ miles north of Ainsworth. It is owned by Mr. Pringle, of London, England, but in 1949 a lease and bond were obtained by F. W. Robinson, of Ainsworth. Mr. Robinson, aided by his son, reopened an old adit that was level with the highway and a few hundred yards south of the Kootenay Florence mill. The adit was advanced 55 feet to make the face 80 feet from the portal. The vein is the typical Ainsworth fissure type, cutting limestone beds, but in the last 50 feet of adit the fissure is tight and no ore is visible. Near the portal, stringers of ore a few inches wide were mined through to the surface 15 feet above and also underhand mined to a maximum depth of 20 feet along a 20-foot section. Air for mining was obtained from the near-by plant of the Ainsmore Consolidated Mines, Limited.

Production: Ore shipped, 5 tons. Gross contents: Silver, 22 oz.; lead, 2,386 lb.; zinc, 821 lb.

[Reference: *Geol. Surv., Canada,* Mem. 117, p. 41.]

Woodbury Creek.

Woodbury Group.* Dr. L. D. Besecker, of Ainsworth, owns this group of claims at the mouth of Woodbury Creek. The Vigilant, Lulu, Diamond Jubilee, Duplex No. 2, and Dixie are relocations of cancelled Crown grants bearing the same names. The Nameless Fraction, Linda, and Donna are other located claims. The Zoa and August Fraction Crown-granted claims were leased from the Government.

This ground includes some of the earliest discoveries in the Ainsworth camp, and from it only a few tons of sorted ore had been shipped from narrow veins. In 1948 Dr. Besecker discovered on a bluff at the lake-shore, a quarter of a mile north of the creek delta, replacement ore adjacent to a fissure vein. On the Vigilant claim an old adit was found to contain ore of similar type.

Privateer Mine, Limited, obtained an option on the ground and started work in August. An ore-bin was built on the highway, and 1,500 feet of tractor-road was constructed to the Vigilant claim; from the end of the road a skipway was built to the adit 100 feet below.

Many steep fractures containing narrow widths of quartz cross Woodbury Creek in the first half-mile from the lake, and some occur on the lake-shore. Parts of these veins are mineralized, and work was done on some of them in early days. The lenses of galena, with some sphalerite found in them, were too small to warrant more than a small amount of exploratory work. The rocks are schists of the Lardeau series, quartzose, micaceous, garnetiferous, and calcareous, with low westerly dips. Some pegmatitic sills intrude the schists. The structure appears on the whole simple, but intricate dragfolds and patches of one type of schist surrounded by another show that complex folding and flowage have occurred.

Apart from lenses and pockets of galena and sphalerite within the quartz veins, the ore consists of a replacement of schist by sulphide minerals. The rock most easily replaced is a soft brownish biotitic calcareous schist. Where replaced and close to replaced areas, it is greenish in colour, due to alteration of the biotite to chlorite. It is replaced as a rule only to a distance of 2 to 3 feet from a quartz vein or from some fracture that has provided a channelway for solutions.

* By M. S. Hedley.

The ore contains abundant pyrrhotite and (or) pyrite and variable amounts of sphalerite and galena. It is seldom massive, but consists typically of rather fine, scattered to coalescing grains of sulphides. The ore contains only a fraction of an ounce of silver per ton.

The principal showing on the lake-shore, from summer water-level to about 30 feet above that level, is closely related to a quartz-filled fracture, strike north 65 degrees west, dip 65 degrees southwestward, on which the hangingwall has dropped about 3 feet. In the upper 20 feet of the showing, replacement ore is about 4 feet wide on either or both sides of the fracture and, just above lake-level, replacement spreads out to the south for a maximum distance of about 25 feet and a height of about 8 feet, at least partly localized by rather flat-lying fractures. A total of 280 square feet in vertical projection was exposed at the end of July. The schist dips at a low angle to the west.

A sample across 3½ feet at the water's edge, just south of the vein fracture, assayed: Gold, *nil;* silver, 0.3 oz. per ton; lead, 4 per cent.; zinc, 6.1 per cent. A sample across 5½ feet, 15 feet south of the vein, assayed: Gold, trace; silver, 0.6 oz. per ton; lead, 3.7 per cent.; zinc, 5.2 per cent. A sample across 5 feet, north of the vein and 12 feet above water, assayed: Gold, trace; silver, 0.5 oz. per ton; lead, 4.5 per cent.; zinc, 5.3 per cent. A grab sample of broken material from the lower part of the showing assayed: Gold, trace; silver, 0.6 oz. per ton; lead, 5.4 per cent.; zinc, 5.7 per cent.

On the Vigilant claim two old adits 25 feet above the creek on the east bank are collared 16 feet apart and follow two steeply dipping quartz veins in a general easterly direction. The veins join and the adits come together about 40 feet in; the combined zone had been followed to a total distance from the portal of 125 feet at the end of October. The vein contains quartz as much as 4 feet wide, but in places it is merely a fracture zone containing strands of quartz and erratic sulphides. Pockets of coarse galena occur in some of the wider quartz. Replacement by sulphides occurs at the split in the vein in a 15-foot thick band of lime schist, which appears to be more favourable than elsewhere, although it differs little in appearance from unmineralized schist. Replacement extends a foot or two from the quartz and consequently is of greatest extent in the angle between branches of the vein. This ore appears to be of the same general type and grade as at the lake-shore.

Operations by Privateer ceased on November 1st. One load of ore, amounting to 9 tons, was trucked to Trail from the Vigilant, and the remainder was trucked to the Kootenay Florence mill. It was estimated that three-quarters of the ore shipped came from the Vigilant and one-quarter from the lake-shore. C. H. Hewat was in charge, with about six men employed.

After Privateer ceased, Dr. Besecker resumed work on the surface above the adits and made two shipments, totalling 13 tons, to Trail.

Production: Ore mined, 654 tons. Gross contents: Silver, 1,574 oz.; lead, 77,115 lb.; zinc, 40,261 lb.

Daisy Bell.

W. J. Turner, of Ainsworth, increased his holdings in 1949 to a total of six claims lying to the south of the south fork of Woodbury Creek. The property is reached by 1.7 miles of road from the Kootenay Florence camp. Work in 1949 was concentrated on the Florence M claim, where an adit was driven on a vein exposed by surface stripping in 1948. The vein is a typical east-west fissure type, cutting limestone beds and dipping about 70 degrees to the south. When visited November 16th, the adit had been driven 110 feet. Ore shipments were being made from this adit, most of these coming from a 40-foot section near the portal, where a roll in the hangingwall was noticeable. This section had been stoped through to surface. Near the face it was observed that the vein ranges in width from 1 to 16 inches and that another roll in the hangingwall occurs. Surface equipment consisted of a Schramm 105-cubic-feet-per-minute compressor driven by an 85-horsepower fluid-drive Chrysler engine.

Production: Ore shipped, 77 tons. Gross contents: Silver, 646 oz.; lead, 29,792 lb.; zinc, 11,566 lb.

Gold-Silver-Lead-Zinc.

Scranton Consolidated Mining Company. Company office, 444 Pacific Building, Portland, Ore.; mine office, Kaslo. C. P. Merkland, president; C. A. McLeish, engineer in charge. Capital: 800,000 shares, no par value. This company owns the Scranton mine, which is inside the Kokanee Glacier Park on Pontiac Creek, a northerly flowing tributary of Woodbury Creek. It is connected by a private road to the Nelson–Kaslo Highway. The mine was operated throughout the winter under the direction of W. T. Graham but was shut down in April. Work during that time was concentrated in the Scranton No. 1 adit, where 59 feet of crosscut was driven, starting about 750 feet in from the portal.

The mine was reopened August 15th under the direction of C. A. McLeish, and closed again November 15th. Two new adits were started on the Scranton claim. The No. 4 was collared 30 feet below No. 1 adit and 130 feet to the south. It was driven in 40 feet. The No. 5 adit was located on the west side of Pontiac Creek and was just collared. A total of thirty-two loads of ore obtained from the No. 1, No. 4, and No. 5 levels was trucked to the smelter at Trail. Nine men were employed.

Production: Ore shipped, 192 tons. Gross contents: Gold, 63 oz.; silver, 1,612 oz.; lead, 38,270 lb.; zinc, 27,547 lb.

Silver Cup. Three Crown-granted claims, the El, the Silver Cup, and the Moonlite, owned by Mrs. C. A. Nellis, lie at the head of Woodbury Creek on the ridge between that Creek and Sawtooth Creek, a tributary of Keen Creek. They are reached by approximately 5 miles of trail from where the Scranton road turns up Pontiac Creek from Woodbury Creek. Late in 1949 A. C. Neiman and associates obtained an option on the property and commenced to extend the Scranton road up Woodbury Creek.

At the summit between Woodbury Creek and Sawtooth Creek a large barren-looking quartz vein in granite extends across several claims. The average strike is north 15 degrees east and the dip about 70 degrees to the east. The width is about 8 feet. The main workings are on the Silver Cup claim, where a crosscut has been driven westerly at elevation 7,900 feet, about 100 feet below the outcrop on the Woodbury Creek side. This crosscut is 73 feet long and intersects the vein 33 feet from the portal. A winze has been sunk on the vein, and 15 feet below the adit level a sublevel has been driven on the vein to the north of the shaft for 35 feet. At the face of this sublevel the vein is 7 feet wide, with 2 to 4 inches of galena showing on the hangingwall. Samples taken at the face gave the following results:—

Location of Sample.	Width of Sample.	Gold.	Silver.	Lead.	Zinc.
	Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Hangingwall	2–4	0.10	9.3	54.9	1.5
Centre	48	0.20	17.2	0.4	......
Footwall	30	0.01	1.7	3.4	......

About 15 feet back from the face the narrow stringer of galena has been underhand mined for a few feet. Here the stringer is 5 inches wide, and a sample assayed: Gold, 0.20 oz. per ton; silver, 13.1 oz. per ton; lead, 63.2 per cent.

The winze is reported to be 45 feet deep with a 48-foot drift to the south off the bottom, but these lower workings were inaccessible when inspected in August. The underground work is believed to have been done over forty years ago. There was, however, one shipment in 1940 under the name of the "Sun" mine of 3½ tons, assaying: Gold, 0.18 oz. per ton; silver, 40.5 oz. per ton; lead, 26.7 per cent.; and zinc, 3.7 per cent.

KEEN CREEK (49° 117° N.E.).*

Silver-Lead-Zinc.

Cork Province (Base Metals Mining Corporation, Limited). Head office, 402 Temple Building, Toronto; mine office, Kaslo. C. Rutherford, consulting engineer; C. Lind, mine superintendent. Capital: 3,000,000 shares, no par value. Early in 1949 this company acquired the Cork Province mine, situated on Keen (south fork of Kaslo) Creek, 10 miles by road from Kaslo. The main level is the No. 3 adit, which is connected by a raise to the No. 1 adit above and by a winze to the No. 4 and No. 5 levels below.

Most of the ore mined in 1949 came from below No. 3 level. This necessitated retimbering a section of the main drift, rehabilitating the inclined winze, and unwatering the lower levels. On No. 4 level, ore was obtained from the "Zinc stope," to the west of the main winze, and from 401 stope to the north of the shaft. On No. 5 level the 502 and 501 stopes to the west of the winze were mined of available ore, the 502 being raised through to No. 4 level. Ore was also mined from No. 1 level, where a short segment was moved from just above the main raise to No. 3 level. Ore shipments were made by truck to the Whitewater mill at Retallack until November.

A programme of diamond drilling was in progress at the end of the year, mostly on the No. 4 level, where a series of holes was drilled from the main vein into the hangingwall. A parallel or offshoot vein is believed to have been found; the best core section was reported from a hole drilled 450 feet to the west of the winze. In December plans were under way to enlarge the winze headframe and install an electric hoist.

On the surface a compressor building was erected to house a Holman 635-cubic-feet-per-minute compressor driven by a 130-horsepower G.M. diesel and also a portable Sullivan 365-cubic-feet-per-minute compressor. During the summer the crew lived in Kaslo, but at the end of November a bunk-house and a cook-house had been established at the mine. The maximum number of men employed was fifteen.

Production: Ore shipped, 7,050 tons. Gross contents of concentrates: Silver, 24,693 oz.; lead, 603,339 lb.; zinc, 1,170,153 lb.; cadmium, 9,507 lb.

[Reference: *Geol. Surv., Canada,* Mem. 184, p. 206.]

Index (Kaslo Silver-Lead Co., Inc.). Company office, 470 Granville Street, Vancouver. C. J. Sims, president. Capital: 3,000,000 shares, 10 cents par value. This Washington company owns by right of location the Index group, which is on Keen Creek, 14½ miles by road from Kaslo. There are mine workings on the property which have been inactive for about thirty years. A crushed zone carrying narrow veins of quartz, galena, sphalerite, and pyrite is exposed on the surface at an approximate elevation of 4,570 feet. This was explored in the past by shallow pits and short adits and by an adit called No. 2, about 180 feet below. A few tons of ore was shipped from these workings in the past, and about fifty sacks of ore was stored at the No. 2 portal when the present company obtained the property. There is also another adit, called "No. 1," driven as a crosscut just below the road and 215 feet vertically below No. 2 level. This crosscut extends for 807 feet, but no mineralized zone similar to that exposed above was found in it.

Under the direction of H. F. Kenward the upper surface showing was stripped. Mapping and geological work were also done, by A. St. Claire Brindle, consulting engineer. In the surface stripping a branch vein was exposed, but no further work was done on this. After the sacked ore from the No. 2 portal was shipped in July, the property became inactive.

* By J. W. Peck.

Production: Ore shipped, 6 tons. Gross contents: Silver, 165 oz.; lead, 2,037 lb.; zinc, 3,168 lb.

[Reference: *Geol. Surv., Canada,* Mem. 184, p. 223.]

Daybreak.—The Daybreak property is on the eastern side of the valley of Klawala Creek, a tributary of Keen Creek. It has been idle for many years. Three men were employed for a brief period in 1949 to open up the caved portals.

PADDY PEAK (49° 117° N.E.).*

Silver-Lead-Zinc.

Utica Mines (1937), Limited. Company office, 640 Pender Street West, Vancouver; mine office, Kaslo. D. N. Armstead, president; D. Williams, mine manager. Capital: 3,000,000 shares, 50 cents par value. The Utica mine is at the head of Twelve Mile Creek, about 15 miles by road from Kaslo. The main entrance to the mine is by No. 7 level, which is connected by a main raise, driven in 1947, to the No. 4 adit level. A sublevel off this raise, started in 1948 and called "No. 5" level, exposed a vein containing 1 to 8 inches of galena in the last 170 feet of its 300-foot length. Stoping was done on this section, called "East" vein, in 1949, and the ore was trucked to the smelter at Trail. On the "West" vein on this level a raise was started toward the No. 4 level, but because of bad ground this had not been completed at the end of 1949. On No. 7 level a raise was started 75 feet west of the main raise under the oreshoot exposed in the No. 5 level.

The mine operated almost continuously throughout 1949. The winter was quite severe, and a snowslide took out the oil-tanks and ore-bins on February 16th, necessitating closing the operation until March 3rd. About twelve men were employed.

Production: Ore shipped, 79 tons. Gross contents: Silver, 8,406 oz.; lead, 16,290 lb.; zinc, 23,234 lb.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1948, p. 141; *Geol. Surv., Canada,* Mem. 184, p. 252.]

TEN MILE CREEK (50° 117° S.E.).*

Silver-Lead-Zinc.

Voyageur. This property, near the head of Ten Mile Creek, is reached by 7½ miles of road from the Kaslo–New Denver Highway. It is owned by the Empire Mines Corporation, of Walla Walla, Wash. The Augustine brothers, of Kaslo, leased the property during 1949 and made a shipment from surface stripping to the smelter at Trail.

Production: Ore shipped, 59 tons. Gross contents: Gold, 11 oz.; silver, 500 oz.; lead, 17,770 lb.; zinc, 14,209 lb.

RETALLACK-THREE FORKS (50° 117° S.E.).*

Silver-Lead-Zinc.

Doherty. This property, on the highway about a mile east of Retallack, was worked under lease by E. H. Lovitt, Limited, for a few weeks in the first part of the year. The mined ore was trucked to the Whitewater mill. The concentrates obtained in milling 2,438 tons of ore, including 932 tons stockpiled in 1948 contained: Gold, 5 oz.; silver, 1,408 oz.; lead, 20,483 lb.; zinc, 253,097 lb.; cadmium, 802 lb.

Whitewater (Kootenay Belle Gold Mines, Limited). Company office, 475 Howe Street, Vancouver; mine office, Retallack. J. L. Trumbull, president; V. McDowell, mine manager. Capital: 750,000 shares, 50 cents par value. Kootenay Belle Gold Mines, Limited, owns 60 per cent. of the stock of Retallack Mines, Limited, which owns the Whitewater mine and mill at Retallack. During the

* By J. W. Peck.

year some retimbering of No. 9 level was done, but no ore was mined. The mill was closed from December 21st, 1948, until March 3rd, 1949. Thereafter ore from the Whitewater dumps and ore recovered from Kaslo Creek was milled. On Carpenter Creek, downstream from Sandon, five placer leases were located. After preliminary screening, material recovered from the creek, containing tailings from former milling operations, was trucked to the Whitewater mill for treatment. Custom milling was also continued. The breakdown was as follows: Total ore milled, 66,989 tons; ore on stockpile, December 31st, 1949, 7,000 tons.

Sources of ore milled:—

	Tons.	
Whitewater mine—		
Kaslo Creek jig tailings	15,363	
No. 2 dump	292	
No. 6 dump	6,022	
No. 7 dump	11,309	
No. 9 dump	1,693	
No. 14 dump	4,711	
Sandon placer leases (Carpenter Creek)	2,730	
Drawn from stockpile	14,068	
		56,188
Custom ore—		
Mayflower, Rossland	621	
Doherty, Retallack	2,438	
Cork Province, Kaslo	7,050	
Echo and Alameda, Retallack	76	
Ruth Hope, Black and Higgins lease	31	
Bosun, New Denver	571	
Lucky Boy, Retallack	14	
		10,801
Total		66,989

On the surface, bulldozer stripping was carried out on the Whitewater vein between the Pringle raise and the Myrtle shaft, a distance of approximately 1,000 feet. The results were reported to be disappointing.

A new diesel plant was installed during the year to make a total power output of 500 horsepower with hydro or 300 horsepower without hydro. A 135-horsepower diesel was also added to operate a compressor for possible underground work. The mill closed December 21st, at which time thirty-eight men were employed. The company plans to install a sink-float plant early in 1950.

Production: Ore milled, 56,401 tons. Gross contents: Gold, 121 oz.; silver, 76,465 oz.; lead, 468,695 lb.; zinc, 1,622,196 lb.; cadmium, 12,933 lb.

Jackson (Selkirk Mining Company).—E. Brown, president. This mine is in the Jackson Basin and is reached by road from Retallack. During 1949 the road was improved, No. 5 portal was rehabilitated, and some ore was shipped to the smelter at Trail.

Production: Ore shipped, 7 tons. Gross contents: Silver, 290 oz.; lead 6,243 lb.; zinc, 1,615 lb.

Lucky Boy.—This property in the Jackson Basin was leased from L. N. Garland by Messrs. Singel, Bennett, and Carpenter. A shipment was made to the Whitewater mill.

Echo and Alameda.—This property in the Jackson Basin was leased from L. N. Garland by Messrs. Singel, Bennett, and Carpenter. A shipment was made to the Whitewater mill.

Lucky Jim (Zincton Mines, Limited). Company office, 616 Stock Exchange Building, Vancouver; mine office, Zincton. J. S. McIntosh, general superintendent; G. Avison, mill superintendent. Capital: 10,000 shares, $1 par value. This company, a subsidiary of Sheep Creek Gold Mines, Limited, owns and operates the Lucky Jim mine at Zincton. Throughout 1949 ore was mined at about the same rate as in 1948: 1000 and 1001 stopes (below No. 9 level) yielded about 50 per cent. of the ore; the 210 and 312 stopes in the upper part of the mine yielded about 12 per cent.; and the other stopes, including 450, 712, 875, 910, 921, and 926, yielded the remainder. The upper and lower sections are connected by raises, and most of the crew enter the mine by the 9th level adit; the remainder travel by truck to the No. 3 level adit.

Development: Drifting, 47 feet; crosscutting, 290 feet; raising, 685 feet; diamond drilling, 8,855 feet. An electric hoist was installed to replace the air-hoist at the top of the winze to No. 10 level. The number of men employed averaged ninety.

Production: Ore milled, 98,453 tons. Gross contents: Gold, 6 oz.; silver, 47,441 oz.; lead, 660,060 lb.; zinc, 12,477,740 lb.; cadmium, 72,672 lb.

Okanagan.—This Crown-granted mineral claim is near the Rambler mine. L. P. Gormley, of Nelson, obtained a lease on it from the Crown and made one 8-ton shipment of ore to the smelter at Trail. Gross contents: Silver, 323 oz.; lead, 3,076 lb.; zinc, 1,429 lb.

Payne.—This old producer, about 1½ miles northeast of Sandon, is owned by R. A. Grimes, of Nelson. Work in 1949 was restricted to that of two men driving a crosscut with hand-steel.

SANDON (49° 117° N.E.).*

Silver-Lead-Zinc.

Palmita.—This claim is adjacent and north of the Victor claim of the Violamac property. During 1949 bulldozer stripping exposed a narrow vein carrying galena. An option was taken up by Kelowna Exploration Company, Limited, but this was later relinquished.

Sylverite (Sylverite Mines, Ltd.). Company office, 470 Granville Street, Vancouver. Capital: 3,000,000 shares, 50 cents par value. In 1949 the Excelda Mines, Limited (head office, Vernon), did a small amount of work on the property, which is adjacent to that of the Violamac Mines (B.C.), Limited. Early in the year a drift was driven in a northerly direction on No. 2 level to get around the Black Colt claim to look for a possible extension of ore into the adjoining Silver Ridge Fraction. T. Avison was in charge of three men employed to do this work.

Later in the year surface stripping exposed a quartz vein on another section of the property adjoining the Palmita. The crew was moved to this site, and some drifting was done under the direction of L. N. Smith, president and manager.

Production: Ore shipped, 4 tons. Gross contents: Silver, 76 oz.; lead, 839 lb.; zinc, 2,265 lb.

Victor (Violamac Mines (B.C.), Limited). Company offices, 67 Yonge Street, Toronto, and 470 Granville Street, Vancouver; mine office, New Denver. Viola McMillan, president; S. Ellis, mine superintendent. This company, a wholly owned subsidiary of Violamac Mines, Limited, owns the Victor mine, 2½ miles by road northwest of Sandon. The mine operated throughout the year and shipped continuously by truck to the smelter at Trail.

On the vein, intersected on No. 4 level in October, 1948, a raise was driven through to No. 3 level, proving the downward continuation of a vein previously worked on that level. Drifting on the vein on No. 4 level proved a shoot of galena averaging over 12

* By J. W. Peck.

inches in width and continuous for 120 feet. The vein strikes northeast and dips nearly vertically to the southeast. Ore on the southwest appears to be cut off by a fault, but an exploratory drive was being driven past the fault at the end of the year. The northeast end has a definite fault cut-off. This oreshoot produced the bulk of the ore in 1949 and was nearly worked through to No. 3 level by the end of the year. On No. 5 level a crosscut intersected the downward extension of the oreshoot and a raise was started on a section showing over 2 feet of galena. The raise was up over 60 feet by the end of 1949.

On the surface a large new bunk-house was nearly completed in December. The number of men employed averaged twenty.

Production: Ore shipped, 1,717 tons. Gross contents: Gold, 96 oz.; silver, 165,897 oz.; lead, 1,516,659 lb.; zinc, 552,452 lb.

Wonderful, Corinth, etc. (Silver Ridge Mining Company, Limited).

Mine office, Sandon. W. Dale Bost, president; John R. Kenney, managing director. Capital: 3,000,000 shares, 50 cents par value. This company continued exploratory work on its group of claims at Sandon. The crosscut off the main adit was extended into the Wonderful claim and then toward the Miller Creek claim, but after advancing over 2,100 feet, no vein system was found. In the lower adit, begun in 1948, 250 feet below and 1,300 feet northeast of the main adit, over 600 feet of crosscutting and drifting was done. This adit is a crosscut for 110 feet and then follows a lead reported to contain small lenses of galena. The ground requires close timbering, however, and no vein could be observed.

In the fall of the year the company restricted its programme to the Corinth claim. In 1948 lessees had made a shipment from stripping a surface vein, and this was investigated by driving a lower adit. This work ceased in November.

Ruth Hope.—C. Higgins and J. C. Black have a lease on this mine at Sandon. A shipment was trucked to the Whitewater mill.

Production: Ore shipped, 21 tons. Gross contents: Silver, 1,931 oz.; lead, 23,984 lb.; zinc, 3,052 lb.

Silversmith.

In 1949 Carnegie Mines, Limited, of Montreal, optioned this old producer at Sandon. Little was done other than an examination by T. R. Buckham. E. Petersen, working the dump on a lease, made a few shipments to the Trail smelter.

Production: Ore shipped, 29 tons. Gross contents: Gold, 1 oz.; silver, 1,348 oz.; lead, 19,936 lb.; zinc, 9,426 lb.

Carnation (Kelowna Exploration Company, Limited).

Company office, 75 West Street, New York, N.Y.; mine office, Sandon. This company continued work on its holdings in the Carnation Basin southwest of Sandon. In July a new portal was collared at elevation 5,480 feet on the Evening claim, and a drive started in a direction south 7 degrees west in expectation of intersecting the downward extension of the Carnation vein exposed in the Carnation No. 3 adit, 800 feet above. By December 9th the adit had advanced 1,090 feet, and it was reported a vein, 6 to 18 inches wide, mineralized with galena and sphalerite, had been intersected 880 feet from the portal.

On the surface a large compressor building was erected, and a 360-cubic-feet-per-minute Sullivan compressor driven by a D-13000 Caterpillar engine was installed. Other machinery consisted of a UD-6 International diesel driving a 16-kw. generator. The site is connected by a 3½-mile road to Sandon, 1,900 feet lower in elevation. J. C. Black directed the work with sixteen men.

On the No. 3 level two men were engaged in hand-steel work. It is reported that they drove 160 feet of crosscut.

Home Rule and Greenhorn. These two Crown-granted claims, together with the adjoining Alice Power group of claims, have been acquired by John R. Kenney, 2132 North Halstead Street, Chicago, U.S.A. After building 2 miles of road east from Cody to the claims, a portal at about an elevation of 5,150 feet was collared on the Little Jack claim of the Alice Power group. This adit was advanced with the object of finding a possible downward extension of the vein indicated in the Greenhorn tunnel 457 feet above, but it was still in overburden, after being driven 50 feet, when work was stopped in August. Operations were under the direction of John R. Kenney, Jr., and three men were employed.

[Reference: *Geol. Surv., Canada,* Mem. No. 184, p. 49.]

LONDON RIDGE (50° 117° S.E.).*

Silver.

McAllister (Noonday Mines, Limited; Alpine Gold, Limited). An option was obtained on this property in 1949 from the Allan Nelson Mining Co., Ltd., by Noonday Mines, Limited, a subsidiary of the Alpine Gold, Limited. The property is on London Ridge and is reached by a road 5½ miles long extending north of Three Forks up Kane Creek. Work was started in August, and the road to the mine was improved and the necessary buildings rehabilitated. Some drifting and stoping were done on the No. 1 level. The ore obtained from this work was trucked to the railway at Three Forks for transshipping to the smelter at Trail. Operations were under the direction of F. H. Crosby. Eight men were employed.

Production: Ore shipped, 34 tons. Gross contents: Silver, 2,649 oz.; lead, 1,633 lb.; zinc, 787 lb.

[Reference: *Geol. Surv., Canada,* Mem. 184, p. 79.]

THREE FORKS-NEW DENVER (49° 117° N.E.).*

Silver-Lead-Zinc.

Rose Marie. This Crown-granted claim is on the south side of Carpenter Creek, about 2 miles from New Denver on the New Denver–Three Forks Road. It is owned by J. Cechelero, of New Denver, and has been inactive for many years. In 1949 L. E. Hale and associates, of Nelson, opened the upper portal and made a shipment from a slash taken near the face of the adit, which extends in about 100 feet.

Production: Ore shipped, 11 tons. Gross contents: Silver, 280 oz.; lead, 2,522 lb.; zinc, 1,804 lb.

[Reference: *Geol. Surv., Canada,* Mem. 184, p. 90.]

SLOCAN LAKE (49° 117° N.E.).*

Silver-Lead-Zinc.

Bosun (Santiago Mines, Limited). Company office, 423 Hamilton Street, Vancouver; mine office, New Denver. R. Crowe-Swords, president; T. R. Buckham, mine manager. Capital: 6,000,000 shares, 50 cents par value. The Bosun mine is on the east shore of Slocan Lake, 1½ miles south of New Denver on the Nelson–Nakusp Highway.

Early in 1949 mining was continued in two small stopes on the western end of the mine about 1,000 feet in from the main No. 6 level portal. This section is mostly mined out above No. 5 level. Some exploration was done in the centre section of the mine, but this was not successful. Efforts were then concentrated on the eastern ore block, where a winze has been sunk to No. 7 level. The winze was unwatered, and drifting was done in an easterly direction from the bottom of the winze, 30 feet below No. 7 level. This

* By J. W. Peck.

drive encountered a short section of ore near the winze that was underhand-stoped on No. 7 level about two years before. During the summer the property was turned over to lessees, but late in the year the company again resumed operations with the intention of deepening the winze.

On the surface a new office building was erected, but mill construction, begun in 1948, was stopped after the foundation was poured. A small jig plant was used to sort the ore before it was trucked to the smelter at Trail. About 600 tons was also trucked to the Whitewater mill.

Production: Ore shipped, 1,208 tons. Gross contents: Gold, 10 oz.; silver, 40,792 oz.; lead, 416,246 lb.; zinc, 124,241 lb.

Buck Fraction.

E. C. Wragge, of Nelson, owns six claims at Silverton, just below and west of the Standard mine of the Western Exploration Company, Limited. The claims are the Crescent, the Buck Fraction, Silverton Boy, Mohawk, Binks Fraction, and the Tram Fraction. All are Crown-granted, except the Tram Fraction and Binks Fraction. It is reported that when the road to the 7c adit of the Standard mine was put across the Buck Fraction in 1937, a lead-zinc outcrop was exposed. In February, 1949, Messrs. Norquist and Nesbitt obtained a lease on this property and did bulldozing stripping in this area. A lead containing galena and sphalerite was exposed, but as it dipped into the hillside with the flat argillite bedding, further stripping was difficult and the project was abandoned.

Van Roi Mines (1947), Ltd.

Company office, 1720 Marine Building, Vancouver; mine office, Silverton. K. G. Nairn, president; N. F. Brookes, managing director. Capital: 2,000,000 shares, no par value. This company owns the Van Roi mine near Silverton. The oreshoot, developed in the southeast section of the mine by drifting in 1948, was mined.

It is reported that Van Roi ore amounting to 5,114 tons was milled, 521 tons at the Western Exploration Company mill and 4,593 tons at the Kenville Gold Mines mill, and that 1,340 tons remained stockpiled at the latter mill. Shipments to the smelter included 210 tons of lead concentrates, 29 tons of lead ore, and 295 tons of zinc concentrates.

Development: Drifting, 227 feet; crosscutting, 99 feet; diamond drilling, 852 feet.

Production: Gross contents of concentrates and ore shipped to smelter—Gold, 153 oz.; silver, 38,227 oz.; lead, 263,916 lb.; zinc, 367,847 lb.; cadmium, 2,742 lb.

Galena Farm.

This old property is about 1½ miles south of Silverton. F. Mills continued to operate it under lease until May. Working with a crew of seven men, he mined ore from remnants in the Noonday Lode from a sublevel 60 feet above the main adit level. Ore obtained was crushed in a small jaw-crusher and then trucked to the Western Exploration Company's mill at Silverton. After May Mr. Mills continued exploration and made one shipment in October.

Production: Ore shipped, 1,881 tons. Gross contents: Silver, 23,090 oz.; lead, 90,114 lb.; zinc, 248,872 lb.

Metallic.

This property is alongside the Silverton–Hewitt Road, about 2 miles south of Silverton. W. Crowe and A. K. Lotz hold an option from the owners, A. S. MacAulay, L. S. MacAulay, and R. S. White. During the first part of 1949 the property was operated under lease to four men—R. Hambly, A. Orr, E. Quail, and L. Porter. The main development done to date consists of two adits 90 feet apart. The partners worked chiefly in the lower adit, using a portable compressor, and connected the two levels. Ore obtained was trucked to Trail. The lease expired in October.

Later in the year the property was again under lease, this time to J. Tarnowski, G. Tarnowski, and J. Heichert. Shipments amounting to 19 tons were made to Trail, this ore being obtained from both levels.

Production: Ore shipped, 55 tons. Gross contents: Gold, 1 oz.; silver, 4,301 oz.; lead, 15,314 lb.; zinc, 20,391 lb.

Western Exploration Company, Limited. Company office, Silverton. A. M. Ham, general manager; R. A. Avison, mine superintendent; T. Leask, mill superintendent. Capital: 2,000,000 shares, 50 cents par value. This company owns the Mammoth and Standard mines near Silverton and the Enterprise mine on Enterprise Creek, about 12 miles south of Silverton. The number of men employed for all operations was 115 at the beginning of the year but toward the end was decreased to sixty-five.

Standard.—This mine was closed from June 1st to October 1st. During the first part of the year about 60 tons per day was produced; most of this ore came from stopes between No. 5 and No. 6 levels. A considerable tonnage was also produced from a stope on No. 7 level, which had been reopened for nearly 4,000 feet. After October, mining was restricted to the 640 stope, and only about 20 tons a day was produced. Most of the ore came from remnants left in the walls of old square-set stopes, necessitating careful mining.

Mammoth.—Development work continued throughout the year. The new No. 9 adit was extended to a length of 1,100 feet, and the projected downward extension of the Mammoth shear was intersected, but no ore was found. A 45-degree raise 456 feet long was driven in the footwall side of the shear to connect with the No. 7, or lowest, level of the old Mammoth mine.

Enterprise.—This mine operated throughout the year, except from August 15th to October 1st. The 530 and 616 stopes produced the bulk of the ore, which amounted to about 30 tons per day. Development drives were made on No. 6 and No. 8 levels. On the No. 8, or lowest, level the back was taken down for 350 feet on a vein averaging 10 inches in width. A new ore-bunker was constructed at the No. 8 portal in preparation for mining ore from that level.

Standard Mill.—The mill at Silverton was operated intermittently during the year, treating ore from the Standard and Enterprise mines as it was mined. Custom ore for the Van Roi and Galena Farm mines was also handled, 300 tons and 1,883 tons, respectively, being treated by the end of November.

Production: Ore milled, 11,698 tons. Gross contents: Gold, 42 oz.; silver, 127,832 oz.; lead, 794,092 lb.; zinc, 2,039,930 lb.

Mabou, Ohio, and Neepawa (Terley Mining, Milling & Smelting Corporation).—Head office, 1946 Gregory Way, Bremerton, Wash.; British Columbia office, 507 Baker Street, Nelson. R. D. Austin, president. This company's property is on Enterprise Creek, adjacent to the Enterprise mine of the Western Exploration Company, Limited. Work in 1949 was restricted to a diamond-drill programme under the direction of W. S. Hamilton. One hole was put down at the portal of a caved adit on the Neepawa claim. The length of the hole was 315 feet, with a vein intersection reported at 275 feet. Work ceased in February.

GWILLIM CREEK (49° 117° N.W.).*

Antimony.

Caroline Group (Antimony Mines & Metals (Slocan), Limited). Head office, Hutton Building, Spokane, Wash.; British Columbia office, 420 Broadway West, Vancouver; mine office, Slocan City. J. Birss, president; M. Hretchka, secretary and mine manager. Capital: 200,000 shares, 50 cents par value. This company owns the Caroline group of claims on Gwillim Creek, 7 miles by rough road from Slocan City. Work was stopped on this property in December, 1948, and was started again about the middle of 1949. A diamond drill was taken into the property, and an attempt

* By J. W. Peck.

was made to drill the quartz vein which dips steeply within granite walls. Small lenses of stibnite are exposed in this quartz vein, chiefly at the higher altitudes. The drill was set up to the west of the vein exposure, and three down holes were drilled. No antimony was obtained in the drill cores.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1948, p. 148.]

SPRINGER CREEK (49° 117° N.E.).*

Silver.

Ottawa. This property, about 3½ miles up Springer Creek, was operated by two groups of lessees during 1949. R. Christie made one shipment of 3 tons, and A. Olsen, E. Grove, and P. Grove also made shipments.

Production: Ore shipped, 70 tons. Gross contents: Silver, 15,701 oz.

Morning Star. This property is on Dayton Creek, a northerly flowing tributary of Springer Creek. It is owned by W. Clements, but a lease and bond were obtained in 1949 by G. A. MacMillan, who made a small shipment.

Production: Ore shipped, 2 tons. Gross contents: Gold, 5 oz.; lead, 88 lb.; zinc, 106 lb.

LARDEAU (50° 117° N.E.).*

Silver-Lead-Zinc.

Spider (Sunshine Lardeau Mines, Limited). Company office, 942 Pender Street West, Vancouver. W. J. Scorgie, manager. Capital: 3,000,000 shares, no par value. This company obtained an option in 1949 on the Spider group from the owner, I. G. Nelson, of Nelson. The claims are Spider, Spider No. 1, Winton, Anaconda, May Fraction, and Gold Bird. The property is 7 miles by road from Beaton. During 1949 shipments of ore were made from oreshoots located on No. 2, No. 3, and No. 5 levels.

Production: Ore shipped, 26 tons. Gross contents: Gold, 3 oz.; silver, 942 oz.; lead, 9,839 lb.; zinc, 7,028 lb.

G.Y.P. This group consists of two fractions lying adjacent to the Nettie L group on the southeast slope of Nettie L Mountain. They belong to J. Main, of Ferguson, who has leased them to A. E. Petersen, of Revelstoke. Late in 1949 Mr. Petersen put three men on the property to repair the trail, road, and camp. It is reported that some work was done later in an old tunnel which follows a mineralized quartz vein.

Wagner (Leadridge Mining Company, Limited). Company office, 640 Pender Street West, Vancouver. F. Cameron, president. Capital: 10,000 shares, no par value. This company, a wholly owned subsidiary of St. Joseph Lead Company of New York, did some trenching and diamond drilling on the Wagner and Jewel groups and some mapping on the Abbott group near the head of Hall and Healy Creeks. The months of June and July were spent rebuilding the 18 miles of trail up Healy Creek. A bridge was constructed across the Lardeau River, 3 miles below Gerrard, and though considerable effort was spent on the trail, pack-trains had difficulty supplying the tent camp established at elevation 6,500 feet, near the summit, between Hall and Healy Creeks.

The main workings are on the Duncan claim. Here the vein outcrops on a small knoll, which protrudes through the Wagner glacier. At elevation 8,200 feet a drift has been driven on the vein in a direction north 50 degrees west for 105 feet, and from the end of this drift a crosscut has been driven to the southwest for 42 feet. A winze sunk on the vein 55 feet from the portal was pumped out in 1949. The vein dips 70 degrees to the southwest. The winze is 54 feet deep with a 20-foot crosscut into the hanging-wall at the bottom. Little mineralization shows in the walls of the shaft, but the

* By J. W. Peck.

crosscut at the bottom exposes a vein 10 feet wide well mineralized with cube galena and pyrite. On the surface the glacier has melted so that the vein is exposed to a point 140 feet lower than the adit to that depth. Above the ice the vein is 7 feet wide and well mineralized with galena. In August, 1949, a diamond drill was set up on the glacier to explore the extension of the vein, and four holes were drilled. Difficulty was encountered with rubble under the ice, and no worth-while results were obtained. The drill was then set up on solid rock below the adit, and a hole inclined downward was drilled, but the core recovery was poor. Another hole was drilled below the ice on the McCartney Fraction, but the results were also inconclusive.

The Wagner glacier is drained by a small tributary of Hall Creek. The tributary exposes a quartz vein similar in strike to the one on the Duncan claim above. Below the Duncan and McCartney fractional claims, the vein is exposed in a distance of 700 feet between elevation 7,375 feet and elevation 7,600 feet. Below this on the Princess Mary and Queen Mary claims, 900 feet of vein is exposed from elevation 6,080 feet to elevation 6,475 feet. The vein here is not as well mineralized as on the Duncan claim.

Across Hall Creek, the Jewel workings consist of shallow adits. One dump of a caved adit contained rich galena specimens. The present company dug deep trenches below this adit in an attempt to pick up the vein but had been unsuccessful when the property was visited September 1st.

Twelve men were employed under the direction of H. V. Sears. Work was stopped in September.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1918, p. 165; *Geol. Surv., Canada*, Mem. 161, p. 79.]

UPPER ARROW LAKE (50° 118° N.E.).*

Zinc.

Big Ledge.—The Consolidated Mining and Smelting Company of Canada, Limited, continued its diamond-drilling programme on this property on Pingston Creek. Drilling was done only during the summer. A total of 5,798 feet was drilled.

LOWER ARROW LAKE.*

Gold-Silver.

Promistora Gold Mines, Limited. (49° 117° N.W.) Company office, Room 701, 220 Bay Street, Toronto; British Columbia office, 675 Hastings Street West, Vancouver. Edith M. Tice, president. Capital: 3,000,000 shares, $1 par value. This company was incorporated to develop a group of claims near Burton, at the north end of Lower Arrow Lake. Work in 1949 was restricted to bulldozer stripping under direction of Dr. F. C. Buckland, consulting engineer.

Norman Group. (49° 118° N.E.) A group of eight recorded claims near Fauquier and adjoining the Crown-granted Completer Mineral Claim is owned by N. Puhaty. They were held under option during 1949 by M. Hretchka and associates. Operations during the year were restricted to building three-quarters of a mile of road and to surface exploration.

CRESTON (49° 116° S.W.).*

Silver-Lead.

Alice. The Alice mine is on the west slope of Arrow Mountain, 2 miles north of Creston. It is owned by K. C. Constable and R. B. Staples. It had been inactive for many years, and the mine was inaccessible. In 1949 the owners built a new road about a mile long to the mine. A start was made on opening up the lower portal, but after advancing 150 feet through caved material, work was stopped in November. Work was under the direction of A. B. Staples.

* By J. W. Peck.

Delaware. This property is at 4,500 feet elevation on Rolf Mountain, to the north of Creston. Three claims—the Delaware No. 2, the Virginia, and the Ohio—are owned by J. W. Hill, of Delaware, U.S.A., but R. W. and F. E. Crawford, of Creston, have a five-year lease. The property has been idle for about twenty years, other than for a few tons shipped in 1947.

It is developed by two main adits, 50 feet apart vertically, driven on a quartz vein striking in a northwesterly direction. This vein dips about 53 degrees to the southwest and ranges in width from a few inches to several feet. The country rock is bedded quartzite. The upper, or No. 1, adit is 125 feet long, while the lower, or No. 2, adit has a total of over 330 feet of drifts and crosscuts. In 1949 work was concentrated on the lower adit, and a stope was started on the vein along a 40-foot section 200 feet in from the portal. Past this stope the vein is cut off by a fault, but in November an exploratory drive picked up the vein past the fault. Small lenses of galena were observed dispersed in the quartz vein, where it was intersected. Another adit, 100 feet below No. 2 adit, is reported to be 65 feet long. No vein is showing in it.

Air for mining was supplied by a small portable compressor. A new road 3.2 miles long was constructed to the lower adit so that ore could be trucked to the railway at Creston. About six men were employed.

Production: Ore shipped, 188 tons. Gross contents: Silver, 702 oz.; lead, 32,657 lb.; zinc, 838 lb.

[Reference: *Geol. Surv., Canada,* Mem. 228, p. 76.]

California. Five claims—the California and California Nos. 1, 2, 3, and 4—were recorded in March, 1949. They lie astride the Canadian Pacific Railway near Wynndel and are owned by C. F. McDougall and R. M. Crawford. A shipment was made in November to the smelter at Trail.

Production: Ore shipped, 9 tons. Gross contents: Silver, 32 oz.; lead, 972 lb.; zinc, 101 lb.

MOYIE LAKE (49° 115° S.W.).*

Silver-Lead-Zinc.

Society Girl. M. Nicholson, owner, continued to make shipments to the smelter from this property, which is 2 miles east of Moyie. The ore was obtained from the No. 2 dump. Mr. Nicholson, assisted by two men, also rehabilitated the upper level and erected a storage shed near the portal.

Production: Ore shipped, 674 tons. Gross contents: Silver, 1,181 oz.; lead, 88,133 lb.; zinc, 36,470 lb.

KIMBERLEY (49° 115° N.W.).*

Silver-Lead-Zinc.

Sullivan (The Consolidated Mining and Smelting Company of Canada, Limited). Company office, 215 St. James Street West, Montreal; mine and smelter office, Trail. R. E. Stavert, Montreal, president; R. W. Diamond, Trail, vice-president and general manager. Sullivan mine office, Kimberley. J. R. Giegerich, mine superintendent; H. R. Banks, mill superintendent. Capital: 4,000,000 shares, $5 par value. The company owns and operates the Sullivan mine on Mark Creek, near Kimberley, and the Sullivan concentrator at Chapman Camp. The following report is based on an outline of the 1949 operations supplied by the management.

Low Level Haulage and Underground Crushing.—During 1949 work was confined mainly to installation of equipment. All machinery was installed in the 3800 level crushing plant, and measuring pockets and chutes were installed below the 15,000-ton fine-ore pocket. With the exception of minor adjustments, this work was completed in October.

* By J. W. Peck.

The 3700 tunnel was extended 260 feet to provide additional tail room. Track ballasting and installation of the trolley wire were completed in October.

Safety.—The Underground School of Instruction continued during the year and trained 217 employees. Many of the shiftbosses assisted in this training programme.

Seven men were trained in mine-rescue work and successfully completed the examinations at Fernie. Three mine-rescue teams competed in the annual mine-rescue competitions held at Fernie, and two of the teams placed second and third. A Chemox-trained mine-rescue team gave a demonstration at the West Kootenay Mine-safety Competitions which were held at Salmo. During the year twenty-four men attended regular monthly practices in mine-rescue work underground. A drift several hundred feet long is filled with smoke when required in these practices.

There were 150 St. John Ambulance awards given to employees at the mine, and twenty-two industrial first-aid certificates were granted during the year. The Sullivan mine team won the Rotary Shield in the first-aid competitions held in Fernie.

Ventilation and Dust.—A new 75-horsepower fan commenced operation in December, 1949, on 80,000 cubic feet per minute at 3.0-inch water gauge for primary exhaust duty on the new underground crushing-plant district. The development of this return airway was completed during the year.

In December a 100-horsepower booster fan was installed underground in 3321 Drift South, to be used during the winter to increase the volume of air taken into the mine through No. 24 shaft.

The average mine-air temperature was 52 to 43 degrees Fahrenheit, with relative humidity ranging from 65 per cent. to saturation. Dust sampling was carried on each month by the Konimeter method.

Aluminium-powder treatments of satisfactory concentration were continued daily in the dry.

Personnel and Housing.—The housing project of 172 units started in 1948 was finished in 1949. The houses are being sold to employees and no down payment is required.

The mine payroll, as of December 15th, was 1,540. Approximately seventy-five students were employed during the summer to replace men on holidays.

Mine Developments.—A total of 864 feet of steelwork was installed in No. 1 shaft during the year. This completed the shaft to the sump below the 2850 level. Drifting was completed from this shaft to 33503 winze on the 3200 level and on the 2850 level. The connection on the 3050 level should be made by the end of the year.

Excavation of the 2850 level crushing unit started in September and should be nearly half completed by the end of the year.

The 3902 conveyer extension from the 3350 level to the 2850 level was started in September and was driven from the 2850 level and from raises off the 3050 level and the 3200 level. By the end of the year, this work should be approximately 75 per cent. complete.

The use of slushers and drawholes is increasing in the mine because of the greater number of pillars being mined and the flatter dips of the orebody on the lower levels. This increased use of slushers also gives greater flexibility in secondary blasting.

Production from pillars has increased to approximately 35 per cent. of total production. Pillars containing up to 195,000 tons have been broken in one blast. Average powder consumption would approximate 0.20 pound of explosives per ton blasted.

Tungsten carbide insert bits, introduced in 1948 for drilling chert, are proving satisfactory. Although their use is still confined to development work in chert, the footage drilled per month has increased to an average of 29,000 feet.

Experimental work is being carried on with insert bits and sectional steel for drilling long holes in ground consisting of mineralized argillite and irregular patches of mineralized chert. Very encouraging results have been obtained. Up-holes at 40 degrees have been drilled to a depth of 82 feet.

Development: Drifting and crosscutting, 15,517 feet; sublevels, 18,804 feet; raising, 23,276 feet; diamond drilling, 67,707 feet.

Production: Ore milled, 2,297,672 tons.

ST. MARY RIVER (49° 116° N.E.).*

Boy Scout Group (Lake Expanse Gold Mines, Ltd.). This company, late in 1949, acquired through R. C. H. Bennett, of Cranbrook, a group of eleven claims on Hell Roaring Creek. Seven of the claims are recorded claims and four are the Crown-granted Warhorse, Hope, Granite, and Faith claims, formerly known as the Boy Scout group. These claims were held on option during the first half of 1949 by the Staple Mines and Minerals, Limited, of Toronto, but this company gave up the option without doing any work. The property is accessible by road to St. Mary Lake and then by 5 miles of trail up Hell Roaring Creek. Work by the Lake Expanse Gold Mines, Ltd., was restricted to a surface diamond-drilling programme on the Warhorse claim under the direction of D. N. Cannon.

Paradise mine—camp and portals.

Silver-Lead-Zinc.

WINDERMERE (50° 116°).†

Paradise (Sheep Creek Gold Mines, Limited). This old property of eight Crown-granted claims was bought by Sheep Creek Gold Mines, Limited, in 1942 and brought into production in 1949. The camp is in the basin at the head of Spring Creek at an elevation of about 7,800 feet, and the workings are on the slope of a high ridge extending eastward from Mount Nelson. The mine is reached by 7½ miles of good mountain road from the mill-site at Jackpine Flat on Toby Creek, which point is 12 miles from Lake Windermere Station. The ore is hauled to the mill by truck.

* By J. W. Peck.

† By M. S. Hedley.

The Parridice, Royal Stag, and Comstock claims were located in 1899 on an impressive oxidized showing, and development work started immediately. In 1901 the first ore was rawhided down to Toby Creek, and 755 tons was shipped to the railroad at Golden. A wagon-road was built to the mine in 1902, and the No. 4, now 7800-foot, level was started in 1903. A tram-line was considered at this time, and even a small smelter, but work slowed in 1905 after a total of 1,950 tons of "sand carbonate" ore had been shipped, and about 5,000 feet of level workings had been driven. The average ore shipped in this early period contained about 51 ounces of silver per ton and about 59 per cent. lead; the last shipment was in 1906.

The mine reopened in 1916 and lower-grade ore was shipped, containing as little as 25 per cent. lead. A good deal of this ore came from the dumps. R. R. Bruce, who had been manager for the Hammond interests since 1903, bought the property in 1917 and continued to operate it. From 1916 to 1926, inclusive, a total of 12,190 tons was shipped, averaging 34 ounces of silver per ton and 36.5 per cent. lead.

This ore was all oxidized and consisted typically of "sand carbonate," in which there was only a small proportion of galena in grains or nodules. Most of the iron and zinc appear to have been leached out. The ore was pockety and, according to reports, was mined from pocket to pocket with little regard to developing ore reserves. The ore was so soft that powder was seldom used in stoping, and heavy timbering was necessary. As the walls were also soft and oxidized and workings caved not long after they were opened, it is not surprising that little is known of the highest workings, especially as geological examination of such ground is difficult at best. Sulphide ore in any quantity was reportedly first found on the 7819 and 7900 levels about 1925; it was of lower grade than the carbonate ore, and consequently the mine entered a new phase, requiring the development of sufficient ore to warrant erection of a mill.

The Victoria Syndicate, of London, bought the property in 1926 and concentrated development on the 7819 and 7900 levels (formerly Nos. 1 and 2 sublevels) and extended 7800 level (formerly No. 4) to reach the ore zone down the rake. A winze was sunk at 40 degrees below 7800 level. A mill with a rated capacity of 50 to 75 tons per day was brought into production early in 1928, and 7,631 tons was treated before the mill was closed in November. A new company, Paradise Holdings, Limited, was formed late in 1929, but all work stopped in 1930.

During the period of milling, an ore zone was investigated near the portal of 7800 level, but most ore was mined from the main inner zone. Some metallurgical difficulties were encountered with the partially oxidized ore, but these were apparently solved. Plans were made to move the mill to Jackpine Flat but were not carried out.

In 1928, 7,631 tons of ore was milled, with a net content of: Gold, 3 oz.; silver, 18,449 oz.; lead, 352,885 lb.; zinc, 557,420 lb.

The property was bought by Sheep Creek Gold Mines, Limited, in 1942, and during the summer months of 1943 and 1944 diamond drilling was done on the portal and inner orebodies below 7800 level. Construction of a 50-ton mill at Jackpine Flat was started in 1948 and was finished during the summer of 1949. The mill was brought into production in August, 1949.

The ore zone is in grey siliceous magnesian limestone of the Mount Nelson formation, which is involved in folds truncated by the unconformably overlying Toby conglomerate which, in turn, is folded and strongly cleaved. The ore zone is near the upper contact of the limestone with overlying slates and is found in fracture zones on the lower levels; it may be further localized by folding. The main zone or series of orebodies rakes at 15 to 20 degrees to the southeast, and a second, partly explored zone rakes at about 15 degrees to the northwest. Most of the workings above 7900 level are caved, and in some others the oxidation is such that geological study is very difficult.

The 7800 level is driven in limestone a few feet to 100 or more feet from the footwall of the slate. About 175 feet from the portal the level encounters an oxidized ore

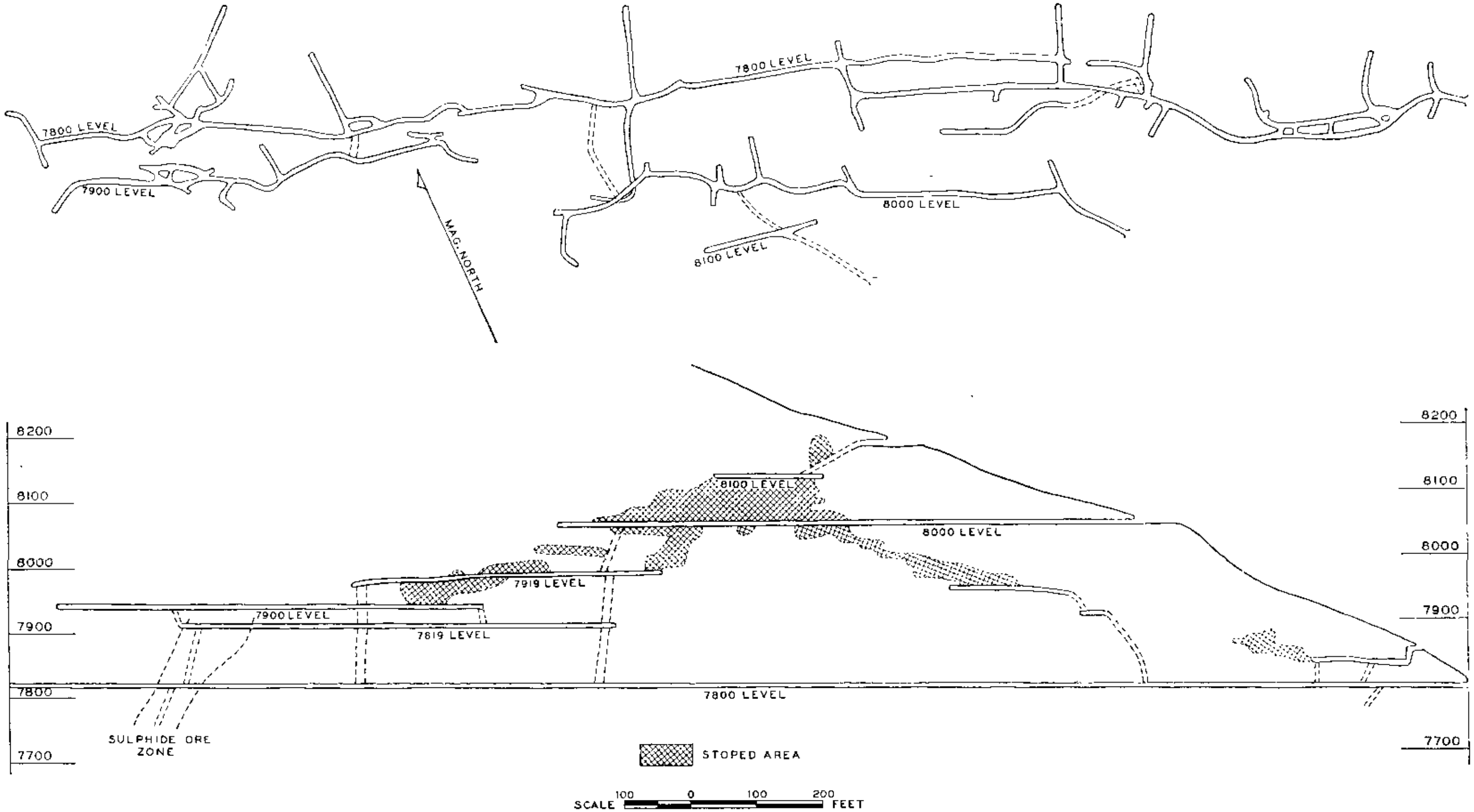


Fig. 24. Paradise mine—plan and longitudinal projection.

zone, on which some stoping was done above and some below to a depth of 130 feet. The next ore is the downward continuation of the main ore zone, about 2,000 feet from the portal. Between these two ore zones a narrow zone of pyritic mineralization is followed for some 600 to 700 feet.

The orebody at present being mined between 7900 level and 7800 level is wide and irregular. On 7800 level most of the ore lies within a pod 70 feet long by 30 feet in maximum width. On 7819 level it is 115 feet long and has a maximum width of about 10 feet. The bottom of the winze is 56 feet below 7800 level, but the ore has been proven to a depth of 75 feet.

The ore contains much pyrite in addition to galena and sphalerite. It is somewhat oxidized to the lowest level known. In old workings, greenish crystals of iron sulphate and white crystals of zinc sulphate are common on some walls and even in old gob piles where sulphides are abundant.

Work in 1949 included rehabilitation of the Victoria Syndicate camp and the surface generally. The 7819 level was extended to the southeast and a raise connection made with 8000 adit level beyond the caved area of old workings. Stoping was begun on 7800 and 7819 levels on the main orebody. A new 7700 adit was advanced 52 feet. An International diesel engine was installed to augment the Vickers-Petter engine of the former operation. The mine road was widened and repaired where necessary to facilitate trucking.

At Jackpine Flat, besides the mill buildings, a bunk-house and also manager's and mill superintendent's residences have been built. The flow-sheet of the 50-ton mill is as follows: A 16 by 16 by 16 coarse-ore bin; 8 by 24 Union Iron Works jaw crusher powered by a 25-horsepower motor; 16-inch by 36-foot conveyer-belt; wood-stave fine-ore bin 12 feet diameter by 14 feet high; fine-ore conveyer 12 inches by 12 feet; Union Iron Works 36-inch by 6-foot conical ball mill; Denver 2-compartment jig; rake classifier; six Denver Sub A lead cells; 4-foot Denver conditioner; six Denver Sub A zinc cells; two S.R.L. pumps; 4-foot 4-disk filter; cyclone filter pump. The power plant consists of one 75-kw. and one 50-kw. Palmer generator direct connected to International diesel engines. Some difficulty was encountered at first in treating the semi-oxidized ore.

An average of about twenty-five men was employed under J. Crowhurst, superintendent.

Production: Ore milled, 4,007 tons. Gross contents in concentrates: Silver, 12,872 oz.; lead, 266,808 lb.; zinc, 299,146 lb.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1900, p. 804; 1903, p. 102; 1915, p. 88; 1927, p. 264; 1928, p. 275. *Geol. Surv., Canada,* Mem. 148, 1926, p. 46.]

Hot Punch (Gwillim Lake Gold Mines, Limited).

This property of six Crown-granted and four recorded claims was optioned by Gwillim Lake Gold Mines, Limited. Head office, 67 Yonge Street, Toronto. K. J. Springer, president. Work was started in 1949 by C. E. Gordon Brown and continued by William Blair. The property is at an elevation of about 6,000 feet near the head of Delphine Creek, a tributary of Toby Creek, and is 25 miles by road from Invermere. The second half of the road, beyond Jackpine Flat, is a truck-road. There is an adequate camp-site on a timbered shoulder of the mountain, but the southernmost showings are on steep ground subject to snowslides.

Located fifty years ago, this property received periodic attention until 1926. Shipments of ore were made in 1908, 1909, 1919, and 1926, totalling 80 tons with an average grade of 43 ounces of silver per ton and 30 per cent. lead, some of which is said to have come from a 78-foot shaft and some from No. 1 adit.

The vein cuts schist and impure limestone. It strikes north-northeastward and dips to the northwest. It is exposed at intervals for a length of about 2,000 feet along the hillside, and at the southern end a probable, flatter continuation can be seen continuing up a rock face toward a glacier. At the southern, accessible end the vein is bedded, or nearly so, and forms a zone of siderite, quartz, pyrite, and some galena and sphalerite. A shaft, reported to be 78 feet deep, sunk apparently at 30 degrees, is now full of water; it is on a very steep hillside. Another small shaft and open-cuts near by show the vein zone to be as much as 2 to 3 feet wide. Farther north, open-cuts at intervals show the vein to conform nearly with the schistosity and to dip steeply to the west. About 1,000 feet north-northeast of the shaft, No. 1 adit is 80 feet long. A 20-foot section was stoped to the surface. A siderite zone 16 inches wide shows in the face and a 10-foot-long lens bearing galena occurs in the floor about midway in the adit.

No. 2 adit, 150 feet lower than No. 1 and 450 feet to the north, was about 80 feet long in June, when preparations were being made to advance it. The vein in this adit was as much as 20 inches wide, containing lenses of sphalerite and galena. A little tetrahedrite was noticed in ore on the dumps. Another old adit, about 200 feet lower than No. 2, is caved and reportedly was not driven on the vein.

During 1949 the road up Delphine Creek was repaired, the camp renovated, a compressor and pipe-line installed, and No. 2 adit was advanced 150 feet before operations ceased. A crew of ten men was employed. Equipment was removed and stored at Invermere in September.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1915, p. 93. *Geol. Surv., Canada*, Mem. 148, 1926, p. 48.]

SPILLIMACHEEN (50° 116° N.E.).*

Silver-Lead-Zinc.

Silver Giant Mines, Limited. Company office, 707 Credit Foncier Building, 850 Hastings Street West, Vancouver; mine office, Spillimacheen. W. R. Wheeler, president; T. G. McLelan, secretary. Capital: 3,000,000 shares, 50 cents par value. The mine is on the west side of Jubilee Mountain, about 7 miles by road from Spillimacheen. The original discovery on this property was made prior to 1890. The surface showings are on the Giant Crown-granted claim. Early reports contain numerous references to the Giant group, but little work was done until 1907, when Golden Giant Mines, Limited, erected an Elmore oil-process concentrating plant of 40 tons capacity. This process was found too expensive, and some experimental work was done with dry tables. The earliest and principal production prior to 1947 was made in 1908, when 500 tons of ore was mined and presumably concentrated. In 1916, 77 tons of ore was shipped, probably by lessees.

In 1926 the property was acquired under option by Pacific Mines, Ltd., and A. W. Davis was placed in charge. During that and the succeeding year diamond drilling was done, No. 5 level was driven, and a raise connecting No. 5 level with No. 3 was put through. No. 6 level was driven in 1929, and in 1930 diamond drilling was carried out below No. 6 level under the direction of J. L. Parker.

The property then lay idle until Silver Giant Mines, Limited, was organized by W. R. Wheeler to acquire it in 1947. Old buildings were rehabilitated and 1,383 tons of ore was shipped from the dumps. In 1948, 294 tons was shipped and, with little more dump ore readily available, some machinery was brought in with a view to erecting a concentrating plant. From the 1,677 tons shipped, recovery was: Gold, 4 oz.; silver, 2,725 oz.; lead, 242,501 lb.; zinc, 11,921 lb.

Late in 1948 Siscoe Gold Mines, Limited, obtained an option and at once started a campaign of sampling and diamond drilling, as well as some drifting and crosscutting. About twenty men, under the direction of C. M. Campbell, Jr., were engaged in this work. The option was dropped in March, 1949.

* By M. S. Hedley.

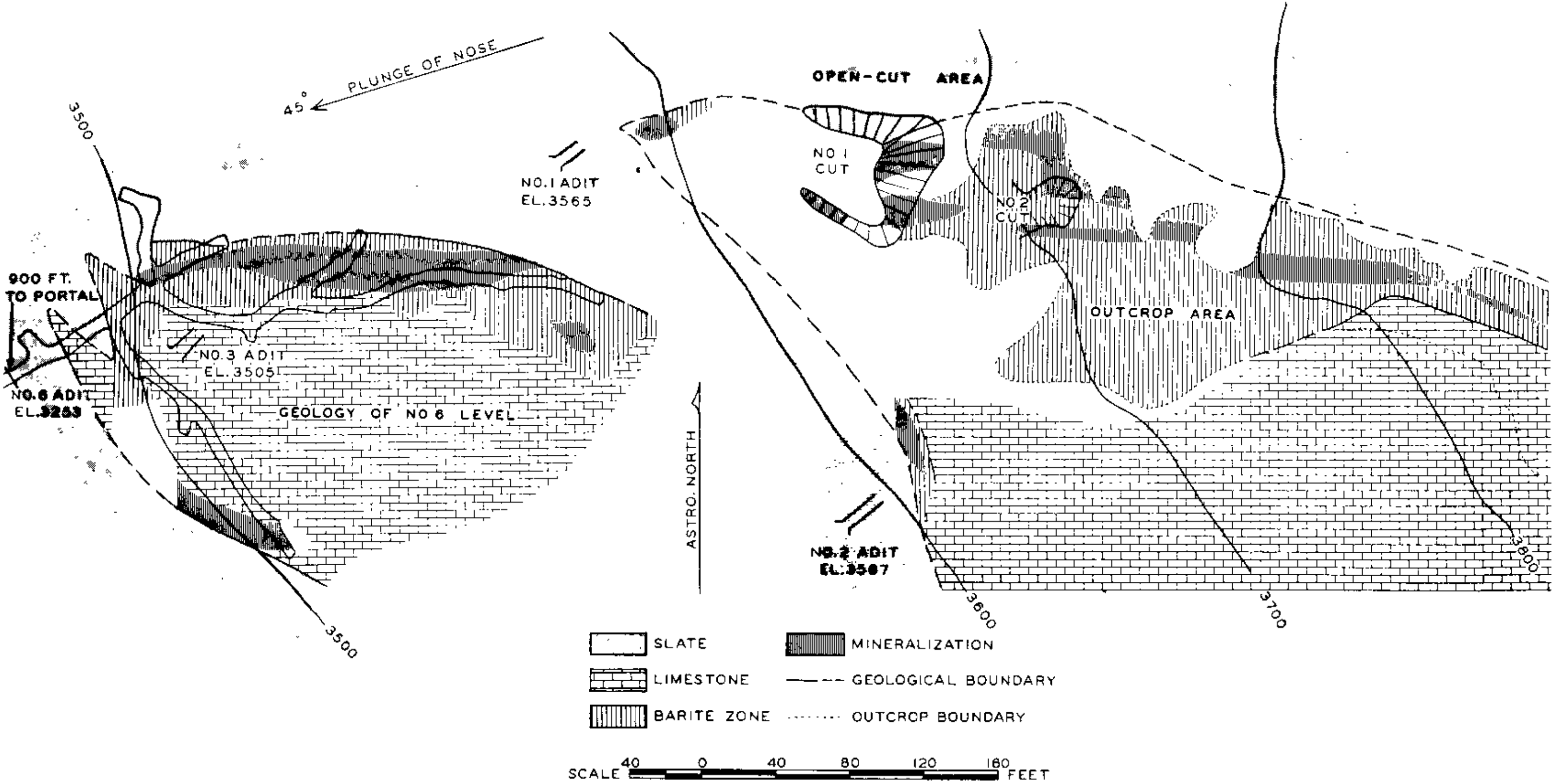


Fig. 25. Silver Giant—geology of open-cut area and No. 6 level.

The camp, consisting of three old log cabins, a small bunk-house, and an office building, is on a flat several hundred feet higher than Spillimacheen River. Water is obtained from a spring. The ground rises gradually to the upper adits and above them rises abruptly to the top of the mountain. The ore zone outcrops on the nose of a small ridge, and on No. 6 level, about 400 feet lower than the outcrop, it is reached by a 1,000-foot crosscut. The portal of No. 6 adit is level with and close to the camp.

The ore deposit is in Jubilee limestone, close to the contact with McKay slates. According to regional mapping, it is on the western limb of a major syncline, but the structure at the mine, mapped in greater detail, is complex. A large regional fault, along which Horsethief Creek quartzites, grits, and schists are thrust against the Cambrian strata, passes about a quarter of a mile west of the camp.

The Jubilee limestone, exposed in bluffs on the western side of the mountain, is light coloured and almost massive. Bedding can be seen only locally, and it is inferred that the evidence of bedding has been destroyed at least in part by intense deformation, which is evident in the adjoining slates. The McKay slates, as seen east of the limestone, consist of thin interbeds of argillite and limestone and have been shattered to form a "pseudo-conglomerate." In the crosscuts on Nos. 5 and 6 levels the strata are for the most part paper slates.

The mine structure is a plunging, overturned anticlinal nose in which slate is wrapped round limestones. In and near the apex there has been replacement of limestone and of slate inclusions by silica, and of limestone by barite, and in this zone there has been deposition of galena and sphalerite. The magnitude of this anticline is not known because only the nose can be seen, and that for a limited distance. There are practically no outcrops of slate in the immediate vicinity of the mine.

Several geological features are of interest, as they could influence long-range development, if any were attempted. The plunge of the nose at 45 degrees in a direction of south 75 degrees west is at variance with a plunge of about 15 degrees to the northwest, indicated by dragfolds in the mine crosscuts. Dragfolds and cleavage-bedding relations in exposures about 1,000 feet north of the mine indicate a northwest plunge, whereas for half a mile farther northwest the plunge is consistently to the southeast. In other words, there is a reversal of plunge not far north of the mine.

The paper slates in the crosscuts west of the anticlinal nose are different from the limy slates poorly exposed on the surface to the east, but several southwest dipping faults, which are seen in the crosscuts, may have brought different horizons of the slates close to the limestone. There is some evidence that these faults are of normal displacement, which is surprising in view of the fact that the major thrust bordering the Horsethief Creek quartzites and schists lies less than half a mile west of the mine. The structural setting is complex, and probably there has been more than one period of deformation.

Replacement by barite, accompanied by varying amounts of silica, has occurred in limestone at the anticlinal nose and at intervals along the lime-slate contact to the summit of the mountain, more than a mile to the southeast and to an elevation of about 5,000 feet. Some masses of barite are seen elsewhere in the limestone. Fine-grained galena with less sphalerite and small amounts of copper minerals occur in the barite masses, associated in the mine to a considerable extent with silica within the barite. Apart from the mine itself, mineralization is scattered, and its presence, together with the barite replacement in which it almost universally occurs, may be in the uneroded roots of a former major ore zone which followed the anticlinal nose and which, together with the nose, has been removed by erosion. The structural rake is steeper than the line of showings on the hillside.

Replacement of limestone by barite took place in the nose and along both limbs of the fold. There was considerable shattering of the rock, shown by inclusions and ribs of slate, more or less transformed to dark silica within the barite zone. Some galena and sphalerite occur within relatively pure barite, but much, possibly as much as 75 per cent., is associated with silica. In fact, the rimming of silicified inclusions by ore minerals is quite marked locally, and as a rule clots or masses of silica within the barite are mineralized. No quantitative estimate was made of the amount of silica in the ore, but it was found that close examination of specimens usually showed the presence of some silica. There is a tendency for the barite zone to be surrounded by an envelope of silicification.

The accompanying map shows the distribution of mineral as known in the open-cut area of initial discovery and on No. 6 level. A small part of the surface detail is projected up from Nos. 1 and 2 levels. The outline of the fold, and the distribution of barite and of ore within it, varies with each level. Geological mapping is based on the writer's observations, although, in drawing extensions of some contacts, Siscoe's diamond-drilling data were used.

The mine workings include two large open-cuts, from which ore was mined in the past, and six levels. Nos. 1 and 2 levels, at almost equal elevation, do not serve to outline the ore zone. No. 3 adit level reaches the orebody by a crosscut 220 feet long, No. 5 by a crosscut 600 feet long, and No. 6 by a crosscut 1,000 feet long. No. 4 is a short intermediate level driven from a raise between Nos. 3 and 5 levels. These workings, supplemented by diamond drilling, outline the apical zone and the steep footwall (northern) barite zone. The flatter, hangingwall barite zone is not fully outlined. No stoping has been done.

Ore occurs principally in the anticlinal nose and along the steep northern limb to a maximum length of about 200 feet and a maximum width of 40 feet. Individual cross-sections vary widely. Fine-grained galena, with a variable but rather low silver content, is the predominant ore mineral; sphalerite and pyrite are erratically distributed. Small amounts of chalcopyrite and bornite and, locally, of a grey copper-arsenic mineral occur. The galena is fine to moderately fine grained and occurs as streaks and clusters of grains. It is rare that a sample across more than a foot can be chosen that will assay more than 25 per cent. lead, and the better-mineralized material will not, as a rule, assay more than about twice the average grade.

Six samples were taken by the writer. These were channelled across average or selected mineralization to indicate possible variation in metal relationships. They illustrate the wide ranges in metal content obtainable, also the fact that silver content is not predictable. The copper is contained, at least in part, in a grey arsenical mineral.

	Width.	Gold.	Silver.	Lead.	Zinc.	Copper.	Remarks.
	Feet.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	
No. 3	5	Trace	0.6	0.6	6.3	Trace	Patchy sphalerite.
No. 3	5	0.01	2.4	9.1	Trace	Trace	Better than average galena.
No. 5	3	0.02	0.3	48.3	*Nil*	Trace	Abundant galena.
No. 5	3	0.01	4.9	0.5	40.0	Trace	Abundant sphalerite.
No. 6	5	Trace	19.7	8.5	Trace	0.2	Average ore, little copper staining.
No. 6	3	Trace	1.3	0.7	Trace	0.9	Abundant copper staining.

Siscoe Gold Mines, Limited, did some 900 feet of drifting and crosscutting and drilled 7,400 feet of holes to a vertical depth of 200 feet below No. 6 level. About 1,300 samples were taken, and assayed for lead only. Initial assaying was low because of interference of barium in the ordinary assay procedure, so 800 samples were reassayed and some others recalculated. According to the tonnage calculation by Siscoe, embodied in engineering records left at the mine, reasonably assured ore, after 10 per cent. dilution, amounted to 154,330 tons, with an average grade of 7.13 per cent. lead. This ore, calculated in blocks, extends from the surface to about 50 feet below No. 6 level, a vertical range of about 600 feet.

The ore zone has been developed within the limits set out above. Additional drifting on both limbs of the fold should be done before it can be said no ore exists farther from the nose. Downward continuation beyond 50 feet below No. 6 level is neither proved nor disproved. Although mineralized intersections were encountered to depths of more than 200 feet, no ore was positively blocked out because the ore zone rakes at such an angle that it presents a difficult target at such depths. The chances of finding a repetition of favourable conditions in some other, perhaps similar, structure are hard to evaluate owing to the lack of outcrops and the evidence of complex structure which, poorly understood as it is, cannot be projected with any certainty.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1923, p. 195; 1927, p. 261; 1930, p. 232. *Geol. Surv., Canada,* Sum. Rept., 1932, Part A II, pp. 173–175. Dept. of Mines, Canada, Investigations in ore dressing and metallurgy, 1929, Rept. No. 342.]

McMURDO (51° 117° S.E.).*

Silver-Lead-Zinc.

Crown Point (Beverly Mines, Limited).

This property of thirteen claims is owned by Beverly Mines, Limited. Head office, 703 Rogers Building, Vancouver; mine office, Golden. Wilson Mellen, Montreal, president; E. A. Boyle, Vancouver, secretary. The property is at the head of McMurdo Creek, a branch of Spillimacheen River, and is reached by 40 miles of road from Parson. The road is in good condition as far as a logging camp at the mouth of McMurdo Creek, but the 8 miles up McMurdo Creek is fit for four-wheel-drive vehicles only.

The property was the subject of a lengthy report in the Annual Report of the Minister of Mines, 1936 (p. E 26 and pp. E 33–E 37), which should be consulted. The present report is a summary and includes data resulting from more recent work.

A detailed geological examination was carried out by the company in 1947 and 1948, and in the latter part of 1948 diamond drilling was done from the Intermediate A adit to find and block out ore. A small amount of surface work and sampling were done on other parts of the property. In 1949 Intermediate A adit was advanced, and further diamond drilling was done.

The camp, of two old and one new log building, is on a flat at an elevation of 5,835 feet (company data). From it a precipitous and narrow road leads southeast about three-quarters of a mile to the A workings, elevation 6,790 feet. A series of veins known as the gold showings is about half a mile farther southeast, at an elevation of about 7,500 feet. The C showings are on another branch of McMurdo Creek about half a mile southwest of the camp and 300 feet higher.

The country is precipitous, and above the floor of the main valley timber is scanty. The creek heads in glaciers, above which rise peaks to heights of more than 8,000 feet.

The rocks consist of schists, quartzites, grits, and small amounts of limestone. They are folded into a broad anticline with, apart from local anomalies, moderate to gently dipping limbs. The crest of this anticline, one of a series of open rolls, can be seen several miles to the northwest and also to the southeast, across Bobbie Burns basin. The dominant cleavage is nearly vertical, axial to the anticline.

The most important are the A showings, which are in limestone on the southwest limb of the main anticline. The limestone and enclosing slate are dragfolded, crumpled, and faulted in a manner the details of which cannot be worked out from surface or underground workings alone. Mapping by the company geologist, D. Hope-Simpson, based on direct observation and interpretation of diamond-drill cores, shows that about 25 to 40 feet of limestone and limy strata are involved in a series of asymmetrical dragfolds that are cut by faults of relatively small displacement. An ore zone, only the fringes of which are exposed in the adit, consists of stringers, pods and

* By M. S. Hedley.

lenses of galena, and less sphalerite; the sulphides both vein and replace the limestone. The zone, as outlined for a length of 255 feet by diamond drilling, appear to have an average cross-sectional area of about 1,200 square feet in which scattered mineralization occurred. The indicated grade was such that the zone could be mined at peak prices for lead, although a considerable extension would have to be proved to warrant construction of a mill. In 1949 the Intermediate A adit was being driven ahead to the southeast to investigate the possible continuation of this orebody.

The C showings, three-quarters of a mile north of the A, consist of an irregular quartz vein in quartzite and schist. C vein is related to an irregular, sharp crumple. The vein is exposed on the steep slope by stripping for a length of about 75 feet. It is from a few inches to 10 feet wide and contains pods and lenses of galena. At the upper end of the stripping the vein splits, and the branches appear to be very irregular. There are two adits 81 feet apart. The upper was driven 145 feet in a southwesterly direction, with a 55-foot branch to the south, 40 feet from the portal. The vein is followed from the portal to the branch, where it pinches out. The southern branch follows a joint, and the main branch farther in intersects a steep, sparsely mineralized shear that is followed 80 feet to the face. The lower adit is 190 feet long in a west-southwest direction. It crosses a westerly dipping shear 90 feet from the portal.

At the southeast edge of the property, just beneath a small glacier at the Bobbie Burns divide, several quartz veins, known locally as the gold showings, occur in an area about 400 feet square. These veins are on the crest of the anticline and for the most part are axial to it, although some have a northerly or easterly strike. The veins are from a few inches to as much as 10 feet wide and are very sparsely mineralized. They are in quartzite, which is about 100 feet thick, and most of the veins pinch out in the underlying schist. They represent fracture fillings in the shattered, more competent rock in the anticlinal crest. The showings were extensively sampled in 1948, and although a few high-grade gold assays were reported from this and earlier sampling, no further work has been considered.

FIELD (51° 116°).*

Silver-Lead-Zinc.

Monarch and Kicking Horse (Base Metals Mining Corporation, Limited). Head office, Room 413, 62 Richmond Street West, Toronto. E. J. Gleason, mine manager; C. Ney, geologist and mine superintendent. Capital: 3,000,000 shares, no par value. This company operates the Monarch mine on Mount Stephen and the Kicking Horse mine on Mount Field, both 2½ miles east of Field. The diesel power plant and the mill of 300 tons capacity are on the railroad; the camp is near by. The east and west Monarch orebodies are at elevations of 5,120 and 5,320 feet respectively, and are serviced by aerial tram. The head of the tram is 700 feet higher than the railway. The Kicking Horse mine, at an elevation of about 5,000 feet, is reached by trail from the highway. Ore is brought down by a gravity aerial tram and is trucked 2 miles to the mill.

The Monarch was located in 1884 during construction of the Canadian Pacific Railway. The east Monarch ore zone was the first to be recognized, and the west Monarch zone, known originally as the Couverapee, was not discovered until about 1916. The Kicking Horse showings, known originally as the Black Prince, were mentioned briefly in old reports but received little attention until 1925.

The Monarch was the first and also the most spectacular discovery on the newly constructed railway. In 1888 about 600 tons of ore was mined and shipped to a short-lived smelting works at Vancouver, and in 1890 about 1,500 tons was shipped to a newly constructed smelter at Revelstoke. The first shipment to an established smelter

* By M. S. Hedley.

Kicking Horse mine—tram-line and surface plant.

was of 67 tons in 1900. A report by the Gold Commissioner in 1906 mentioned the possibility that a smelter at Golden might be leased and operated on Monarch ore; this is a reference to a small smelting plant about which little is known.

After a small amount of further work the property was bought by the Mount Stephen Mining Syndicate, who did further development work and, in 1912, commenced operation of a 70-ton gravity mill which closed the next year after milling 30,400 tons.

The mine was reopened in 1915 and was operated until the summer of 1916 by Great Western Mines, Limited. They treated 6,780 tons of ore, including some jig tailings from the former operation, and produced almost as much zinc as lead.

About this time the Couverapee, now west Monarch, ore zone was discovered, and several hundred tons of sorted ore was mined, using Monarch workings and facilities. The two properties were amalgamated in 1919. There was further intermittent operation under different management until 1925, when the property, together with the undeveloped Kicking Horse, was acquired by Pacific Mines Development and Petroleum Co., Limited, under the presidency of A. B. Trites.

In the period before 1925, operations were intermittent, and it seems probable from the record that, with the possible exception of some shipments of sorted ore, the work did not pay. Mining was not systematic, the method of handling broken ore was expensive, and it may be presumed that mill recoveries were low. Also, the zinc content was to some extent a detriment, and very little was recovered in the form of zinc concentrates.

Production prior to 1925 amounted to a gross figure of 44,628 tons. Ignoring shipments in 1888 and 1890, for which figures are unreliable, the shipped and milled ore, with gross metal content of ore and concentrate, were as follows: Shipped ore—1,682 tons; silver, 18,986 oz.; lead, 1,899,310 lb. Milled ore—40,846 tons; silver, 26,682 oz.; lead, 5,772,110 lb.; zinc, 682,362 lb. Much zinc, of course, was discarded or lost.

Development on a sound basis continued through 1926 and most of 1927. In 1928 the property was acquired by Goldfield Consolidated Mines, Ltd., through the agency of F. R. Eichelberger. Mining Corporation of Canada acquired an interest, and in February, 1929, Base Metals Mining Corporation, Limited, was formed to operate the property with F. R. Eichelberger as manager. Control of the company was held by Goldfield Consolidated Mines, Ltd.

Base Metals Mining Corporation has continued to operate the property since 1929, with only one year, 1932, in which all work was suspended. There was no production in 1931 and 1932 and from 1936 to 1939.

The present mill was built in 1929 and was brought into production in November of that year. It was closed in 1930 and reopened in 1933. By the end of 1935 ore reserves had been largely depleted, and the mill was closed. Development work was done during the following four years, and milling operations were resumed in 1940.

From 1929 to 1949, inclusive, ore milled amounted to 773,445 tons, with a gross content in concentrates of: Silver, 697,208 oz.; lead, 84,310,170 lb.; zinc, 129,747,211 lb.

Prior to 1925 most of the ore was mined from the east Monarch ore zone, but once proper connections were made with it, attention was naturally focused on the larger and richer west Monarch. Ore was trucked to the mill from the Kicking Horse for the first time in 1941, since which time that mine has produced most of the tonnage, and the ratio of zinc to lead has greatly increased.

Approximately 800,000 tons of ore has been mined during the life of the property. At no time have the reserves apparently amounted to more than 200,000 tons, and for the past five years the end has been continually in sight, yet more ore has continued to be found, and growing knowledge of the deposit tends to strengthen the belief that other orebodies will be found in what is an alteration zone of major proportion.

The ore deposits occur in Middle Cambrian dolomitic limestones of the Cathedral formation. They are at or near the base of a prominent dolomitic alteration zone, which is partly brecciated and is at the top of a band of dark-grey to black dolomitic limestone. The ore is further localized in part by fracturing, but many ore margins have no visible localizing factor.

The alteration zone, in which bedding is obliterated, is of major size, being 4,000 to 4,500 feet long, as measured on the mountain faces, and up to 400 feet thick. Brecciation throughout the lower part is said to be related to minor structures in the underlying thin-bedded rock. The orebodies occur in the breccia, but the reasons for their exact position are in doubt. Wrinkles or open folds in the underlying rock may have had a localizing effect, but the recognition of such folds is complicated by the fact that the lower surface of the alteration-breccia is not a bedding surface and the breccia in places penetrates the black dolomitic limestone. In fact, some of the recently discovered ore in the east Monarch ore zone lies within the black dolomitic limestone.

The alteration-breccia zone may be related to fault movements in the region, but the writer believes it more probable that it was related to dragfolds, shattered and now obliterated, on the eastern flank of a broad anticline.

The west Monarch orebody, from which about 300,000 tons was mined, was 1,760 feet long from the face of the cliff to a point where it pinched out. It was 158 feet wide at the cliff, tapering to the south, and was 8 to 55 feet thick, averaging 19 feet. This orebody rises at an angle of 8 degrees in a direction south 15 degrees east.

The original east Monarch orebody lies about 650 feet east of the west Monarch, is parallel, and is similar in general character. As first mined, it consisted of two closely spaced orebodies in a length of about 700 feet from the cliff, but later development, still in progress, has indicated further bodies in a total explored length of 2,300 feet. These lie to the south and east, suggesting an en echelon development, and this pattern suggests possibilities for further development. The east Monarch zone has produced more than 200,000 tons.

The Kicking Horse orebodies appear to line up with those of the Monarch across a gap of 3,800 feet between the cliff faces of Mount Stephen and Mount Field. Because of this fact and because they occur in essentially the same structural position, it is probable that they are parts of a major ore zone that has been eroded by the Kicking Horse Valley.

The No. 1 Kicking Horse orebody or zone is 580 feet long in a direction north 30 degrees west and is flat. In its southern part it averaged 40 feet wide and 15 feet thick. The No. 2 or western zone is 1,400 feet long, trending north 40 degrees west for 700 feet then north 57 degrees west. It is irregular in outline. Additional ore has been found recently, and it is probable that future exploration will greatly alter the present concept of ore distribution.

Grade is variable within all the orebodies. Lead is more localized than zinc, and the end limits of orebodies tend to be more zincy than the average. The Monarch mine has contained a higher percentage of lead than the Kicking Horse. The richest orebody was the west Monarch, from which 226,500 tons of the ore mined averaged 1.7 ounces of silver per ton, 10.5 per cent. lead, and 12.5 per cent. zinc. The No. 1 Kicking Horse averaged about 13 per cent. zinc and little lead. The silver content is variable and does not follow the lead assay, although it is associated with lead rather than with zinc.

Mining is by benching in open stopes and scraping to draw points. Once an orebody is reasonably well outlined, a haulage drift can be driven beneath it, but the flatness of the orebodies and their relative position prevents systematic development. Diamond drilling is a necessity in exploration and as a guide to mining because the factors localizing ore are seldom recognizable or can be predicted within narrow limits.

In 1949 the Monarch operated on a one-shift basis, and two shifts were maintained at the Kicking Horse. Most of the lead came from the Monarch. The average number of men employed was eighty-five.

Production: Ore milled, 49,619 tons. Gross contents in concentrates: Silver, 23,688 oz.; lead, 4,892,561 lb.; zinc, 5,279,548 lb.; cadmium, 12,337 lb.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1915, pp. 80–82; 1925, p. 80; 1928, p. 274; 1929, pp. 285–290; 1935, pp. E 13–E 19; 1938, pp. 27, 28. *Geol. Surv., Canada*, Mem. 55, 1914. *Ec. Geol.*, Vol. 32, 1937, pp. 471–493. *C.I.M.*, 1948, Structural geology of Canadian ore deposits, pp. 231–237.]

KINBASKET LAKE (51° 118° N.E.).*

Silver-Lead.

Kootenay Exploration, Limited. Company office, 560 Baker Street, Nelson. W. S. Hamilton, president. Capital: 200,000 shares, 50 cents par value. This company was formed in 1948 to develop a group of ten claims on the southwest end of Kinbasket Lake. Two of the claims are the Crown-granted Mogul and Timbasket claims. Work in 1949 was restricted to assessment work consisting of surface stripping. This work, done late in the year, is reported to have opened up an interesting replacement of lead-silver mineralization in limestone formation.

REVELSTOKE.*

Zinc.

Mastodon. (51° 118° S.E.) This property, on the divide between the south fork of Carnes Creek and La Forme Creek, is reached by 1 mile of road and 6 miles of trail from a point on the Big Bend Highway 17 miles north of Revelstoke. It has been idle for many years but was acquired in 1948 by D. F. Kidd and associates.

* By J. W. Peck.

Most of the development work was done between 1916 and 1918. It consisted chiefly of a 37-degree inclined shaft 110 feet deep and about 90 feet of drifting and crosscutting at the 90-foot level. In 1949 the No. 2 crosscut adit was started 460 feet northwest and 200 feet below the mouth of the inclined shaft and driven 530 feet nearly due east. At 470 feet from the portal the 201 drift was driven southeast for 210 feet, and from the end of this drift the 203 crosscut was driven east for 170 feet. About half-way along the 201 drift the 202 crosscut and the 201 crosscut were driven respectively 25 feet to the northeast and 45 feet to the southwest. From the 201 crosscut a 48-degree raise was put up to the southwest to connect with the bottom level of the inclined surface shaft.

This development, done in 1949, was to investigate at depth showings exposed in the inclined shaft. The country rock is dolomite, dipping to the east. Bands of sphalerite lie with the bedding and appear to be best where the bedding flattens. In the last 115 feet of the 201 drift 18 inches of sphalerite is exposed, and in the 203 crosscut bands of 18 inches and 3 inches are exposed at 10 feet and 50 feet respectively from the 201 drift. The management reports that good ore was found in the upper part of the raise, but in the lower part the structure pinches as the bedding steepens. It is reported that there is another band of sphalerite exposed in a drift started near the face of the main adit crosscut.

On the surface a new bunk-house and a compressor building were erected. The old log cook-house was also rehabilitated. All equipment had to be freighted in by horses; over 100 tons was delivered to the property before the snow melted in May. From January 17th to November 15th the total underground development consisted of 1,060 feet of drifting and crosscutting and 260 feet of raising. In addition, 1.5 miles of road was built and a programme of surface trenching and geological mapping was carried out. Ten men were employed under the direction of E. Larson.

Silver-Lead-Zinc.

Regal Silver (Stannite Mines, Limited). (51° 117° S.W.) Company office, 744 Hastings Street West, Vancouver; mine office, Albert Canyon. A. S. MacCulloch, vice-president and manager. Capital: 3,000,000 shares, no par value. This is a new company formed to take over the Regal Silver and Snowflake properties, which are on Clabon Creek, 7½ miles by road from Silver Creek Siding, a freight stop on the Canadian Pacific Railway 19 miles east of Revelstoke. These properties have been idle since 1941, when some work was done at the Regal Silver in an unsuccessful attempt to obtain tungsten from the ore.

The Regal Silver mine has about 10,000 feet of underground development and is serviced by adits on the 10, 9, 8, 5, and 3 levels. The lower three of these levels are connected by raises. The veins are a quartz-sulphide type in slate with a dip that flattens from 55 degrees in the upper workings to 34 degrees in the lower workings. The Snowflake mine lies above the Regal Silver mine on the same vein system and is developed by about 2,000 feet of underground work in three levels.

In 1949 the camp, which had suffered from snowslides, was rehabilitated and two new buildings were erected. Underground a raise was started to connect 8 level to 5 level and some drifting was done on 5 level. No work was done on the Snowflake, but the company hopes to eventually connect by a raise, which would be over 400 feet in length, the 5 level of the Regal Silver to the lowest level of the Snowflake. Seventeen men were employed when the property was visited September 26th.

[References: B.C. Dept. of Mines, Bull. 10 (1943). *Minister of Mines, B.C.*, Ann. Rept., 1929, p. 330.]

SKAGIT RIVER (49° 121° S.E.).*

Copper.

A.M. (Canam Mining Corporation, Ltd.). Company office, 571 Howe Street, Vancouver. J. W. Heffernan, president. The company owns or controls the A.M. group of eight Crown-granted claims and sixteen located claims usually referred to as the Invermay group. The A.M. group is in a basin at the head of a northward-flowing tributary which joins the Skagit River near Mile 30 on the Hope–Princeton Highway. The Invermay claims are in an adjoining basin to the west, at the head of Silver Daisy Creek. The showings on the A.M. group are described briefly, and those on the Invermay in more detail in the Annual Report of the Minister of Mines, 1938 (pp. F 10, F 11, and F 23–F 26 respectively). The general geology of the region is mentioned in that publication and elsewhere.† The present report deals with the A.M. only. It is based on a nine-day visit to the property in August, 1949, when the surface was mapped by plane-table, and the workings were mapped and sampled.

Between the years 1930, when the showings on the A.M. were discovered, and 1938 development work by The Consolidated Mining and Smelting Company of Canada, Limited, included some open-cuts and six adits aggregating 2,700 feet in length. Excepting two surface diamond-drill holes totalling 970 feet, drilled by the present owners in 1947, no further development work has been done on the A.M. group. Operations during the summer of 1949 included rehabilitation of camp accommodation for a small crew, installation of a small semi-portable diesel-driven compressor and ventilating fan near the portal of No. 6 adit, and the construction of a road from a point near Mile 30 on the Hope–Princeton Highway to the A.M. workings. This road is about 7 miles long, and in places the grade is too steep for any vehicle but a tractor.

Figure 26 is a map of part of the west side of the basin covered by claims of the A.M. group. From the floor of this basin, at about 5,200 feet elevation, the surface rises steeply westward in a series of small, isolated rock bluffs and intervening broad talus slopes to the sharp crest of a ridge at 6,600 feet elevation.

The principal rocks are thin-bedded sediments of the Dewdney series.‡ These rocks are thought to be tuffaceous. They include light-coloured beds containing much feldspar and darker and more argillaceous beds. Most of the rocks are fine grained, but occasional beds are composed of pea-sized fragments. However, no stratum was found sufficiently distinctive or continuous to serve as a horizon marker.

A peculiar medium-grained rock resembling diorite was found in one small isolated outcrop, and similar rock was noted in No. 5 adit. Microscopic examination suggests this rock represents thoroughly recrystallized feldspathic beds rather than igneous bodies. Plagioclase of intermediate composition is the most abundant constituent. It is clouded with minute inclusions of feldspathic material, and the grains have highly irregular and somewhat indefinite borders; these features are characteristic of feldspar that replaces earlier mineral grains. The feldspar is in part replaced by quartz and carbonate. Clusters of bluish tourmaline crystals are scattered at random throughout the rock.

Tabular sill-like bodies of metamorphosed ultrabasic rock are numerous in the area mapped. On the southeast side of the basin, similar rock forms conspicuous sills as much as 100 feet thick in the evenly bedded sediments. The rock is medium to coarse grained, except near its contacts, where it becomes fine grained. It has a mottled appearance due to dark-green crystals of hornblende and lighter-green crystals. Under the microscope these "crystals" are seen to be aggregates with prismatic outlines,

* By W. H. White.

† *Cairnes, C. E.: Geological explorations in Yale and Similkameen mining divisions, southwestern British Columbia, Geol. Surv., Canada,* Sum. Rept., 1922, Pt. A, pp. 88–126.

‡ *Geol. Surv., Canada,* Sum. Rept., 1922, Pt. A, p. 97.

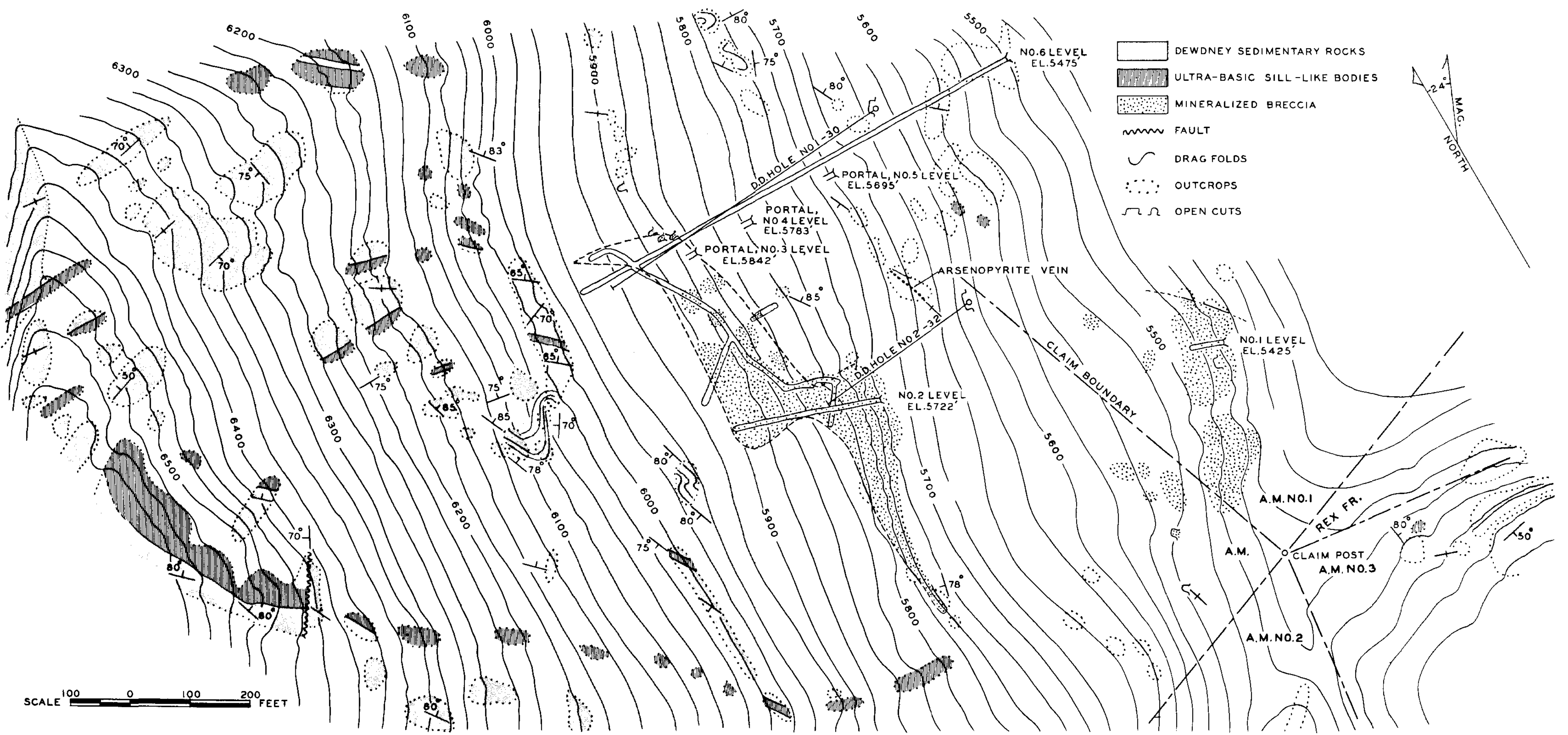


FIG.26. PART OF A.M. GROUP, SKAGIT RIVER

thought to be pseudomorphic after pyroxene; they consist of masses of minute needles of antigorite in an isotropic matrix. The hornblende prisms are splintered and are partly replaced by antigorite. A little carbonate is present and occasional grains of pyrrhotite can be found, but feldspar and sericite were not seen. They might be correlated with other ultra-basics not far away.

Southeast of the A.M. group the strata strike regularly north 15 degrees west and dip at moderate angles to the northeast. In sharp contrast, the structure in the area shown in Figure 26 is complicated by close folding and probably faulting. Large well-developed dragfolds, with axes plunging steeply northwestward, are indicated at three places in Figure 26. The diverse attitudes of bedding in other isolated outcrops suggest the presence of additional dragfolds.

The principal mineral deposits of the A.M. property are two large masses of mineralized breccia, composed of angular unsized fragments of Dewdney series rocks apparently cemented entirely by introduced minerals. Being relatively resistant to weathering, the breccia forms bluffy outcrops, which are brick red in colour and appear to outline fairly closely the limits of the breccia masses. The probable extent and peculiar shape of the more westerly breccia zone are indicated on Figure 26. Where observed at a few points on the surface and underground, the contacts of the breccia body are conformable with the bedding of the adjacent strata, and the shape of the body as a whole simulates that of the large dragfolds exposed a short distance to the west. An origin related to folding of the strata can be postulated for this breccia body. Exposures in bluffs about 500 feet to the east near the floor of the basin are thought to indicate a separate breccia body, of which the extent and shape are not delimited. No. 1 adit is driven in this body.

The mineral of economic interest, chalcopyrite, occurs in the matrix of the breccia. The matrix is made up of calcite, chlorite, quartz, tourmaline, pyrrhotite, chalcopyrite, and pyrite. Under the microscope it is apparent that these minerals partly replace the feldspathic rock fragments of the breccia, and that the fragments have been recrystallized along their borders. Notable quantities of tourmaline crystals are disseminated throughout both matrix and fragments. Pyrrhotite is irregularly replaced by the gangue minerals and by chalcopyrite.

A different type of deposit was seen in one outcrop 200 feet south of the portal of No. 5 adit. This is a vertical stringer lode about 12 inches wide, striking north 20 degrees west. It is composed of stringers of quartz and calcite with masses of black tourmaline and some arsenopyrite. The same or a similar lode crosses No. 5 adit about 40 feet west of the portal. A specimen composed largely of arsenopyrite, selected from the lode in No. 5 adit in 1938, assayed: Gold, 1.86 oz. per ton; silver, 12.3 oz. per ton; copper, *nil*.* Other such deposits have been reported elsewhere on the property.

Figure 26 shows the surface cuts, the two surface diamond-drill holes, Adit No. 2, Adit No. 6, and the portals of Adits 3, 4, and 5. Adits 3, 4, and 5 consist of straight crosscuts driven to and through the more westerly breccia body. As they lie almost directly above No. 6 level, they are omitted from the plan to avoid confusion. Adits numbered 6, 5, 4, and 3, at elevations 5,475, 5,695, 5,783, and 5,842 respectively, all driven westerly in almost the same vertical plane, explore the more westerly breccia body through a vertical range of 367 feet. A vertical cross-section in the plane of these workings shows the breccia body dipping about 75 degrees to the west and maintaining a width of about 85 feet. However, the position of the intersection of the breccia in No. 1 diamond-drill hole, at a point 95 feet lower than No. 6 adit, indicates that below this working the dip changes to the east. The vertical range from the outcrop of the breccia body to the intersection in No. 1 drill-hole is 525 feet.

No. 2 adit, elevation 5,722 feet, was driven in the bend in the breccia body shown on the figure. The first 125 feet is in breccia, the next 75 feet in altered, somewhat

* *Minister of Mines, B.C.*, Ann. Rept., 1948, p. 10.

crumpled, thin-bedded strata striking westerly, and the last 50 feet again breccia. No. 2 diamond-drill hole cut about 90 feet of breccia 250 feet below the No. 2 adit. The east side of the breccia body at this place appears to be vertical.

No. 6 adit is the only working that explores the breccia body laterally. It starts as a crosscut driven due west for 730 feet, at which point it reaches the east contact of the breccia body. The adit continues 105 feet farther westward; this working, known as No. 1 crosscut, is in breccia for its entire length. A drift follows the east contact of the breccia 45 feet north-northwesterly, then swings due west, still on the breccia contact, continuing 40 feet to the face. The suggestion was made in an earlier paragraph that the breccia appears to be conformable with the bedding of the enclosing strata. This is shown clearly in this working, where the bedding of the strata turns sharply westward, following the breccia contact. From the main crosscut another drift follows the east side of the breccia body 415 feet southeastward. The contact undulates somewhat, the average strike being north 30 degrees west. At 200 feet from the main crosscut, No. 2 crosscut extends 130 feet southwesterly. The working is in breccia, but bedded strata appear in the face. At 410 feet from the main crosscut, No. 3 crosscut extends 80 feet southwesterly, being in breccia to the face. These workings explore the breccia body for 480 feet along its strike. The body may continue to the southeast beyond the workings, but to the northwest it curves westward and in all probability pinches out in a short distance, as suggested in Figure 26. The underground workings, driven by hand, are narrow and low. They would need to be enlarged before they could be used for mining purposes.

No. 1 adit, elevation 5,425 feet, is the only working in the other breccia body south of the portal of No. 6 adit. The working extends 70 feet westerly in crushed breccia.

Innumerable faults, which are not apparent on the surface, are exposed in all the underground workings in both wallrocks and breccia bodies. A particularly persistent fault zone follows the east side of the breccia body in No. 6 adit. The faults strike northeasterly, northerly, and northwesterly and have widely variable dips. All appear to be post-mineralization in age. Although many of the faults have conspicuous gougy zones, movement along them appears to have been slight. The faults have been responsible for very poor core recoveries in diamond drilling. They might have to be considered in any large-scale mining operations.

The following table gives the assays of forty-seven channel samples taken in the workings. Samples were cut in the three crosscuts in No. 6 adit, in No. 5, No. 4, and No. 1 adits. The breccia body was severely oxidized and therefore not sampled in No. 3 adit. No. 2 adit was not sampled because it does not provide a representative cross-section. Since no abrupt changes in mineralogy or in structure occur in any section of the mineralized bodies, the channels were cut in 10-foot sections along the northern wall of each working. The total weight of the forty-seven samples was 440 pounds.

The workings were examined with a Geiger counter, and the forty-seven samples were tested with a sensitive laboratory counter. The radioactivity of twenty-two of the samples was found to be equivalent* to between 0.011 and 0.040 per cent. U_3O_8; the U_3O_8 equivalents for the remaining samples ranged from a few thousandths of 1 per cent. to less than a hundredth of 1 per cent. U_3O_8.

* Radioactivity measured with the laboratory Geiger-Mueller counter is expressed as the percentages of uranium oxide (U_3O_8) that would give a radiation count equivalent to that obtained in testing the sample.

Location.	Width.	Gold.	Silver.	Copper.	Uranium Oxide Equivalent.*
No. 6 Adit, No. 1 Crosscut.‡					
Main crosscut plus—	Feet.	Oz. per Ton.	Oz. per Ton.	Per Cent.†	Per Cent.
0– 10 ft. west	10	0.02	0.5	1.0	0.012
10– 20 ft. west	10	*Nil*	0.1	0.7	0.015
20– 30 ft. west	10	0.01	0.2	0.5	0.017
30– 40 ft. west	10	0.01	Trace	0.6	0.011
40– 50 ft. west	10	0.02	*Nil*	0.6	0.025
50– 60 ft. west	10	*Nil*	0.2	0.7	0.030
60– 70 ft. west	10	0.01	0.2	1.0	0.040
70– 80 ft. west	10	0.04	0.3	0.8	0.025
80– 90 ft. west	10	0.02	0.7	1.6	0.025
No. 6 Adit, No. 2 Crosscut.					
Main drift plus—					
0– 10 ft. west	10	0.05	0.7	1.6	0.018
10– 20 ft. west	10	Trace	0.3	0.3	0.003
20– 30 ft. west	10	*Nil*	0.1	Trace	0.001
30– 40 ft. west	10	*Nil*	0.1	Trace	0.002
40– 50 ft. west	10	*Nil*	0.1	Trace	0.0025
50– 60 ft. west	10	*Nil*	0.2	Trace	0.002
60– 70 ft. west	10	Trace	*Nil*	Trace	0.0015
70– 80 ft. west	10	Trace	0.4	0.3	0.002
80– 90 ft. west	10	*Nil*	*Nil*	Trace	0.0015
90–100 ft. west	10	*Nil*	*Nil*	Trace	0.0015
100–110 ft. west	10	Trace	Trace	Trace	0.0015
110–120 ft. west	10	*Nil*	*Nil*	Trace	0.0015
120–130 ft. west (face)	10	*Nil*	0.1	Trace	0.002
No. 6 Adit, No. 3 Crosscut.					
Main drift plus—					
0– 10 ft. west	10	0.02	0.9	0.8	0.0055
10– 20 ft. west	10	Trace	0.3	0.3	0.003
20– 30 ft. west	10	0.01	0.4	0.3	0.001
30– 40 ft. west	10	0.02	0.2	0.4	0.001
40– 50 ft. west	10	0.01	0.9	1.2	0.001
50– 60 ft. west	10	0.01	0.2	0.4	0.002
60– 70 ft. west	10	Trace	0.3	Trace	0.0015
70– 80 ft. west (face)	10	*Nil*	*Nil*	Trace	0.0015
No. 5 Adit.					
Portal plus—					
355–365 ft. west	10	0.01	0.5	1.3	0.014
365–375 ft. west	10	0.02	0.5	1.2	0.030
375–385 ft. west	10	Trace	0.5	2.0	0.015
385–395 ft. west	10	Trace	1.3	1.8	0.016
395–405 ft. west	10	Trace	0.6	1.3	0.0095
405–415 ft. west	10	Trace	0.7	1.4	0.014
415–425 ft. west	10	*Nil*	0.6	1.3	0.0065
425–435 ft. west	10	0.01	0.4	0.8	0.006
No. 4 Adit.					
Portal plus—					
150–160 ft. west	10	0.01	0.6	1.8	0.025
160–170 ft. west	10	0.01	0.6	1.8	0.024
170–180 ft. west	10	Trace	1.3	1.8	0.019
180–190 ft. west	10	0.30	1.1	1.3	0.023
190–200 ft. west	10	0.01	0.9	0.8	0.011
200–210 ft. west	10	*Nil*	0.3	0.7	0.017
210–220 ft. west (face)	10	*Nil*	1.6	1.5	0.018
No. 1 Adit.					
Portal plus—					
40– 50 ft. west	10	*Nil*	0.5	0.7	0.0015
50– 60 ft. west	10	Trace	0.2	Trace	0.001

* *See* foot-note on page 212.

† Copper less than 0.3 per cent. is reported as trace.

‡ The last 15 feet of this crosscut is caved.

CHEAM RANGE (49° 121° S.W.).*

Copper.

Lucky Four (Rico Copper Mines, Limited).

The Lucky Four property covers ground near the summit of mountains of the Cheam Range, southerly from Laidlaw, a point on the highway between Chilliwack and Hope. The claims of the original Lucky Four group were recorded in 1915 and later were Crown-granted. Ownership of the old Lucky Four group of six Crown-granted mineral claims is registered in the name of The Royal Trust Company, in trust for the estate of Donald McLeod. Rico Copper Mines, Limited, has an option agreement under which the company may acquire title to the Lucky Four claims. For this option agreement and for claims in two other widely separated localities, Rico Copper Mines, Limited, issued shares under date of March 9th, 1949, to Panameric Mines and Resources, Limited, Grant Mahood, and Cheam Copper Company, Ltd. Rico Copper Mines, Limited, is the registered owner of five Crown-granted claims or fractions adjoining or close to the Lucky Four claims. Rico Copper Mines, Limited, also holds a large number of mineral claims recorded in July, September, and October, 1949, surrounding the Crown-granted claims.

Theodore E. Arnold is the assessed owner of the Pi Fraction (L. 988), the Phee Fraction (L. 1002), and the Merry Widow claim (L. 1094). The Pi and Phee Fractions (*see* Fig. 27) cover a triangular area lying between the Main and the East showings. The Merry Widow claim is southeast of the area covered by Figure 27.

Rico Copper Mines, Limited, a private company, was registered January 18th, 1949, and was converted to a public company October 4th, 1949. The head office of the company is 511 Credit Foncier Building, Vancouver. William J. Asselstine, of Vancouver, is president, and Grant Mahood, of White Rock, B.C., is a director. The authorized capital is 3,000,000 shares without nominal or par value; 1,264,800 shares have been issued for the acquisition of mineral claims or of options on mineral claims.

The Lucky Four group is described in the Annual Reports of the Minister of Mines, 1918 (pp. 284–286) and 1919 (p. 234); and also in the Geological Survey, Canada, Summary Report, Part A, 1922, pages 127 to 133. The present report is based on a three-day examination made near the end of August, 1949, during the course of which a plane-table map was made of the area embracing mineralized zones, here referred to as the Main showing and the East showing.

The route to the property begins from the Trans-Canada Highway near Laidlaw. A logging-road is followed 8 miles southerly to Jones (Wahleach) Lake, and from the end of the most easterly branch of this road a circuitous trail 7 miles long leads to a camp-site at treeline, elevation about 5,300 feet. The Main showing is on the crest of the range at elevation 6,200 feet, about a mile southwesterly from the camp-site. The northern side of the Cheam Range is steep, rough, and in many places precipitous; but to the south the surface slopes more gently and evenly toward the Chilliwack River valley. Snowfields and a few small glaciers persist near the crest of the range, particularly on the northern side. Comparison of the 1949 position of the snowfield, which partly conceals the Main showing, with the position shown in a Geological Survey photograph taken in 1921 shows that the snowline has receded only a few feet in the intervening twenty-eight years.

The Main showing on the Lucky Four group was discovered in 1915, and two years later an attempt was made to explore it by diamond drilling through the snowfield. In 1919 an adit about 200 feet long was driven beneath the East showing. The property then remained inactive until acquired recently by Rico Copper Mines, Limited. During the summer of 1949 this company had a small crew engaged in building a road southerly from Jones Lake up a deep, timbered valley. This valley terminates abruptly 3 miles south of Jones Lake, at about 3,400 feet altitude, at the base of impassable

* By W. H. White.

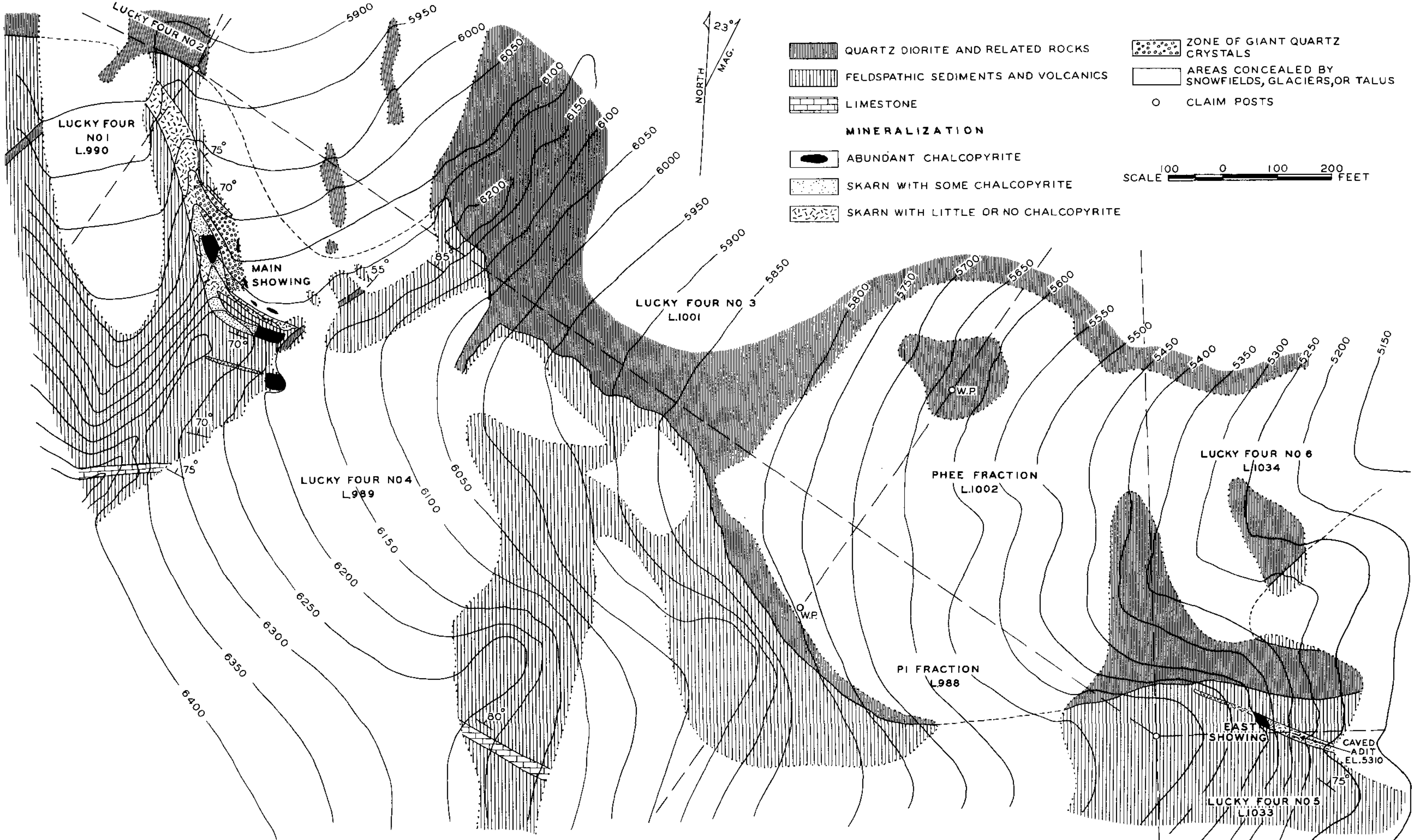


FIG. 27. PART OF LUCKY FOUR GROUP, CHEAM RANGE.

cliffs several hundred feet high. The horizontal distance from the head of this valley to the Main showing is about 1 mile, and the difference in elevation is about 2,800 feet.

The main geologic feature of the property, shown on Figure 27, is an intrusive contact between a large body of granodiorite and a series of sedimentary rocks which are part of the Chilliwack group. This contact is irregular in detail but has a general trend north 70 degrees west. The absence of any marked deflection of the outcrop where it crosses the steep crest of the range near the Main showing indicates that the contact is essentially vertical.

The sedimentary rocks strike northwesterly approximately parallel to the granodiorite contact and dip either vertically or steeply to the northeast. Within a zone about 300 feet wide adjacent to the granodiorite, the sedimentary rocks are closely crumpled, highly metamorphosed, and contain abundant feldspathic material from the intrusive body. The original rocks are now represented by quartz-feldspar-mica schists and gneisses. The mineralized zones are within this zone of altered sediments, the Main showing being about 150 feet from the granodiorite contact and the East showing less than 50 feet from the contact.

The Main showing is a skarn zone that outcrops as a prominent steep bluff on the crest of the mountain and extends northwesterly down a precipitous spur. The skarn zone is a coarsely crystallized mass of brown garnet and contains sheaves of curved, columnar, black crystals believed to be zoisite, dark-green pyroxene, calcite, and clear quartz. Some of the minerals are remarkable for their large size and well-developed crystal form. A zone of giant quartz crystals about 20 feet wide adjoins the main skarn zone on its northeastern side. The massed quartz crystals range from 4 to 14 inches in diameter and up to 40 inches in length. Metallic minerals, which occur interstitially among the non-metallic crystals, include chalcopyrite, pyrrhotite, arsenopyrite, pyrite, and molybdenite. Only the chalcopyrite is of economic interest.

The skarn zone is about 50 feet wide, has an exposed horizontal length of 500 feet and a vertical range of 400 feet. At the crest of the mountain the skarn zone ends abruptly against foliated gneiss and a granitic dyke. Northwestward it disappears beneath a small glacier but does not reappear on the other side of the glacier 200 feet beyond.

As shown on Figure 27, the distribution of copper mineralization within the skarn zone is very erratic. Much of the skarn contains little or no chalcopyrite; some contains the mineral sparsely disseminated; and in marked contrast, several small areas are of almost solid chalcopyrite. The three main bodies of massive copper ore exposed in the Main showing have an aggregate plan area of 2,500 square feet. Two of these exposures are bounded on all sides by barren or slightly mineralized skarn, but one end of the third extends below snow-line. Several other masses of chalcopyrite, each only a few square feet in area, project above the snow-line along the northeastern side of the skarn zone.

The East showing is on the southern slope of the mountain, 2,000 feet southeasterly from and 800 feet lower than the Main showing. In this intervening distance large areas of the entire contact zone are exposed. As no skarn or copper mineralization is visible in these exposures, it is evident that the East showing is a separate deposit rather than an extension of the Main showing. The East showing is a skarn zone 15 feet wide, having an exposed horizontal length of 150 feet. Northwestward it splits into narrow stringers and disappears in the gneissic banding; whereas to the southeast it is drift-covered. One body of massive chalcopyrite, with a plan area of 300 square feet, occurs in this zone. The caved portal of an adit, apparently driven beneath this mass of ore, is 75 feet lower than the outcrop. The adit is said to have been driven 200 feet.* This distance would place the face of the adit more than 50 feet past the farther side of the ore exposed on the surface. Only barren skarn was found on the dump at the portal.

* *Minister of Mines, B.C.,* Ann. Rept., 1919, p. 234.

The skarn zones contain irregularly distributed mineralization, including some high-grade copper ore, and larger areas sparsely mineralized with chalcopyrite. The areas of high-grade ore to be seen in 1949 were, in the Main zone, 2,500 square feet, and, in the East zone, 300 square feet. The vertical extent of these bodies cannot be stated, as the results of diamond drilling in 1918 to test the main zone, and of driving the adit in 1919 below the exposure in the East zone, were not published.* The area underlain by skarn is large, and parts of it may carry enough copper to be of milling grade under favourable circumstances.

A third showing, which was not examined, is some 6,000 feet northwesterly from the Main showing. It appears as a reddish area in a high cirque isolated by precipitous bluffs and glaciers. Some mineralized float, which may have come from this place, has been found below the glaciers, but because of its inaccessible location it is doubtful if the outcrop has ever been examined, except through field glasses. The intervening ground is largely covered by snowfields and talus. It may be that other bodies of copper-bearing ore exist in the intervening ground or elsewhere in the contact zone.

HOWE SOUND (49° 123° N.E.).†

Copper-Zinc.

Britannia Mining and Smelting Co., Limited. Head office, 730 Fifth Avenue, New York, N.Y.; mine office, Britannia Beach. H. H. Sharpe, president; E. C. Roper, manager; T. M. Waterland, mine superintendent. The company owns and operates Britannia mine at Britannia Beach. The following data, supplied by the management, give details of the operations in 1949. The development work totalled 12,826 feet for all sections of the mine and was made up as follows:—

	No. 8 Mine.	Bluff Mine.	E. Bluff Mine.	Fairview Mine.	No. 5 Mine.	Victoria Mine.	Miscellaneous.	Total.
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Drifts	2,087	1,041	......	1,117	......	40	......	4,285
Crosscuts	492	482	......	65	57	8	......	1,104
Raises	1,583	2,726	......	1,938	77	273	......	6,597
Powder-blast workings	....	553	25	262	......	......	......	840
Totals	4,162	4,802	25	3,382	134	321	......	12,826
Diamond Drilling.								
Core drilling	9,203	3,502	......	6,994	......	......	......	19,699
Blast-hole drilling	3,294	21,639	......	837	......	......	60	25,830
Totals	12,497	25,141	......	7,831	......	......	60	45,529

The tons broken in the various sections of the mine by different mining methods were as follows:—

	Shrinkage.	Cut and Fill.	Powder Blast and Cave.	Blast-hole Diamond Drill.	Open Sq. Set.	Sq. Set and Fill.	Total.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
No. 8 mine	73,653	9,960	....	36,159	16,092	6,763	142,627
Bluff mine	139,648	....	177,041	176,459	....	....	493,148
E. Bluff mine	....	....	30,737	....	....	....	30,737
Fairview mine	55,186	....	103,282	6,396	....	....	164,864
No. 5 mine	23,494	....	....	....	705	....	24,199
Victoria mine	....	25,771	....	....	....	15,650	41,421
Totals	291,981	35,731	311,060	219,014	16,797	22,413	896,996
Development	....	....	....	....	....	....	13,948
Total	....	....	....	....	....	....	910,944

* Information from a private source indicates that neither the drill holes nor the adit cut mineralization of consequence.—*Editor.*

† By R. B. King.

The consumption of explosives and blasting accessories for the year is as follows: Powder, 17,888 cases; No. 8 electric blasting-caps, 14,017; No. 6 blasting-caps, 302,834; safety fuse, 2,231,323 feet; and Primacord, 17,265 feet.

An active ventilation programme in charge of a full-time ventilation engineer, has been carried on throughout the year. Aluminium dust has been dispersed regularly in all change-rooms.

The safety engineer now has a full-time assistant to facilitate his work. "Job safety training" along with first-aid training is encouraged to the utmost.

The Management-Labour Accident Prevention Committee has functioned throughout the year. A new slogan originating through this Committee urges that "To-day is the day to work safely."

Two first-aid competitions were held at Britannia during the spring. The annual competition for the Department of Mines cup was held at the Townsite as usual. The winner of this event competed for the Howe Sound Trophy, which was put up by the British Columbia St. John Ambulance Association, at a second competition which was held at the Beach.

The Britannia 1949 safety record shows that compensable injuries occurred at the rate of 0.75 per 1,000 shifts worked, as compared to 0.661 per 1,000 shifts worked in 1948. The severity rate for 1949 was 18.1 per 1,000 shifts, as compared to 22.6 per 1,000 shifts worked in 1948. Four fatalities occurred at the property during the year.

The total number of men on the mine payroll at the year-end was 543, as compared with 543 at the beginning of the year. The total number of shifts worked in the mining department during 1949 was 149,849, as compared with 133,067 during 1948.

Production: Ore milled, 880,580 tons. Gross contents: Gold, 9,966 oz.; silver, 82,920 oz.; copper, 17,938,353 lb.; zinc, 13,315,279 lb.; lead, 482,545 lb.; cadmium, 70,505 lb. In addition, 33,119 tons of pyrite concentrates was produced.

PENDER HARBOUR (49° 123° N.W.).*

Copper.

Caron Mining Co., Ltd. John Cline and associates formed this private company to work the Cambrian Chieftain property, which is 6 miles by road northeast of Pender Harbour. A truck-road was built this year from tidewater to the property. Copper ore is mined in open-cuts, hauled by truck to Pender Harbour, and loaded on scows for shipment to the smelter at Tacoma, Wash.

Production: Ore shipped, 266 tons. Gross contents: Gold, 15 oz.; silver, 2,032 oz.; copper, 74,284 lb.

TEXADA ISLAND (49° 124° N.W.).*

Gold-Copper.

Little Billie Mine (Vananda Mines (1948), Limited). Company office, 640 Pender Street West, Vancouver; mine office, Vananda. A. E. Jukes, president; H. E. Doelle, managing director; F. R. Thompson, mine manager. The Little Billie mine is almost half a mile southeast of Vananda, on the east shore of Texada Island. Milling was stopped in October, 1949. A development programme begun in November included driving westward on the sixth level, and raising and stoping on the fifth level. Underground development for the year totalled 290 feet of drifting on the sixth level, and 318 feet of development raising, of which 33 feet was above the sixth, 79 feet above the fifth, and 33 feet above the fourth level. Stope raising in the various stopes totalled 140 feet. The average number of men employed was fifty.

Production: Ore mined, 24,223 tons; crude ore shipped, 738 tons; ore milled, 23,485 tons. Gross contents: Gold, 3,482 oz.; silver, 10,726 oz.; copper, 498,940 lb.

* By R. B. King.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1944, pp. 66, 163–174; 1948, p. 156.]

POWELL RIVER (49° 124° N.E.).*

Germanium.

Lang Bay. Lang (Wolffsohn) Bay is 14 miles along the coast south of Powell River and can be reached by a good road from that point. The rocks in the vicinity of Lang Bay are undisturbed sediments, which were regarded by O. E. Leroy† as probably of Eocene age. They are well exposed along the banks of Lang Creek within a mile of where it empties into Lang Bay. Up to 35 feet of medium-grained sandstone is exposed, and in places the creek has cut through the sandstone and revealed the underlying shale. This shale is irregularly carbonaceous.

In both the sandstone and the shale, sparse thin streaks and roughly circular patches of coaly matter are found. The largest streak seen was 3 feet long and 3 inches thick, but no patch exceeded 2 feet in diameter.

Samples of this coal were sent to the Department of Mines by Charles Fynney, of Powell River. An analysis showed that the coal is sub-bituminous and, further, that it contains a minor amount of the rare element germanium. One ash sample assayed as high as 1 per cent. germanium.

Because of the germanium content of Fynney's samples, these coal exposures were examined. The examination indicated that the coal occurs only as small patches and streaks. No germanium was detected in samples of sandstone and shale.

NENAHLMAI LAGOON (50° 127° N.E.).‡

Copper-Gold-Silver-Lead.

Dud. This property consists of the Dud No. 1 Mineral Claim, held under option by H. T. Jeffries from Greta B. McCorkell, Vancouver. It lies between Nenahlmai and McKinnon Lagoons, which are southern extensions of Seymour Inlet. Allison Harbour, the nearest port, is 20 miles by water from the camp. The area is one of low relief, and the workings, half a mile from tidewater, are only about 350 feet above sea-level.

This claim was staked in 1939 by R. Dudley Smith, who optioned it to Greta B. McCorkell in the same year. In 1941, 674 tons of ore was shipped to Tacoma, Wash. In 1943 the claim was purchased by Greta B. McCorkell, and in 1947 she optioned it to H. T. Jeffries, who has done work on it intermittently since then.

The workings are on a quartz vein that strikes north 44 degrees east and dips 40 degrees southeastward. By underhand open stoping the vein has been exposed for about 40 feet in depth and 60 feet in length. An inclined shaft is also being sunk on the vein. The maximum width of the vein, as exposed in these workings, is 60 inches.

A new road 4,000 feet long is being constructed from tidewater to the mine workings.

Production: Ore shipped, 6 tons. Gross contents: Gold, 3 oz.; silver, 55 oz.; lead, 973 lb.; and zinc, 516 lb.

VANCOUVER ISLAND.§

ZEBALLOS (50° 126° N.W.).

Gold.

Privateer Mine, Limited.—N. McConnell, Ed Yarrow, and H. Clement leased the Prident section of this property in 1949. Operations were on a limited scale. Fifteen

* By W. R. Bacon.

† Leroy, O. E.: Preliminary report on a portion of the main coast of British Columbia and adjacent islands included in New Westminster and Nanaimo districts, *Geol. Surv., Canada*, pp. 23, 24 (1908).

‡ By R. B. King.

§ By R. B. King, except as noted.

tons of ore was shipped to the smelter at Tacoma, Wash. Gross contents: Gold, 200 oz.; silver, 79 oz.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1947, p. 181; 1948, p. 157.]

MUCHALAT ARM (49° 126° N.E.).*

Zinc.

Danzig. This property, on the south side of King Passage in Muchalat Arm, about 15 miles by boat from Nootka, is owned by Danzig Mines, Inc., 309 Lloyd Building, Seattle, Wash. J. J. Badraun, president. It is reported to consist of eighteen Crown-granted claims that include Lots 1568 to 1584, inclusive, and Lot 1813.

Most of these claims were located between 1933 and 1937, but Lot 1813 was located in 1940.

The camp cabin, trail and road from the beach, and the two adits are shown on the key map in Figure 28. The Baltic adit on the beach is on Lot 1582 (Baltic No. 1 claim) and the Silverado adit on Silverado Creek is on Lot 1579 (U.P. Fraction).

The Baltic adit and several surface workings prospect gold-bearing quartz veins exposed on the steep, wooded slopes immediately above the adit. The workings were examined by Bancroft in 1935 and have been described by him.† No work has been done on these workings since 1938.

The total recorded production, which was in the period 1934 to 1939, amounted to 143 tons, containing 179 ounces of gold and 321 ounces of silver. Mr. Badraun‡ reports that most of this ore came from the Baltic adit.

The Silverado adit, elevation 200 feet, was driven to intersect the downward extension of zinc ore exposed in surface cuts between 340 and 405 feet elevation. The surface cuts were dug and the adit driven as far as the main drift in 1938 by Danzig Mines, Inc. During this time the company hand-sorted several tons of zinc ore from the largest open-cut (Fig. 28) and conveyed it by a short aerial tramway to an ore-bunker about 50 feet down the hill from the adit.

Premier Gold Mines, Limited, held an option on the property between September, 1948, and January, 1949, and during the life of their option drove the main drift in the Silverado adit. No work has been done on the property since January, 1949.

The Silverado adit and workings above it explore a zone of disconnected lenses of sphalerite that have partly replaced a bed of limestone 10 feet thick, strike north 20 to 30 degrees west, dip 75 degrees southwestward, along its southwestern contact with greenstone. The greenstone, a tuff or lava completely recrystallized to a hornblende hornfels, extends an unknown distance southwesterly from the showings. Northeasterly, along the crosscut, the greenstone is succeeded by another band of limestone, strike northwesterly and dip southwestward, that is not less than 80 feet thick. This limestone is cut by a northerly trending feldspar porphyry dyke, dip 70 degrees southwesterly and 15 feet wide.

The zone of sphalerite lenses is traceable on the surface for 370 feet (Fig. 28). As seen on the surface and in the drift, the lenses range in width from a few inches to 7 feet and in length from 25 to 100 feet.

Several diagonal faults cut the ore lenses. A fault at the intersection of the crosscut and the drift displaces the ore lens here, 30 feet to the left. The direction and displacement are unknown along the fault at the north end of the drift and along faults in the most northerly and southerly open-cuts (Fig. 28).

* By J. S. Stevenson.

† Bancroft, M. F.: Gold-bearing deposits on the west coast of Vancouver Island and Esperanza Inlet and Alberni Canal. *Geol. Surv., Canada*, Mem. 204, pp. 18–20 (1937).

‡ Personal communication.

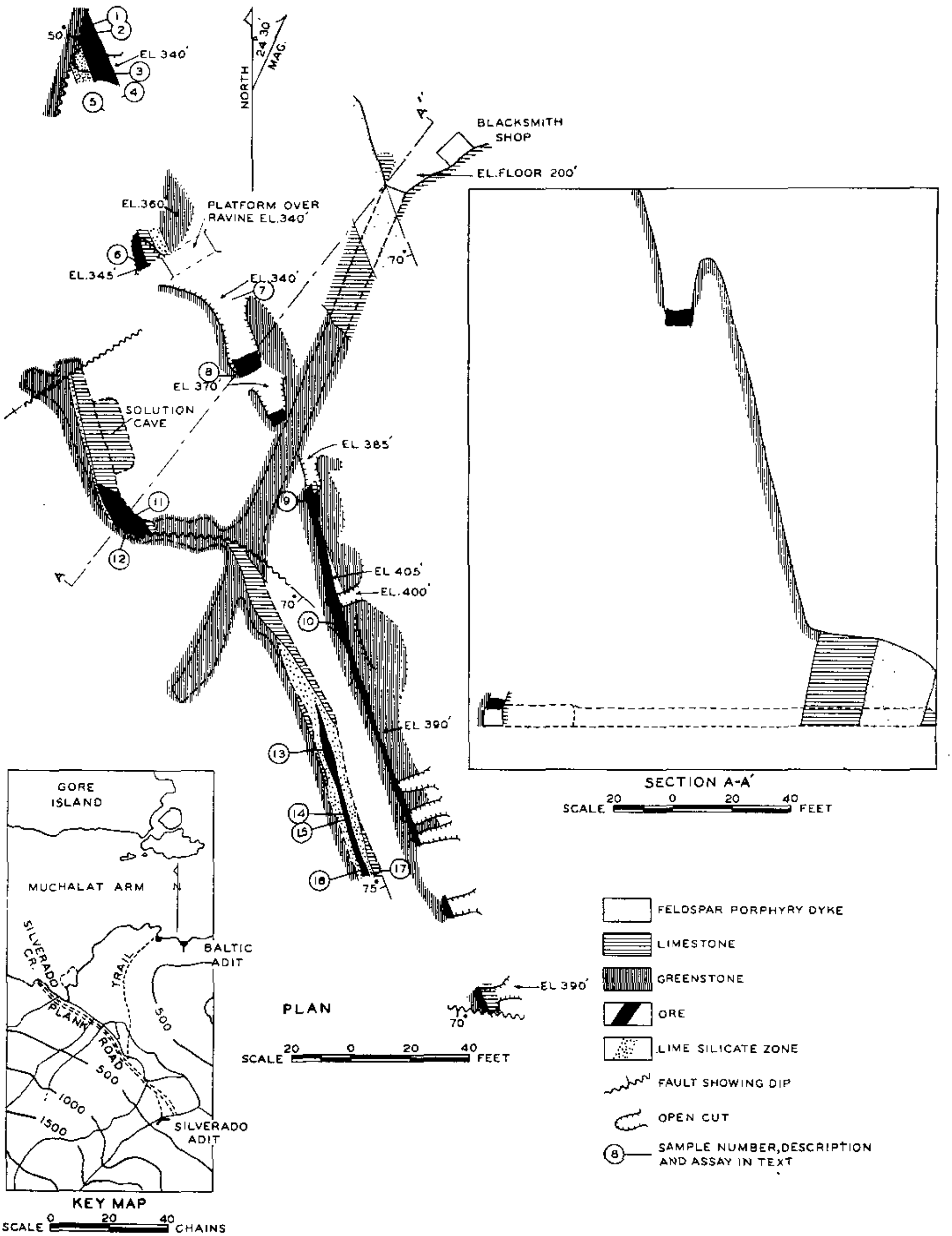


Fig. 28. Danzig—key map and tape and compass survey of workings, showing geology and location of samples.

The ore lenses consist of sphalerite with small amounts of chalcopyrite, pyrrhotite, and magnetite in a gangue that consists principally of quartz, calcite, and light-green diopside. Much of the ore is rhythmically banded and consists of alternating layers of sphalerite and gangue one-sixteenth of an inch to an inch thick.

A zone of lime-silicate minerals up to 4 feet thick occurs on either side of the ore lenses in the south drift and in the north drift extends along the west side of the ore and continues northerly to the face beyond the extent of the ore. The minerals in this zone include quartz, calcite, diopside, tan garnet, cream-coloured zoisite, and, in small amounts, scattered grains of sphalerite.

The writer took several samples across the sulphide lenses. The locations of these samples are given in Figure 28, and the assays in the following table:—

ASSAYS OF SAMPLES TAKEN ON SURFACE AND UNDERGROUND.

Sample No.	Width.	Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Ft. In.		*Oz. per Ton.*	*Oz. per Ton.*	Per Cent.	Per Cent.	Per Cent.
1	2 0	Pocket of decomposed lime-silicate gangue with some sphalerite	0.10	1.5	*	0.32	2.7
2	4 4		Trace	0.5	*	*	30.9
3	7 0	Along south wall of cut, abundant heavy sphalerite	Trace	0.1	*	*	23.8
4	....	Boulders of mixed pyrrhotite and chalcopyrite at mouth of cut	0.01	2.7	5.6	*	*
5	4 0	On surface 8 feet south of south side of cut across the lens of pyrrhotite	*Nil*	0.5	0.91	*	*
6	4 0		Trace	0.3	*	*	25.1
7	....	Representative sample from ore-pile, volume 320 cubic feet at mouth of dump, probably represents shipping ore	0.04	0.1	*	*	21.4
8	4 0	Face of cut, black, pulverulent, lime silicate and some sphalerite, contains 1.3 per cent. Mn	0.01	0.1	*	*	0.75
9	2 0	Face of cut, across ore, abundant sphalerite	0.01	Trace	*	*	55.8
10	1 0	In shallow cut, across mixed chalcopyrite and sphalerite	Trace	6.5	14.1	0.7	25.7
11	0 6	Back and north wall, selected fluorescent material; less than 0.3 per cent. WO_3	†	†	†	†	*
12	4 0	Back, across full width of vein matter	0.04	0.5	*	*	29.4
13	2 0	Back, across full width of vein matter	Trace	0.1	*	*	34.1
14	1 0	Back, across full width of vein matter	0.02	4.3	11.1	*	1.0
15	2 0	Back, across full width of vein matter	*Nil*	0.3	*	*	25.5
16	1 0	In face across full width of vein matter	0.05	0.2	*	*	24.4
17	4 0	In face, across 4 feet of white crystalline limestone in hangingwall of ore; CaO, 50.6 per cent.; MgO, 0.78 per cent.; Fe, 0.6 per cent	†	†	†	†	†

* Indicates less than 0.3 per cent.
† Not determined.

TRANQUIL INLET (49° 125° S.W.).

Gold.

Fandora (Camac Mining Co., Limited). Company office, 602 Stock Exchange Building, Vancouver. By agreement this company has been given control of development of property comprising the Edmar, Gold Flake, Bell, and E.M. group, held by the Tofino Gold Mining Co., Ltd. The property is on the Tranquil River, about 6 miles from the head of Tranquil Inlet. Underground development done on the property up to 1947 consisted of 1,300 feet of drifting and crosscutting on four adit levels at elevations of 1,500, 1,700, 1,900, and 2,100 feet respectively. Surface work by Camac Mining Co., Ltd., was started to trace the vein in an easterly direction and to a lower elevation. An adit at a lower elevation is planned to determine the boundary between the oxidized and unoxidized vein material, and also to provide an adit closer to the proposed camp.

Considerable work was done in 1949 in repairing and rebuilding a road from Tranquil Inlet to the camp-site. Fifteen men were employed.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1946, pp. 186–188.]

JORDAN RIVER (48° 124° S.E.).*

Sunloch and Gabbro. These two adjacent copper properties at Jordan River were optioned in 1949 by Hedley Mascot Gold Mines, Ltd., from their respective owners, The Consolidated Mining and Smelting Company of Canada, Limited, and Gabbro Copper Mines, Limited. The Sunloch property consists of thirty Crown-granted claims, including the Sunloch No. 5 (L. 796), Sunloch No. 6 (L. 797), and Tiger (L. 838). The Gabbro, adjoining the Sunloch on the west, consists of twenty-three Crown-granted claims, including the Vulcan Nos. 1, 2, 3, and 5, Yellow Jacket, Black Hornet, Adaline, War Eagle, and Hornet Fraction, being Lots 819, 820, 821, 823, 827, 828, 829, 830, and 836 respectively. All these claims were staked in the period 1915 to 1920. In 1949 Hedley Mascot staked ten claims and a fraction adjoining the Gabbro Claims on the west.

Between 1916 and 1920 open-cuts and strippings were made on both properties. The River, Centre, and Cave adits, totalling 3,776.3 feet of underground workings, were driven, and 3,470.5 feet† of diamond drilling in eleven holes was done on the Sunloch property. On the Gabbro property the Winkler adit, 100 feet long, and the Hornet adit, 30 feet long, were driven.

Work done in 1949 by Hedley Mascot on the two properties consisted principally of diamond drilling. Twenty-eight holes, aggregating 9,354 feet, had been drilled before exceptionally high water in the Jordan River flooded desirable drilling-sites and forced suspension of drilling in November.

The Jordan River flows southwesterly through the centre of the area comprising the two properties. The adits have been driven from one bank or the other of the river. Most of the diamond drilling has been done from the bed of the river at low water. However, four holes were drilled from points northwest from and 500 feet above the river on the Vulcan No. 5 claim, and five holes were drilled from points between 400 and 700 feet southeast of the river and about 400 feet above it.

The present report will be concerned principally with the mineralized zones examined by Hedley Mascot.

The deposits include eleven northwesterly trending copper-bearing shear zones known, from northeast to southwest, as River, Centre (Archibald), Gordon, Cave, Turnbull, Stewart, Robertson, Winkler, Tiger, Hornet, and Caulfield. The zones are in two northwesterly trending belts of basalt approximately 3,000 feet wide that are separated by a northwesterly trending body of gabbro about 2,000 feet wide. In these zones the basalt has been replaced by hornblende and has been mineralized in varying degrees with chalcopyrite, pyrrhotite, and pyrite. The amount of copper in the zones is variable, and not all the zones carry sufficient copper to be of economic interest. Small amounts of nickel have been reported from pyrrhotite in some of the zones.

The River zone, the most northeasterly, is toward the centre of the Sunloch No. 6 claim, where it has been explored by the River adit and by eighteen diamond-drill holes. The zone ranges in width from a foot to 100 feet and is traceable for about 1,100 feet. This length includes 520 feet of shear zone followed by the River adit and an additional 570 feet indicated by diamond drilling. An open-cut above the

* By J. S. Stevenson.

† *Minister of Mines, B.C.*, Ann. Rept., 1920, pp. 220, 221.

adit and diamond drilling above the adit indicate that chalcopyrite mineralization in this zone extends for at least 200 feet above the adit. The mineralization has been traced to a depth of about 600 feet below the level of the adit by a hole drilled from a point 100 feet northwesterly from the portal of the adit.

The Centre (Archibald) zone is on the Sunloch No. 6 claim, 300 feet southeasterly from the River zone. It may also include a band of mineralization referred to as the Gordon that is 50 feet northeasterly from the main zone of mineralization. The Centre zone has been cut by the Centre adit and followed by a drift, 100 feet long, in the River adit. It has also been intersected by two drill-holes. The Centre adit cuts across a 120-foot width of widely spaced stringers of chalcopyrite. As seen in the River adit, the zone has been mineralized by chalcopyrite over a maximum width of 4 feet, for a length of about 50 feet along the drift. The total width of discontinuous mineralization, including the Centre and Gordon zones, is about 120 feet. The traceable length of this zone, as measured from the Centre adit to the drift in the River adit, is 660 feet.

The Cave zone is toward the southwestern corner of the Sunloch No. 6 claim, about 200 feet southwesterly from the Centre zone. It contains widely spaced stringers and lenses of chalcopyrite over a width of about 130 feet. This widely scattered type of mineralization has been traced by the Cave adit for about 500 feet and extended a further 90 feet by diamond drilling. Little is known of its extent above the adit, but a hole drilled below the adit indicates that the mineralization is traceable to about 200 feet below the level of the adit. If showings of chalcopyrite on the Vulcan No. 6 claim belong to the Cave zone, then the total traceable length of this zone would be about 1,500 feet.

The Turnbull zone is reported to be on the Vulcan No. 5 and No. 6 claims, about 100 feet southwesterly from the Cave zone. It is reported to be about 8 feet wide and traceable for 400 feet. A few open-cuts were made on this zone several years ago, but no underground work was done. Hedley Mascot drilled three holes below the zone and intersected mineralization about 100 feet below the outcrop.

The Stewart zone is on the Vulcan No. 3 claim, about 2,000 feet southwesterly from the Cave zone. The work on this zone consists of several strippings and open-cuts dug about 1923. Other than sampling, no work has been done by Hedley Mascot on this zone. The mineralized zone consists of mixed chalcopyrite and pyrrhotite for a width of about 30 feet. The cuts have traced the zone for about 200 feet along the strike.

A northeasterly trending mineralized shear, 10 feet wide, on the northwest bank of the river on the eastern boundary of Vulcan No. 1 claim was drilled by Hedley Mascot. The mineralization in this zone is traceable for 200 feet on the surface and to a depth of 40 feet.

The Robertson zone, not seen by the writer, is reported to trend northerly close to the line between the Black Hornet and Hornet Fraction. The only working reported to be on it is an open-cut, now completely overgrown, on the north bank of the river. The zone is reported to be about 12 feet wide in this cut.

The Winkler zone is on the Vulcan No. 2 claim, about 2,500 feet southwesterly from the Cave zone. It has been prospected by an adit 100 feet long and by two strippings dug about 1920. A hole drilled by British Metals Corporation about 1929 intersected copper mineralization about 100 feet below the level of the adit. A hole drilled by Hedley Mascot in 1949 intersected copper mineralization about 175 feet below and 320 feet northwesterly from the adit. The zone, about 10 feet wide, is traceable for about 100 feet by intermittent strippings.

The Tiger zone is on the Tiger claim, about 400 feet southwesterly from the Winkler zone. It has been prospected by strippings and by two drill holes drilled by

Hedley Mascot. The mineralized zone ranges in width from a few feet to 20 feet and has been traced for about 300 feet.

A northwesterly trending zone referred to as the Yellow Cliff zone crosses the boundary between the Black Hornet and Tiger claims on the south side of the river. This zone has been traced for 120 feet by pits dug by Hedley Mascot in 1949. Mineralization extends over a width of 8 feet.

The Caulfield zone is in the southeastern corner of the Black Hornet claim, about 300 feet southwesterly from the Tiger. This zone has been prospected by a small amount of stripping and by four short X-ray diamond-drill holes drilled by Hedley Mascot. The work has been insufficient to indicate either the width or extent of the zone along the strike. A hole drilled to cut the downward extension of the zone at about 50 feet failed to intersect mineralization.

The Hornet zone, at the junction of the Adaline, Yellow Jacket, War Eagle, and Black Hornet claims, is on Sinn Fein Creek, a southerly flowing tributary of the Jordan River, and about 1,700 feet northerly from the junction of the creek with the river. The work on this zone consists of one open-cut and an adit 30 feet long dug about 1920. No further work was done on the zone by Hedley Mascot. The mineralization in this zone is poorly defined and consists of a few stringers of chalcopyrite over a width of about 50 feet.

Duncan (48° 123° N.W.).

Copper-Zinc.

Twin J (Vancouver Island Base Metals, Limited).*

Company office, 553 Granville Street, Vancouver. C. Rutherford, manager. For a share consideration the Vancouver Island Base Metals, Limited, acquired the property of Twin " J " Mines, Limited, on Mount Sicker, near Duncan. The company unwatered and repaired the Tyee shaft to the 1,200-foot level, drove 30 feet of sub-level drift and 190 feet of raise, both above the 265-foot level, and cleaned out and retimbered 720 feet of caved workings on the third level. It also did 6,000 feet of diamond drilling from underground and 1,000 feet from the surface. The property was shut down in October and was still inactive at the end of the year.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1944, p. 67.]

Jane, Sally, and Sally No. 2.†

The Jane, Sally, Lucky Strike, and Bob claims, held by Mrs. Winifred N. McLellan, of New Westminster, and the Sally No. 2 claim, held by T. R. Brewer, of Victoria, are located on the southern and western slopes of Mount Richards, a bluffy hill 5 to 6 miles north of Duncan. Relatively recent work in the form of surface trenching and cleaning out of old workings has been done on the Jane claim, and old workings are present on the Sally and Sally No. 2 claims.

The rocky hillsides of Mount Richards rise abruptly from rolling farm lands to elevations of about 1,000 feet above sea-level. In general, the hillsides are lightly timbered with fir, arbutus, and oak trees, but in places they are densely covered with small evergreens and thick underbrush. Outcrops, though abundant, are thickly moss-covered.

Jane.—The workings are widely spaced, but all are within a mile of the main Duncan–Nanaimo Highway. The workings on the Jane Mineral Claim are about half a mile southeast of Westholme Railway-station and are reached by a narrow farm road and an old railroad grade that turns east from the main highway less than a quarter of a mile south of Westholme Station.

The workings include two short adits and several open-cuts between elevations of about 450 and 600 feet above sea-level. Lenses of sulphides in schistose quartz-

* By R. B. King.
† By J. T. Fyles.

feldspar porphyry are exposed. The porphyry forms a dyke-like body about 450 feet wide trending north 70 degrees west parallel to the strike of the schistosity. It is bounded on both sides by massive fine- to medium-grained diorite that appears to intrude the porphyry. In places along its contacts the diorite is slightly schistose; in others it shows a narrow chilled margin.

Mineralization in the adits consists of lenses of fine-grained, dense, massive sulphides lying parallel to the schistosity of the porphyry. Pyrrhotite, sphalerite, chalcopyrite, and pyrite are the principal sulphides, and small amounts of quartz and calcite appear to form the only gangue minerals.

The lower adit trends south 65 degrees east along the southern contact of the porphyry for 50 feet, and at about 40 feet from the portal a crosscut extends north into the porphyry for 30 feet. Several lenses of sulphides occur in the lower adit, the largest of which is about 6 inches wide and 4 feet long. The upper adit runs south 65 degrees east for 15 feet and is 25 feet above and nearly 25 feet north of the lower adit. Sulphide lenses are more numerous in the upper adit than in the lower, and the largest is 1 foot to 18 inches thick and 4 to 5 feet long. The following table gives assays of samples taken in the adits. The assays show that no silver or gold was present in any of the samples.

Description.	Width.	Copper.	Zinc.
	Inches.	Per Cent.	Per Cent.
Lower adit 20 feet from portal	30	Trace	1.9
Lower adit near north end of crosscut	24	*Nil*	1.7
Upper adit above portal	36	0.05	16.1
Upper adit near face	30	Trace	2.5

Several open-cuts in the porphyry east and north of the adits expose pyritic schists and quartz veinlets. The schists contain coarsely crystalline pyrite, but no other sulphides were seen, and assays show they contain no silver or gold. Quartz (veinlets) in the form of irregular lenses up to 6 inches wide and 3 feet long occur in both the schist and massive diorite, but they appear to contain no sulphides.

Sally.—Workings on the Sally claims are at the base of Mount Richards, a few hundred yards northeast of Richards Trail, a narrow road branching southeast from the main highway a little more than half a mile south of Westholme Station.

One adit, 45 feet long, was seen on Sally No. 2 claim. It is less than a quarter of a mile northeast of a point on Richards Trail, a quarter of a mile from the highway. The adit is in massive diorite containing a few small lenses of quartz. Diorite above the adit is cut by a vertical, irregular quartz vein striking north 60 degrees east and extending up the hill for about 100 feet. The vein is made up of a series of lenses of coarsely crystalline quartz up to 1½ feet wide and 4 to 6 feet long along an otherwise barren fracture. Locally, clusters of sulphides, mainly pyrite and chalcopyrite, are present in the quartz, especially where northwesterly trending fractures intersect the main fracture. A sample of high-grade material taken from a pile of broken quartz at the side of the vein assayed 5.6 per cent. copper and *nil* in silver and gold.

Workings on the Sally claim are nearly half a mile southeast of the adit on the Sally No. 2 claim. They include three open-cuts and a caved adit along a vertical shear zone striking about north 50 degrees west. The shear zone, which cuts porphyritic andesite, is 4 to 6 feet wide and is exposed over a length of about 500 feet. It contains massive coarsely crystalline pyrite, largely oxidized to limonite in the workings. No sulphides other than pyrite appear to be present, and samples from the shear zone and from the waste dumps assayed *nil* in silver and gold and only a trace of copper.

Mineralized areas and specimens on the Jane and Sally claims were tested for radioactivity, but none was detected.

QUINSAM LAKE (49° 125° N.W.).*

Iron.

Iron Hill (Coast Iron Company, Limited).

Company office, 475 Howe Street, Vancouver. Capital: 500,000 shares, no par value. The property is on Iron Hill, near Upper Quinsam Lake, approximately 25 miles southwest of the town of Campbell River. It is now (October, 1949) under option to The Argonaut Co., Ltd., 736 Granville Street, Vancouver. This company has drilled twenty-one diamond-drill holes, all within one-third of a mile of the recent quarrying operations. Neither the core nor the drilling results were available when the property was visited on October 5th, 1949.

Mining by the Coast Iron Company, Limited, was started in December, 1948, and continued until March, 1949, and 4,885.9 long tons of iron ore was shipped to Wenatchee, Wash. Operations were carried on in two adjacent quarries, the larger of which exposes a face measuring 85 feet horizontally by 75 feet down a 45-degree slope. The face of the smaller measures 90 feet horizontally by 50 feet down a 50-degree slope.

As described in previous Reports, the deposits are contact metamorphic in type, consisting of varying amounts of garnet and magnetite.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1916, pp. 296, 297; 1948, p. 158. *Geol. Surv., Canada,* Iron ores of Canada, Vol. 1, British Columbia and Yukon, pp. 73–78.]

* By W. R. Bacon.

Placer-mining.

CONTENTS.

The first article reviews dragline dredging in 1949 and in preceding years. It is followed by notes on other placer-mining operations in 1949.

REVIEW OF DRAGLINE DREDGING IN BRITISH COLUMBIA.*

Dragline dredging† originated in California in 1933. In that year three operations produced gold valued at about $2,000. In 1941, 112 dragline plants were operated in California and produced almost $8,000,000 of placer gold. For a ten-year period the average recovery of gold from a total of almost 200,000,000 cubic yards of gravel dredged was about 18.2 cents per cubic yard.

* By Stuart S. Holland.

† A dragline dredge is composed of a standard dragline shovel for digging and a separate, gravel-washing and gold-concentrating plant built on pontoons and floating in a pond.

Operations of this type were unknown in British Columbia before 1941. In that year two dredges began working. The first dragline dredge to operate was the A. R. Watkins dredge which, beginning in May, worked on the Similkameen River for a short time in the early summer. Later, beginning about mid-July, 1941, the dredge of North American Goldfields, Limited, worked the full season of 1941 on the Fraser River just upstream from Alexandria Ferry. This dredge worked for an additional month in 1942 and was closed finally at the end of April.

No dredges operated in the years 1943, 1944, and 1945, but in 1946 four were working. In subsequent years two, eight, and seven dredges have operated for varying periods in 1947, 1948, and 1949. The following table summarizes information for the six years of operation since 1941. In that time placer gold to the value of $984,014 has been produced from about 4,073,215 cubic yards of gravel.

OUTPUT OF DRAGLINE DREDGES.

Year.	Dredges operated.	Quantity dredged, Cubic Yards.	Recovery.	
			Total Value.*	Value per Cubic Yard.
1941	2	±200,000†	$36,896	18.4c.
1942	1	25,000‡	4,156	16.6c.
1946	4	271,000	52,147	19.2c.
1947	2	362,000	59,070	16.3c.
1948	8	1,508,935	458,523	28.4c.
1949	7	1,706,280	373,222	21.8c.

* *In Canadian funds.*
† Alexandria operation only.
‡ Estimated.

A. R. Watkins and Sons. Early in 1941, A. R. Watkins, a dredge operator from Linden, Calif., held an option on Placer-mining Leases Nos. 818 and 829 from Cam Roy Mining Company, of Princeton. These two leases are on the Similkameen River about 2 miles south of Princeton. Low bench gravel had been worked for several years before 1941 by Cam Roy Mining Company under the direction of J. A. Campbell of Princeton. In 1940 that company recovered 180 ounces of gold from about 10,000 cubic yards of gravel.

In April, 1941, A. R. Watkins assembled a dragline dredge on the Similkameen River close to the Cam Roy workings and below the foot of the canyon. The dragline shovel was a Lima 101 with a 50-foot boom and a 1¼-cubic-yard bucket. The washing plant, with a capacity of 800 to 1,000 yards per day, had a 23-foot trommel and a 45-foot stacker. Hungarian riffles, of wood faced with strap iron, were used for saving gold. The dredge began working in May. Gravel, which lies to a depth of about 10 feet above a clay false bedrock, was dug in and along the edge of the Similkameen River. Operations ended early in June. Recorded gold recovery was 45 ounces valued at $1,395. The total yardage dug is not known. After the Watkins dredge was removed, Cam Roy Mining Company operated for about fifty days and reported the recovery of 139 ounces of gold, valued at $4,328, and 26½ ounces of platinum, valued at $523, from about 8,000 cubic yards of gravel mined.

Atkinson Dredging Company, Limited. Registered office, 902 Rogers Building, Vancouver. S. K. Atkinson, president; W. E. Christie, superintendent. The company formerly held about forty-five placer leases on the Similkameen and Tulameen Rivers near Princeton. It now holds one, a special placer lease, on Similkameen River extending upstream for about 5 miles from the mouth of Wolfe Creek. The company assembled a dragline dredge on the Similkameen

River about a mile southwest of Princeton and near the steam-electric power plant of The Granby Consolidated Mining, Smelting, and Power Company, Limited. Dredging started on November 7th, 1947, and continued along a 1-mile stretch of river until August 14th, 1948. The equipment was then dismantled and moved to a point on the Similkameen River about 3 miles downstream from Princeton. Dredging began there on September 17th, 1948, and continued until October 17th, 1948, during which time 2,174 lineal feet along the river was dredged. The dredge worked from April 20th to November 8th during 1949 and dredged upstream along the north side of the river to within 1 mile of Princeton.

The dredge consists of a diesel-driven Bodinson-type washing plant having a rated capacity of 5,000 cubic yards per day and equipped with Pan American jigs for gold recovery. The dragline shovel is a Lima 1201 with an adjustable 70- to 90-foot boom and a 3-cubic-yard Esco bucket.

Recorded production from this operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.				
		Gold.	Silver.	Platinum.	Total Value.	Value per Cubic Yard.
		Oz.	Oz.	Oz.		
1948	299,935	986	120	242	$48,005	16c.
1949	267,627	623	80	100	29,733	11.1c.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1948, p. 180; *Western Miner*, November, 1948, p. 41.]

North American Goldfields, Limited.—Company office, 513 Royal Bank Building, Vancouver. G. A. Collins, president. This company currently holds four special placer leases, all on the Quesnel River: one covers French Flat, one covers Drummond Flat upstream from Beavermouth, one extends for 4 miles from Little Canyon, and one extends for 5 miles along the river from Gravel Creek.

At Alexandria.—In 1941 this company installed a dredge on a low bench on the east side of the Fraser River upstream from the Alexandria Ferry. The surface of the bench is about 10 feet above high water-level of the Fraser River and is underlain by 2 to 5 feet of barren silt and 9 or 10 feet of loose gravel containing fine flaky gold in the upper part. There were few boulders larger than 12 inches across.

The washing plant, carried on wooden pontoons, was diesel-driven. The gold-saving equipment consisted of about 800 square feet of riffle tables floored with a hard-surfaced, slightly corrugated Brussels carpet. The dragline shovel used was a Lima with a 60-foot boom and a 2½-cubic-yard Page bucket.

The dredge operated from July 15th to November 15th, 1941, and from March 27th to April 26th, 1942.

Recorded production from this operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.				
		Gold.	Silver.	Platinum.	Total Value.	Value per Cubic Yard.
		Oz.	Oz.	Oz.		
1941	200,000	1,061	....	14	$35,501	17.8c.
1942	?	201	22	....	4,156	....

At Ashby and Speers Bench.—In 1946, by agreement with St. Eugene Mining Corporation, Limited, the company assembled a dredge on the Ashby and Speers leases, which cover a high bench on the south side of the Cariboo River about a mile west of the mouth of Spanish Creek. This bench ground had been worked for many years as a small-scale hydraulic before being taken over in 1944 by St. Eugene Mining Corporation, Limited. The bench lies about 70 feet above the Cariboo River. About 15 feet of gold-bearing gravel lies above soft, sticky, silty clay.

The equipment consisted of a diesel-driven Dominion dragline shovel with a 1½-cubic-yard bucket and a washing plant mounted on wooden pontoons built from locally cut timber. The gold was saved in sluice-boxes. The dredge worked from mid-June until the first week in September, 1946, under the supervision of R. Collins. The equipment was then dismantled and trucked to French Flat on the Quesnel River. Later it was sold and was shipped to McLeod River near Peers, Alta.

Recorded production from the Ashby and Speers bench operation was as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.		
		Gold.	Total Value.	Value per Cubic Yard.
		Oz.		
1946	60,000	524	$13,646	22.7c.

At French Flat.—In 1948 the company installed a dredge on French Flat on the Quesnel River about 24 miles by road from Quesnel. A Lima dragline shovel was obtained through arrangement with American Gold Fields. The dredge operated for a short time in the summer of 1948 before it shut down. At that time American Gold Fields moved both shovel and washing plant to its leases on Whisky Flat near Antler Creek.

Recorded production for the French Flat operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.		
		Gold.	Total Value.	Value per Cubic Yard.
		Oz.		
1948	30,000	61	$1,805	6c.

[References: B.C. Department of Mines, Bull. No. 16, p. 34; *Minister of Mines, B.C.*, Ann. Rept., 1946, p. 199; 1948, p. 178.]

Beavermouth Dredging Company, Limited.—Company office, 902 Rogers Building, Vancouver. E. Nipple, Seattle, Wash., president; F. Roberts, manager. This company currently holds eight placer leases on the Cottonwood River lying about 1 mile downstream from the mouth of Umity Creek and acquired from G. R. Baker, of Quesnel.

At Beavermouth.—In 1946 the company, under a royalty agreement with Collins Pacific, Ltd., operated a dredge on the Quesnel River at Beavermouth on a special lease held by the latter company. On October 1st, 1946, the Beavermouth Company took over a new washing plant built by Collins Pacific, Ltd. The company, starting on October 5th, dredged a strip about 1,000 feet down Beaver Creek to the junction with Quesnel River and then another strip about 1,500 feet along the east side of Quesnel River upstream from the mouth of Beaver Creek. Work stopped there in mid-November, 1946.

Equipment consisted of a Lima 801 dragline shovel with a 55-foot boom and 2-cubic-yard Page bucket. A Bodinson steel-pontoon washing plant was equipped first with riffles, but these were later replaced by ten Pan American jigs.

Recorded production for the Beavermouth operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.		
		Gold.	Total Value.	Value per Cubic Yard.
		Oz.		
1946	30,000*	99	$2,970	About 10c.

* Estimated.

On Cottonwood River.—In 1947 the equipment was dismantled and assembled on the Baker leases on Cottonwood River about a mile below the mouth of Umity Creek. No dredging was done that year.

The Baker leases are reached by 3 miles of road running north from Mile 18 on the Barkerville Road. In 1948 the company began dredging shallow gravels that lie above grey boulder clay along the edge of Cottonwood River. The company operated for a short time before closing.

Recorded production from this period of operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.		
		Gold.	Total Value.	Value per Cubic Yard.
		Oz.		
1948	12,000	115	$3,565	29.7c.

In October, 1948, the company optioned its dredge and leases to the Cottonwood Syndicate for a trial period of three months. The Cottonwood Syndicate consisted of Marwell Construction Company, Limited; Paul Fiorito, of Seattle, Wash., and J. W. Boothe and T. M. Gerety, of Princeton. The Cottonwood Syndicate continued operations on the same leases and recovered 174 ounces of gold, valued at $5,400, from 45,000 cubic yards of gravel, the average recovery being 12 cents per cubic yard.

The company resumed dredging in 1949 and worked until the end of August before closing.

Estimated production for this period of operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.		
		Gold.	Total Value.	Value per Cubic Yard.
1949	28,000	....	$3,000*	About 11c.

* Estimated.

Inland Dredging Company, Limited.

H. O. Anderson, president. This company, under a working agreement with Umity Valley Gold Mines, Limited, dredged on leases held by the latter company. A small dragline dredge was brought in from California in the summer of 1946 and leased by its owner, Mr. Weaver, to the Inland Dredging Company. The dredge was assembled on the south side of Cottonwood River opposite the mouth of Umity Creek. The ground is reached by 3 miles of road turning off at Mile 18 on the Barkerville Road.

Equipment consisted of a Bucyrus Erie dragline shovel with a 1-cubic-yard bucket and a small steel-pontoon washing plant equipped with riffle tables. Barren silt, about

5 feet thick, was stripped by bulldozer and the underlying gold-bearing gravel, 5 to 7 feet thick, was dredged to the grey boulder-clay false bedrock.

Dredging began on September 15th, 1946, and continued for a short time, with a recovery of 44 ounces of gold, valued at $1,320. Operations were resumed in 1947, and 82 ounces of gold, valued at $2,460, was recovered. A strip about 400 feet long was dredged on the south side of the river and another about 500 feet long on the north side of the river, with an estimated total of about 20,000 cubic yards. The estimated recovery was about 19 cents per cubic yard.

Operations were terminated in 1947, and the dredge was sold to C. Docherty, of Quesnel.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1946, p. 199.]

Cariboo Gold Dredging Co. Company office, 104 Chamber of Commerce Building, Seattle, Wash. J. B. Hardcastle, president; R. R. Moore, manager. This company, by agreement with Umity Valley Gold Mines, Limited, began operations on Special Placer Lease No. 4673, held by the Umity company. In 1948 the company assembled a dredge on the north side of Cottonwood River about half a mile downstream from the Barkerville Road bridge on a low gravel bench stretching between two rock canyons.

Equipment consisted of a Lorain 83 dragline shovel with a 2-cubic-yard Esco bucket and a steel-pontoon diesel-electric washing plant using Pan American jigs for saving gold. Dredging began on June 16th, 1948, and a strip about 450 feet long was dug downstream along the north side of the river. On July 31st, 1948, the washing plant sank in its pond. Since then no further dredging has been done.

Production reported for the short period of operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.		
		Gold.	Total Value.	Value per Cubic Yard.
		Oz.		
1948	15,000	52	$1,612	10.7c.

Swift River Dredging Co., Ltd. Company office, 475 Howe Street, Vancouver. This company is controlled by E. A. Kent, 260 California Street, San Francisco, Calif., and is dredging on leases that are held by Kent on the Cottonwood and Swift Rivers. J. V. Rice has been manager of all operations. Extensive test work was done on the leases on the Cottonwood and Swift Rivers in 1940, 1941, and 1945. In June, 1946, the company shipped in a dragline dredge and assembled it on the Cottonwood River downstream from the mouth of Lightning Creek.

The equipment consists of a $2\frac{1}{2}$-cubic-yard North West dragline shovel using a 2-cubic-yard Page bucket. The washing plant was assembled from sectionalized parts, has steel pontoons, and uses expanded metal screen as riffles in boxes 30 inches wide.

Dredging was begun on July 7th, 1946, and continued until November. A strip 100 to 250 feet wide and about 4,000 feet long was dug downstream along the bed and bars of the Cottonwood River. Gold-bearing gravel from 7 to 15 feet deep, averaging 9 feet thick, lies above barren boulder-clay false bedrock. Quantity dredged in 1946 was estimated to be 190,000 cubic yards.

In 1947 dredging started in April and was continued upstream along the river bottom on Cottonwood and Swift Rivers to a point on Swift River about a mile above the mouth of Lightning Creek. The washing plant was enclosed and at the end of December, 1947, was still operating. About 350,000 cubic yards of gravel was dredged.

In 1948 the dredge, working from April to November, dug about a quarter of a mile upstream from its position at the end of 1947, then crossed to the west side of the Swift River, and dug its way about half a mile downstream. About 300,000 cubic yards of gravel was dredged.

Tailings on Swift River from operations of Swift River Dredging Company.

No dredging was done by the company in 1949. The washing plant remained on the Swift River while the dragline shovel was engaged in contract digging elsewhere.

Recorded production by company operation on the Cottonwood and Swift Rivers is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.			
		Gold.	Silver.	Total Value.	Value per Cubic Yard.
		Oz.	Oz.		
1946	190,000	977	......	$34,211	18.0c.
1947	350,000	1,615	......	56,610	16.2c.
1948	300,000	1,328	114	27,541	9.2c.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1946, p. 198.]

Trebor Placer Exploration, Ltd. Company office, 103 Royal Trust Building, Vancouver. R. D. Mueller, president and manager. This company has leased placer ground held by Lightning Creek Gold Alluvials, Ltd., which that company had tested in 1946 and 1947. The previous testing, which had been done along a stretch of Lightning Creek below the canyon at the foot of Mexican Hill and extending downstream to a point about half a mile above the junction of Lightning Creek and Cottonwood River, was checked by Trebor Placer Exploration, Ltd., early in 1948. In the autumn of 1948 a dredge was assembled on Lightning Creek near the foot of Mexican Hill, half a mile east of Mile 33 on the Barkerville Road. This work was done under the supervision of J. M. Harper.

Dredging was begun in May, 1949, and continued until November 20th. The dredge worked out the flat where it had been assembled and then dug its way downstream through a narrow rock canyon to reach the extensive river flat that extends downstream from a point about a quarter of a mile east of the Gagen Creek Road crossing. Large boulders gave much trouble while the dredge was digging through the rock canyon. Gold-bearing gravel to an average depth of about 6 feet overlies grey boulder clay. The flat is thickly wooded with spruce and cottonwood, and considerable expense has been entailed through heavy clearing.

The equipment consists of a Marion dragline shovel using a 2½-cubic-yard bucket and a Bodinson steel-pontoon washing plant equipped with riffle boxes for saving gold.

During 1949 R. D. Mueller was in charge of operations.

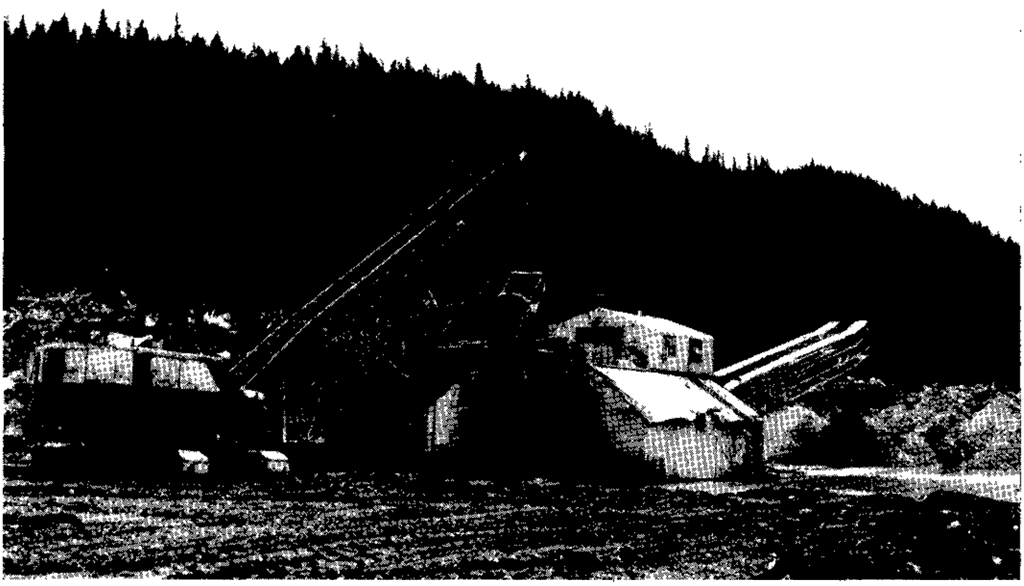
Recorded gold production by company operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.		
		Gold.	Total Value.	Value per Cubic Yard.
		Oz.		
1949	288,655	2,150	$75,250*	26c.

* Approximate value.

Summit Mines, Ltd.

Company office, 601 Royal Trust Building, Vancouver. R. H. Wallace, manager; E. Krause, dredge superintendent. This company is controlled by Larsen, Harms, and associates, of Sacramento, Calif. By agreement with the owners, the company has dredged on Placer-mining Leases Nos. 1986 and 2561, which extend downstream from the junction of Pinus (Pine) and Shepherd Creeks past the junction of Summit Creek.



Summit Mines, Ltd., dragline shovel and washing plant.

In 1947 some test holes were sunk on Pinus (Pine) Creek upstream from its junction with Summit Creek near J. P. Roddick's old cabin. Satisfactory results were obtained, and gold-bearing gravel was found to extend to a depth of from 18 to 30 feet. In 1948 a dredge was assembled near Roddick's cabin, which is about 5½ miles along the Bear Lake Road from its junction with the Barkerville Road. Dredging began in May, 1948, and continued until October. In 1949 dredging began on March 28th and continued until October 17th, when all operations at Summit Creek ceased.

The first area dredged extended for about 1,400 feet downstream from the junction of Pinus (Pine) and Shepherd Creeks and the maximum width at its lower end was about 500 feet. In this area the gold-bearing gravel is from 16 to 25 feet deep and lies above a clay false bedrock. Downstream, below a rocky, narrow canyon on a wide bench alongside the Bowron Lake Road, the gravel is deeper, the clay false bedrock is absent, and the gold content is less.

Equipment consists of a Marion 40A dragline shovel with an 85-foot boom and a 3-cubic-yard bucket, and a Hickinbottom steel-pontoon all-riffle washing plant built by Guntert and Zimmerman, of Stockton, Calif.

Recorded gold production from this operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.			
		Gold.	Silver.	Total Value.	Value per Cubic Yard.
		Oz.	Oz.		
1948	339,000	2,828	277	$99,221	29.2c.

In 1949 a slightly greater yardage was dredged and the value of gold produced was slightly less than in 1948.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1947, p. 192; 1948, p. 175.]

American Gold Fields. Executive office, 634 Sixty-ninth Street Northeast, Portland, Ore. Murrel Nelson, president; Dewey Noble, dredge superintendent. In 1948, by agreement with the owners, the company drilled the ground at Whisky Flat between Cunningham Pass and Antler Creeks. In the autumn of 1948 the dredge, which earlier in 1948 had been operated by North American Goldfields, Limited, at French Flat, was assembled at Whisky Flat.

The equipment consists of a 1201 Lima dragline shovel with a 90-foot boom and both 2- and 3-cubic-yard Esco buckets, and a steel-pontoon washing plant equipped with Hungarian riffles of wood.

Dredging was started on September 29th and continued until October 14th, 1948. In 1949 dredging began early in May and terminated about September 12th. During the early part of the 1949 season, difficulty was experienced in maintaining the water-level in the pond because of drainage northward through the old Yellow Lion drift workings. An area about 1,600 feet long and from 200 to 400 feet wide was dredged. Work was stopped about 600 feet from the extreme south end of Whisky Flat and about 300 feet north of the old hydraulic pit at McBean bench. Gravel to a depth of about 25 feet lying on bedrock was dredged.

Recorded gold production from this operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.			
		Gold.	Silver.	Total Value.	Value per Cubic Yard.
		Oz.	Oz.		
1948	18,000	250	......	$6,941	38.5c.
1949	160,000	1,719	290	60,530	37.9c.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1948, p. 176.]

United Mining & Dredging Company, Inc. Company office, 308 Randall Building, Vancouver. C. R. Williams, president. John McGowan was manager until September, 1949, when he was replaced by J. V. Berry. In 1947 the company tested placer ground on the Willow River, 2 miles by road from Rouchon Creek. This work was done by R. G. Collins. In 1948 test work was begun on placer leases on Big Valley Creek near the workings of J. T. A. Fleury, close to the turn on Big Valley and 1½ miles south of Lottie Creek. The camp is 10½ miles along the Eight Mile Lake Road from its junction with the Barkerville Road.

In the summer of 1949 a dredge was assembled downstream from Fleury's workings. Dredging was stopped on September 28th. The dredge started in old tailings below Fred Fleury's cabin and dug about 400 feet up the west side of the creek, turned and came back down the east side, then crossed through its own tailings toward some gold-bearing gravel indicated by drill holes.

The equipment consists of a Dominion dragline shovel with a 62-foot boom and a 1½-cubic-yard bucket, and a steel-pontoon all-riffle washing plant. The washing plant was formerly on the Ashby and Speers bench and was shipped from Peers, Alta.

Fleury had successfully worked, by hand, shallow post-glacial concentrations of gold on top of glacial gravels and boulder clay, but the ground had not been tested adequately for dredging.

Production reported for 1949 is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.		
		Gold.	Total Value.	Value per Cubic Yard.
		Oz.		
1949	12,000	300	$8,800	74c.

Moccasin Mines, Ltd. Company office, 5261 Stockton Boulevard, Sacramento, Calif. R. C. Henrici, manager. This private company is controlled by Larsen, Harms, and associates, of Sacramento, Calif. Placer leases held by R. G. Wilms on McDame Creek downstream from Centreville and other special leases on McDame Creek have been acquired by the company. In 1947 test work was done along the creek near the old Pendleton workings. Between October, 1947, and January, 1948, the company built 68 miles of truck-road from Mile 648 on the Alaska Highway to McDame Creek. A dredge was shipped in and assembled early in 1948.

Dredge equipment consists of a diesel-electric Bucyrus-Monighan walking dragline shovel with a 4½-cubic-yard bucket and a steel-pontoon washing plant.

Dredging began on May 21st, 1948, and continued until late autumn. Gravel to a depth of about 18 feet lies on sand that acts as a false bedrock. Most of the gold is said to be in the bottom 4 feet of gravel above the sand and is thought to be in lenses that appear to narrow as the dredge works downstream. Depth to bedrock is unknown, but is greater than 90 feet, which was reached in one drill hole that did not strike rock.

In 1949 the dredge worked from May to November. The company built a road up French Creek and on up Spring Creek and drilled in French Creek valley during the season. About twenty-five men were employed on all operations.

Recorded gold production from McDame Creek operation is as follows:—

Year.	Quantity dredged, Cubic Yards.	Recovery.			
		Gold.	Silver.	Total Value.	Value per Cubic Yard.
		Oz.	Oz.		
1948	365,000	7,543	717	$264,533	46.7c.

In 1949 the dredge handled a considerably larger yardage and recovered a considerably smaller amount of gold than in 1948.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1947, p. 190; 1948, p. 173.]

ATLIN.*

Construction of new roads and improvements made to existing roads have reduced the cost of transportation to the old placer camps at Atlin and McDame Creek. The reduction in transportation costs is important to placer-mining and, coupled with economies that may be effected by modern mechanical dirt-moving equipment, may be of great importance, particularly in mining some of the deposits of lower-grade gravel.

A new 60-mile road was built to connect Jakes Corner on the Alaska Highway with the town of Atlin. Supplies are now being freighted over the new road. The first major mining operation in the area since the war is the rehabilitation of the Noland mine by Transcontinental Resources, Ltd.

At McDame Creek, Moccasin Mines, Ltd., have improved the road from the Alaska Highway, extended the road up McDame Creek, and built a new road up French and Spring Creeks.

Spruce Creek (59° 133° N.W.).

Noland Mines, *Limited.* Company office, Royal Bank Building, Vancouver; mine office, Atlin. W. B. Milner, president; MacLeod White, manager. The Noland mine camp is at the confluence of Dominion Creek with Spruce Creek, about 12 miles by motor-road from the town of Atlin. Noland Mines, Limited, was incorporated in 1949 for the purpose of purchasing, under an option basis, the following placer leases, held by John W. and Vera Noland: Dorothy, Sunlight, Goodwill, New Year, Chance, Dream, St. Nicholas, Canyon, Mossberry, Venus, Christmas Eve, Glacier, Shamrock, Last Chance, Billy, Knapp, and Side Hill. These leases extend along the hitherto highly productive channel of Spruce Creek, as well as along its projected strike. In addition, the company also located two special placer-mining leases along the further projection of the channel.

The mine workings are accessible from two vertical shafts, the Noland shaft and the Eastman shaft. The Eastman or No. 2 shaft is 200 feet deep and was sunk in the rimrock on the north side of the pay channel. From this shaft, two drifts follow the channel easterly upstream for 2,300 feet. The drifts were driven 6 feet high, including about 2 to 2½ feet in decomposed bedrock. The two drifts are connected at intervals by crosscuts, which divide the ground into minable blocks. Most of this underground work was done by the Columbia Development Company, on a lease from J. W. Noland. The lease expired in 1946, and, except for some salvage mining of pillars, little additional work had been done until the present company took over.

Work on the property commenced about June, 1949, and consisted of rehabilitating the existing surface buildings, constructing several new buildings, diverting the waters of Dominion Creek by a flume to provide additional water for sluicing, retimbering part of the underground workings, laying track, installing pipe-lines, and generally

* By F. J. Hemsworth.

preparing the mine for production. A new headframe was erected over the Eastman shaft, a new hoist-house constructed, and an electric hoist installed. Power is provided by one 125-horsepower compressor diesel unit and one 150-horsepower diesel alternator unit.

Construction work and rehabilitation of the extensive underground workings was completed by the middle of December, when underground development was begun. This work consisted of continuing the development heading eastward, as well as extracting pillars left in place by the previous operators. Mining methods in general follow established practices in drift placer-mining, with the exception that considerable use is made of P15 pickhammers. This tool appears to be well suited for drift placer-mining, and its use eliminates much blasting. For harder rock, jackhammers equipped with jacklegs are used, and steel is fitted with detachable tungsten-carbide bits. A Mancha trammer and special scoop-type mine cars carry the gravel to the mine shaft station.

The gravel is hoisted in the 26-cubic-foot skip and dumped into a steel chute, which discharges by gravity on to the coarse belt-feeder. From this belt, gravel is fed into the 15-foot by 44-inch trommel with three pressure nozzles spraying the revolving drum. The oversize is discharged at the lower end of the trommel into a waste bin, from which it is removed by truck. The trommel discharges the washed gravel into a dump box. The dump box is 5 feet long and tapers to 20 inches wide. It is followed by 48 feet of sluice-boxes 20 inches wide, with 3-inch steel riffles, followed by a taper to 14 inches about 7 feet long containing 2-inch steel riffles. A clean-up is generally made once a week. Test sluices are laid out parallel to the main sluices and are 24 feet long and 12 inches wide, containing 1-inch steel riffles. A steel door located within the trommel diverts gravel for testing into these boxes.

Production, representing gravel from development faces and track clean-ups, amounted to only 14 ounces 10 pennyweight, and some production from previous clean-ups amounted to 33 ounces 15 pennyweight. The mine went into actual production on January 3rd, 1950. An average of from forty to fifty men were employed at the mine.

Joker, Poker, & Croker Leases. V. A. Brister and his son Jack hold these leases on a lay from the Isaac Mathews estate. The workings are about 8 miles by motor-road from Atlin. In 1949 most of the work consisted of drift mining on the Joker bench lease. A by-pass, around ground caved by the 1947 floods, was made to the Mathews drain, and some gold was recovered from this work.

BOULDER CREEK (59° 133° N.E.).

Norman Fisher and five partners operated the Boulder Creek Placers under lease from the Consolidated Mining and Smelting Company. The hydraulic pit is at about 4,000 feet elevation, 3 miles above Surprise Lake, and about 12 miles by road from Atlin. A 16-inch pipe-line carries water from the dam on Boulder Creek, one-half mile above the workings. Two 6-inch monitors are used to wash the gravels into the sluice. The gold is collected in 100 feet of sluice-boxes containing riffles of 40-pound rails. Tailings are stacked with a scraper. The underlying rock is granite, and the large number of boulders impede the work. The boulders are dragged out of the pit with cable slings and a hoist powered by a D-6 tractor. During the 1949 season about 40,000 cubic yards of gravel was sluiced.

In addition to the gold production from Boulder Creek Placers, 3 tons of black sand was shipped. This black sand was concentrated from the residue from the gold clean-up and contained high percentages of tungstate and tin. The shipment was consigned to Derby and Company, of London, England. G. S. Eldridge and Company, of Vancouver, assayed the black sand and acted as agents. The following assays are available through the courtesy of Clarence M. Sands, the shipper (amount 60 bags=6,002 pounds=3 tons) :—

	13 Bags " Coarse."	47 Bags " Fines."
Tungstate (WO_3)	46.88%	49.01%
Tin (Sn)	7.42%	10.75%
Arsenic (As)	Trace	Trace
Gold (Au)	2.50 oz. per ton	2.93 oz. per ton
Silver (Ag)	0.86 oz. per ton	1.32 oz. per ton
Platinum (Pt)	0.27 oz. per ton	0.41 oz. per ton
Palladium (Pd)	*Nil*	*Nil*
Iridium Metals (Ir)	0.11 oz. per ton	0.11 oz. per ton

Otter Creek (59° 133° N.E.).

Ture Mattson and Walter Sweet did some further test-drilling on Otter Creek. This was assessment work, financed by the Walter Johnson Company, of San Francisco, who are agents for Compagnie Française des Mines D'or du Canada.

McKee Creek (59° 133° S.W.).

Oscar Swanson and George Watt worked the Lucky Strike Lease on a lay from Mrs. J. M. Adams. This is a hydraulic operation washing the 100-foot bank of gravels on the north side of McKee Creek. Two 6-inch monitors were used, one to wash into the sluice and the other to stack the tailings. Bedrock is an altered volcanic rock and there are few boulders. When large boulders are encountered, they are broken with 75-per-cent. Submagel and the pieces washed through the sluice-boxes. Five men were employed during the season.

Ruth Lease and Leftover Lease. Louis and Joe Piccola continued drift mining on the south bench of McKee Creek a short distance below the junction with Eldorado Creek. The rimrock rises rapidly on this side but is rolling and irregular. If water were available, this ground would best be worked as a hydraulic operation.

OMINECA.*

At Germansen Lake a new road has been built by Mrs. W. Tait around the north side of the lake and on to Silver Creek to connect with the road to Takla Landing. Another new road was completed, joining the Manson Creek Road with a placer operation on the Nation River.

Slate Creek (55° 124° N.W.).

Yuba Consolidated Gold Dredging Company. Company office, San Francisco, Calif.; mine office, Manson Creek P.O. Clarence Carlson, manager. The camp is on Slate Creek, about 1 mile from Manson Creek P.O. Yuba Consolidated carried out a systematic drilling programme on ground leased from The Consolidated Mining and Smelting Company. One 6-inch drill was operated on this test work. Drill cuttings were run through a rocker and the concentrate panned. Six men were employed during the 1949 season.

Manson Creek (55° 124° N.W.).

Harvey Barnhill holds three bench leases on Manson Creek, 1 mile above its junction with Slate Creek. He built 1½ miles of new road into his operation. An Allis-Chalmers tractor was used for stripping and to bulldoze gravel into the hydraulic pit. One 2-inch monitor was operated with water pumped from Manson Creek. Two men were employed.

* By F. J. Hemsworth.

Plug Hat Creek (55° 124° N.W.).

G. H. Loper & Sons. This is a hydraulic operation conducted by George H. Loper and his sons. The pit is about 300 feet wide and 100 feet deep and is close to the Manson Creek–Germansen Landing Highway, about 1 mile south of the Landing. Flume and ditch carry water 14 miles from Germansen Lake for the three 6-inch monitors. Two monitors were used for washing down the gravels and the other for tailings disposal. Tailings were sluiced into the Germansen River, 2 miles above its junction with the Omineca River. A portable Continental gasoline engine and Worthington compressor supplied air for two jackhammers. Large boulders were drilled and blasted to allow them to pass through the tailings flume. Five men were employed.

Twin Creek (55° 125° N.E.).

Martin Mine, Ltd. Company office, 470 Granville Street, Vancouver. Mrs. Winnifred Tait, manager. Some hydraulicking was done by this company during the early part of the 1949 season. Gravels, from a pit on Twin Creek, were washed with a 4-inch monitor. Bedrock was not reached and the results were disappointing. The crew of twelve men was then transferred to road work. Under Mrs. Tait's supervision, a road around the north side of Germansen Lake was completed to connect with the Takla mercury mine road. At the close of the season some test work was done on leases on Kwanika and Sylvester Creeks.

Nation River (55° 123° S.W.).

Nation River Project. Company office, Box 2844, Boise, Idaho; mine address, Fort St. James. Stuart W. Wood, manager. This company completed the 18-mile road from the Manson Creek Highway into its leases on the Nation River. Preliminary testing had shown fair gold values in the surface gravels. After completion of the road, a 5-inch aeroplane drill, mounted on a truck, was brought in to determine the depth to bedrock and the average gold values. Several test holes were drilled on the north side of the Nation River a short distance below its junction with Sixty-five Mile Creek. Eleven men were employed on the road work and five men on the test-drilling.

CARIBOO.*

Hixon Creek.

Hixon Placers, Inc. (53° 122° S.W.) Company office, 1905 Second Avenue, Seattle 1, Wash. H. W. Hargood, president; C. J. Morris, superintendent. The company continued their hydraulic operation, 3 miles east of the Cariboo Highway at Hixon, on ground owned by B. Briscoe, of Vancouver. Two pipe-lines 1,500 feet long were installed, to supply water under a head of 60 feet. Each had an 18-inch intake and a 12-inch outlet. In addition, 264 feet of 4-foot sluice-boxes were installed, a pumping plant was installed and 300 feet of 4-inch line laid, 5 acres of ground was cleared, and a lighting plant and camp buildings were constructed.

The company reports that about 125,000 cubic yards of material was hydraulicked from the pit.

Canyon Creek (53° 122° S.W.).

J. E. Wandell, of Clovis, Calif., and J. Norman, of Quesnel, assembled a 4-inch suction dredge on Canyon Creek at Hixon. A small amount of gravel was washed at the mouth of Canyon Creek and on the Fraser River at that point.

* By J. E. Merrett.

Ahbau Lake (53° 122° S.E.).

Twentieth Exploration, Limited.—J. Troy, Quesnel, superintendent. This private company, controlled by Morrison-Knudsen Company, Inc., of the United States, constructed a bridge over the Cottonwood River 3 miles north of Mile 18 on the Barkerville Road and built 33 miles of road to Hay Lake at the south end of Lodi Lake. It is planned to install a washing plant in 1950 on leased ground between Ahbau and Lodi Lakes and to continue test work started in 1949.

Willow River (53° 121° S.W.).

Williams Creek.—Stephen F. Papp, by bulldozing and sluicing, washed 2,500 cubic yards of gravel at Richfield.

J. J. Gunn hydraulicked 600 cubic yards of gravel from a bedrock bench on the east side of Williams Creek opposite Barkerville.

Emory Gulch.—Tony Calfa hydraulicked 5,000 cubic yards of gravel on Emory Gulch.

Lowhee Creek.—O. K. Nason and his four partners continued working their lay from Lowhee Mining Company in Lowhee Creek. Both rims have been cleaned for 1,500 feet from the head of the pit. Hydraulicking removed 75,000 cubic yards of gravel.

Burns Creek.—Two hundred cubic yards of gravel was washed on the lease held by L. E. North and W. E. North.

Ketch Placers.—R. H. McDougall has been making preparations at this property to hydraulic the Devil's Canyon channel which cuts across the lower stretch of Burns Creek.

Slough Creek.—W. M. Hong and two men hydraulicked 16,500 cubic yards of gravel near the northern end of the Slough Creek benches close to Nelson Creek. A good recovery was reported; one 2-ounce nugget was found.

Devil's Lake Creek.—Eric Rask hydraulicked 2,000 cubic yards of gravel on the east bank and at the headwaters of Devil's Lake Creek.

Leo Bedford hydraulicked 5,000 cubic yards of gravel on the Barton lease on the west side of Devil's Canyon.

Coulter Creek.—J. M. Chouse completed 25 feet of drifting and washed 100 cubic yards of gravel on Coulter Creek.

New Creek.—A. St. Louis and Russell Burt were preparing for a hydraulic operation on New Creek, a tributary of Slough Creek.

Slade Creek.—George Murlock hydraulicked 500 cubic yards of gravel on ground held by E. North, F. Chong, and W. Hong on Slade Creek, a tributary of Tregillus Creek.

Hyde Creek.—P. McColm hydraulicked 600 cubic yards of gravel on Dr. O. R. Hougen's lease near Hyde Creek, a tributary of Tregillus Creek. The ground being worked is a narrow bench channel 20 feet wide and 30 feet deep. Water is obtained from Pup Creek by a ditch 3,000 feet long.

Aura Fina Creek.—Beaver Channels, Limited; K. K. Langford, manager. A bulldozer was used to make 2 miles of ditch, 12 feet wide, between upper Aura Fina Creek and the Aura Fina and Phantom workings of this company. This ditch should provide an adequate supply of water to either working. It will be piped to the Phantom workings under a head of 130 feet and to the Aura Fina workings under a head of 240 feet.

Pundata Creek.—T. Elder, T. Pierce, and F. Peterson sluiced 300 cubic yards of gravel on Pundata Creek, a tributary of Willow River. Twenty-seven ounces of gold was recovered.

Eight Mile Lake.—Maurice Anderson hydraulicked 100 cubic yards of gravel near Eight Mile Lake on the Big Valley drainage.

Big Valley Creek.—United Mining & Dredging Company, Inc. (*see* p. 236).

Cooper Creek.—A. Frankish, of Calgary, hydraulicked 5,000 cubic yards of gravel on the West Fork of Cooper Creek, a tributary of Sugar Creek.

ANTLER CREEK (53° 121° S.E.).

Burdette Creek.—J. M. Paterson and A. Holm hydraulicked 1,500 cubic yards of gravel at the junction of Burdette and Antler Creeks.

Wolfe Creek.—E. S. Dowsett hydraulicked 500 cubic yards of gravel.

Sawflat Creek.—Cariboo Antler Gold Dredging Co. reported five men were employed for two and one-half months prospecting on Sawmill Flats.

Grouse Creek.—Paul Gaines sank 30 feet of shaft on his lease.

Antler Mountain Gold, Ltd.—Two men hydraulicked 4,000 cubic yards of gravel on this company's Grouse Creek leases.

Canadian Creek.—D. S. Ross and J. Holland hydraulicked 10,000 cubic yards of gravel. When the water-supply became too low for hydraulicking, a drift that explores the west side of the pay channel was extended and is now more than 125 feet long.

French Creek.—French Creek Hydraulic Placers, Limited, 502 McLean Building, Vancouver. R. N. Van Bibber, of Illinois, employed four men drill testing and hydraulicked 20,000 cubic yards of gravel.

Guyet Placer.—Mines Operating, Incorporated. Company office, Northern Life Tower, Seattle, Wash. A. G. Barnett, president; A. C. Johnston, superintendent. This company has a hydraulic operation on ground known as Guyet Placer. In 1949 an effort was made to find the extension of the pay channel at the head of the pit. Hydraulicking started from the southwest side of the face of the pit has, so far, failed to disclose this channel.

Empire Creek.—George Milbourne hydraulicked 2,000 cubic yards of gravel at the junction of Empire and Antler Creeks.

Shepherd Creek.—One thousand cubic yards of gravel was hydraulicked on ground held by R. D. Rees.

Summit Mines, Ltd. (*see* p. 234).

Whisky Flat, Cunningham Pass.—American Gold Fields (*see* p. 235).

LIGHTNING CREEK (53° 121° S.W.).

Houseman Creek.—Mr. and Mrs. L. Biggs cleaned their pit on Houseman Creek preparatory to hydraulicking.

Amador Creek.—The Amador Pit was not in operation in 1949.

Perkins Creek.—C. A. Ritchie has installed a 135-horsepower double-drum scraper to assist in moving gravel to the sluice-boxes, as normally the water-supply is not adequate for a full season's operation. Four thousand cubic yards of gravel was hydraulicked.

Grub Gulch.—Ennerdale Placers, operated by F. W. Freeman and J. Hind, hydraulicked 6,000 cubic yards of gravel.

Last Chance Creek.—Alf Brown, of Stanley, continued prospect drifting on the 75-foot level from the shaft on Last Chance Creek. Approximately 100 feet of drift has been completed on various headings. It is reported that satisfactory quantities of gold were recovered from these headings.

Anderson Creek.—E. M. Falk sluiced 300 cubic yards of gravel, which had been mined in a drift.

Donovan Creek.—H. Rottacker and one helper extended the sluice-boxes in his pit 110 feet and hydraulicked 12,000 cubic yards of gravel.

Lightning Creek.—Trebor Placer Exploration, Ltd. (*see* p. 233).

COTTONWOOD RIVER (52° 122° N.E. AND 52° 122° S.E.).

Swift River Dredging Co., Ltd. (*see* p. 232).

Cariboo Gold Dredging Co. (*see* p. 232).

Umity Valley Gold Mines, Limited.—R. A. Nienaber, of Seattle, Wash., tested ground held by Umity Valley Gold Mines, Limited, on the Cottonwood River at Mile 18. He also tested ground on Umity Creek.

Beavermouth Dredging Company, Limited (*see* p. 230).

Quesnel River Area.

Richmond Hill Mining Co., Ltd. (52° 121° N.E.) Company office, Richmond Hill, Ont. E. Lang, Keithley Creek, superintendent. This company's property on Spanish Creek was worked by Geometals, Ltd., in 1948. The spring thaw in 1949 caused two large slides to cave from the pit face. These swept out the monitor and part of the sluices. Richmond Hill Mining Company cleaned the pit and hydraulicked part of the east bank before the operation closed at the end of August. A crew of nine men was employed.

Cariboo Metals Limited. (52° 121° N.E.) Company office, 850 Hastings Street West, Vancouver. A. von Alvensleben, manager. This private company installed a 1½-cubic-yard shovel and a pitcher-type dry-land washing plant on their leases on the hill south of Cedar Creek near Quesnel Lake. While the washing plant was being redesigned, the dragline was used with portable sluices to wash 10,000 cubic yards of gravel. Water was pumped and supplied at 168 pounds per square inch through 5,500 feet of 12-inch pipe.

In addition, 30,000 cubic yards of gravel was removed from a cut preparatory to setting the washing plant in operation. A crew averaging seven men was employed.

Lawless (Half Mile) Creek.—(52° 121° N.W.) Clifford V. Landon, of Seattle, Wash., and a crew of three men commenced laying 2,100 feet of pipe for hydraulic operations on Lawless Creek, half a mile from Quesnel Forks.

Spring Creek.—F. Fredericks sluiced 500 cubic yards of gravel at the junction of Spring Creek and Quesnel River.

Big Canyon.—(52° 122° N.E.) T. W. Corless and his father sluiced 1,500 cubic yards of gravel on their lease above the Big Canyon on the Quesnel River. A tractor is used to push gravel to the sluice-boxes, and water for sluicing is pumped from the river.

Keithley Creek (52° 121° N.E.).

Lee Fournier on Keithley Creek.—Twenty-five feet of shaft was sunk and 1,000 cubic yards of gravel was hydraulicked half-way between Four Mile and Weaver Creeks.

H. Asserlind and V. Johnson.—An incline was driven 36 feet north on the west side of the drift at a point 167 feet from the portal. Bedrock was reached in the incline 6 feet below drift level and 5 feet above Keithley Creek water-level. A section of gravel, two sets wide and four sets long, was mined from the east side of the main drift.

A. E. McGregor and G. A. Goldsmith.—These partners have leases on Keithley Creek between Honest John and Donaldson Creeks. Four thousand cubic yards of gravel was hydraulicked, and 85 feet of drift was completed.

R. W. Youngash.—Sixty feet of timbered drift was driven in search of an old channel on the bench on the east bank of Little Snowshoe Creek, half a mile above Snowshoe Creek.

Cariboo Keithley Gold Placers.—K. C. F. Monckton hydraulicked 600 cubic yards of gravel on French Snowshoe Creek three-quarters of a mile above the Yanks Peak Road bridge over French Snowshoe Creek.

LILLOOET (50° 121° N.W.).*

Bridge River.

Leases of G. Haycock.—Four men were employed on this property, and, aided by a dragline, they ground-sluiced 1,800 cubic yards of gravel on the Bridge River near Moha.

* By J. E. Merrett.

Leases of W. L. Baker.—In preparation for sluicing in 1950, maintenance and repair work were done on this property, which adjoins Haycock's leases near Moha.

Frank Haugh on Marshall Creek.—In 1949, 470 cubic yards of gravel was sluiced.

FRASER RIVER.

Fountainview Placers.—This property, on the Fraser River opposite Fountain Station on the Pacific Great Eastern Railway, was optioned by A. Greenway from G. Powell, of Lillooet. A 1,000-cubic-yard per day trommel, a dragline scraper, an overhead tractor-loader, and sluice-boxes were installed. During 1949, 2,000 cubic yards of gravel was washed.

Leases of A. C. Hutton and A. Moreby.—These partners have installed suction equipment on the Fraser River above its confluence with Cayoosh Creek. High water in the Fraser River prevented operations in 1949.

McGILLIVRAY CREEK.

Lease of Mrs. L. Weeden.—One hundred cubic yards of gravel was sluiced on this lease one-half mile above the Pacific Great Eastern Railway.

Lease of E. P. Hicks.—Ninety cubic yards of gravel was sluiced on this lease, which adjoins and is upstream from Mrs. Weeden's lease.

SIMILKAMEEN.*

SIMILKAMEEN RIVER (49° 120° S.W.).

Atkinson Dredging Company, Limited (*see* p. 228).

TULAMEEN RIVER.

Tulameen Dredging Company, Limited.—(49° 120° S.W.) T. M. Gerety, manager. This company operated a suction-type dredge on the Tulameen River from October 10th to November 26th, 1949. The plant was floated on pontoons and power was produced by diesel-electric machinery. The main centrifugal pump operated an 8-inch diameter suction pipe pierced at the lower end with 1¼-inch diameter holes; thus, only small-sized material was permitted to pass through the pump. Dredging started on the Tulameen River near the north-east end of Billeter Avenue, Princeton, and about 500 feet upstream from the confluence of the Tulameen and Similkameen Rivers. Three men were employed.

After working upstream about 200 feet, the dredge was torn from its moorings on the night of November 26th by an unexpected flash flood caused by unusually heavy rains. The dredge was carried swiftly downstream, where it was broken up on the rocks and completely wrecked.

Slate Creek Placers, Ltd.—(49° 120° N.W.) E. A. Goode, president; E. M. Morgan, secretary-treasurer. This company is engaged in exploratory work on Placer-mining Lease No. 1250 about 3½ miles west of the village of Tulameen. An adit started in 1948 to prospect for an old channel of Olivine (Slate) Creek subsequently caved and was abandoned. A new adit, with the same objective, was started a few feet to the left of the former portal. The new adit was advanced 133 feet when work was stopped for the winter. Three men were employed.

* By E. R. Hughes.

Structural Materials and Industrial Minerals.

CONTENTS.

INTRODUCTION.

This section contains progress notes on properties and operations producing structural materials and industrial minerals in British Columbia. Brief reports on a few undeveloped properties are also included.

For a detailed list of occurrences of the various structural materials and industrial minerals, as well as a selected group of references on these same materials, the reader is referred to Minister of Mines, British Columbia, Annual Report, 1947, pages 203 to 224.

Statistics regarding production of structural materials and industrial minerals are given in the following tables:—

Table I, page 15, sub-headings " Non-metallics " and " Clay Products and other Structural Materials."

Table X, page 26, " Production in Detail of Structural Materials."

Table XI, page 27, " Production in Detail of Miscellaneous Metals, Minerals, and Materials."

ASBESTOS.

Acme Asbestos Cement Co., Ltd.*—Company office, 1222 Sixty-seventh Avenue East, Vancouver. Robert Sanderson, president. The company obtained an option in 1949 on a group of claims on Sproat Mountain, 4 miles north of Arrowhead. In 1949 a geological survey of the property was made by Dr. V. Dolmage. No other work was done.

[References: *Geol. Surv., Canada,* Mem. 161, p. 111; *Minister of Mines, B.C.,* Ann. Rept. 1928, p. 313.]

BARITE.

Mountain Minerals, Limited.* Company office, Morris Building, P.O. Box 273, Lethbridge, Alta. R. A. Thrall, managing director. Capital: 2,000 shares, $100 par value. This company owns a barite quarry near Parson and another near Brisco. Because of market conditions, operations were curtailed during 1949. At the Parson quarry about 500 tons was mined and shipped in addition to 500 tons that had been stockpiled at the Parson siding. At the Brisco quarry no mining was done, but a stripping programme was carried out to determine the extent of the vein deposit. W. McPherson was in charge, with two men employed.

* By J. W. Peck.

BUILDING-STONE.

ANDESITE.

Haddington Island.*—(50° 127° N.E.) J. A. and C. H. McDonald, of Vancouver, operated this quarry throughout the summer to obtain building-stone. This stone is handled by derricks, loaded on scows, and taken to Vancouver for shaping. Ten men were employed during the operating year.

Vancouver Granite Co., Limited.* Nelson Island (49° 124° N.E.). Company office, 744 Hastings Street West, Vancouver; quarry, Nelson Island. W. C. Ditmars, general manager. This quarry is operated to recover dimension stone for monuments and for building. Stone which is not of this quality is sold for jetty-rock or rubble. The rock is drilled and then wedged or blasted to size. Three 20-ton capacity wooden derricks were installed to handle the stone. The blocks are shipped to Vancouver for cutting and finishing or exported to the Pacific Northwest States.

The average number of men employed is nine.

GRANITE.

Coast Quarries, Limited.* Granite Falls (49° 122° S.W.). Company office, 1840 Georgia Street West, Vancouver; quarry office, Granite Falls. W. A. Bickell, manager; T. H. Burrows, superintendent. Mr. Bickell succeeded J. H. Davidson as manager in 1949. This company quarries granite at Granite Falls, on the North Arm of Burrard Inlet. Two quarries are being operated to produce jetty-rock, rip-rap, and rubble. After blasting, the rock is loaded by diesel-driven shovels, of 1-cubic-yard capacity, into semi-cylindrical skips of 10-ton capacity. These skips are then transported by a steam-operated derrick and loaded on scows. Trucks are also used to haul broken rock to scows.

Fifteen men are employed when the quarry is operating at its maximum output.

Gilley Bros., Limited.* Pitt River (49° 122° S.W.). Company office, 902 Columbia Street, New Westminster; quarry office, Pitt River. J. H. Gilley, general manager; Francis J. MacDonald, superintendent. This quarry, on the east shore of Pitt River, produces granite for jetties and dykes. The rock is drilled and blasted and then loaded by mechanical shovels into trucks. A 1½-cubic-yard shovel driven by compressed air and a diesel-driven ¾-cubic-yard shovel comprise this loading equipment. Trucks dump the rock into a chute, from which scows are loaded.

Construction of a new crushing plant was completed this year. A 42- by 60-inch jaw crusher was installed. Chutes and conveyer-belts facilitate loading crushed rock on scows.

A 675-horsepower hydro-electric plant was also installed during the year.

The average number of men employed during the year was thirty.

Valley Granite Products, Ltd.* Cheam View (49° 121° S.W.). Company office, 114 First Avenue, Chilliwack; plant, Bridal Falls. Roy Edwards and Hyla T. Hudson, owners. In March, 1943, R. Edwards and H. T. Hudson purchased Valley Granite Products, Limited, from L. Hausler. The granite quarry and crushing plant are several miles east of Rosedale (49° 121° S.W.).

The crushing plant has a capacity of 8 tons a shift and produces bird, chicken, and turkey grit. Stucco dash and some ornamental stone are also produced.

The average number of men employed is four.

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* By R. B. King.

CEMENT.

British Columbia Cement Company, Limited.* Head office, corner of Fort and Wharf Streets, Victoria. N. A. Tomlin, managing director; C. S. Williams, general superintendent. Quarries are operated at Bamberton (48° 123° N.W.) on Vancouver Island and at Blubber Bay (49° 124° N.W.) on Texada Island to produce limestone and greenstone used in manufacturing cement. At Bamberton three quarries produced lime rock during the year. Greater production from the third quarry is planned. Broken rock is loaded by electric shovels into "dumptors" and trucks and hauled to the crushing plant. Gyratory crushers and ball mills reduce the rock to fine sizes to make a slurry that is burned in rotary kilns. Approximately 12,000 tons of rock is quarried monthly. The number of men employed in quarrying averages twenty-one in the company's plant at Bamberton.

At Blubber Bay three limestone quarries were operated. The broken rock is loaded by diesel-powered shovels into dump cars that are hauled over a narrow-gauge railroad to a crushing plant. Crushed rock is loaded on scows by conveyer-belts and shipped to the plant at Bamberton. Approximately 18,000 tons of limestone is produced monthly. The number of men employed during 1949 averaged thirty-five.

CLAY AND SHALE.†

During the 1949 field season, samples of clay were collected from deposits in several parts of the Province. These samples were sent to the Mineral Dressing and Process Metallurgy Division, Ceramic Section, Bureau of Mines, at Ottawa. Grateful acknowledgment is hereby made to the Bureau for making ceramic tests on the samples.

The following notes record the location of the deposit from which the sample was obtained; the characteristics of the clay deposit observed in the field; and, in quotations, the conclusions regarding the clay taken from the report of the Mineral Dressing and Process Metallurgy Division, Bureau of Mines, Ottawa. Note 1 records the results of tests made in the laboratory of the British Columbia Department of Mines, Victoria, on seven samples from the deposit at Clemretta.

1. *North Shore of François Lake, 2 Miles West of Clemretta Post Office, Lot 703, Range 4, Omineca District; Property of J. Alto.*—This clay is part of Pleistocene (or Recent) drift that forms a triangular point on the north shore of the lake. The largest exposure is a wave-cut bank, 25 feet high and 100 feet long at water-level, on the east side of the point. Another small natural exposure of clay is on the west shore of the point about 2,000 feet west of the first outcrop. A few pits dug in the area between these beach exposures have reached the clay bed at various depths. The clay is brown, fine grained, sticky when wet; it is in flat-lying layers and contains scattered concretions up to 4 inches in diameter. The layers of clay average an inch in thickness and have thin films of silt between them.

Some of the clay bloats well and produces a good-quality light-weight product when heated in a stationary furnace at a temperature of 2100° F. for five minutes. However, tests in the British Columbia Department of Mines laboratory indicated that the bloating quality varies with the sample location. Only two of seven samples showed good bloating possibilities.

2. *Road Cut on No. 16 Highway 1.7 Miles East of Endako.*—A bank 10 feet high of sandy, limy, brown clay, exposed in a small road cut.

"Unsuitable for use in the manufacture of ceramic products."

3. *Railway Cut at Mile 113 West of Prince George.*—A bed 30 feet thick of sandy, limy, brown clay, exposed for 300 feet along the top of a railway cut. The clay bed has a slight dip to the northeast, contains scattered concretions, and is underlain by

* By R. B. King.

† By J. W. McCammon.

beds of fine sand. This cut is about 500 feet south of the road cut described in location 2, and the clay is probably a continuation of the same bed.

" Has no economic value."

4. *Road Cut on No. 16 Highway 9.7 Miles East of Endako, Top Half of the Exposure.*—A 20-foot bed of clay, overlying sand and gravel, exposed in three small road cuts. A bed of clay, apparently the same one as just mentioned, is exposed in a 300-foot long road cut 0.3 mile farther east on the highway. This deposit forms part of a low bench around the southwest end of Fraser Lake. The clay is sandy, limy, brown, and contains scattered concretions.

" No economic value."

5. *Road Cut on No. 16 Highway 9.7 Miles East of Endako, Bottom Half of Exposure.*—This sample was taken from the bottom part of the deposit described under location 4.

" There is a possibility of using this material for the manufacture of common brick for backing-up purposes."

6. *Banks South of No. 1 Highway 3 Miles East of Kamloops, Top of Deposit.*—This sample is from a clay bed 50 feet above road level. The clay is interbedded with silts that form a terrace of G. M. Dawson's " White Silt " formation (Report on Kamloops Map Sheet, British Columbia, 1895, p. 252B, Geological Survey, Canada). The clay is light brown, gritty, and limy.

" Not suitable for use in the manufacture of ceramic products."

7. *Banks South of No. 1 Highway 3 Miles East of Kamloops, Bottom of Deposit.*—This sample is from a 3-foot thick bed of clay at road level below the bed at location 6.

" No value as a raw material for ceramic products."

8. *Road Cut on Okanagan Lake Highway 12.3 Miles North of Summerland.*—Two beds of brown, silty, limy clay, each 1 foot thick, exposed in a small cut beside the road.

" No economic value."

9. *Road Cut on Okanagan Lake Highway 5.5 Miles North of Summerland.*—Thin layers of brown and grey, silty, limy clay, exposed in a bank beside the highway.

" Not suitable for use in the manufacture of ceramic products."

10. *Top of Terrace 5.5 Miles South of Summerland on the Okanagan Lake Highway.*—A 3-foot thick bed of clay, exposed near the top of a terrace 300 feet north of the highway. The clay is brown to grey, silty, and limy.

" Not recommended for use in the manufacture of ceramic products of any kind."

Abbotsford Fire and Pressed Brick Co., Ltd.*

Abbotsford (49° 122° S.E.). Office and plant, Abbotsford. Mr. Blackmon, manager; Charles Goldsmith, plant manager. Surface clay is mined by hand from a shallow clay pit and is trucked about a mile to the plant. Dry pressed bricks are formed here and are burned in rectangular wood-fired kilns. The plant was reopened in September, 1949, after being shut down for a year. When this company is operating its pit and plant, it employs eleven men.

Bear Creek Brick Company.*

Surrey (49° 122° S.W.). Head office, Victoria Brick and Tile Supply Company, Vancouver; plant, Archibald Road, Surrey District. A. T. Ayling, plant manager. Surface clay is mined from a pit adjacent to the plant. The height of the face in the clay pit seldom exceeds 10 feet. On a narrow-gauge track, cars of 5-cubic-foot capacity haul the clay to the brick-forming plant. The bricks are formed by a wet-press process and placed in hacks to be weather-dried. Wood-fired scove kilns are built for burning brick.

This company operated during the summer of 1949 and employed an average of seven men.

* By R. B. King.

Burrard Brick Company.* Pleasantside (49° 122° S.W.). Plant and office, Pleasantside. F. C. Stanley, manager; J. E. Hutchinson, plant manager. Common brick is produced from local surface clay. Clay is mined from a shallow pit approximately 600 feet from the plant. Small charges of 20 per cent. stumping-powder, loaded in holes drilled by auger, are used to loosen clay for hand-shovelling. The brick is formed by a stiff-mud extrusion process and is weather-dried in hacks. Rectangular up-draught wood-fired kilns are used for burning brick.

The number of men employed during the operating year averaged four.

Clayburn Company, Limited.* Kilgard (49° 122° S.E.). Company office, Credit Foncier Building, Vancouver; plant office, Kilgard. R. M. Hungerford, managing director; R. Ball, superintendent. In January a fire destroyed the forming plant of the company, and the mine and plant were shut down until November. A modern plant for crushing and pulverizing and for forming sewer pipe was constructed on the site of the former plant and put into operation.

A large plant for production of standard firebrick and special shapes is being constructed at Abbotsford. This plant will include continuous kilns and modern machinery for forming.

Pacific Clay Products, Limited.* Pleasantside (49° 122° S.W.). Office and plant, Pleasantside. Mr. Bell, owner and plant manager. This company produces common brick from local surface clay, mined from a shallow pit. Charges of 20 per cent. stumping-powder are placed in holes drilled at the floor of the pit and are blasted to loosen the clay. A stiff-mud extrusion process is used to form the bricks. These bricks are weather-dried before being placed in rectangular wood-fired kilns for burning.

The average number of men employed during the operating year is four.

Port Haney Brick Company, Limited.* Haney (49° 122° S.W.). Company office, 846 Howe Street, Vancouver; plant, Haney. E. G. Baynes, president; J. Hadgkiss, plant manager. The company operates a large plant producing structural tile, drain tile, and flue lining, as well as face brick and common brick. Clay is mined from open pits near the plant. The deposit is being worked in benches with faces 10 feet high. A ½-cubic-yard shovel digs the clay and loads it on trucks for transportation down a 5-per-cent. grade to the plant. The clay is dried in a rotary kiln, then conveyed to a dry pan for grinding. Bricks and tile are formed by a stiff-mud extrusion process. The product is dried in a drying plant under controlled temperature before being placed in wood-and-coal down-draught beehive kilns. The drying plant was constructed this year. Fifty men were employed.

Richmix Clays, Limited.* Kilgard (49° 122° S.E.). Work office, 2890 Twelfth Avenue East, Vancouver; mine, Kilgard. G. W. Richmond, manager. Fireclay is mined from one of the same seams worked by the Clayburn Company. Quarrying is by room-and-pillar methods with systematic removal of the pillars. Five men are employed and approximately 150 tons is mined each week.

FLUORITE.

Spar 1 and Spar. 2.† Birch Island (51° 119° N.W.). Ole Johnson, of Chu Chua, holds two claims, the Spar 1 and Spar 2, on a fluorite deposit east of Foghorn Creek on the summit of Red Ridge, 2 miles south of Birch Island. Birch Island is a station on the Canadian National Railways on the south bank of the North Thompson River, 80.9 miles north of Kamloops. A bridge connects the village with the North Thompson Highway.

* By R. B. King.

† By J. W. McCammon.

There is a wide, well-built switchback trail 3 miles long from the village to the old Smuggler mine camp at 3,700 feet elevation. The fluorite deposit is at 4,500 feet elevation, about a mile farther by rough trail from this camp.

This fluorite ground was originally covered by two claims, the Atlantic and Pacific, located in 1918 by A. G. McDonald for J. F. Gardiner and E. H. Mansfield. The same ground was included in the claims of the Smuggler property, which was prospected for silver-lead in 1926 and 1927 and for manganese in 1929. O. Johnson relocated the ground as the Spar 1 and Spar 2 Mineral Claims in 1942 and still holds them. The claims were diamond drilled by the B.C. Fluorspar Syndicate in 1943. They are at present leased to T. A. E. Sjoquist and associates, of Kamloops, who hold other claims surrounding the Spar 1 and Spar 2.

The deposit has been described by R. P. D. Graham in the Munition Resources Commission, Canada, Final Report, 1920, pages 49 to 52, and by J. F. Walker in the Geological Survey of Canada, Summary Report, 1930, Part A, pages 146 to 150. It is mentioned in the Minister of Mines, B.C., Annual Report, 1930, pages 192 and 193.

The fluorite occurs in the centre of the top of a small flat knob that forms the end of a long ridge that extends north from Granite Mountain. The ground is open with fairly abundant outcrops on the top of the ridge but is bushy and steep with few outcrops on the sides of the ridge.

Walker mapped the rocks in the area of the claims as metamorphosed sediments with granodiorite bodies, possibly Precambrian in age.

At the fluorite showing the country rock is an altered, intrusive porphyry composed chiefly of feldspar. About a quarter of a mile southeast along the ridge-top trail there is an outcrop of reddish, gneissic, granitic rock. Schistose, well-bedded sediments outcrop in the vicinity of the old Smuggler workings two-thirds of a mile down the trail north from the fluorite.

The fluorite occurs in massive form and as small angular grains disseminated among other minerals. Massive fluorite was observed in open-cuts 4, 6, and 7 (*see* Fig. 29) and in an old adit north of the main showing.

A zone of pale-mauve fluorite, 4 feet wide, crosses near the centre of open-cut 4. The fluorite is badly shattered and occurs as closely spaced, irregular, pod-like masses up to a foot thick with small lenses of quartz in a matrix of the disseminated fluorite. A few grains of galena were noted in one quartz lens. The remainder of the open-cut exposes disseminated fluorite. Massive fluorite occurs similarly in open-cuts 6 and 7. There are no rock exposures between open-cuts 4 and 6 or between open-cuts 6 and 7. The massive fluorite in all three pits has a similar colouring and the same general attitude, so is probably one continuous zone.

The other massive fluorite examined was in a 30-foot adit 300 feet lower than and 2,000 feet north of the main fluorite outcrop. This adit is driven along a rusty shear that strikes north 50 degrees east through altered granitic rock. Whitish fluorite forms an 8-inch wide lens that extends for 7 feet in from the portal and then pinches out. More fluorite is exposed in a continuation of the same shear 40 feet above the portal. Black earthy manganese oxide is exposed in patches with the fluorite in the adit.

The disseminated fluorite forms an irregular, tabular zone that strikes northeasterly and dips northwesterly. This zone, exposed for 1,000 feet along the strike, varies in surface width from 150 feet at a point just south of open-cut 8 to a width of 450 feet at a point 500 feet north of open-cut 1. The boundaries of the zone are not well defined. The fluorite is found mainly as angular purple grains, mostly small, but some up to 0.3 inch in diameter, mixed with varying amounts of other minerals. In the centre of the zone the fluorite is very conspicuous and forms a large part of the rock-mass. The concentration of fluorite gradually decreases outward from the central area until this mineral is no longer visible to the unaided eye. Beyond the limits of the

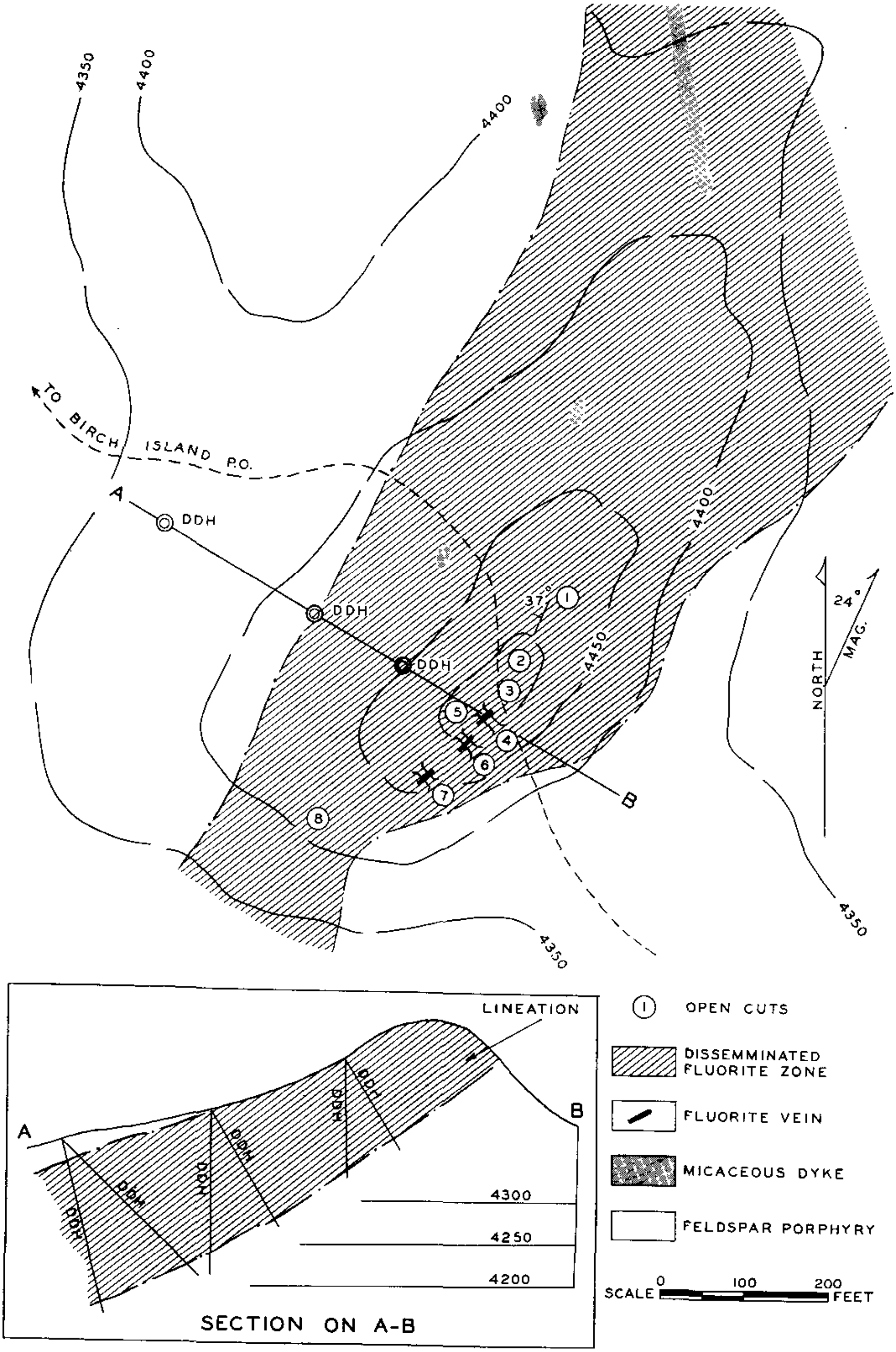


Fig. 29. Birch Island fluorite.

fluorite the rock is composed mostly of feldspar. The east and west zone boundaries indicated in Figure 29 are drawn along the limits at which fluorite ceases to be visible to the unaided eye. The zone probably extends farther north and south than the map shows, but overburden in those directions prevented bedrock observations to prove or disprove such an extension.

The open-cuts reveal a distinct banding of the rock in this mineralized zone caused by linear arrangement of grains and by concentrations of mineral grains of different colours. This banding has a general northeasterly strike and a northwesterly dip that varies from 35 degrees in open-cut 6 to 65 degrees in open-cut 7, with an average throughout the zone of about 40 degrees. Diamond-drill records of the B.C. Fluorspar Syndicate indicate the continuation of this dip of the fluorite zone as shown in the generalized cross-section in Figure 29.

A system of jointing is present, particularly conspicuous in open-cuts 1 and 2. These joints have the same general strike as the banding mentioned above, and their dip is almost vertical. The joint planes cut across the various mineral grains, thus indicating that the joints formed after mineralization.

Rock from the central part of the mineralized zone is fine grained and mauve to purple-grey. In the hand specimen it appears to be an aggregate of purple and white fluorspar grains, pyrite cubes, and grains of a softer, dirty-white mineral, which the microscope indicates to be celestite. Scattered feldspar crystals, sericite, and occasional grains of galena are also visible. Under the microscope it can be seen that the large grains of fluorspar are fractured and that the fractures are filled with celestite. Where the fluorite grains are small they are usually interspaced with similar-sized grains of celestite.

At the edge of the fluorite zone the rock is pale grey and consists of a dense siliceous-looking groundmass with scattered feldspar laths and pyrite cubes. Thin sections of this rock showed the groundmass to consist of a mass of tiny feldspar laths with little or no quartz. The large feldspar phenocrysts, which are orthoclase and microcline, are fractured and corroded. Sericite is scattered through the groundmass.

Outside the zone containing visible fluorite the rock is light grey and consists mostly of large orthoclase and microcline crystals up to half an inch long. Thin sections of this rock showed it to be 90 to 95 per cent. orthoclase and microcline in large phenocrysts with a few small plagioclase crystals and the interstices filled with tiny feldspar laths, sericite, and pyrite. Weathering of the pyrite has stained the surface exposures yellow.

A brecciated appearance is noticeable in the rock at certain places. This is most pronounced in open-cut 5 and to some extent in open-cut 2.

About 600 feet north of open-cut 1 there is a lens of material consisting largely of lead-grey mica in crystals up to 1 inch in diameter and pyrite with minor amounts of fluorite. This outcrop forms a small bluff. It has the appearance of an altered intrusive but may simply be a concentrated patch of the minerals. One or two similar but smaller outcrops were seen. The logs of several drill holes mention occurrences of like material. Another larger outcrop of this material lies southeast of the fluorite area.

Work done on the property at the time of this examination consisted of eight small, shallow open-cuts near the central part of the fluorite zone. All exposed disseminated fluorite, whereas open-cuts 4, 6, and 7, as mentioned previously, disclosed sections of massive fluorite. The B.C. Fluorspar Syndicate did a lot of diamond drilling in the fluorite zone during 1943. The logs of the drill holes were kindly made available to the Department of Mines through the courtesy of B. S. W. Buffam and W. F. James.

Samples taken in August, 1949, gave the following assays:—

Sample.	CaF_2.	$SrSO_4$.	FeS_2.	$BaSO_4$.	Ce.	La.	Y.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.			
1. Open-cut 1, across 10 feet	26.7	18.6	5.4	......	†	†	*
2. Open-cut 2, across 15 feet	37.2	22.6	3.8	1.9	....	†	....
3. Open-cut 3, across 14 feet	13.8	0.6	2.8	......	*	†	....
4. Open-cut 4, west end, across 19 ft.	13.6	8.4	2.0	......	*	†	....
5. Open-cut 4, centre, across 4 feet	66.2	1.2	1.0	......	....	....	....
6. Open-cut 4, east end, across 10 ft.	12.0	11.8	0.6	4.7	*	*	....
7. Open-cut 5, across 6 feet	11.3	9.0	4.8	......	*	†	....
8. Open-cut 6, across 6 feet	56.5	1.1	1.6	......	....	*	....
9. Open-cut 7, across 11 feet	49.3	7.1	1.2	1.8	†	†	....
10. Open-cut 8, across 27 feet	29.7	21.2	3.0	2.1	†	†	*

* Indicates trace.
† Indicates greater than trace, but actual amount not determined.

As yet no successful process has been developed to separate and concentrate the fluorite and celestite. Graham reports the results of tests by the Department of Mines at Ottawa as follows:—

" *Concentration Tests.*—The sample (10 lb.) of the fine-grained purple material taken by Prof. Graham was subjected to concentration tests at the Ore Dressing and Metallurgical Laboratories of the Mines Branch, Department of Mines. The sample was crushed to 50 mesh and a small portion taken for analysis. It was found to contain 3.70 per cent. of iron sulphide. Small tests were made by table concentration and flotation to remove these sulphides. Analysis showed 1.94 per cent. of iron sulphide in the table product, and 1.07 per cent. in the flotation product. Table concentration removed the coarse pyrite but a percentage of the fine pyrite slimed and was carried over into the fluorite product. Flotation concentration remove the fine pyrite but a percentage of the coarse pyrite was too heavy to float satisfactorily and remained in the fluorite product. A combination of table and flotation concentration should give satisfactory results.

" *Conclusions.*—The fine-grained purple material is too impure to use as a flux or for purposes other than, possibly, the production of hydrofluoric acid. It is doubtful if such use could profitably be made of it. The celestite apparently cannot be removed by concentration. The coarser-grained material in the zone bordering the fine-grained band probably contains too low a percentage of fluorite and too much pyrite to be utilized. The white fluorite is of excellent quality but was only observed in a few small exposures."

Preliminary tests by the British Columbia Research Council gave the following results:—

" Pyrite formed about 10 per cent. of the ore, fluorite 20 to 30 per cent., celestite 15 to 25 per cent., and feldspars 40 to 50 per cent., with quartz a minor ingredient.

" Feldspars exhibit a relatively coarse-grained texture, being veined, surrounded, and partly replaced by a mixture of fluorite, celestite, and mica. This mixture ranges from medium to very fine grained in texture, being substantially finer than 325 mesh in places. Although some relatively large fluorite grains occur free from celestite, in many places the two minerals are intimately intergrown.

" For satisfactory unlocking of fluorite and celestite a grind of less than 200 mesh is indicated.

"*Spectrographic Examination.*—Products from a preliminary flotation test were spectrographed with the following results (per cent. approximate only):—

	Pb.	Ba.	Mo.	Cu.	Y.	La.	Ce.
Sulphide concentrate	3	....	2	0.1	0.2	1.0	0.2
Celestite product (about 80 per cent. celestite)	0.2	1.0	0.2	0.01	0.3	2.0	2.0
Fluorite product (about 30 per cent. celestite)	0.1	2.0	0.05	0.01	0.3	2.0	2.0
Fluorite middlings	0.2	1.0	0.1	0.005	1.0	2.0	2.0
Tailings	0.1	....	0.1	0.005	0.05	1.0	0.2

"Although quantitatively the above results are only relatively correct, the amount of rare earths present is very interesting. These appear to be definitely associated with the fluorite and celestite and not with sulphides or feldspars."

GYPSUM.

Gypsum, Lime and Alabastine, Canada, Limited.*

Falkland (50° 119° S.W.). Head office, Paris, Ont.; British Columbia office, 509 Richards Street, Vancouver. Norman Jessiman, British Columbia manager; Cecil J. Miller, quarry manager. This company mines gypsum at Falkland, 40 miles from Kamloops on the Vernon–Kamloops Highway and on the Vernon branch of the Canadian National Railway. Gypsum is mined from open quarries 500 to 600 feet above the railway on the steep hillside north of the village. Compressed-air jackhammers are used for drilling; 30 per cent. Forcite and 25 per cent. Stopeite blasting-powder is used for blasting. Broken rock is loaded by power-shovels and transported by trucks to a crushing plant and bunkers at the railway for shipment to the company's mill at Port Mann. The quarries operated throughout the year. During the summer a bulldozer was used to do extensive stripping to prepare for the development of a new quarry 1½ miles northwest of the old quarry sites. Twenty-seven men were employed.

Columbia Gypsum Products, Inc.†

(50° 115° S.W.) Head office, 40 Harrison Building, Bremerton, Wash.; British Columbia office, 601 Royal Trust Building, Vancouver; quarry office, Windermere. L. G. Brown, president. This company is developing a gypsum quarry in Windermere Creek valley, 9 miles by road from Windermere Lake Station on the Kootenay Central branch of the Canadian Pacific Railway.

Work in 1949 was restricted to opening a quarry face in preparation for full production when the company's fabricating plant is completed in Spokane. A good quarry face of white gypsum was established, and a depth of at least 70 feet of gypsum was proved by drilling. Two carloads of gypsum were shipped to plants in Calgary for trial.

More gypsum was found in the area, and the company obtained seventeen claims to the north between Windermere Creek and Shuswap Creek. A block of claims was also staked on the Kootenay River 6 to 8 miles north of Canal Flats. J. M. Cummings was in charge of operations during the year.

Canada Cement Company.†

Mayook (49° 115° S.W.). Two claims, the Cave and the Sunrise, are located astride the Cranbrook–Fernie Highway 16 miles east of Cranbrook and a quarter of a mile northeast of Mayook. They are owned by the Canada Cement Company but were operated under lease during 1947, 1948, and 1949 by A. Howard, of Fort Steele. The gypsum is grey, and its main use is in the cement industry; the company's plant is at Exshaw, Alta.

* By E. R. Hughes.

† By J. W. Peck.

Since the start of operations in November, 1947, a quarry pit has been opened up that extends for about 300 feet in length, 100 feet in width, and 20 feet in depth. Compressed air is supplied by a portable Ingersoll-Rand compressor. Loading is done by a bulldozer equipped with a lift shovel attachment. The gypsum is trucked to a loading bin at Mayook siding. The number of men employed averaged four.

Production in 1947 was 1,546 tons; in 1948, 12,185 tons; and in 1949, 14,238 tons.

LIMESTONE.

F. J. Beale.*

(52° 127° S.W.) The Gunboat Passage quarry, 6 miles east from Bella Bella, was operated for the first seven months of the year. In August, 1949, the machinery was moved to Walker Point in Burke Channel. Limestone was mined at the Walker Point quarry until October, when storms forced a shut-down. All the lime rock produced was taken by Pacific Mills at Ocean Falls. About eight men were employed.

Koeye River Limestone Company.*—(51° 127° N.W.) P. Christiansen, owner and manager. The quarry is on the Koeye River, 6 miles south of Namu. It was operated intermittently throughout the year. The lime rock was loaded on scows and towed to Pacific Mills at Ocean Falls.

Clinton Lime Holdings, Ltd.†

(51° 121° S.W.) Company office, 850 Hastings Street West, Vancouver; plant office, Clinton P.O. F. E. Wilkes, president; J. M. Simpson, superintendent. This deposit of travertine or calcareous tufa is 3 miles west of Clinton, on the Pacific Great Eastern Railway. In 1949 agricultural lime was produced by a crew of five men, quarrying with the aid of a bulldozer and shovel loader intermittently until June.

Beale Quarries, Limited.‡

Vananda (49° 124° S.W.). Head office, 744 Hastings Street West, Vancouver; quarry office, Vananda. W. D. Webster, superintendent. This company produces, from its quarry, " man rock " for paper mills, and pulverized rock for agricultural and industrial uses and for rock dusting coal mines. Quarried rock is loaded on trucks by diesel-driven shovels and transported to the plant. This rock is dumped on a grizzly that separates the " man rock " from the undersize or spalls. The " man rock " goes directly to scows for shipments. The spalls are conveyed to a stockpile and from there taken to the crushing and pulverizing plant.

The production of all products from this plant is 6,000 tons per month.

The average number of men employed is twenty-one.

Marble Bay Quarry.‡

Vananda (49° 124° N.W.). Office and quarry, Vananda. Stanley Beale, manager. In addition to quarrying at the Marble Bay quarry, Mr. Beale opened a quarry on Lot 25 in August, 1949. The latter quarry is 1½ miles from the west coast of the island and is 3½ miles by road south of Vananda. Limestone is quarried to produce " man rock " for pulp mills. The mechanical equipment used is two diesel-driven shovels, each of ½-cubic-yard capacity, and trucks of 5- and 10-ton capacity.

Approximately 3,000 tons of limestone is broken a month. The average number of men employed during the year is seven.

Pacific Lime Company, Limited.‡

Blubber Bay (49° 124° N.W.). Head office, 744 Hastings Street West, Vancouver; plant, Blubber Bay. F. W. Harvie, general manager; A. M. Stewart, assistant general manager; A. A. Lee, plant superintendent. This company operates lime quarries and a lime-burning plant near Blubber Bay. Approximately two-thirds of the limestone that is quarried is burned for lime products; the remainder is used for smelter flux, cement manufacture, and in pulp mills.

* By F. J. Hemsworth.
† By J. E. Merrett.
‡ By R. B. King.

In the lime-burning plant two multiclone dust-collecting units were installed to collect dust from the rotary kiln. These are working efficiently by reducing to a negligible quantity the volume of dust lost. Two large, prefabricated steel-truss buildings covered by aluminium sheeting have been erected for warehouse and machine-shop space.

To promote safety, a committee composed of management and employees has been formed. It meets at regular intervals to discuss safety procedures.

The average number of men employed during the year was 145.

Agassiz Lime Quarry.*—Agassiz (49° 121° S.W.). Hiram Cutler, owner. This quarry and plant, situated nearly 2 miles southwest of Agassiz, produce agricultural limestone. Broken rock is hauled to the plant by a loader of ¼-cubic-yard capacity. The daily capacity of the plant is about 12 tons. Seven men are employed.

Fraser Valley Lime Supply Company.*—Popkum (49° 121° S.W.). In September, 1949, Del Dash, James G. Henderson, and Thomas Mair started operating the quarry at Popkum which was, until March, 1949, worked by the Adanac Lime Company.

The plant can manufacture 40 tons per shift of pulverized lime for agricultural use.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1948, p. A 188.]

The Consolidated Mining and Smelting Company of Canada, Limited (Fife).† (49° 118° S.E.) Head office, Trail; quarry at Fife. Quarrying of limestone continued throughout the year. The material is blasted from benches, loaded into narrow-gauge cars by a gas shovel, and trammed 500 feet to a loading-bin on the Canadian Pacific Railway. It is then shipped to Trail to be used as a flux in the smelter. Work at the present site commenced in 1942, and up to 1944 limestone was mined by glory-hole methods. Underground workings consisted of a drift 440 feet long and two crosscuts 170 feet and 140 feet long respectively, connected by raises to the glory-holes. In 1944 a quarry floor was established 50 feet to the west of the adit, and by the end of 1949 a pit 320 feet long, 70 feet wide, and 80 feet deep had been quarried. It is estimated that this site has produced 220,000 tons since 1942. Toward the end of 1949, however, the limestone was becoming more difficult to reach by present methods, and a new quarry was established 280 feet vertically above the old quarry floor. This necessitated building a road to the new site, and the material obtained will be trucked directly to a loading-ramp at the railway. Operations during 1949 were under the direction of M. Agostonelli, and eleven men were employed.

MARL.

Cheam Marl Products, Limited.*—Popkum (49° 121° S.W.). A. M. Davidson, manager. Marl is mined from a deposit near the east shore of Cheam Lake. Drainage ditches have been dug, and some overburden has been removed to dry the marl.

Two men are employed.

Marlime, Limited.* Popkum (49° 121° S.W.). W. Munro and R. Gunn are mining marl from a deposit on the east shore of Cheam Lake. A ½-cubic-yard dragline shovel digs marl that is hauled by truck to a drying plant. A rotary kiln fired by sawdust is used to dry the marl, which is then pulverized and bagged.

The plant produces nearly 10 tons a day. Five men are employed.

PERLITE.

Perlite is a volcanic glass characterized by a concentric "onion-skin" fracture and usually a 2- to 5-per-cent. water content. The raw rock is most commonly greenish-grey

* By R. B. King.
† By J. W. Peck.

to black but may show shades of brown to red. When heated rapidly in a furnace, many perlites, as well as some siliceous volcanic glasses that do not show perlitic fractures, expand into a frothy material of low density.

Commercially expanded perlite is a granular to powdery material and is generally white. Because of its cellular nature it is light in weight and has good insulating and soundproofing qualities. These characteristics make it useful in the construction industry. Expanded perlite is used chiefly in lightweight concrete aggregates, insulating and soundproofing pre-cast wallboard, and in lightweight plaster. Published data indicate a saving of 2,000 to 4,000 pounds when expanded perlite is used in place of sand in the plaster for 100 square yards of wall.

At the time of writing, one brand of expanded perlite sells in Vancouver at a retail price of $1.50 for a sack containing 3 cubic feet with an approximate weight of 30 to 36 pounds. Perlite is used largely in place of sand, which sells in Vancouver for $3.25 per cubic yard, equivalent to 12 cents per cubic foot. In California, where perlite is being used in substantial volume, the price averages about 30 cents per cubic foot.

Raw perlite is either quarried or extracted by conventional underground mining methods. It is then crushed, screen-sized, and expanded in a furnace. The expanded product is marketed as closely sized material in bulk or in sacks.

Transportation both before and after processing is likely to be the biggest single item in the production cost of expanded perlite. For this reason, then, the value of a perlite deposit will depend largely on the cost of moving the material to a potential market. In British Columbia the greatest potential market would be Vancouver and vicinity. In the United States, to date, the perlite-producing operations are on or near railways and are close to their markets.

Perlite is found in areas of Tertiary or Recent volcanics. It is believed that any glass in formations older than these would by now be devitrified and therefore useless for the perlite industry.

(The above information is taken largely from a publication "Expansible Perlite in British Columbia," by W. H. Mathews, which can be obtained by writing to the British Columbia Department of Mines, Victoria, B.C.)

Francois and Francois No. 2 (Western Gypsum Products, Limited).*

Francois Lake (54° 125° S.W.). Head office, 504 MacArthur Building, Winnipeg, Man. This company owns the Francois, Francois No. 2, and Francois Fraction claims on the north shore of Francois Lake about 4¼ miles east of Francois Lake P.O. Access to the property is by road along the lake shore from Francois Lake P.O. At the time of examination this road was suitable for truck travel to a point 3.6 miles east of the post office; the remaining part was impassible because of mud holes. The entire road could be put into working condition without great cost. Francois Lake P.O. is 14½ miles by good gravel highway from the C.N.R. station at Burns Lake.

The Francois and Francois No. 2 claims were recorded in the autumn of 1948 by N. B. Davis, of Ottawa, who sold them in January, 1949, to Western Gypsum Products, Limited. The claims were surveyed in July, 1949, at which time the Francois Fraction was recorded for the gypsum company. Local residents have recorded eight additional claims surrounding those located by Mr. Davis.

For 300 feet from the lake shore the ground rises gently as a bench wooded with poplar. From this bench a sharp rise extends for about 700 feet, whence the slope flattens again for a third of a mile to the foot of steep bluffs that mark the edge of the rolling top of the hill. The area is largely drift and timber covered. Outcrops are scarce and are found chiefly at the bluffs, along the shoreline, and in the large ravine in the centre of the Francois claim.

The perlite occurs in a series of rocks that consists of volcanic flows and beds of fragmental rock. Armstrong† subdivides the series into an older group of rocks, con-

* By J. W. McCammon.

† Map 907A, Fort St. James sheet, Canada, Dept. of Mines and Resources, 1946.

sisting mainly of andesites with conglomerate, Cretaceous or later in age; and a younger group, Eocene or Oligocene in age, consisting of rhyolites with tuffs.

The andesites outcrop on the lake shore about 1 mile east of the claims. Some of the flows are slightly porphyritic and others, at the top of the series, are amygdaloidal.

A coarse conglomerate overlies the andesite but was not seen in contact with it. The conglomerate contains boulders up to a foot in diameter. It is exposed by intermittent outcrops for 1,000 feet along the shore and has an attitude about the same as the andesite.

Francois Lake, looking easterly from landing at Francois Lake Post Office.

This conglomerate, in turn, is overlain by a series of interbedded tuffs and dense, cherty-looking rhyolitic flows. The tuffs are light grey to buff and of fine grain size. The cherty-looking rhyolite layers vary from dark greenish-grey dense rock to mottled brown and grey granular-looking material. Under the microscope the rock looks like a devitrified glass and is seen to consist of a cryptocrystalline groundmass with small scattered orthoclase phenocrysts and patches of brown glass. The dense layers are spherulitic and, in certain places, contain irregular openings, the walls of which are covered with lithophysae up to 6 inches in diameter.

A bed of coarse tuff, near the top of the rock series mentioned in the last paragraph, is buff to grey and contains mixed, slightly rounded fragments of dark volcanic porphyry, perlite, and pumiceous material up to three-quarters of an inch in diameter.

On the lake shore, and also at a point about 4,000 feet north of the shore, there is a bed of the cherty-looking rhyolite above the tuff. The perlite lies directly on the rhyolite at these two places. At an outcrop between these locations, perlite lies directly on the tuff. The perlite band is about 40 feet thick where exposed on the claims held by the gypsum company, but it seems to pinch out and disappear on the next claim to the north. The rock itself is light grey with scattered darker streaks. Is shows well-developed perlitic structure, which gives it a granular appearance. When exposed to weathering, it crumbles around the granules formed by the perlitic fractures. The perlite and rhyolite probably are derived from similar magma, but the rhyolite cooled under conditions that caused incipient crystallization rather than formation of perlite. Armstrong,* in a brief description of the deposit, includes two analyses of the perlite,

* *Geol. Surv., Canada*, Mem. 252, pp. 198, 199.

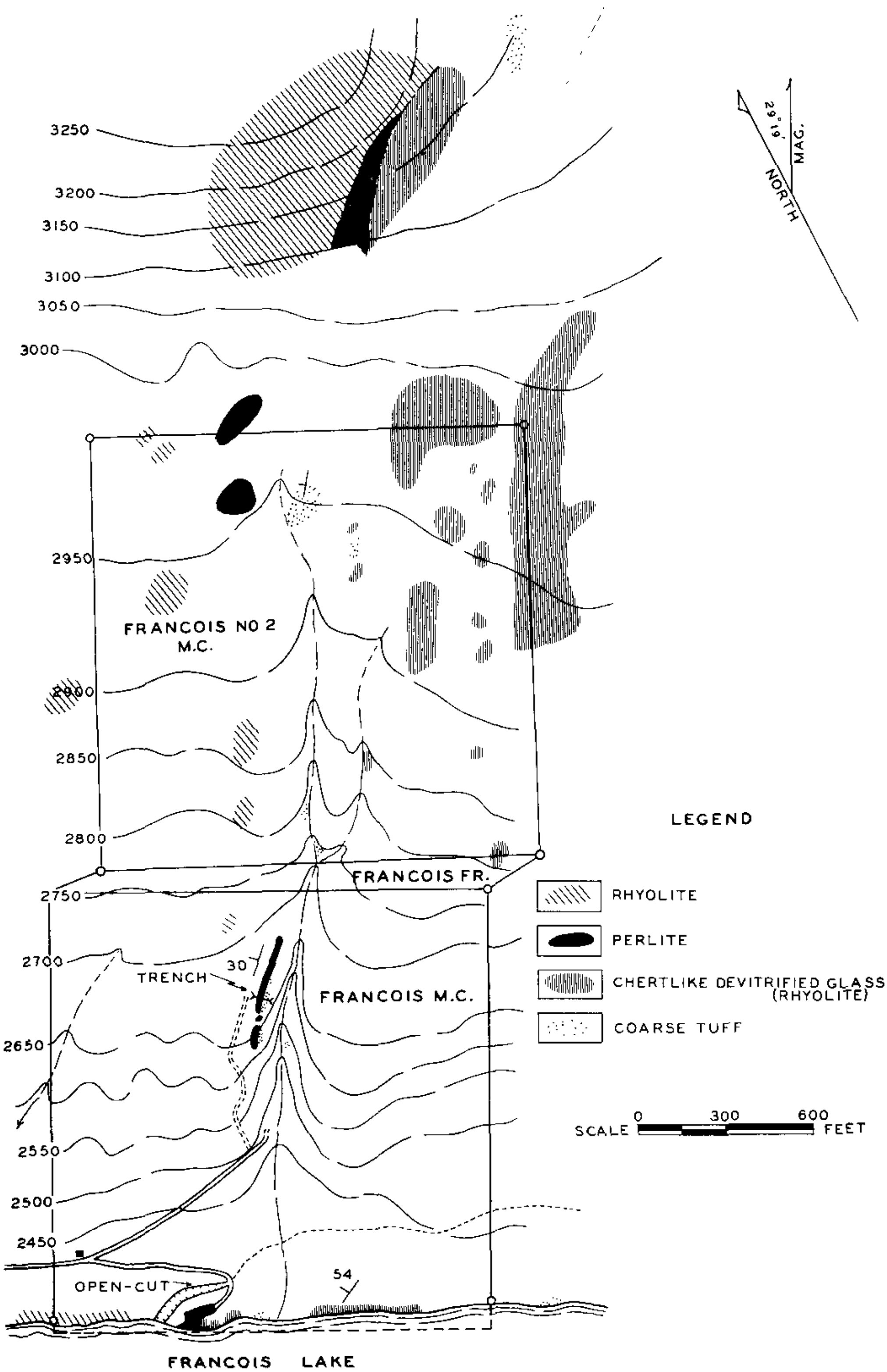


Fig. 30. Sketch plan of perlite deposit—Western Gypsum Products, Ltd.

which show it to be about 73 per cent. silica, 12 per cent. alumina, 1 per cent. iron oxide, 4½ per cent. each of soda and potash, 3.8 per cent. water, and less than 1 per cent. lime and magnesia.

A series of light-coloured rhyolite flows caps the perlite. These flows vary from pale grey to reddish-brown. Flow lines are very pronounced. The groundmass is dense and contains scattered colourless orthoclase laths up to three-sixteenths of an inch in length.

The whole series of rocks has a general strike of north 40 degrees east and an average dip of 30 degrees to the northwest.

The southwest boundary of the Francois claim is along the lake shore, and the claim extends to the northeast. Adjoining the northeast boundary is the Francois Fraction and adjoining the Fraction to the northeast, in turn, is the Francois No. 2 claim. The claims are indicated in Figure 30.

On the lake-shore exposure of perlite an area approximately 40 by 80 feet had been stripped, and a shipment of the perlite was removed for testing. Here the perlite, about 40 feet thick, lies directly on a bed of reddish-brown cherty-looking rhyolite. Two other small showings of the rhyolite lie immediately to the east, and coarse tuff outcrops 200 feet east of the perlite. A trench 20 feet wide and 200 feet long, trending east and west, 60 feet north of the lake-shore stripping, was bulldozed to a depth of 15 feet without exposing bedrock.

Perlite outcrops again 1,000 feet northeast of the lake-shore exposure at the top of a bluff that forms the west side of a gully. At this point the perlite, about 45 feet thick, lies directly on top of coarse tuff. The outcrop extends for about 400 feet along the gully. The top of the exposure is covered by silty overburden. An open-cut 10 feet long had been made on the contact of the tuff and perlite about the middle of the exposure.

The next perlite outcrop is near the centre of the northeast boundary-line of the Francois No. 2 claim. Here, two areas, each about 100 feet square, are exposed. The rock has a perlitic groundmass but contains hard, dense, spherulitic bodies about the size of peas. No other rock is exposed adjoining either of these outcrops. Between this perlite and the gully outcrop are a few scattered outcrops of rhyolite to the west and tuff to the east.

A fourth exposure of perlite is 400 feet northeast of the Francois No. 2 Mineral Claim, on the side of a sharp rise. The perlite pinches out between light-coloured rhyolite above and cherty-looking rhyolite below. Tuff occurs 300 feet to the northeast, beyond an area of drift.

In the initial phase of operation on the Francois claims, perlite could be mined by quarrying or open-pit methods, but the increasing thickness of rock overlying the perlite would probably necessitate underground mining after a quarry face had been advanced a short distance.

About 100 tons of perlite rock was shipped to the Company's plant at Calgary. A small quantity was shipped to Montreal for testing. The writer was shown a sample of the expanded perlite that had been processed in Montreal. It was a fine, white, granular material of very light weight.

Olive, Ralph, Gem 1, Gem 2.* Empire Valley (51° 122° S.E.). Lawrence Frenier, of Clinton, holds four claims in Empire Valley, approximately 40 miles northwest of Clinton. The claims cover deposits of perlite rock about 3 miles west of the Fraser River on Lot 5151 on Spring Creek, a tributary of Lone Cabin Creek. The claims may be reached from Empire Valley Ranch by a rough jeep-road 6 miles long. Empire Valley Ranch is 75 miles by secondary road from Clinton. An alternate route that has been suggested would involve construction of 13 miles of

* By J. W. McCammon.

road over rough country to Big Bar Ferry, which is 35 miles by secondary road from Kelly Lake on the Pacific Great Eastern Railway.

The country in the vicinity of the claims is characterized by open, gentle slopes with scattered pine trees. Overburden appears light, and outcrops are fairly abundant.

The Olive and Ralph claims are on top of a ridge on the west side of a small valley. The Gem No. 1 and Gem No. 2 claims are half a mile to the east on the ridge that forms the other side of this valley.

The Olive and Ralph claims extend in tandem from north to south along the top of a low flat ridge. The perlite appears to be a flat-lying flow covering the top of the ridge about 200 feet above the valley floor. Continuous outcrops of perlite extend for 1,000 feet east to west at the south end of the ridge. Intermittent outcrops appear for 500 feet to the north. Float indicates probable extension of the perlite much farther north. In places the top of the perlite flow is extremely vesicular. Elsewhere there is a thin mantle of overburden. At the south end of the exposure, perlite forms cliff faces, which indicate a flow thickness of 150 to 200 feet. To the west, in the bed of a small creek, the perlite overlies what is probably a flow breccia. This contains angular fragments up to 3 inches in diameter of reddish volcanic porphyry, perlite, and of a dense, white, chert-like rock, probably a phase of the perlite rock. On the eastern side the perlite overlies a bed of finer breccia that dips to the east. This breccia contains fragments similar to those in the breccia to the west. The two exposures of breccia are probably parts of the same bed. The perlite itself is a light- to dark-grey glassy rock with well-developed perlitic structure that gives it a crumbly texture, particularly where weathered.

The Gem No. 1 and Gem No. 2 claims are in tandem from north to south on top of a rounded, narrow ridge 500 feet above the floor of the valley. The perlite overlies a basic volcanic porphyry that contains stringers and nodules of chalcedony. A brownish fine-grained breccia lies on top of the perlite. The perlite is exposed by intermittent outcrops for 2,000 feet north to south and for 200 feet east to west. The rocks have a general northerly strike and an easterly dip.

At the time of examination no development work had been done on any of the claims. However, from natural exposures it was apparent that the volume of perlite rock on the claims is large.

Small-scale tests in the Department of Mines laboratory indicate that the raw perlite expands to form a white product, most of which will float on water.

Mining could be easily done by quarrying on the Ralph and Olive claims, but overlying rock on the Gem claims would prevent quarrying on them.

SAND AND GRAVEL.

Capilano Crushing Co., Ltd.* West Vancouver (49° 123° S.E.). Office and plant, 606 Marine Drive Southwest, Vancouver. W. Purvis, manager. This company operates a rock-crushing plant at the mouth of Capilano Creek. A 1-cubic-yard dragline, digging water-laid gravel from the creek, loads 5-ton capacity trucks. The crushing, washing, and screening plant has a capacity of 600 cubic yards per day of sized products. The average number of men employed during the year was seven.

Deeks-McBride, Ltd.* Company office, 1051 Main Street, Vancouver. J. W. Sharpe, general manager. Two gravel pits, with crushing and screening plants, were continuously operated in 1949 by this company. One pit is at Coquitlam (49° 122° S.W.) and one is at Seymour Creek (49° 123° S.E.). At the Coquitlam plant 500 cubic yards of gravel are crushed and screened per day. The mechanical equipment used for loading the gravel and transporting it to the plant

* By R. B. King.

consists of a dragline of 1-cubic-yard capacity, a gasoline locomotive, and narrow-gauge cars of 2-cubic-yard capacity. Ten men are employed.

At the Seymour Creek pit the semi-consolidated gravel is blasted from gravel banks 40 feet high. The mechanical equipment for handling gravel is a ¾-cubic-yard capacity diesel-operated shovel and trucks of 5-ton capacity. The crushing section of the plant was redesigned and rebuilt, and was put into operation in September, 1949. Cantilever structures, on which conveyer-belts run, are used to elevate gravel from a jaw crusher to a surge pile and from the surge pile to the screening plant.

The plant operates sixteen hours a day and produces 1,200 cubic yards of sized products in that time. The average number of men employed is thirty.

Highland Sand and Gravel Company, Limited.* Seymour Creek (49° 123° S.E.). Company office and plant, Lynnmour. W. J. Barrett-Leonard, manager. Sand and gravel, as well as crushed and sized gravel products, are produced by this company. The sand and gravel are blasted from a 50-foot gravel face and are loaded into 5-ton trucks by two diesel-driven shovels, each of ¾-cubic-yard capacity. A crushing, screening, and washing plant is operated to obtain sized products. This plant produces 300 cubic yards of sized gravel products a day. In 1949 a plant was built at the pit to form bricks and drain pipe of cement. The average number of men employed during the year was twenty-three.

Road Materials, Ltd.* Lynnmour (49° 123° S.E.). Office and plant, Lynnmour. J. E. Priest, manager. This company operates a sand and gravel pit and a processing plant for road materials. In July, 1949, a second unit was added to the processing plant, which increased the capacity to 500 cubic yards a day. Hoe-type scrapers are used to drag gravel from the pit face to a portable crushing plant. Trucks haul the crushed gravel to a stockpile at the processing plant. The number of men employed was fourteen.

Austin Road Gravel Pit.*—Austin Road, Coquitlam (49° 122° S.W.). Office and plant, Austin Road. William Trouten, Jr., manager.

Gravel and sand are produced by this company. A ⅜-cubic-yard capacity gasoline-driven shovel loads gravel and sand directly into trucks. The number of men employed is four.

Colebrook Sand & Gravel Company, Limited.*—Cloverdale (49° 122° S.W.). Office and plant, R.R. 1, Cloverdale. F. Bray and J. Bray, owners and operators. Two grades of sand and gravel are excavated at this pit. One grade is used for fill and the other is used in cement construction. A ½-cubic-yard capacity diesel-driven shovel loads gravel into trucks. A pit face 15 to 20 feet high is maintained. Two men are employed.

Greater Vancouver Sand and Gravel Company, Limited.* New Westminster (49° 122° S.W.). Office, 445 Second Street West, New Westminster; plant, 333 North Road, New Westminster. T. Burnett, manager; James Mutter, plant foreman. Sand and gravel, as well as crushed and sized gravel products, are produced by this company. Production is continuous throughout the year. The mechanical equipment used is a diesel shovel of ¾-cubic-yard capacity and a portable crushing and screening plant capable of handling 2,000 cubic yards of gravel a day. Four men are employed, and trucks are used to haul gravel from the pit.

Maryhill Sand and Gravel Company, Limited.* Coquitlam (49° 122° S.W.). Company office, 902 Columbia Street, New Westminster. J. H. Gilley, manager. This sand and gravel pit on the Fraser River near Coquitlam, employing a crew averaging fifty men, has operated continuously throughout the year. Monitors are used to wash gravel into enclosures from gravel banks. The gravel is loaded by a shovel of 1-cubic-yard capacity on to conveyer-belts that transfer it to the crushing plants. The washing, crushing, and screening plant has a capacity of 200 cubic yards an hour.

* By R. B. King.

SODIUM SULPHATE.

Cedars.* Cherry Creek (50° 120° N.W.). C. W. Austin, of Celista, holds one claim, the Cedars, which covers a small lake-bed sodium sulphate deposit three-quarters of a mile south of Kamloops Lake, 12 miles west of Kamloops. The lake can be reached by driving 2½ miles east up an old road that leaves the Kamloops–Cache Creek Highway at a gate on the east side 14½ miles west of Kamloops. The C.P.R. tracks are about 800 feet lower than the lake and half a mile to the north.

This deposit has been described as Lake No. 2, Kamloops Area, in Bulletin No. 4, Saline and Hydromagnesite Deposits of B.C., pp. 34, 35, by J. M. Cummings, published in 1940 by the British Columbia Department of Mines.

The examination upon which this report is based was made at the end of October, 1949, when Mr. Austin was working on the deposit.

The lake was dry, except for a few small circular areas near the centre of the south shore. The lake bed was covered with closely spaced, raised mud rings of the "crystal bowl" formation, typical of these saline deposits. These rings varied from 3 to 40 feet in diameter. The surface of the mud was covered with a white salt crust of so-called "winter crystal" that varied in thickness from one-quarter of an inch to 2 inches, being thickest near the centres of the mud rings. Thick layers of crystal had accumulated around the wet spots previously mentioned.

A layer of grey to black sticky mud with salt crystals scattered through it underlies the surface salt coating. The mud ranges in thickness from 3 inches near the centre of the lake to 4 feet at some spots near the shore and averages less than a foot thick.

The main bed of "permanent crystal," consisting of compact, rather clean crystalline salt, is below this mud and apparently underlies most of the lake bed. Seven small pits had been dug through the mud into the crystal bed. Water was encountered at 18 inches depth, so further digging was abandoned at the time. A thin steel rod was used as a probe to delimit the area of crystal bed. The rod was easily pushed through mud, but it would not penetrate the salt bed. Starting from the lake centre, a traverse was made out to and around the shore, probing with this rod. When a solid bottom could no longer be reached, it was assumed that the edge of the crystal bed had been reached. The dotted line on the accompanying map (Fig. 31) indicates the outer edge of the salt bed as determined by the above method. As noted later, the crystal bed within this line may not be continuous. The pits dug into the crystal bed are also shown in Figure 31. The depths of the pits were: Pits 1, 6, and 7, 1 foot; pits 3 and 4, 18 inches; pits 2 and 5, 2 feet. All were still in solid crystal. A hole drilled by hand auger from the bottom of pit 2 passed through the crystal bed and reached mud at a depth of 10 feet, indicating a crystal thickness of 12 feet at this point. An auger hole drilled 4 feet deep from the bottom of pit 5 was still in crystal, indicating a crystal thickness here greater than 6 feet. Lack of time prevented the drilling of more holes. Nichols,† referring to this same lake, states "two pits have been dug to depths of 4 and 9 feet respectively, and two holes were drilled—to depths of 7 feet near the edge of the depression and of 19 feet near the centre—without reaching the bottom of the deposit of crystal."

Mr. Austin suggests that the crystal bed may not form one continuous sheet beneath the lake bed but rather may consist of a series of solid, steep-sided, bowl-shaped masses, the upper rims of which are close together at the surface and push up the mud that forms the rings seen on the surface. The steel probe could be pushed down easily through the rings, indicating that there was mud between adjacent "bowls."

* By J. W. McCammon.

† Nichols, H. G.: *Minister of Mines, B.C.*, Ann. Rept., 1930, p. 196.

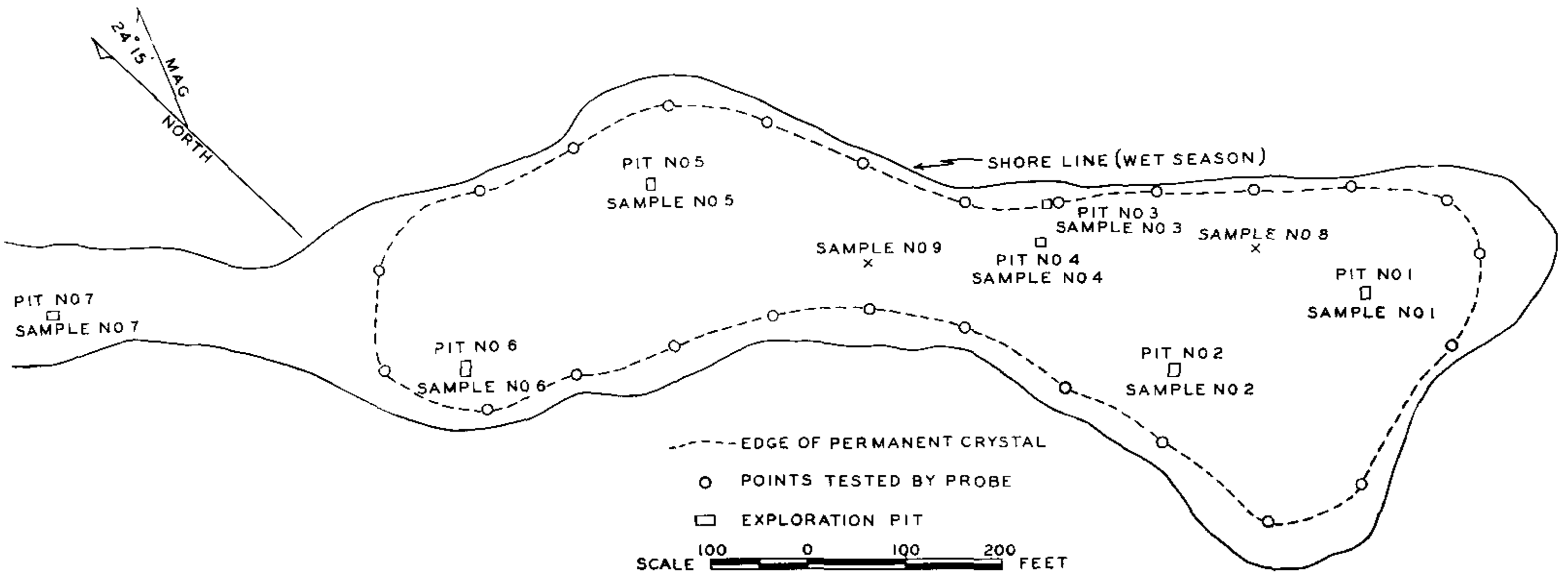


Fig. 31. Lake No. 2, Kamloops—plan showing test-pits and samples.

The 10-foot drill hole in pit 2 was just 3 feet in from the edge of a ring 30 feet in diameter. This would indicate that the sides of the " bowls " are steep, and therefore the volume of mud in the spaces between neighbouring " bowls " would not be great. The thickness of the bowl at its centre would undoubtedly be greater than 10 feet.

An accurate estimate of the quantity of salt in the deposit is impossible because of the limited number of thickness determinations. However, the estimate by Cummings* of 100,000 to 200,000 tons of raw salt (mirabilite—$Na_2SO_4 \cdot 10H_2O$), yielding 40,000 to 80,000 tons of sodium sulphate, seems justified.

Samples taken in 1949 gave the following results:—

	Sample Number.								
	1.	2.	3.	4.	5.	6.	7.	8.	9.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Na_2SO_4	82.40	97.66	58.90	87.82	95.74	87.86	83.47	97.19	93.86
Na_2CO_3	*Nil*	0.70	*Nil*	*Nil*	3.59	*Nil*	*Nil*	2.38	2.43
NaCl	Trace	Trace	Trace	Trace	0.15	0.05	*Nil*	0.10	0.08
K_2SO_4	0.65	0.15	0.89	0.52	0.20	0.39	0.50	0.13	0.24
$CaSO_4$	....	....	0.29	....	....	....	....	....	....
$CaCO_3$	2.30	0.11	4.64	1.60	Trace	1.54	2.32	Trace	0.34
$MgSO_4$	4.03	*Nil*	7.35	2.18	*Nil*	2.57	4.73	*Nil*	*Nil*
$MgCO_3$	1.93	Trace	Trace	1.94	Trace	1.73	1.88	Trace	0.94
Insol.	7.25	0.79	27.31	5.13	0.25	4.86	6.49	0.14	1.13

(Hypothetical combination of salts, samples dried at 105° C. Water of crystallization on selected crystals= 55.01 per cent.)

1. Taken across bottom of pit No. 1.
2. Cuttings from auger hole drilled 3 feet deep from bottom of pit No. 2.
3. Taken across bottom of pit No. 3.
4. Taken across bottom of pit No. 4.
5. Cuttings from auger hole drilled 4 feet deep from bottom of pit No. 5.
6. Taken across bottom of pit No. 6.
7. Taken across bottom of pit No. 7. (Pit No. 7 is in the centre of a small neck of the lake beyond the northwest limit of Figure 31.

8 and 9. Winter crystal from surface of mud at positions indicated in Figure 31.

* B.C. Dept. of Mines, Bull. 4, 1940, p. 35.

Inspection of Lode Mines, Placer Mines, and Quarries.

By H. C. Hughes, Senior Inspector of Metalliferous Mines.

CONTENTS.

PRODUCTION.

The output of metal mines for 1949 was 6,095,441 tons. This tonnage was produced from 118 mines, of which 54 produced 100 tons or more.

FATAL ACCIDENTS.

During 1949 there were eleven fatal accidents connected with actual mining operations in underground metal mines, including underground placer mines. This was twelve less than in 1948. In addition, there were two fatal accidents in above-ground operations, one arising from a slough of gravel in a gravel pit and the other from falling rock in a granite quarry. A description of these accidents is included.

There were 5,758 persons employed below and above ground in metal mines and 1,203 persons in concentrators in 1949. The ratio of fatal accidents per 1,000 persons employed was 1.58 as compared with 3.43 in 1948.

The tonnage mined per fatal accident during 1949 was 554,131 tons, compared with 245,881 tons in 1948.

The tonnage mined per fatal accident during the last ten-year period was 526,019 tons.

The following table shows the mines at which fatal accidents occurred during 1949, with comparative figures for 1948:—

Mining Division.	Mine.	No. of Fatal Accidents. 1948.	1949.
Atlin	Polaris-Taku	1	....
Clayoquot	Privateer	2	....
Fort Steele	Sullivan	4	2
Greenwood	Dentonia	1	....
Lillooet	Bralorne	1	2
Lillooet	Pioneer	1	1
Lillooet	Elizabeth group	2	....
Omineca	Silver Standard	1	....
Nelson	Emerald	....	1
Osoyoos	Hedley Mascot	....	1
Osoyoos	Nickel Plate	2	....
Similkameen	Slate Creek Placers	1	....
Similkameen	Copper Mountain	2	....
Slocan	Zincton	1	....
Vancouver	Britannia	4	4
Totals		23	11

A fatality from Gilley Brothers' Pitt River granite quarry and another from the Austin Road gravel pit have been omitted from this table.

The following table classifies the fatal accidents as to the cause and location:—

Cause.	Number.	Location.
Explosives	1	Underground.
Falls of ground	1	Underground.
Falls of ground	2	Quarry and gravel pit.
Underground haulage	2	Underground.
Ladder broke	1	Underground.
Shaft hoisting	3	Underground.
Fall from platform	1	Mill.
Inspecting bin	1	Crusher plant.
Hung-up chute	1	Underground.
Total	13	

On February 17th, 1949, Herman Christian Walch, miner at Hedley Mascot mine, received a glancing blow from a derailed car which fractured his left leg. He died in the Princeton Hospital later in the day while under an anæsthetic administered for the purpose of setting the leg. The original injury was a simple fracture and his condition on arrival at the hospital was described as " very good."

On March 3rd, 1949, Karl Algot Hogberg, driller, was almost instantly killed when he was struck by a rock which fell from the face of Gilley Brothers' Pit River granite quarry. The face had been scaled down and pronounced safe. The deceased was drilling about 200 feet from where the rock fell, and it rolled that distance down the sloping pile of broken rock and struck him when he was about 20 feet from where he had been working and was retreating to a place of safety.

On March 9th, 1949, Allan Scott Drummond, mining engineer and relief shiftboss, died as a result of multiple injuries received when he fell from a ladder which gave way while he was descending 39240 raise in the Sullivan mine. The raise was not a regular manway but was being examined by the deceased and another shiftboss. Drummond fell and rolled about 40 feet down a 50-degree slope.

On March 20th, 1949, Nelson Earl Roynon, rod-mill and ball-mill operator, died as a result of injuries received when he fell from a platform to a concrete floor in the Emerald mill of the Canadian Exploration Company. The platform had satisfactory railings, but the evidence would indicate that the deceased sat where he could watch operations and dozed off and fell about 15 feet.

On April 1st, 1949, John Henry Olver, miner; Albert Denis, skip-tender; and Alan Ray Fraser, skip-tender's helper, were all almost instantly killed while riding the cage in the East compartment of the Victoria shaft at Britannia mine. The men, contrary to regulations, were riding with a load of drill steel. The steel evidently caught in the shaft timbering about 70 feet above 2950 station, causing Denis and Fraser to be thrown out and Olver to be pinned between the cage and the timber. Denis and Fraser were found on the 4100 level or shaft bottom.

On April 15th, 1949, Norman Frank MacDonald, mucker, died as a result of injuries received earlier in the day when he drove an eye-bolt into a bootleg containing unexploded powder in the 4425 sublevel, No. 8 orebody of the Britannia mine. A hole for the eye-bolt had already been drilled, and it is hard to understand why the deceased used the bootleg. The use of bootlegs for holes for eye-bolts is strictly against company regulations owing to the danger incurred if undetonated powder should be in the hole.

On April 22nd, 1949, Joseph Alexander Clark, repairman, died of suffocation when he was buried by a cave-in of fine muck in the No. 1 fine chute at the surface crushing plant of the Sullivan mine. The deceased descended the chute on a safety belt to investigate a hang-up when the cave-in occurred. He was dead when extricated about thirty minutes later. Fellow workmen had suggested that a ladder be used, but the deceased thought the safety belt sufficient.

On May 21st, 1949, Frederick Harold Davey, miner, died as a result of injuries he received when the muck in a hung-up chute at the Pioneer mine, over which he was working, gave way and caused him and his equipment to fall into the chute. The deceased had been instructed to sprag up over the chute before he commenced drilling but had neglected to do so.

On October 3rd, 1949, Colin Lewis Leard, brakeman, was almost instantly killed when he was crushed between the motor he was driving and a chute in the Bralorne mine. Deceased was driving the motor and stopped when he saw a piece of timber at the side of the track. He backed up to allow the motorman to remove the timber and evidently did not turn around to see if the way were clear. The chute projected far enough over the track so that he struck it with his head.

On October 5th, 1949, Paul Sanfrid Anderson, miner, died as a result of injuries received when he was struck by a slab of rock in a stope in the Bralorne mine. Deceased was alone when the accident happened. There was a scaling bar beside him, so he was evidently barring down when the rock fell.

On October 6th, 1949, William Trouton, shovel-operator's helper, died as a result of injuries sustained when he was struck by a piece of hardpan which fell from the 10-foot face of the Austin Road gravel pit. The deceased was tripping the shovel when the piece fell. He was warned and started to retreat but stopped running when he heard the piece of hardpan strike the shovel track. The piece broke and one of the fragments continued rolling and struck him about the hips and legs, knocking him over. He was 76 years of age.

FATAL ACCIDENTS AND ACCIDENTS INVOLVING LOSS OF TIME.

Accidents that caused the death of thirteen men and 411 accidents that caused injuries involving loss of more than seven days were reported to the Department. These accidents were investigated and reported upon by the Inspectors of Mines.

The following three tables classify the accidents as to cause, as to the occupation of those injured, and as to the parts of the body injured. The thirteen fatal accidents are included in the first two tables but not in the third.

Accidents causing Death or Injury classified as to Cause.

Cause.	Number of Accidents.	Percentage of Total.
Blasting	3	0.7
Breaking of staging, pipes, etc.	8	1.8
Fall of ground	76	17.9
Fall of material, flying material	39	9.2
Fall from ladders, etc.	4	0.9
Lifting and handling material and equipment	99	23.3
Machinery and tools	107	25.2
Slipping	53	12.5
Run of ore and waste	7	1.6
Burns and shock	5	1.2
Miscellaneous	23	5.7
Totals	424	100.0

ACCIDENTS CAUSING DEATH OR INJURY CLASSIFIED AS TO OCCUPATION OF THOSE INJURED.

Occupation.	Number of Accidents.	Percentage of Total.
Underground—		
Barmen	6	1.4
Chute-pullers	11	2.6
Haulage-men	48	11.3
Miners	168	39.6
Muckers	63	14.8
Pipe-fitters and trackmen	16	3.8
Timbermen	20	4.7
Miscellaneous	19	4.4
Surface—		
Shops	9	2.1
Mill	33	8.0
Surface, general	31	7.3
Totals	424	100.0

ACCIDENTS CAUSING INJURY CLASSIFIED AS TO THE PARTS OF THE BODY INJURED.

Location.	Number of Accidents.	Percentage of Total.
Head and neck	15	3.7
Eyes	21	5.1
Trunk	45	10.9
Back	74	18.0
Arms	33	8.0
Hands and fingers	103	25.0
Legs	60	14.6
Feet	39	9.5
Toes	20	5.0
Shock	1	0.2
Totals	411	100.0
Fatal accidents	13	
Total	424	

DANGEROUS OCCURRENCES.

On January 10th, 1949, a circumferential crack was discovered in the flange starting at the barrel of the No. 2 drum on the Island Mountain hoist. This was repaired immediately and then replaced.

On January 14th, 1949, on the lower section of the main incline on the tramway at the Nickel Plate mine, a considerable amount of slack was allowed to form in the cable. This was due to poor visibility from the central operator's station and extremely cold weather, causing excessive friction on the cable itself. The rope was checked from the central station to the tipple under slack conditions. Except for a few waves over a length of 12 feet the rope received no damage.

On January 17th, 1949, in the 3800 adit of the Sullivan mine, a workman was using a pneumatic chipping-machine in the ditch. The blow of the steel set off a small charge of powder concealed in a bootleg. The workman suffered only bruises and minor cuts.

On February 14th, 1949, at the upper section of the main surface tramway of the Kelowna Exploration Company's Nickel Plate mine, a skip was derailed at the upper end of the trestle above the central loading-station. About 5 feet of extra slack was given the rope which slipped over the side of the trestle and caught under the end of a tie. The central station operator noticed the trouble and stopped hoisting in time to prevent any damage being done to the equipment. The rope and attachments were checked and found to be in good order. No passengers were riding and no one was injured.

On February 16th, 1949, on the surface at the Reeves MacDonald mine a Quonset hut 40 feet long and 40 feet wide collapsed suddenly with 20 inches of snow on the roof. No one was in the hut at the time. It is believed there was some defect in the material and erection procedure.

On February 17th, 1949, a circumferential crack was discovered in the flange of the No. 1 drum of the Island Mountain hoist. This was repaired immediately and then replaced. Both this and the crack in the No. 2 drum on January 10th, 1949, were believed to have been caused by fatigue in the cast-iron flange in ten years' service and to the extra strain imposed by having a sixth layer of rope recently put on the drum.

On April 14th, 1949, in the mill of the Kelowna Exploration Company at Hedley, an acetylene generator exploded while a welder and his helper were operating the welding equipment. The helper received slight injuries but did not lay off work.

On April 21st, 1949, three men were working at the bottom of a 50-foot inclined winze on the 2570 level of Kenville mine. The hoistman had momentarily left the hoist when it released the bucket and allowed it to run down the slide to the bottom. One man suffered from a fractured leg. Regulations were laid down to prevent a similar occurrence.

On May 17th, 1949, on 35177 sublevel west, of the Sullivan mine, two repairmen entered a working-place which had not been in use for about one month. They checked the air with a candle, but when one man advanced to the face he collapsed and fell 15 feet down a drawhole. He was not injured. Samples of the air showed an oxygen content of only 5.4 per cent.

On May 30th, 1949, at the No. 1 aerial tramway of the Hedley Mascot Gold Mines, Ltd., it was decided to change the bucket on the south side of the tramway in order to move some of the heavier equipment down. While this was being done, a hook on the rigging straightened out and let the bucket run down the tram. It rode the ropes to the No. 3 tower, where it became partly derailed but continued on down and completely demolished No. 4 tower. No one was injured. It was decided not to repair the tramway as only a small amount of equipment remained to be moved.

On June 23rd, 1949, the south cage in the No. 8 shaft at Britannia mine jammed in the shaft six sets below the 4800 level. No one was riding the cage at the time. Some squeezing of the shaft timbers is apparent at this location.

On July 20th, 1949, at the 38139 drawhole in the Sullivan mine, three men had spit eighty-seven holes, of which seven were misfires from a previous round. In spitting the misfires, one of the old fuses must have been lit, causing one hole to explode prematurely. Fortunately all of the men had reached a place of safety before the hole exploded. Such a large number of holes should have been blasted in more than one operation to prevent any mistake occurring.

On August 20th, 1949, at the Bralorne mine, a miner failed to have all approaches to a blast properly guarded and thereby endangered the lives of two men who were approaching. Fortunately the men smelled the fuse burning and stopped before walking into the blast. The miner's blasting certificate was cancelled.

On September 1st, 1949, the cage-tender had loaded the east cage in the No. 2 shaft of the Pioneer mine with old timbers at the 1700 level to take to the water-tunnel level for disposal. The load was secured with chains and the cage door closed, except for one panel which, of necessity, had to be left open for access to and from the cage. The cage-tender signalled the cage to the water tunnel and rode the cage himself.

About seven sets below 3 level a short piece of wood shifted and caught a wall plate. This jar shifted the main load, causing its top to engage the next wall plate. The hoistman felt the jar and stopped the cage at the fourth set below 3 level. Two wall plates on the south side and one on the north side were cracked. No one was injured.

EXPLOSIVES USED IN MINES.

The table below shows the quantities of explosives and blasting accessories used in the metal mines and quarries in British Columbia in 1945, 1946, 1947, 1948, and 1949:—

	1945 Total.	1946 Total.	1947 Total.	1948 Total.	1949 Total.	1949.	
						Mines.	Quarries.
High explosives (lb.)	3,677,200	3,960,150	5,464,900	6,209,950	7,022,000	6,719,750	302,250
Blasting-caps	1,151,000	1,464,300	1,780,700	1,816,000	2,082,400	1,827,400	255,000
Electric blasting-caps	28,200	4,910	117,650	61,150	146,760	129,830	16,925
Delay electric blasting-caps	6,200	29,425	55,700	78,800	36,170	34,170	2,000
Primacord (ft.)	135,000	135,500	258,000	417,000	421,000	421,000	....
Safety fuse (ft.)	7,315,000	11,625,300	13,722,100	16,053,900	16,838,400	15,667,100	1,171,300

PROSECUTIONS.

On May 3rd, 1949, a foreman in charge of the crushing plant at the Sullivan mine was charged with an infraction of General Rule 226 of the "Metalliferous Mines Regulation Act" as a result of a fatal accident to a workman on April 22nd, 1949, who entered the bin to clear a hang-up. He was acquitted, as his instructions regarding the use of a ladder for the work had been disregarded by the deceased.

AIR-SAMPLING.

Air samples were taken wherever conditions indicated the possibility of noxious gases or the oxygen content being below normal. Thirty-one samples were taken and analysed for oxygen, nitrogen, carbon dioxide, carbon monoxide, methane, hydrogen, etc. This number is only about half that taken last year. This decrease is attributed to the wider use of the newer and more sensitive types of methane and carbon monoxide detectors which permit the detection of very small amounts of these gases. This allows ample time for their dilution and removal before they reach dangerous concentrations. Flame safety lamps are still used in the Bridge River area for the detection of methane.

DUST AND VENTILATION.

Problems in dust-control and ventilation have continued to receive attention from mine operators and Government departments. Complete dust-count surveys were made in fifteen of the larger metalliferous mines in the Province by the Silicosis Branch of the Workmen's Compensation Board. Over-all dust counts were generally found to be below the range where a hazard is thought to exist. In some cases a definite lowering of dust count was found where an improvement in ventilation had been brought about.

Aluminium therapy treatment for the prevention of silicosis is available at practically all mines of any size where a silicosis hazard exists.

MINE-RESCUE, SAFETY, AND FIRST AID.

During the year 1949 the mine-rescue stations at Cumberland, Nanaimo, Princeton, and Fernie were fully maintained with modern equipment and a trained instructor at each station. Each station is equipped with several sets of McCaa and Gibbs two-hour oxygen machines, one set of Chemox one-hour oxygen machines, Burrell all-service gas masks, inhalators, methane and carbon monoxide detectors of the latest type, and a complete supply of first-aid equipment. Supplies and equipment for charging and servicing this equipment are also maintained.

Two of the larger metal mines, Sullivan and Copper Mountain, each have a complete set of McCaa two-hour machines and complete sets of Chemox are maintained by the mines at Hedley, Bridge River, Wells, and Britannia. This year the Department put a Chemox set at Salmo to serve the mines in the Sheep Creek and Nelway areas.

Training in the use of mine-rescue equipment is given at the stations to all who apply for it, and, in addition, fully trained teams are given regular monthly practice-training as a unit, not only to keep them familiar with the use of the machines, but to teach them the need and value of teamwork in mine-rescue operations.

Teams trained at mines remote from the stations are visited and examined by one of the instructors from the stations. The Inspector of Mines and instructor for the district arrange the course of instruction and conduct the examinations at these mines. The instructors from the stations also perform a valuable service to the mines with mine-rescue equipment in their areas in that they periodically check the equipment of these mines to see that it is always in serviceable condition.

A certificate of competency in mine-rescue work is granted to each man who takes a full training course and passes the examination set by the Department of Mines.

During 1949, in addition to the regular teams in training, sixty-eight men took the full training course and were granted certificates of competency, as follows:—

Cert. No.	Name.	Where trained.	Cert. No.	Name.	Where trained.
2303	John William Peck	Nelson.	2337	William E. Ganske	Copper Mountain.
2304	Louis Andrew Sclippa	Nelson.	2338	Robert Jamieson	Copper Mountain.
2305	Harry Tymchuk	Nelson.	2339	Edward Kuzyk	Copper Mountain.
2306	James Francis Hutter	Tulsequah.	2340	Alphonse B. Lommer	Copper Mountain.
2307	Percy E. Heasman	Vancouver.	2341	J. H. Parliament	Copper Mountain.
2308	James Douglas Graham	Natal.	2342	Donald W. Pringle	Copper Mountain.
2309	Jean Leon Desjardins	Natal.	2343	Hugh Wanke	Copper Mountain.
2310	Stanley Joseph Kotek	Natal.	2344	Peter Richard Kotush	Kimberley.
2311	Dominic Romano	Natal.	2345	Stewart Morton Reid	Kimberley.
2312	Giuseppe Caravetta	Natal.	2346	Theodore Edward Oliynyk	Kimberley.
2313	James Walsh, Jr.	Natal.	2347	Albert Robert Unwin	Kimberley.
2314	Robert Owen Corrigan	Fernie.	2348	James Ross	Kimberley.
2315	James White	Fernie.	2349	Anthony Eliuk	Kimberley.
2316	William Puckey Haile	Fernie.	2350	Roy Paterson Easton	Kimberley.
2317	Robert Leon Dally	Fernie.	2351	Thomas Taylor	Michel.
2318	Edward Francis Chappell	Fernie.	2352	William Henry Davey	Michel.
2319	Maurice M. Burke	Alice Arm.	2353	Francis Joseph Gigliotti	Michel.
2320	Robert C. James	Wells.	2354	Avellino Persello	Natal.
2321	Thomas Johnston	Wells.	2355	Andrew Ferland	Natal.
2322	Glen A. Mackay	Wells.	2356	Bruce W. Stewart-Murray	Vancouver.
2323	Stanley C. Scott	Wells.	2357	R. Bowcott	Beaverdell.
2324	Adrian H. Murrell	Wells.	2358	E. L. Viney	Beaverdell.
2325	Harold E. Alton	Wells.	2359	W. H. Cameron	Beaverdell.
2326	Whitney L. Seholt	Wells.	2360	F. Harding	Beaverdell.
2327	Daniel L. MacLean	Wells.	2361	K. St. Dennis	Beaverdell.
2328	Eric Schwab	Wells.	2362	C. Carey	Beaverdell.
2329	Richard L. Bater	Wells.	2363	V. Scott	Beaverdell.
2330	Ross S. McIvor	Wells.	2364	R. O'Connor	Beaverdell.
2331	Keith W. Burton	Wells.	2365	John L. Menzies	Nanaimo.
2332	Marcel Guiguet	Wells.	2366	Jim Raffle	Nanaimo.
2333	James C. Forman	Wells.	2367	Gordon Odgers	Nanaimo.
2334	Lloyd T. Vear	Wells.	2368	James Albert Boyce	Cumberland.
2335	Frederick G. Southam	Wells.	2369	Reginald Watson	Cumberland.
2336	Raymond Galloway	Copper Mountain.	2370	Douglas Currie	Cumberland.

The Mine Safety Associations in the different centres in the Province, aided by the safety engineers and Inspectors of Mines, continued to encourage mine-rescue and first-aid work and safety education in their respective districts.

First-aid and mine-rescue competitions were held in Nanaimo, Princeton, Kimberley, and Lillooet.

At Nanaimo a total of five teams competed in the mine-rescue competition. These were from White Rapids, No. 8 mine at Cumberland, No. 10 mine at South Wellington (two teams), and Tsable River. The winning team was from Tsable River and was captained by Tom Eccleston.

At Princeton four teams, two from Copper Mountain and one each from Nickel Plate and Tulameen Collieries, competed. The winning team from Copper Mountain was captained by E. H. Pickard.

At Kimberley seven teams competed. These were from Sullivan mine (three teams), Michel (two teams), Coal Creek, and Fernie. The competition was won by the Fernie team, captained by Albert Littler.

As a result of the extensive campaign to train mine-rescue teams in the metal-mining areas in 1948 the Central British Columbia Mine Safety Association was formed to serve the Cariboo and Bridge River areas and Britannia.

The competition at Lillooet was the first held by this association. It is believed to be the first mine-rescue competition where self-contained breathing apparatus of the Chemox type was used. In all, twenty-five of these machines were used in the competition, and they were found to be entirely suitable for this work.

Five teams, one each from Pioneer, Bralorne, Island Mountain, Cariboo Gold Quartz, and Britannia, competed. It was the first time any of the men had entered a mine-rescue competition, and the performance turned in by all teams was very gratifying. The winning team was from Island Mountain and was captained by J. T. McKelvie.

The Department of Mines had a suitable shield made, which is to be competed for annually by teams in this new association.

In addition to the above, local first-aid competitions were held at Bralorne, Britannia, and Salmo. At Bralorne, teams from the Pioneer mine competed, and at Salmo teams from the Sheep Creek, Emerald, and Reeves MacDonald were present. Teams of women and juniors competed in all these competitions. The efforts made to get women and children and those not actually engaged in mining to participate are very commendable and do much to keep up interest in this important work.

A feature of the Salmo meet was a very fine exhibition of mine-rescue work by a trained team from Kimberley using Chemox apparatus. This work was directed by Joe Shaw, veteran first-aid and mine-rescue instructor from Kimberley, and did much to create interest in this type of work.

As in former years the Department of Mines sponsored these meets and contributed to a large part of the expenses, but credit for the success of these competitions must be given to the efforts and enthusiasm of the officials and men at the various mines.

Coal-mining.

By H. C. Hughes, Chief Inspector of Mines.

CONTENTS.

PRODUCTION.

The output of the collieries is now given in short tons. The output of the coal mines of the Province for the year 1949 was 1,917,296 tons, an increase of 108,278 tons or 5.9 per cent. over 1948; 328,165 tons of the total output came from strip mines at Michel and Princeton.

Vancouver Island collieries produced 603,298 tons, an increase of 154,883 tons or 34.5 per cent. over 1948.

The Northern District produced 23,744 tons, an increase of 3,963 tons or 20.3 per cent. over 1948.

The Nicola-Princeton District produced 51,678 tons, an increase of 41 tons over 1948.

The East Kootenay District produced 1,238,576 tons, a decrease of 50,609 tons or 3.9 per cent. from 1948.

The following table shows the output and *per capita* production daily and for the year 1949 at the various mines:—

OUTPUT AND PER CAPITA PRODUCTION, 1949.

Colliery and Mine.	Total Coal mined during Year (Tons).	Days worked.	Total Number of Employees.	Coal mined per Employee daily (Tons).	Coal mined per Employee for Year (Tons).	Number of Employees Underground.	Coal mined per Underground Employee daily (Tons).	Coal mined per Underground Employee for Year (Tons).
Comox Colliery (No. 8 mine)	208,114	225	448	2.06	464	363	2.54	573
Tsable River Colliery	79,213	230	144	2.40	550	129	2.67	614
South Wellington No. 10 mine	245,271	250	242	4.05	1,013	204	4.81	1,202
White Rapids mine	61,813	241	127	2.02	487	116	2.21	533
Chambers' mine	2,574	180	6	2.38	429	4	3.57	643
Loudon mine	1,103	205	4	1.34	276	4	1.34	276
Cassidy mine	40	29	4	0.34	10	3	0.45	13
Lewis mine (Timberlands)	741	245	2	1.51	370	2	1.51	370
Deer Home mine	581	132	2	2.20	290	2	2.20	290
Wellington mine (Carruthers)	704	213	2	1.65	352	2	1.65	352
Stronach mine	1,889	218	6	1.44	315	5	1.73	378
Furnace Portal mine	1,255	148	3	2.82	418	2	4.23	627
Tulameen Collieries, Ltd.	29,776	229	84	1.54	354	65	2.00	458
Taylor Burson mine	4,075	287	6	2.36	679	5	2.83	815
Coldwater mine	1,762	238	6	1.25	293	5	1.47	352
Black mine (strip)	15,618	58	25	......	......	......	......	......
Old Princeton Colliery (strip)	437	34	3	......	......	......	......	......
Bulkley Valley Colliery	11,380	183	37	1.68	307	30	2.07	379
Reschke mine	6,158	225	9	3.04	684	8	3.42	770
Peace River mine	4,820	261	10	1.84	482	7	2.63	688
Gething mine	1,386	132	7	1.50	198	5	2.10	277
Elk River Colliery	338,899	241	377	3.73	899	299	4.70	1,133
Michel Colliery	587,567	240	686	3.48	856	500	4.89	1,175
Michel strip mine	312,110	......	66	......	......	......	......	......

COLLIERIES OF VANCOUVER ISLAND INSPECTION DISTRICT.

The output of Vancouver Island Collieries was 603,298 tons. Of this amount, 124,175 tons or 20.6 per cent. was lost in preparation for the market, 3,925 tons or 0.6 per cent. was consumed by the operating companies as fuel, 451,074 tons was sold in the competitive market, and 24,124 tons was added to stock. Of the amount sold in the competitive market, 410,873 tons or 91.1 per cent. was sold in Canada, 19,159 tons or 4.3 per cent. was sold in the United States, and 21,042 tons or 4.6 per cent. was sold in other countries.

Collieries of the Nicola-Princeton District.

Of the gross total of 51,678 tons produced by the collieries of the Nicola-Princeton District, 100 tons was added to stock and 51,578 tons was sold in Canada.

Collieries of the Northern District.

A total of 23,832 tons was sold in Canada from the Northern District, 63 tons was used by the operating companies as fuel, and 151 tons was taken from stock held over from last year, the output for the year being 23,744 tons.

Collieries of the East Kootenay District.

The output of the collieries in the East Kootenay District was 1,238,576 tons. Of this amount, 143,578 tons or 11.6 per cent. was lost in preparation for the market, 19,025 tons or 1.5 per cent. was consumed by the operating companies as fuel, 228,792 tons or 18.4 per cent. was used in making coke, and 842,979 tons was sold in the competitive market. Of the amount sold in the competitive market, 756,696 tons or 89.8 per cent. was sold in Canada and 86,283 tons or 10.2 per cent. was sold in the United States.

The following table shows the *per capita* production of the various districts for the year 1949:—

Output and per Capita Production in Various Districts, 1949.

District.	Total Coal mined during Year (Tons).	Total Number of Employees at Producing Collieries.	Coal mined per Employee for Year (Tons).	Number of Men employed Underground in Producing Collieries.	Coal mined per Underground Employee for Year (Tons).
Vancouver Island District	603,298	990	609	836	721
Nicola-Princeton District	35,623	96	371	75	475
Northern District	23,744	63	376	50	474
East Kootenay District	926,466	1,063	871	799	1,159
Whole Province	1,589,131	2,212	718	1,760	903

Note.—The above table deals only with coal mined from underground operations. Coal-stripping operations and the men employed at strip mines are not included.

The following table shows the production and distribution of coal by the various collieries and districts, also distribution of men employed, compiled from returns furnished by the owners.

Collieries of British Columbia—Production, 1949 (in Short Tons).

Mine.	Sold.			Total Sales.	Lost in Washing.	Used in making Coke.	Used under Companies' Boilers, etc.	Total for Colliery Use.	Stocks.		Difference.		Output for the Year 1949.
	In Canada.	In U.S.A.	Elsewhere.						First of Year.	Last of Year.	Added to.	Taken from.	
Vancouver Island District.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Canadian Collieries (D.), Ltd.—													
Comox Colliery (No. 8 mine)	123,050	8,662	15,564	147,276	48,052	....	1,985	50,037	2,929	13,730	10,801	....	208,114
Tsable River Colliery	43,315	3,049	5,478	51,842	20,472	....	698	21,170	744	6,945	6,201	....	79,213
South Wellington No. 10 mine	181,482	5,737	....	187,219	51,611	....	957	52,568	3,854	9,338	5,484	....	245,271
White Rapids mine	54,139	1,711	....	55,850	4,040	....	285	4,325	889	2,527	1,638	....	61,813
Chambers' mine	2,574	....	....	2,574	....	....	....	....	....	....	....	....	2,574
Loudon mine	1,103	....	....	1,103	....	....	....	....	....	....	....	....	1,103
Cassidy mine	40	....	....	40	....	....	....	....	....	....	....	....	40
Lewis mine (Timberlands)	741	....	....	741	....	....	....	....	....	....	....	....	741
Deer Home mine	581	....	....	581	....	....	....	....	....	....	....	....	581
Wellington mine (Carruthers)	704	....	....	704	....	....	....	....	....	....	....	....	704
Stronach mine	1,889	....	....	1,889	....	....	....	....	....	....	....	....	1,889
Furnace Portal mine	1,255	....	....	1,255	....	....	....	....	....	....	....	....	1,255
Totals, Vancouver Island District	410,873	19,159	21,042	451,074	124,175	....	3,925	128,100	8,416	32,540	24,124	....	603,298
Nicola-Princeton District.													
Tulameen Collieries, Ltd.	29,776	....	....	29,776	....	....	....	....	....	....	....	....	29,776
Taylor Burson mine	4,075	....	....	4,075	....	....	....	....	....	....	....	....	4,075
Coldwater mine	1,672	....	....	1,672	....	....	....	....	....	100	100	....	1,772
Black mine (strip)	15,618	....	....	15,618	....	....	....	....	....	....	....	....	15,618
Old Princeton Colliery (strip)	437	....	....	437	....	....	....	....	....	....	....	....	437
Totals, Nicola-Princeton District	51,578	....	....	51,578	....	....	....	....	....	100	100	....	51,678
Northern District													
Bulkley Valley Colliery	11,468	....	....	11,468	....	....	63	63	684	533	....	151	11,380
Reschke mine	6,158	....	....	6,158	....	....	....	....	....	....	....	....	6,158
Peace River mine	4,820	....	....	4,820	....	....	....	....	....	....	....	....	4,820
Gething mine	1,386	....	....	1,386	....	....	....	....	....	....	....	....	1,386
Totals, Northern District	23,832	....	....	23,832	....	....	63	63	684	533	....	151	23,744
East Kootenay District.													
Crow's Nest Pass Coal Co., Ltd.—													
Elk River Colliery	251,803	57,715	....	309,518	25,625	....	3,756	29,381	25	25	....	....	338,899
Michel Colliery	504,893	28,568	....	533,461	117,953	228,792	15,269	362,014	267	4,469	4,202	....	899,677
Totals, East Kootenay District	756,696	86,283	....	842,979	143,578	228,792	19,025	391,395	292	4,494	4,202	....	1,238,576
Grand totals for Province	1,242,979	105,442	21,042	1,369,463	267,753	228,792	23,013	519,558	9,392	37,667	28,426	151	1,917,296
Coke.													
Crow's Nest Pass Coal Co., Ltd.—													
Michel Colliery	83,893	67,248	....	151,141	....	....		....	2,206	6,740	4,534	....	155,675

COLLIERIES OF BRITISH COLUMBIA—MEN EMPLOYED, 1949.

Mine.	White Men.																		Chinese.			Strip-mining.						Total Men employed.		
	Supervision and Clerical.			Miners.			Helpers.			Labourers.			Mechanics and Skilled Labour.			Boys.			Labourers.			Super-vision.			Other Workmen.					
	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.
Vancouver Island District.																														
Canadian Collieries (D.), Ltd.—																														
Comox Colliery (No. 8 mine)	20	8	28	174		174				87	30	117	78	28	106	4		4		19	19							363	85	448
Tsable River Colliery	7		7	67		67				17	10	27	35	5	40	3		3										129	15	144
South Wellington No. 10 mine	10	4	14	100		100				73	19	92	21	12	33		3	3										204	38	242
White Rapids mine	7		7	76		76				18	8	26	15	3	18													116	11	127
Chambers' mine	1		1	3		3							1		1					1	1							5	1	6
Loudon mine	1		1	3		3																						4		4
Cassidy mine	1		1	2		2								1	1													3	1	4
Lewis mine (Timberlands)				2		2																						2		2
Deer Home mine	1		1	1		1																						2		2
Wellington mine (Carruthers)				2		2																						2		2
Stronach mine				5		5					1	1																5	1	6
Furnace Portal mine				2		2					1	1																2	1	3
Totals, Vancouver Island District	48	12	60	437		437				195	69	264	150	49	199	7	3	10		20	20							837	153	990
Nicola-Princeton District.																														
Tulameen Collieries, Ltd.	1	9	10	44		44	13		13	5	5	10	2	5	7													65	19	84
Taylor Burson mine				5		5					1	1																5	1	6
Coldwater mine				3		3	2		2		1	1																5	1	6
Totals, Nicola-Princeton District	1	9	10	52		52	15		15	5	7	12	2	5	7													75	21	96
Northern District.																														
Bulkley Valley Colliery	2	2	4	15		15	9		9	4	3	7		2	2													30	7	37
Reschke mine	1		1	4		4	2		2	1	1	2																8	1	9
Peace River mine	2	1	3	2		2	2		2		2	2	1		1													7	3	10
Gething mine	1		1	4		4					2	2																5	2	7
Totals, Northern District	6	3	9	25		25	13		13	5	8	13	1	2	3													50	13	63
East Kootenay District.																														
Crow's Nest Pass Coal Co., Ltd.—																														
Elk River Colliery	19	12	31	164		164				45	49	94	71	13	84		4	4										299	78	377
Michel Colliery	30	23	53	244		244				67	63	130	159	97	256		3	3										500	186	686
Totals, East Kootenay District	49	35	84	408		408				112	112	224	230	110	340		7	7										799	264	1063
Strip Mines.																														
Black mine (Princeton)																							7	7		18	18		25	25
Old Princeton Colliery (Princeton)																										3	3		3	3
Michel mine (Michel)																							20	20		46	46		66	66
Totals for strip mines																							27	27		67	67		94	94
Grand totals for Province	104	59	163	922		922	28		28	317	196	513	383	166	549	7	10	17		20	20		27	27		67	67	1761	545	2306

NOTE.—U.=Underground; A.=Above ground; T.=Total.

Coal-preparation Plants.

The primary object of preparation plants is to remove from the raw coal all rock and other non-combustible material that would reduce the calorific value of the fuel. A second practice followed at many modern plants is blending the different grades or sizes of coal or the products from different seams to form a fuel for a specific purpose, such as stoker fuel.

Elk River Colliery.—The equipment of the cleaning plant, housed in a steel and brick structure, 120 by 100 feet and 68 feet high, includes two furnaces for heating the air supplied to the driers, two Ty-rock 6- by 16-foot sizing screens, three Vissac jigs, two Vissac driers, one M.C. centrifugal drier, three Ty-rock dewatering screens, two boom-loaders, and three box-car loaders.

The raw coal is transported from the 300-ton storage bin or carried directly from the rotary dump by a 42-inch belt conveyer to the screens whereby the coal is sized and the minus ¼-inch slack removed. The slack is by-passed directly to railway cars, but the coarser sizes are passed through the Vissac jigs for the removal of rock and other non-combustible material, then over the dewatering screens to the driers whereby most of the surface moisture is removed. The plant is equipped so that the different sizes, after being dried, may be segregated or blended to suit the market demands.

Michel Colliery.—The preparation plant, erected in 1938, is capable of treating a maximum of 380 tons of coal per hour of operation. The coal is sized by shaking screens and vibrating screens prior to being transported to the rock-removing jigs. All sizes above ¼-inch are treated on three Vissac jigs; those below ¼-inch are diverted to a pneumatic table separator. The moisture adhering to the washed coal under 1⅝-inch size is removed by a stream of air delivered to four Vissac driers at a temperature of approximately 700° F. The coal is sprayed with hot oil immediately before it is loaded in railway cars. This is done to prevent the liberation of dust in subsequent handlings.

Comox Colliery.—This preparation plant at Union Bay is of the wet type throughout and handles the output from the Comox No. 8 and Tsable River mines.

A reciprocating feeder delivers the coal from the track bin on to a 30-inch belt conveyer which in turn transports the coal to a two-deck 6- by 14-foot Ty-rock screen that has 1¼-inch and 3/16-inch perforations whereby the coal is sized to plus 6-inch, 1¼- to 3/16-inch, and minus 3/16-inch. All sizes above 3/16-inch are treated by two Vissac jigs for the removal of rock and the minus 3/16-inch is diverted to four Masco wet-type cleaning tables.

The coarse sizes in the refuse are crushed and recirculated through the cleaning plant for recovery of the coal that formerly adhered to the rock. The washed coal is again screened to size before loading for market. Because of the difference in densities in the raw material coming from the two mines, each coal is, of necessity, treated separately.

Nanaimo Preparation Plant.—This plant, situated near the site of the old No. 1 mine tipple, is of the wet type and handles the coal from the No. 10 South Wellington and White Rapids mines.

The coal is brought to the plant in railway cars from the respective mines and is dumped on to a feeder conveyer of the plate type that transports the coal to a Hummer screen wherein the minus ¼-inch slack is removed and diverted to Deister tables for rock-removal. From these tables the slack is loaded into railway cars. All sizes above ¼-inch are treated in two Howe cones, and after cleaning the coal is again sized by a shaker screen before it is loaded into railway cars.

LABOUR AND EMPLOYMENT.

During 1949, 2,306 persons were employed in and about the coal mines of the Province, a decrease of 160 from 1948. Fewer men were employed in stripping operations.

The maximum number of working-days is rated at 290, but the largest mines work only five days per week by agreement with the Miners' Union. In the Vancouver Island District approximately 20 per cent. of the possible working-days were lost because of working the five-day week and absenteeism, and because during the latter part of 1949 the mines in the Comox area were worked only three or four days per week because of lack of demand for coal. In the Nicola-Princeton District over 20 per cent. of the working-days were lost because of poor demand for coal from this area. In the East Kootenay District the loss of working-days averaged about 17 per cent. Floods in the area during June, and absenteeism, were mainly responsible for this loss.

COMPETITION FROM COAL PRODUCED OUTSIDE OF BRITISH COLUMBIA.

During 1949 the shipment of Alberta coal to British Columbia totalled 891,132 tons; coke shipped was 54,532 tons, and briquettes 47,235 tons. The following table shows the amount of Alberta coal brought into British Columbia during the past ten years:—

Year.	Short Tons.	Year.	Short Tons.
1940	311,232	1945	868,396
1941	304,928	1946	982,413
1942	652,222	1947	899,403
1943	963,000	1948	945,700
1944	678,960	1949	891,132

Of the 1,369,463 tons of coal marketed, 250,769 tons was sold for industrial uses in Alberta, Saskatchewan, Manitoba, Ontario, and Yukon Territory; 474,631 tons was sold for railroad use in Canada; 11,446 tons was sold for railroad use in United States; 93,519 tons was exported to the United States; and 21,519 tons was sold for ships' bunkers. The amount sold for domestic and industrial uses in the Province was 517,579 tons.

ACCIDENTS IN AND AROUND COAL MINES.

During 1949, 2,306 persons were employed in and around coal mines, including strip-mining operations. One fatal accident occurred during the year, as compared with five during 1948. The number of fatal accidents per 1,000 persons employed was 0.43, compared with 2.04 in 1948, 0.82 in 1947, 1.73 in 1946, 2.05 in 1945, 1.06 in 1944, 2.80 in 1943, 4.23 in 1942, 1.47 in 1941, and 2.08 in 1940. The average for the ten-year period was 1.87.

The number of fatal accidents per 1,000,000 tons of coal produced during 1949 was 0.52, compared with 2.77 in 1948.

The following table shows the collieries at which fatal accidents occurred during 1949, with comparative figures for 1948:—

Name of Company.	Name of Colliery.	1949.	1948.
Canadian Collieries (D.), Ltd.	No. 8 mine, Cumberland	....	1
Canadian Collieries (D.), Ltd.	White Rapids mine	....	1
Crow's Nest Pass Coal Co., Ltd.	Elk River Colliery	....	1
Crow's Nest Pass Coal Co., Ltd.	Michel Colliery	1	....
Southern Trucking Co., Ltd.	Corbin Colliery (strip)	....	1
Fred Mannix & Co., Ltd.	Black mine, Princeton (strip)	....	1
Totals		1	5

The following table shows the various causes of fatal accidents in 1949 and their percentages of the whole, together with comparative figures for 1948:—

Cause.	1949.		1948.	
	Number	Per Cent.	Number	Per Cent.
By falls of roof and coal	1	100.00	2	40.00
By mine cars and haulage (underground)	....	....	1	20.00
By trucking and haulage (strip mines)	....	....	2	40.00
Totals	1	100.00	5	100.00

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the years 1949 and 1948:—

Cause.	1949.		1948.	
	Number of Fatal Accidents.	Tons of Coal mined per Fatal Accident.*	Number of Fatal Accidents.	Tons of Coal mined per Fatal Accident.
By falls of roof and coal	1	1,917,296	2	640,765
By mine cars and haulage	....	....	1	1,281,530
Totals	1	1,917,296	3	427,177

* Excludes coal from strip mines.

The following table shows the number of tons of coal mined in stripping operations for each fatal accident in their respective classes in the years 1949 and 1948:—

Cause.	1949.		1948.	
	Number of Fatal Accidents.	Tons of Coal mined per Fatal Accident.	Number of Fatal Accidents.	Tons of Coal mined per Fatal Accident.
By truck haulage	....	....	2	263,744

The following table shows the fatalities from various causes in coal mines during the year 1949, compared with 1948, according to inspection districts:—

District.	Number of Deaths from Accidents.			Totals.	
	Falls of Roof and Coal.	Mine Cars and Haulage.	Trucking and Haulage (Strip).	1949.	1948.
Vancouver Island	....	....	....	....	2
Nicola-Princeton	....	....	....	....	1
East Kootenay	1	....	....	1	2
Northern	....	....	....	....	....
Province, 1949	1	....	....	1	....
Province, 1948	2	1	2	....	5

Ratio of Accidents.

District.	Accident Death Rate.			
	Per 1,000 Persons employed.		Per 1,000,000 Tons of Coal mined.	
	1949.	1948.	1949.	1948.
Vancouver Island	....	2.08	....	4.45
Nicola-Princeton	....	8.00	....	19.34
East Kootenay	0.88	1.94	0.87	1.55
Northern	....	....	....	....
Province, 1949	0.43	....	0.52	....
Province, 1948	....	2.04	....	2.77

During 1949 there was only one fatal accident connected with actual operations in underground coal mines and there were no fatal accidents in strip-mining operations.

On February 15th, 1949, Michael Kulcar, miner, was instantly killed at Michel Colliery. He was setting a row of posts next to a pillar for a new conveyer run when a piece of rock fell from the roof.

In addition to one fatal accident, a total of 420 of a serious nature were reported to the Department by the management of the various mines. All these accidents were investigated and reported by the Mine Inspectors.

The following table shows the occupations of the men involved in these accidents and the percentage of the total number for each occupation. The fatal accident is included in the total.

Accidents in Coal Mines, 1949, classified as to Occupation.

Occupation.	Number of Accidents.	Percentage of Accidents.
Underground—		
Brushers	40	9.5
Drillers and facemen	87	20.7
Loaders and muckers	125	29.8
Panmen	15	3.6
Haulagemen	71	17.0
Trackmen and pipe-fitters	11	2.6
Firebosses	15	3.6
Timbermen	10	2.2
Miscellaneous	6	1.5
Surface—		
Shops	2	0.5
Labour	32	7.6
Miscellaneous	6	1.4
Totals	420	100.0

The following table shows the causes of the accidents and the percentage of the total number from each cause. The fatal accident is included in this table.

ACCIDENTS IN COAL MINES, 1949, CLASSIFIED AS TO CAUSE.

Cause.	Number of Accidents.	Percentage of Accidents.
Fall of ground	112	26.6
Fall of material and flying material	26	6.2
Gas	—	—
Lifting and handling equipment, material	97	23.1
Machinery and tools	72	17.2
Slipping	101	24.0
Miscellaneous	12	2.9
Totals	420	100.0

The following table shows the numbers and percentages of all accidents involving injuries to various parts of the body:—

CLASSIFICATION AS TO INJURY.

Injury.	Number of Accidents.	Percentage of Accidents.
Head and neck	24	5.7
Eyes	12	2.9
Trunk	95	23.0
Back	26	6.2
Arms	32	7.6
Hands and fingers	105	25.0
Legs	79	18.8
Feet	21	4.9
Toes	25	5.9
Totals	419	100.0
Fatal	1	
Total	420	

EXPLOSIVES.

The following table shows the quantity of explosives used in coal mines during 1949, together with the number of shots fired, tons of coal produced per pound of explosive used, and the average number of pounds of explosive per shot fired (these quantities include all the explosives used for breaking coal and for rock work in coal mines) :—

Vancouver Island District.

Colliery.	Quantity of Explosives used in Pounds.	Coal mined (Tons).	Total Number of Shots fired.	Tons of Coal per Pound of Explosive used.	Average Pounds of Explosive per Shot fired.
Comox Colliery (No. 8 mine)	46,850	208,114	81,810	4.44	0.57
Tsable River Colliery	40,100	79,213	53,100	1.97	0.76
South Wellington No. 10 mine	73,988	245,271	83,220	3.31	0.89
White Rapids mine	16,300	61,813	33,000	3.79	0.49
Chambers' mine	400	2,574	1,100	6.43	0.36
Loudon mine	1,750	1,103	2,000	0.63	0.87
Cassidy mine	200	40	100	0.20	2.00
Lewis mine (Timberlands)	1,700	741	1,800	0.43	0.94
Deer Home mine	300	581	500	1.93	0.60
Wellington mine (Carruthers)	700	704	926	1.00	0.75
Stronach mine	2,400	1,889	2,450	0.78	0.98
Furnace Portal mine	600	1,255	700	2.09	0.85
Totals for district	185,288	603,298	260,706	3.25	0.71

Nicola-Princeton District.

Tulameen Collieries, Ltd.	9,200	29,776	17,500	3.23	0.52
Taylor Burson mine	2,950	4,075	2,500	1.38	1.18
Coldwater mine	2,800	1,762	1,160	0.63	2.41
Black mine (strip)	180	15,618	40	86.77	4.50
Old Princeton Colliery (strip)	....	437	....	....	....
Totals for district	15,130	51,678	21,200	3.42	0.74

Northern District.

Bulkley Valley Colliery	3,950	11,380	4,215	2.88	0.93
Reschke mine	1,750	6,158	2,300	3.52	0.76
Peace River mine	1,800	4,820	2,460	2.68	0.73
Gething mine	500	1,386	800	2.77	0.62
Totals for district	8,000	23,744	9,775	2.97	0.82

East Kootenay District.

Elk River Colliery	38,850	338,899	43,228	8.72	0.89
Michel Colliery	68,235	899,677	77,749	13.18	0.87
Totals for district	107,085	1,238,576	120,977	11.56	0.88
Totals for Province	315,503	1,917,296	412,658	6.07	0.76

Quantity of Different Explosives used.

	Lb.
Monobel of different grades	291,880
Permissible rock powder	23,623
Total	315,503

MACHINE-MINED COAL.

During the year 1949 mining-machines produced approximately 979,385 tons or 61 per cent. of the total output from underground mining. All strip-mine coal is removed by mechanical means.

The following table gives the district, number of machines, how driven, and type of machines used:—

District.	Number driven by		Type of Machine used.	
	Electricity.	Compressed Air.	Chain Under-cutting.	Puncher Type.
Vancouver Island	....	27	24	3
Nicola-Princeton	....	8	....	8
Northern District		5	....	5
East Kootenay	...	43	17	26
Totals	....	83	41	42

In addition to the above, 144 air-picks were used in the mines of the Crow's Nest Pass Coal Company.

SAFETY LAMPS.

There were 2,341 safety lamps in use in the coal mines of the Province. Of this number, 177 were flame safety lamps and 2,164 were approved electric lamps, mostly the Edison model.

Approved Safety Lamps—Electric and Flame.

The following is a list of approved safety lamps, electric and flame:—

The Wolf lamp, flame type.

The Koehler lamp, flame type.

The Edison electric lamp (cap) as approval No. 18 of the United States Bureau of Mines, and all Edison cap lamps up to and including Model P, carrying the approval certificate No. 26 of the United States Bureau of Mines. Model R-4, approval certificate No. 29, was placed on the approval list this year.

The Wheat electric lamp and having approval No. 20 as issued by the United States Bureau of Mines.

The Wolf electric lamp, No. 830C.

The electric lamp manufactured by the Portable Lamp and Equipment Company, under approval No. 27 of the United States Bureau of Mines.

M.S.A. single-cell trip lamp, carrying United States Bureau of Mines approval No. 1009, approved for use on haulage trips in mines.

ELECTRICITY.

Electricity is used for various purposes on the surface at seven coal mines and underground at four. A total of 17,789 horsepower was used in and about these mines. Detailed information as to how and where this power is used is given in the report of the Electrical Inspector of Mines.

VENTILATION.

Information regarding the quantity of air passing in the main airways and working-places in the various mines is given in the reports of the District Inspectors. Blasting operations are not allowed in working-places where methane can be detected on the flame of a safety lamp. Sometimes it has been necessary for the District Inspector to issue orders prohibiting blasting, but where a gas-cap was detected on the flame of a safety lamp, the fireboss usually stopped blasting operations immediately. It has been found on inspection visits that generally the quantity of air passing through the airways is more than ample to meet requirements.

METHANE DETECTION.

The principal instruments used to detect small quantities of methane in the airways are the Burrell gas detector and the M.S.A. detector.

Regular tests are made on every shift in the working places and airways by the firebosses and other mine officials, principally by means of the flame safety lamp. Inspectors and mine officials have also trained many of the workmen to make tests for gas with the flame safety lamp, and many of them are able to estimate the percentage of gas in the air very closely. Every candidate for a miner's certificate must show a thorough knowledge of the flame safety lamp and the method of testing for methane gas before he is given a certificate.

MINE-AIR SAMPLES.

In addition to regular tests by use of the flame safety lamp and methane detector, the Inspector of Mines in each district takes mine-air samples regularly in main return airways and the return airways of the various splits, so that a complete record may be kept of the condition of the air passing through the mine. During 1949 forty-eight samples were taken.

INSPECTION COMMITTEES.

The provisions of the "Coal-mines Regulation Act," section 65, General Rule 14, require that an inspection committee of workmen shall inspect the mines regularly on behalf of the workmen and make a true report of the conditions found. In all the larger mines of the Province this rule is fully observed and copies of the reports are sent to the Inspector of the district. The reports show that the committees do their work in a careful and painstaking manner and at times they have found gas in an area due to a temporary derangement of the ventilation system. Not only have they reported this, but have made a return visit and, if conditions had been remedied, have made an additional report stating the area had been cleared of gas.

This method of inspection makes the work of these committees valuable.

COAL DUST.

The danger of accumulations of coal dust on the roadways and in the working-places is fully realized, and as a rule the regulations regarding the control of coal dust are fully carried out. Large quantities of limestone dust are used continually in the larger mines to dust roadways and working-places, and roadways are periodically cleaned of dust.

Dust samples are taken regularly from roof, side, and floor of the mine roadways and analysed for incombustible content; these reports are forwarded to the Inspector. In 1949, 1,988 dust samples from the various mines were analysed and in almost all these samples the incombustible content was well over 50 per cent.

DANGEROUS OCCURRENCES.

On January 25th, 1949, at 6.30 p.m., a fire occurred in the main pumping station adjacent to the shaft bottom in No. 8 mine, Comox Colliery. The pump bearings had seized owing to the pump being permitted to run without water after it had emptied the sump. The resulting overload on the motor caused it to overheat and take fire. Prior to this accident the pump was not equipped with an automatic cut-out to shut off the power when the water had reached a predetermined level in the sump. Immediately following the above occurrence a proper cut-out was installed and has operated efficiently ever since.

On June 8th, 1949, in a chain pillar between Nos. 5 and 6 rooms off the No. 2 conveyer-belt road "A" West mine, Michel Colliery, James Walsh, fireboss, fired a shot consisting of four sticks of Monobel No. 14 powder. A few minutes later it was noticed that smoke was issuing from the loose coal. On instructions from the fireboss the miners spread the coal and a flame flared up, which immediately died out. Further investigation disclosed in the loose coal a half-stick of unexploded powder on which the paper wrapping was charred.

On November 14th, 1949, at 8.30 p.m., in the Tsable River mine, while a trip of loaded cars was being hauled up the main slope, the coupling pin between the first and second cars came out, allowing the loads to run back down the slope. Apparently the drag failed to stop the trip, and the runaway cars were not stopped until they reached the safety switch approximately 200 feet below No. 3 Left level. This mishap occurred when the loaded trip was at No. 1 Right level, and the runaway cars travelled a distance of between 400 and 500 feet before being derailed. Much damage was done to the slope below No. 3 Left level. Air-lines, water-lines, and timbers were displaced and damaged, but no person was injured. Immediately after this accident a more efficient drag was installed behind all loaded trips.

BUMPS.

No bumps of a serious nature were reported during the year.

OUTBURSTS OF GAS.

On March 2nd, 1949, at 11.15 a.m., in No. 3 mine, Elk River Colliery, a series of small face blowouts of gas occurred, displacing about six cars of coal from the face of the crosscut between the main and counter slopes. The quantity of methane gas released was sufficient to cause the withdrawal of the men from the face of the crosscut and from the face of the main slope. Work was resumed at the face of the crosscut at 4 p.m. on the same day.

On October 5th, 1949, in No. 3 mine, Elk River Colliery, the coal at the face of No. 3 split of No. 2 Left room, slope section, started at 6.40 a.m. to give the usual warnings of an impending blowout. A few minutes later the face blew out in the upper right side, displacing a few cars of coal and giving off methane gas quite freely. The men working at the lower end of the slope were withdrawn but were able to return to their places after one hour.

On October 5th, 1949, in No. 3 mine, Elk River Colliery, the face of the drainage road at 8.40 p.m. started to give warning of a blowout, which occurred a few minutes later. The men working in this place and in the places on the return side were withdrawn to safety. About 150 tons of coal was displaced, and the quantity of methane gas liberated was so great that it fouled the No. 4 Incline section and made it necessary to withdraw the men for the remainder of the shift.

On October 7th, 1949, in No. 3 mine, Elk River Colliery, at 10.45 a.m., a major blowout occurred at the face of No. 3 split, off No. 2 Left room, slope section. Adequate warning was given by the impending blowout so there was time in which to withdraw all the men from this district. About 500 tons of coal was displaced, and it was estimated that approximately 1,000,000 cubic feet of methane gas was liberated. It was then necessary to withdraw all the men from the mine as quickly as possible. There were no casualties. Owing to the continuous outflow of gas the mine remained idle until 8 a.m. on October 11th. On account of the seriousness of the above situation in the event of a recurrence of a major blowout, it was decided by the management and the Mines Department to work the section affected on a single-shift basis; also, the mine was divided into two separate ventilating districts. As an added precaution, Chemox rescue apparatus has been stored at a suitable station in the mine.

PROSECUTIONS.

During 1949 five men were prosecuted for infractions of the "Coal-mines Regulation Act," as follows:—

Date.	Colliery.	Occupation of Defendant.	Offence charged.	Judgment.
Oct. 18	Michel (Crow's Nest Pass Coal Co., Ltd.)	Miner	Jumped off man-trip while in motion	Fined $20 and costs.
Dec. 1	Michel (Crow's Nest Pass Coal Co., Ltd.)	Miners (4)	Jumped off man-trip while in motion	Each fined $22.50 and costs.

SUPERVISION OF COAL MINES.

During 1949 seventeen companies operated twenty-one mines, employing 1,761 men underground. In the supervision of underground employees there were 8 managers, 15 overmen, and 98 firebosses, or 1 official for every 14½ men underground.

"COAL SALES ACT."

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 Names of Coal.	Colliery and District.	Producing Company.
Comox	Nos. 5 and 8 mines, Comox Colliery (Cumberland)	Canadian Collieries (D.), Ltd.
Old Wellington	No. 9 mine (Wellington)	Canadian Collieries (D.), Ltd.
Ladysmith-Wellington	No. 10 mine (South Wellington)	Canadian Collieries (D.), Ltd.
Hi-Carbon	Mixture of Canadian Collieries' coal and B.C. Electric coke	Canadian Collieries (D.), Ltd.
Lantzville-Wellington	Lantzville (Lantzville)	Lantzville Colliery.
Chambers-Extension	Chambers' (Extension)	R. H. Chambers.
Wellington Big Flame	Richardson mine	A. B. Richardson.
Biggs-Wellington	Biggs' mine (Wellington)	Biggs mine.
Berkley Creek-Little Wellington	Berkley Creek Colliery (Extension)	Hugh McLean Davidson.
Cassidy-Wellington	Cassidy mine (Cassidy)	A. H. Carroll.
Middlesboro	Middlesboro (Merritt)	Middlesboro Collieries, Ltd.
Tulameen Valley Coal, Princeton	Tulameen (Princeton)	Princeton Tulameen Coal Co.
Granby Tulameen	Granby (Princeton)	Granby Consolidated M.S. & P. Co., Ltd.
Hat Creek	Hat Creek (Lillooet)	Canada Coal and Development Co., Ltd.
Tulameen Gem	Tulameen Collieries (Princeton)	Tulameen Collieries.
Bulkley Valley	Bulkley Valley (Telkwa)	Bulkley Valley Colliery, Ltd.
Crow's Nest, Elk River	Elk River (Coal Creek)	Crow's Nest Pass Coal Co., Ltd.
Crow's Nest, Michel	Michel (Michel)	Crow's Nest Pass Coal Co., Ltd.
Black Yale	Black mine (Princeton)	Inland Collieries, Ltd.
Jackson Tulameen	Jackson Colliery (Princeton)	British Lands, Ltd.
Merritt Diamond Vale	Diamond Vale Colliery (Merritt)	Merritt Coal Mines, Ltd.
Telcoal	Telcoal Colliery (Telkwa)	Telkoal Co., Ltd.
Black Prince	Black mine, Princeton	Fred Mannix & Co., Ltd.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

First-, Second-, and Third-class Certificates and Mine Surveyors' Certificates.

The Board of Examiners, which was formed on July 10th, 1919, consists at present of H. C. Hughes, Chief Inspector of Mines, chairman; E. R. Hughes, member; and Robert Bonar, secretary and member. John MacDonald retired from the Board on December 31st, 1949, and James Strang retired on January 31st, 1950.

The meetings of the Board are held in the office of the Department of Mines in Victoria. The examinations are held in accordance with the amended rules of the Board of Examiners and approved by the Minister of Mines. The examinations are held at least once a year and oftener if necessary. One examination was held on May 18th, 19th, and 20th, 1949, and another in the Peace River District on July 7th, 1949.

The total number of candidates at these examinations was as follows: For first-class certificates, 0; for second-class certificates, 1 (1 passed); for third-class certificates, 12 (8 passed); for mine surveyors' certificates, 6 (4 passed).

The following is a list of the candidates who were successful in the various classes:—

Second class: Thomas Henry Cunliffe.

Third class: James Douglas Graham, James Eugene Morris, Reginald Vernon Watson, John William Clark, Frank Gigliotti, John Krall, James Albert Boyce, and Samuel Protti.

Mine surveyors: Celeste De Paoli, Edward R. Hughes, Alfred Joseph Leroy, and Alwin Holland.

In addition to the above, interchange certificates were granted without full examination to several candidates who held coal-mine official certificates of equal rating from other Provinces or from Great Britain.

The following were granted interchange certificates:—

First class: Leslie M. McDonald, Dewi R. Morgan, and Edward A. McDonald.

Third class: Edward J. Thomas.

Examinations for Certificates of Competency as Coal-miners.

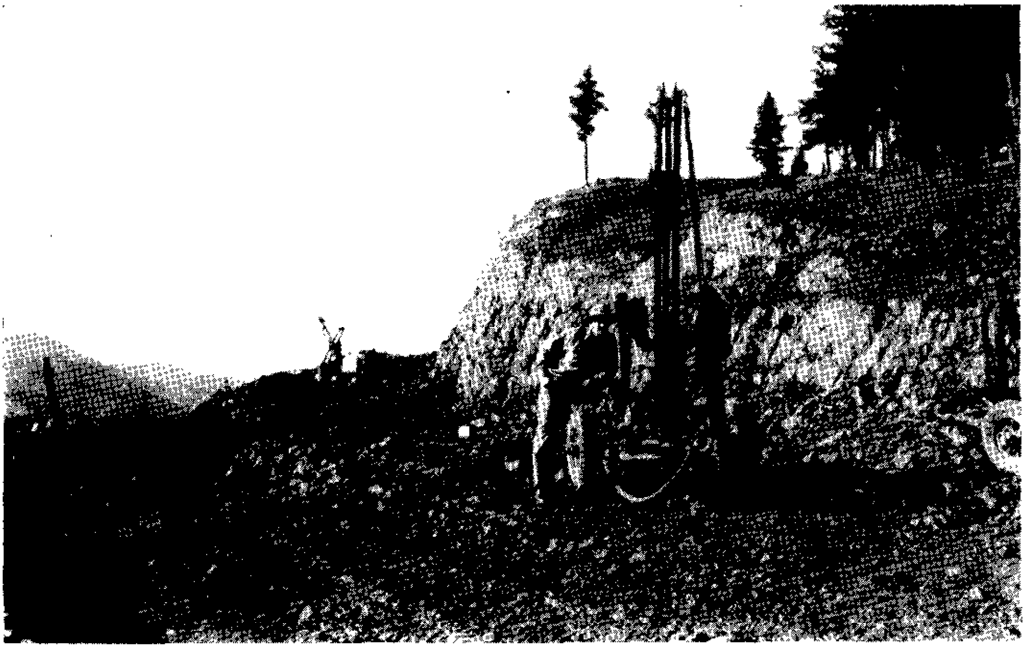
In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act further provides that every coal-miner shall be the holder of a certificate of competency as such. Examinations are held regularly in the coal-mining districts, and no certificate is granted where the candidate has failed to satisfy the Board as to his fitness, experience in a coal mine, and a general working knowledge of the English language.

During 1949 there were 133 candidates for coal-miners' certificates; of these, 131 passed and 2 failed to qualify.

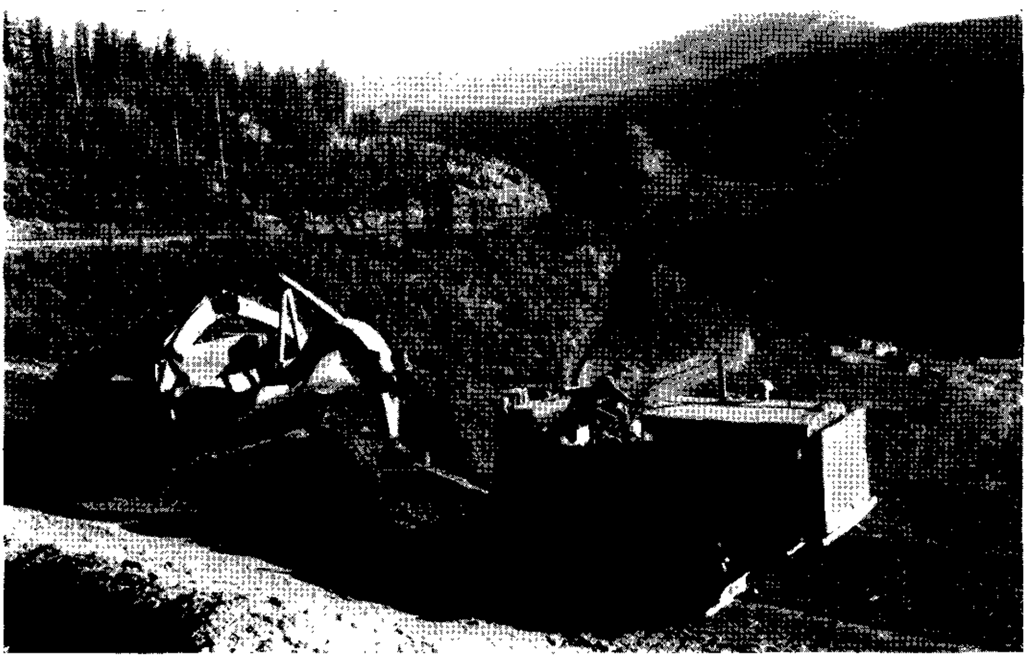
In addition to the certificates granted above, substitute certificates were issued to those who had lost their original certificate.

The Board of Examiners desires to thank the different coal-mining companies for the use of their premises for holding examinations where necessary.

The Inspector of Mines in each district has authority, under the "Coal-mines Regulation Act," to grant to an applicant, after a satisfactory examination, a provisional certificate as a coal-miner, 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 examination.



Wagon-drill at Michel, a strip-mining operation.



Beginning a strip-mining operation near Michel.

NOTES ON COAL MINES.

VANCOUVER ISLAND INSPECTION DISTRICT.

By John MacDonald.

Canadian Collieries (Dunsmuir), Limited.

F. Ronald Graham, chairman of the board, Vancouver; Norman R. Whittal, president, Vancouver; Harry R. Plommer, managing director, Nanaimo; S. V. Isaacson, secretary-treasurer, Nanaimo; R. K. Smart, general superintendent, Nanaimo; E. O. T. Simpson, assistant general superintendent, Cumberland; J. A. Quinn, district superintendent, Cumberland. During 1949 this company operated No. 10 mine at South Wellington and White Rapids mine at Extension, in the Nanaimo district; and in the Comox area, No. 8 mine of Comox Colliery and the new Tsable River mine. The mines in the Nanaimo area were operated steadily all year, but those in the Cumberland area were reduced to three and four days a week in the latter part of 1949 as a result of a reduced demand for coal. Descriptions of these operations and progress notes on them are given in the following pages according to district.

NANAIMO (49° 123° S.W.).

No. 10 Mine, South Wellington.—W. Frew, manager; J. Wilson, overman; A. Hannah, T. Jordan, F. Bell, W. Roper, J. Frew, H. Kirkpatrick, J. McArthur, F. Johnson, and T. McCann, firebosses. This mine is in the Cranberry District, about half a mile south of the old No. 5 mine and approximately 7 miles south of Nanaimo. No additions were made to the surface plant during the year. A full description has appeared in previous Annual Reports.

This mine is in the Douglas seam and, notwithstanding the fact that pillar drawing has been converging rapidly on the main haulage roads, careful planning regarding the disposition of the crew by the management has been responsible for the mine maintaining its position for another year as the chief producing mine in the Vancouver Island Inspection District. In 1949 production amounted to 245,271 short tons over a working period of 250 days. The average number of employees was 200 underground and 38 on the surface. The major part of the above tonnage has come from pillar extraction. Principal development work done during the year included the following drivage: 3,000 feet in No. 1 Right district off the main slope, and 3,000 feet in No. 1½ Heading district off the same slope.

First-aid requirements have been kept at the usual high standard. In addition to the main first-aid station adjacent to the lamp-cabin, emergency stations are located at strategic points both underground and on the surface. Thirty employees are qualified to render first aid to the injured. Two mine-rescue teams have kept up regular training each month at the mine-rescue station at Nanaimo. No blowouts or other dangerous occurrences were reported. As in past years, although extensive pillar extraction has naturally resulted in considerable crushing and squeezing on all roadways, in general, working conditions have been found fairly satisfactory during the course of inspection. Measurements taken at the last inspection in December showed a total quantity of 108,000 cubic feet of air a minute passing in the main returns for the use of 200 men employed during the full three-shift period of twenty-four hours. Eight samples of air were collected in the main return airways, all of which were under 0.2 per cent. methane. One hundred and two samples of dust were gathered from the various roadways; all the samples contained a much higher incombustible content than the minimum standard set by the Coal-dust Regulations. One hundred tons of limestone dust was used to reduce the coal-dust hazard on the roadways, and 20 tons was used for tamping explosives. Searches were made at regular intervals for matches and other prohibited articles, but none were found. Seventy-one minor accidents were reported and investigated. There were no serious accidents or fatalities.

White Rapids Mine, Extension.—A. Newbury manager; J. T. Brown, overman; A. Bennett, J. Marrs, T. McCourt, A. Kirkham, M. Brodrick, and A. Dunn, firebosses. This mine is situated in Sections 3 and 4, Range 1, in the Cranberry District, approximately 9 miles by road south of Nanaimo. It is operated in the Wellington seam and produced 61,813 short tons over a working period of 241 days with a crew averaging 102 men employed underground and 11 on the surface. A description of the seam and general method of working has appeared in previous Annual Reports.

The main first-aid station is located next to the lamp-cabin and is under the care of the lampman, who is a fully qualified first-aid attendant. Emergency kits are taken underground each shift to the loading-points on the levels and are readily available for the men engaged on the walls. Fifteen employees are qualified to render first aid to the injured. One mine-rescue team has taken regular training at the mine-rescue station at Nanaimo.

Development work during the year amounted to 1,400 feet of drivage in No. 1 diagonal slope district where three longwalls, each 300 feet in length, were in operation at the end of the year. Although the seam is low, averaging 30 inches in height, and has an exceedingly weak roof, working conditions have been found fairly satisfactory during the course of inspection. Measurements taken at the last inspection in December showed a quantity of 25,000 cubic feet of air a minute passing in the main return for the use of sixty-one men. Readings taken regularly in the main return air current failed to show any appreciable percentage of methane. Seventy-two samples of dust were collected, all of which were well above the minimum standard of incombustible content as set by the Coal-dust Regulations. Fifty-eight accidents, one of which was serious, were reported and investigated. Fourteen minor accidents were reported from the surface departments of the company in the Nanaimo area. All of these were investigated. There were no fatal accidents during the year.

Chambers' No. 4 Mine, Extension.

R. H. Chambers and associates, operators; R. H. Chambers, fireboss. This mine is in the Extension district and operates in the barrier pillar which separated the former Extension No. 1 and Extension No. 3 mines. Production in 1949 amounted to 2,574 short tons over a working period of 182 days with a crew averaging six men. Working conditions have been found fairly satisfactory during the course of inspection. One minor accident was reported and investigated.

Deer Home No. 2 Mine, Extension.

R. Hamilton and associates, operators; R. Hamilton, overman. This mine, in the vicinity of the old Vancouver slope in the Extension district, is operating in a small section of outcrop pillars left in this area when the old Extension No. 3 mine was abandoned. This is purely a salvage operation. Production in 1949 amounted to 575 short tons over a working period of 132 days with a crew of two men employed. General working conditions have been found fairly satisfactory during the course of inspection. No accidents were reported during the year.

Furnace Portal Mine, Harewood.

J. Biggs, operator and fireboss. This mine is on the Harewood Ridge and is operating in a small area of outcrop coal left by former operators. Production in 1949 amounted to 1,255 short tons over a working period of 151 days with a crew of three men employed. General working conditions have been found satisfactory during the course of inspection. No accidents were reported during the year.

No. 7 Mine, Cassidy.

J. McKellar and associates, operators; G. Murray, manager. This is a new mine opened up at Cassidy on Range 7, Section 2, and the eastern 500 feet of Range 6, Section 2, in the Cranberry District. Prospecting operations were begun early in September and the coal seam was tapped near the end of October. During the whole of November, all operations were confined to the erection of a tipple and coal bunkers on the surface, and grading a suitable road into the mine, which is a short distance in a southerly direction from the old Cassidy No. 5 mine. Production commenced on December 7th and amounted to 44 short tons. This mine is operating in a virgin portion of the Douglas seam and has every prospect of turning out to be a good mine. George Murray has been appointed as the official in charge. Working conditions have been found satisfactory in the course of inspection. No accidents were reported from this mine.

No. 8 Mine, Timberlands.

J. R. Wilson and G. Lewis, operators; J. R. Wilson, fireboss. This mine is operating in the Wellington seam, in a small area of outcrop coal that was left when the Wellington mine was abandoned by Canadian Collieries (Dunsmuir), Limited. To gain access to another part of this mine, a new slope was driven during the year. This provided drainage of another area of coal which can now be recovered when weather conditions are favourable. Production in 1949 amounted to 741 short tons over a working period of 245 days with a crew of two men engaged. Working conditions have generally been found satisfactory in the course of inspection. No accidents were reported during the year.

Cassidy Coal Dump.*

(49° 123° S.W.) Owned by A. H. Carroll, Adam Ross, and John McKellar, of Cassidy; option to purchase held by B. I. Nesbitt, of Vancouver. The dump is situated at Cassidy, about a quarter of a mile from the Island Highway and somewhat less from the Esquimalt and Nanaimo Railway. Cassidy is midway between Ladysmith and Nanaimo, being 9 miles from either place.

The dump is composed of refuse from the coal washery operated by The Granby Mining, Smelting and Power Company, Limited, from 1918 to 1932. Records show that approximately 440,000 long tons of waste were discarded on to the present dump during these fourteen years of washery operation. At various times an unspecified amount of this was rewashed and 13,400 long tons of marketable coal was obtained. An unknown but probably negligible amount of washery refuse was sluiced directly back to the workings for stowing.

Mr. Nesbitt sampled the dump by test-pits and found that the ash content of the coal became progressively lower toward the eastern end of the dump. On October 10th and 11th, 1949, the writer sampled the eastern end of the dump, making use of Mr. Nesbitt's pits. The samples obtained were analysed for ash content. The positions from which the samples were taken are indicated in Figure 32, and the results of the analyses are tabulated on page 296.

A composite of the sixteen samples taken in pits G, H, I, J, N, O, P, and Q yielded the following analysis:—

Moisture	per cent.	1.7
Volatile combustible matter	,,	30.2
Fixed carbon	,,	38.2
Ash	,,	29.9
Heat value	B.t.u./lb.	9,630

The arithmetical average of the ash analyses of the sixteen individual samples involved is 29.9 per cent.

A composite of the sixteen samples taken in pits R, S, T, U, V, W, X, and Y yielded the following analysis:—

Moisture	per cent.	1.7
Volatile combustible matter	,,	30.7
Fixed carbon	,,	40.8
Ash	,,	26.8
Heat value	B.t.u./lb.	10,190

* By W. R. Bacon.

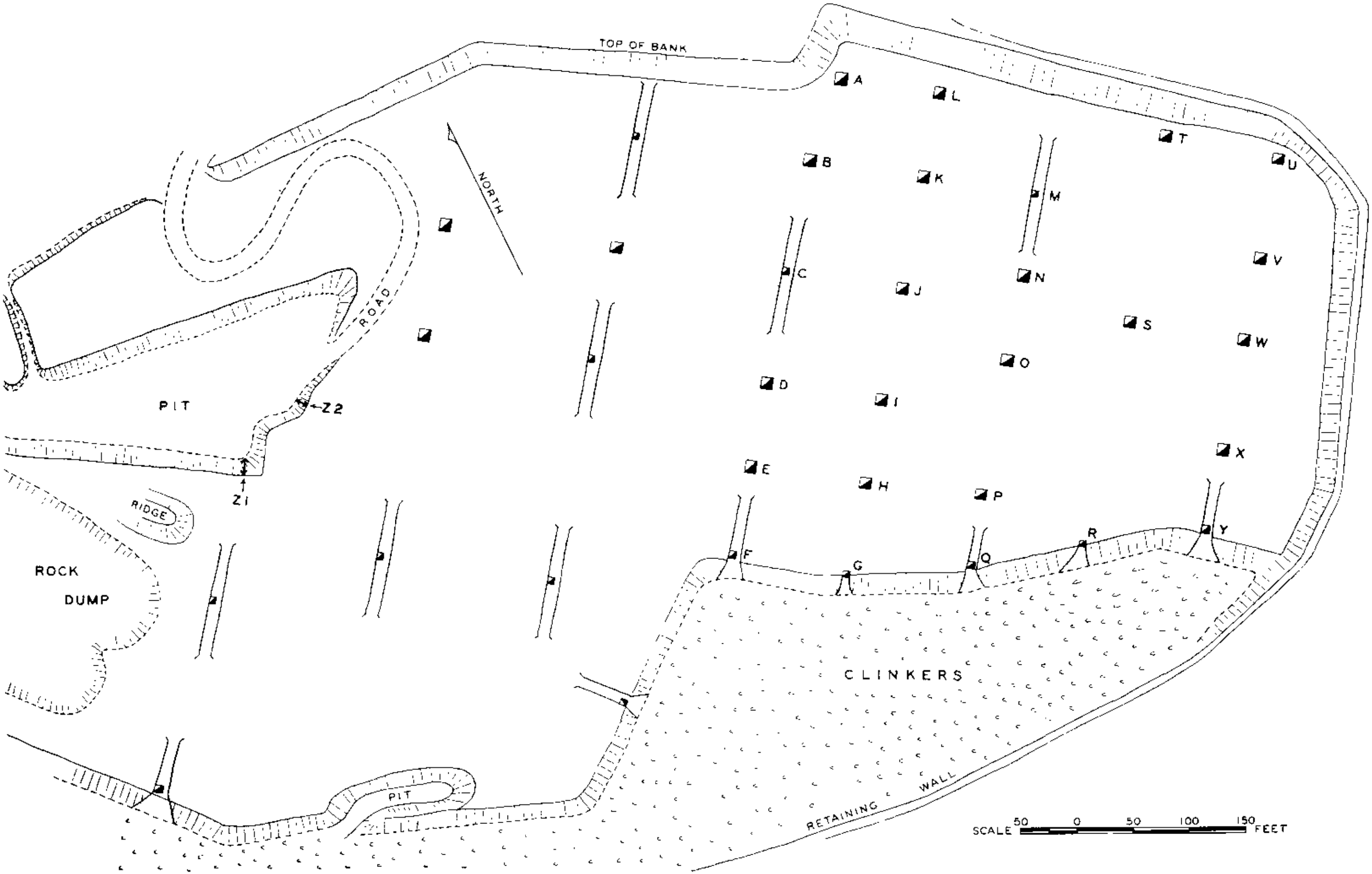


Fig. 32. Plan showing test-pits, Cassidy coal dump, Cassidy. After plan by B. I. Nesbitt.

The arithmetical average of the ash analyses of the sixteen individual samples involved is 26.9 per cent.

The ash content was determined on the air-dried samples. Moisture determinations were made on several of the samples and ranged from 1.65 per cent. to 2.20 per cent., but for most of the samples the moisture was between 1.8 and 2 per cent.

Sample Location.	Depth.	Ash Content.	Sample Location.	Depth.	Ash Content.
	Feet.	Per Cent.		Feet.	Per Cent.
A	0– 3	62.6	N	5–10	26.8
A	3– 6.5	32.5	O	0– 5	32.0
B	0– 5	62.8	O	5–10	29.7
B	5–10	47.2	P	0– 5	27.6
C	0– 5	46.5	P	5–10	27.7
C	5–10	37.8	Q	0– 5	25.2
D	0– 5	42.8	Q	5–11	22.8
D	5–10	36.9	R	0– 5	27.5
E	0– 5	39.9	R	5–10	21.6
E	5–10	52.1	S	0– 5	29.2
F	0– 5	32.8	S	5–10	27.3
F	5–10.5	54.9	T	0– 5	34.6
G	0– 5	27.3	T	5–10.5	23.7
G	5– 9	25.3	U	0– 5	25.9
H	0– 5	34.1	U	5– 8.5	24.0
H	5–10	27.2	V	0– 5	29.9
I	0– 5	38.5	V	5–10	23.1
I	5–10	33.4	W	0– 5	27.7
J	0– 5	38.5	W	5– 9	27.1
J	5–10	28.1	X	0– 5	29.8
K	0– 5	59.0	X	5–10	24.8
K	5–10	36.9	Y	0– 5	28.7
L	0– 5	46.3	Y	5–10	25.9
L	5–10	30.3	Z1	0– 6	48.8
M	0– 5	42.6	Z1	6–12	38.5
M	5–10	27.2	Z2	0– 5	47.0
N	0– 5	34.8	Z2	5– 9	42.5

Composite Samples.

Description.	Moisture.	Ash.	Vol. Comb. Matter.	Fixed Carbon.	Heat Value.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	B.t.u./Lb.
Composite of the sixteen samples from pits G, H, I, J, N, O, P, Q	1.7	29.9	30.2	38.2	9,630
Composite of the sixteen samples from pits R, S, T, U, V, W, X, Y	1.7	26.8	30.7	40.8	10,190

North Wellington (49° 124° S.E.).

Loudon's No. 5 Mine. W. Loudon and associates, operators; W. Loudon, fireboss. This mine is on the opposite side of the ridge from the old No. 9 mine in the Wellington district and is in the upper Wellington seam. Production in 1949 amounted to 1,083 short tons over a working period of 205 days. Working conditions were found usually satisfactory during the course of inspection. No accidents were reported during the year.

Carruthers & Wakelam No. 3 Mine. R. B. Carruthers and W. Wakelam, operators; R. B. Carruthers, fireboss. This mine is in the immediate vicinity of the Loudon mine and also is in the upper Wellington seam adjacent to the old No. 9 mine abandoned workings. Production in 1949 amounted to 702 short tons over a working period of 213 days. Working conditions have been found satisfactory during the course of inspection. No accidents were reported during the year.

Stronach No. 2 Mine. C. Stronach, operator; H. Gilmour, fireboss. This mine also is in a section of the upper Wellington seam adjacent to the old No. 9 mine. While some development work has been done during the year, most of the output has come from pillar extraction, beginning at the old No. 9 faceline and working back in the direction of the main slope. Production in 1949 amounted to 1,772 short tons over a working period of 218 days with crew averaging six men. Working conditions in general were found satisfactory during the course of inspection. No accidents were reported during the year.

Stronach No. 3 Mine. This mine, near the Stronach No. 2 mine, was operated for a few months. A slope was driven from the surface, with the intention of recovering coal thought to have been left in pillars in the old Wellington lower-seam workings. However, the results were disappointing, and work was discontinued in the latter part of the year. Production in 1949 amounted to 95 short tons over a working period of forty-three days. Working conditions were found fairly satisfactory during the course of inspection. No accidents were reported during the year.

Comox (49° 124° N.W.).

Canadian Collieries (Dunsmuir), Limited. *No. 8 Mine, Comox Colliery, Cumberland.*—J. S. Williams, manager; A. W. Watson, overman; D. Morgan and J. Weir, shiftbosses; T. Robertson, A. Dean, A. Maxwell, J. W. Smith, D. Waddington, T. Shields, A. Jones, L. Cooper, J. Vaughan, F. Coates, C. Williams, P. Queen, J. Queen, J. Clarkson, T. Wynne, J. Knowles, and J. Christie, firebosses. This mine is close to the Lake Trail road and is approximately 2 miles east of the mine camp at Bevan. The seams in this area are reached by two shafts each 1,000 feet deep, but the whole of the output has come from the upper, or No. 2, seam. All operations have been indefinitely suspended in the lower, or No. 4 seam as a result of faulted ground in this area. Eight longwalls, each with an average length of 300 feet and a seam thickness ranging from 36 to 42 inches, were operated during the year. Production in 1949 amounted to 208,114 short tons over a working period of 224.5 days with a crew averaging 350 men employed underground and 30 on the surface.

Two Goodman duckbills are operated steadily on developing new walls and driving airways. To increase efficiency in general, the management decided to reduce from 300 feet to 250 feet the length of the new walls now being opened so that the full cycle of cutting, panning, and loading will be completed every twenty-four hours. This system will also provide the safest possible working conditions on the walls as the men will be working a fairly good roof, whereas, in the past, delays in cleaning off the cut have resulted in the roof breaking badly along the facelines. A Joy loader was purchased and put into operation on development in No. 2 slope and has given very satisfactory results. On No. 5 Right wall, off No. 2 slope, a Huwood bottom-belt conveyer was installed. This discharges on to a main Huwood trough-belt conveyer on No. 5 Right level; both of these units have proved very satisfactory and are a decided improvement over the shaker-conveyer, especially on the actual faceline where the elimination of the noise of the shaker-conveyer gives the men a better opportunity to detect roof movements. On all other walls, shaker-conveyers of the Meco type are used to transport the coal along the facelines to the main loading-points on the various levels.

Except for occasions when abnormal emissions of gas were encountered on the North side walls, working conditions in general have been found fairly satisfactory in the course of inspection. Under the above conditions, blasting was always suspended pending the effective removal of all visible gas-caps from the general body of the air. To provide the best possible ventilation, a number of new airways have been driven and existing airways have been repaired and enlarged. At the last inspection in December, air measurements showed a total quantity of 199,500 cubic feet a minute passing in the main return for the use of 350 men in the full three-shift period of twenty-four hours. Twenty-seven samples of air were taken in the main returns, the methane content of these varying from 0.42 per cent. in the North side return to 1.18 per cent. in the No. 1 Main South return. One hundred and ninety-eight samples of dust were gathered from the various roadways. All of these samples were above the minimum standard of incombustible content as set by the Coal-dust Regulations. A total of 272,000 pounds of limestone dust was used during the year, 181,600 pounds being used in treating roadways and the remainder in blasting operations. Frequent searches were made for matches and other prohibited articles, but none were found. Two hundred and two accidents were reported and investigated. Three of these were serious, while the remainder were classed as minor. No fatal accidents occurred during the year. One dangerous occurrence was reported and investigated fully. This occurred at the main pumping station adjacent to the shaft bottom when one of the motors overheated and caught fire.

Tsable River Mine.—S. Lawrence, manager; T. Eccleston, A. Somerville, M. Brown, M. Frobisher, A. Cullane, L. Hutchinson, and W. Herd, firebosses. This mine is in the Tsable River area, approximately 5 miles west of Buckley Bay on the Island Highway. On May 1st the temporary plant used for the original prospect slope was abandoned and the new permanent plant put into operation. This consists of a tipple with single-car rotary dump discharging into a 500-ton capacity bunker, which is equipped with a scraper chain for spreading the coal in the bunker. The main slope hoist is behind the tipple. It is a single-drum hoist, driven by a 500-horsepower 250 r.p.m. 2,200-volt liquid-rheostat-controlled motor. The power is transmitted through a steel rope-laced flexible coupling to the pinion shaft. The gear ratio is 29:115 through a herringbone pinion and gear. The drum barrel is 6 feet 3 inches in diameter by 3 feet 6½ inches between flanges and when full will hold 8,000 feet of 1⅛-inch rope. At present 4,500 feet of rope is in use. The hoist is equipped with a Lilly controller and a "dead man" control. The Lilly controller prevents overspeeding and overwinding of the trip while hoisting men and material. The "dead man" control is an added feature which protects the man-trip by automatically bringing it to rest should anything happen to the hoistman. The main slope trip is composed of ten 1½-ton cars using a suitable drag when hoisting material but equipped with an approved safety car on all man-trips. Underground power is supplied by a Canadian Ingersoll-Rand compressor direct-driven by a 500-horsepower motor and having a capacity of 3,300 cubic feet of air. Provision has been made for an additional unit when required. The original compressor plant is still intact and consists of the following units: One Canadian Ingersoll-Rand compressor, belt-driven by a 150-horsepower motor and having a capacity of 950 cubic feet; one Canadian Ingersoll-Rand compressor with a capacity of 660 cubic feet, belt-driven by a 150-horsepower motor; and one Gardner-Denver compressor, belt-driven by a 150-horsepower motor and having a capacity of 750 cubic feet. Fresh water is supplied by a 5-inch 5-stage centrifugal pump located at the river bank. The pump has a capacity of 350 gallons per minute and discharges into a 20,000-gallon storage tank. The mine is ventilated by a 40-inch diameter Keith-type fan capable of delivering 40,000 cubic feet of air a minute against a water-gauge of 2 inches. The wash-house, with accommodation for 200 men, lamp-cabin, and fully approved first-aid room are all housed in one building. The mine office building houses the manager and timekeeper's office, storeroom, and office for the firebosses. A main powder magazine has been built in compliance with the regulations, and a smaller building is at a convenient location for the storage of the daily supply of explosives from which the men receive their powder issue before going on shift. A well-equipped blacksmith and car-repair shop is housed in one building convenient to the main slope portal. Fire protection is provided by fire hydrants and hoses at all strategic points, and all buildings are equipped with approved fire-extinguishers. A qualified industrial first-aid attendant is employed on each shift, and an ambulance is always stationed at the mine in readiness for any emergency.

Development work done during the year amounted to 9,632 feet of drivage, divided between the main slope proper and the various levels off each side of the slope. Six duckbills are in use; four of these are used for advance work and the other two for preparatory work. The main ventilation system is being provided for by the driving of four slopes, two of these acting as intakes and the outer two as returns. A new main return airway is being driven through to the surface where the main ventilating fan will be installed. Auxiliary ventilation, for advancing the levels and counters, is provided by booster fans pending the driving of the necessary crosscuts. A typical seam section shows: Coal, 42 inches; shale, 10 inches; and coal, 46 inches. The roof consists of 12 to 24 inches of shale overlaid by a hard sandstone, and the floor is a hard sandy shale.

General working conditions have been found satisfactory in the course of inspection. At the last inspection in December, air measurements showed a quantity of 40,800 cubic feet a minute passing in the main return for the use of forty men. Tests with the safety lamp in the main return airway failed to show any trace of methane travelling in the air current. Although the workings are naturally wet throughout, 16 tons of limestone dust was used in treating manholes, etc., and 50 tons was used in blasting operations. Production in 1949 amounted to 79,213 short tons over a working period of 229.5 days with a crew averaging 120 men employed underground and 15 on the surface.

Searches have been made at regular intervals for matches and other prohibited articles, but none were found. Forty-eight accidents, one of which was serious, were reported and investigated. Nineteen minor accidents were reported from the various surface departments of the company in the Cumberland area and all were investigated.

At all the larger mines in the Nanaimo and Cumberland areas regular inspections were made each month by the inspection committees appointed by the workmen, and copies of all their reports have been forwarded to the office of the Inspector through the courtesy of the various committees. All report books required to be kept at the mines were examined regularly and usually found to be in order.

NICOLA-PRINCETON INSPECTION DISTRICT.

By E. R. Hughes.

Five collieries were operated in this district during 1949. They were Tulameen Collieries, Limited, at Princeton; Taylor Burson Coal Company, Limited, at Princeton; the Black mine at Princeton; the Old Princeton Colliery at Princeton; and the Coldwater Coal Mines at Merritt. The first attempt to strip-mine on a large scale in the Princeton area proved disappointing to the operators and was abandoned at the end of March. Further surface prospecting was done in the vicinity of Collins Gulch and "Bear's Den," near Coalmont, by F. Glover and J. S. Ney, and a truck-road was built into the property. Further efforts to find a coal seam on Lot 2258 (S.), Princeton, by surface bulldozing, were unsuccessful. Assessment work was done at the Sunshine mine at Merritt. An application was made to develop and produce coal on Lot 35, White Lake coalfield.

No fatal accidents occurred in the coal mines in this district during the year. Thirteen compensable accidents were reported, and one of these was classed as serious.

There were no prosecutions under the "Coal-mines Regulation Act" during the year, nor were there any dangerous occurrences to report.

The Similkameen Valley Mine Safety Association held its annual field-day competitions at the Memorial Park, Princeton, on Saturday, June 11th. The mine-rescue and first-aid events were well contested and an excellent standard of work was exhibited.

Four teams competed in the mine-rescue event, which was won by a Copper Mountain team captained by Edward H. Pickard.

PRINCETON (49° 120° S.W.).

Tulameen Collieries, Limited. Head office, 716 Hall Building, Vancouver. Thomas M. Wilson, manager; David M. Francis, overman; Arthur Hilton, Thomas Bryden, Frank Bond, William Forsyth, and A. M. Allan, firebosses. The only mine operated by this company during the year was the Pleasant Valley No. 4 mine, about 2 miles west of Princeton.

Pleasant Valley No. 4 Mine.—In the part of the main Princeton seam lying between the abandoned Pleasant Valley No. 2 mine and the old Tulameen Nos. 2 and 3 mines, development was continued. Pillar extraction in the No. 1 north section was completed in November, and preparations were being made to seal off the abandoned workings.

No. 3 slope was continued due east to a point 1,000 feet from the point, between No. 1 and No. 2 North levels on No. 2 slope, from which it was started in 1948. Nos. 3 to 12 North levels, inclusive, have been driven northeasterly from the No. 3 slope and are being advanced toward the Tulameen River barrier pillar. Two levels, No. 6 and No. 7 South, have been started from near the bottom of No. 3 slope to prospect the area to the southwest, and a counter has been started that will parallel No. 3 slope to the south. The face of No. 3 slope is under a cover of 960 feet and is the deepest ever worked in the Princeton coalfield.

In Nos. 6 to 12 North levels, inclusive, the coal ranges in thickness from 5 feet 8 inches to 6 feet and includes five bands of impurities totalling from 4 to 7 inches in thickness. The analysis made at the Department of Mines laboratory in Victoria of a sample of coal taken from the face of No. 11 North level on November 15th was moisture, 16.6 per cent.; volatile combustible matter, 30.6 per cent.; fixed carbon, 41.9 per cent.; ash, 10.9 per cent.; sulphur, 0.7 per cent.; heat value, 9,825 British thermal units.

All mining in development places is done with post-type punching-machines, and in pillar-drawing operations the coal is usually blasted from the solid. Polar Monobel No. 4 is used to blast down the machine-cut coal as well as to break down the pillar coal. Marl, from a local deposit, is used to rock-dust the mine roadways to combat the dangers arising from the presence of coal dust, and is also used to tamp loaded explosives. The broken coal is hand-loaded into mine cars of 1.3 tons capacity, which are hand-trammed from the faces to collecting sidings. Loaded cars are hauled up the Main slope by an electric hoist on the tipple, and in some places small compressed-air hoists are used to gather individual cars into trips at sidings for easier handling on the main haulage.

No explosive concentration of methane was found during any inspection, and there were no reports of such explosive gas being found by mine officials; on three occasions, however, the air current was found to be sluggish in the lower workings of No. 3 slope, and on one inspection a slight trace of methane was found in the same lower workings. The main mine fan forces air into the mine, and the main haulage road is also the main return airway. At the end of the year the fan was supplying 36,000 cubic feet of air per minute, under a pressure of 0.8 inch water-gauge, for the use of forty men.

Most of the coal mined at this colliery is used at the Granby Company's steam-electric power plant near Princeton. The remainder of the output is sold on the local domestic market. The average daily output for the first eleven months of the year was 125 tons. The output was increased to approximately 200 tons daily toward the end of the year, at which time sixty-eight men were employed underground and ten on the surface.

Taylor Burson Coal Company, Limited.

Jackson No. 1 Mine.—This mine is on the south half of Lot 88, 4½ miles southwest of Princeton, and half a mile south of the Taylor No. 1 mine. This half-section of coal land is owned by British Lands, Limited, whose agent is C. H. Jackson, Kelowna. The property has been leased to the Taylor Burson Coal Company, Limited, who reopened the mine during April, 1948, after a shut-down of three years. The portal of the main adit is at an elevation of 3,047.3 feet and is at the southwest corner of the coal lease. The seam presently being worked is reached through a cross-measure adit driven from the tipple elevation for a distance of 170 feet southeasterly. Contact with the seam is made at right angles to the strike at a point 20 feet from the southern boundary of the property; consequently all mine development is necessarily northward from the adit. Operations were continuous throughout the year, and the face of the Main level was advanced to a point 736 feet northeasterly from the cross-measure adit. At a point on the Main level 510 feet northeasterly from the cross-measure adit a third ventilation raise was driven up the full pitch of the seam for a distance of 225 feet to the surface. From this new raise two counters to the Main level are being developed, with the necessary crosscuts for ventilation. The seam is 86 inches thick, including a 1-inch clay parting, a 1-inch shale parting, a 2-inch shale parting, and a 14-inch band of mixed coal and shale. It dips easterly on a pitch of 55 degrees. The coal is blasted from the face of the raises and counters and is loaded from chutes on the Main level.

A sample of coal taken from the face of the Main level on November 10th analysed at the Department of Mines laboratory at Victoria gave the following results: Moisture, 21.2 per cent.; volatile combustible matter, 31.7 per cent.; fixed carbon, 38.2 per cent.; ash, 8.9 per cent.; sulphur, 0.7 per cent.; heat value, 8,910 British thermal units.

The ventilation is natural and, so far, has been sufficient for this small-scale operation. No methane was found during any of the inspections made in 1949. The average monthly output for the first ten months of the year was 247 tons. Toward the end of the year the output was increased and 788 tons was produced in November, at which time seven men were employed.

Fred Mannix & Company, Limited.—Head office, 332 Seventh Avenue West, Calgary. K. Collett, project manager, coal operations, Calgary; B. Montgomery, superintendent at Princeton.

Black Mine.—During the first three months of the year this company produced a total of 15,618 tons of coal from a surface-stripping operation on Lot 87, situated in the Finlay Creek district, 6 miles southwest of Princeton and about half a mile south of the Jackson mine; this is on the site of the former underground operations known as the Black mine. Production was suspended at the end of March, and the pit was fenced off and abandoned.

Princeton Colliery, No. 1 Mine.—The company also did some preliminary testing on the site of the old Princeton Colliery, No. 1 mine, on Lot 1822, adjoining the town of Princeton to the south. The overburden was drilled and two large excavations uncovered part of the workings of the abandoned Princeton colliery. This testing and excavating was discontinued in April, and the company removed all its equipment from the Princeton district.

After the withdrawal of Fred Mannix & Company, Limited (*see* above), a lease on this property was obtained by Joseph P. Wukelick, Princeton. During October preparations were made to resume operations, and in November 95½ tons of coal was produced. Present operations consist of mining coal by hand from an area previously stripped of overburden by the Mannix Company. Two men were employed.

Lot 2258 (S.), M. J. Mullin and Sons.—This is a coal claim of 121 acres 1 mile southeast of Princeton. A licence to mine coal was granted to M. J. Mullin and Sons, Princeton, under the provisions of the "Coal Act." The licensees believe that the main Princeton seam, and possibly other seams, will be found on the claim. During 1948 several trenches were dug and a bulldozer was used for one week in a search for an outcrop. In 1949 a bulldozer was again used for three days. No coal outcropping was found.

Coalmont (49° 120° S.W.).

Hayes & Vittoni Prospect.—This prospect, between Blakeburn and Coalmont, is near the No. 7 tower of the abandoned aerial tramway formerly operated by the Coalmont Collieries, Limited. Six seams have been discovered, three of which have been partly developed by underground work, and the other three uncovered by trenches and open-cuts. The seams range in thickness from 3 feet to 5 feet 6 inches, including bands of clay and shale. Most development work had been done in the No. 1 tunnel, which had been advanced to a point 90 feet from the portal. Underground work was suspended at the end of June, 1947, and has not been resumed since. During 1948 and 1949 a bulldozer was used in unsuccessful efforts to discover a thicker seam, believed to be in this area.

Collins Gulch Prospect.—This coal property consists of two coal claims, Lots 293 and 294, covering an area of 2 square miles. A licence to mine coal has been granted to F. Glover and J. S. Ney, Vancouver, under the provisions of the "Coal Act." Coal is exposed on both sides of Collins Gulch, 2 miles west of Coalmont and 2 miles south of Tulameen, at a point approximately 1½ miles from the Tulameen River, and approximately 800 feet above the river. The gulch cuts through the strike of the coal measures, and at the point of exposure the coal seams dip toward the south.

Coal was discovered on Collins Gulch over fifty years ago. The early work done in this area included an adit driven into the hillside on the east side of the gulch. The entrance to this adit caved, so that the extent of the workings could not be ascertained. During 1948 Messrs. Glover and Ney did some prospecting on the west side of the gulch and built a road from near the Hayes and Vittoni prospect into the new showing. A large seam of coal is incompletely exposed at Collins Gulch. The work done is insufficient to determine the full thickness of the seam and the extent of the included impurities. This seam is thought to be the principal seam worked in the now abandoned Coalmont Colliery, of which the nearest workings are about a mile from the Collins Gulch outcrop. No underground work was done in 1949, but a truck-road was built from the Blakeburn road to Collins Gulch, a distance of about 3 miles, and other surface work included bulldozing at Collins Gulch and at "Bear's Den," on Lot 294. This work uncovered a thin seam at Collins Gulch, as well as a showing of undetermined nature at "Bear's Den." Work was suspended for the winter.

Merritt (50° 120° S.W.).

Coldwater Coal Mines.—C. E. Thomas, operator; Robert Murray, fireboss. This property, formerly operated by the Middlesboro Collieries, Limited, is about a mile south of the city of Merritt. Present activity is confined to Coldwater Hill, about half a mile east of the old Middlesboro Colliery office.

Coldwater No. 3 Mine.—This mine is in the No. 3 seam, which underlies the No. 2 seam. The seam is 28 to 30 inches thick, has a hard sandstone roof, and pitches 22 degrees in a southeasterly direction. A sample of the coal, taken in 1948 by the operator and analysed by the British Columbia Electric Railway Co., Ltd., gave a heat value of 14,337 British thermal units.

The new slope, started in December, 1946, was advanced to a point 350 feet from the portal and is being driven southeasterly on a pitch of 14 degrees. Four levels have been started from the south side of the slope and are named respectively Nos. 1, 2, 3, and 4 Right levels. No. 1 Right level was driven 430 feet from the slope to a fault and stopped. At the end of the year No. 2 Right level had been driven 370 feet from the slope and the face of No. 3 Right level was 250 feet from the slope. No. 4 Right had been advanced about 30 feet. The four levels have been advanced parallel to the original No. 3 Mine Main level, and ventilation crosscuts have been driven to connect the levels. Coal is blasted from the solid and is then hand-loaded into 1-ton cars which are hand-trammed from the face to the Main slope. The cars are then hauled up the slope by a gasoline-operated hoist on the surface. Ventilation is natural and has, so far, been sufficient for such a small operation. No methane has yet been detected in the mine workings. The average monthly production for the first eleven months of the year was 163 tons. Five men were employed underground and one on the surface.

Sunshine No. 3 Prospect. David R. Fairley, operator. This prospect is on the North Half of Lot 181 and is 1 mile north of the city of Merritt. A small amount of prospecting has been done for many years, but in recent years only assessment work has been done. The coal claim covers an area of 80 acres. In the Sunshine No. 3 prospect a coal seam is reached in a cross-measure adit 305 feet long. In former years a level was advanced about 300 feet northeasterly on the strike of the seam from the adit face and a slope was driven down from the level about 50 feet on a 30-degree pitch. A cave occurred at the top of the slope, and the assessment work this year consisted of repairing and timbering the roadway at this point. No coal was produced and no other work was done.

EAST KOOTENAY INSPECTION DISTRICT.

By R. B. Bonar.

Crow's Nest Pass Coal Co., Ltd. T. G. Ewart, president, Fernie; Thomas Balmer, vice-president, 305 Great Northern Railway Building, Seattle, Wash.; T. H. Wilson, general manager, Fernie; H. Wilton Clark, general superintendent, Fernie; A. L. McPhee, treasurer, Fernie; W. R. Prentice, secretary, Fernie; C. B. Newmarch, geologist, Fernie. This company operates the Elk River and Michel Collieries.

Elk River Colliery.—(49° 114° S.W.) James Littler, manager. Underground operations are under the direct daily supervision of four overmen and fifteen firebosses.

No. 1 East Mine.—Carmichael McNay, overman; Leonard Brett and John Cairns, firebosses. The operation at this mine consists entirely of the extraction of the pillars formed during the earliest working of the mine. As the coal is fairly soft, pneumatic picks are used to advantage by the miners. The coal is hand-loaded into cars which are hauled by horses to the partings where the trips are made up. From the partings the trips are hauled by a compressed-air hoist to the head of the endless-rope system, which is now about 450 feet from the mine portal. From there the coal is hauled to the Elk River preparation plant, about 4,000 feet away, by a steam locomotive.

Although the life of this mine is limited, it was still one of the major producers of coal at the Elk River Colliery during the year.

Very little methane is given off by the pillars during their extraction. The ventilation in general throughout the year was good, although numerous old roads were encountered and the ventilating current was rather sluggish. For this reason considerable coal dust, held in suspension at and near the working-faces, was evident at times, especially in the Nos. 5 and 6 East sections. The fan delivers 92,000 cubic feet of air per minute, of which 63,000 cubic feet is supplied to the actual working-places for a total crew of seventy men and twenty horses, while 29,000 cubic feet is circulated through the abandoned workings.

Two new sections near the head of the endless haulage system are being developed to the rise and dip off the main level to prolong the life of the mine when the reserves of Nos. 5 and 6 East sections are depleted.

No. 4 Mine.—James Bushell, overman. This mine is on the retreat, and all production of the single shift employed comes from rooms driven off the new incline started early last year inby old No. 3 Incline. These rooms are driven through the left side pillars of No. 3 Incline and will form longwalls whereby the bulk of the coal will be recovered on the retreat. It is estimated that the extraction of these pillars and of the main entry pillars, will extend the life of the mine another year and a half.

The coal is conveyed from the splits and rooms by compressed-air shaker-conveyers to the belt conveyer on the incline, whereby it is transported to the loading-point on the main level. The coal is then loaded into mine cars and hauled by horses to the mine portal, a short distance from the tipple rotary dump.

The ventilation, maintained by a double-inlet Sirocco fan 5 feet in diameter, was found to be adequate throughout the year.

No. 9 Mine.—Daniel Chester, overman; John Sweeney, Ralph Larner, Albert Littler, James Morris, James Corrigan, William Waller, and Ralph Baker, firebosses.

As reported in the Annual Report of the Minister of Mines for 1948, all work to the high side off the main level in the No. 6 slope section and at the face of the main level was stopped because of the faulted ground encountered. To maintain production, the output from the No. 5 slope section was raised to nearly its full capacity.

The rock tunnel, started near the face of the main level late in December, 1948, encountered coal beyond the fault, after it was driven about 500 feet. The coal, about 8 feet 4 inches thick, is fairly free from rock bands and is of the highest quality. The main level has now been extended in coal for about 800 feet inby the fault, and four inclines have been driven off the main level, near the face, about 300 feet. The roof exposed so far beyond the fault consists of broken shale and is not the regular conglomerate roof.

The coal is mined by radial-punching machines and blasted. It is loaded into mine cars in the rooms and into shaker-conveyers in the splits and crosscuts. The trips are hauled up the slopes by compressed-air hoists to the main haulage level, where they are gathered into larger trips which are then hauled to the mine portal by horses.

Anticipating a large area of coal beyond the above-noted fault and consequently a considerable daily output, the management has given much thought to the Main level haulage problem. After consultation with the Inspection Branch of the Department of Mines, it was decided to try a diesel locomotive. A North British diesel locomotive has been ordered, and probably will be in operation in this mine in 1950.

Preparatory to the installation of this proposed haulage system the company has made considerable progress in straightening the curves in the Main haulage level and are double-tracking it with 56-pound steel.

Much thought is now being given to electrifying the mine because the main haulage road is of considerable length and will be extended in the near future and because of the low efficiency of compressed-air locomotives.

The ventilation is maintained by an 8-foot reversible Jeffrey fan and, in general, throughout the year was found to be adequate. The friable coal, the method of mining, and the use of radial punchers have necessitated the use of large amounts of limestone dust to combat efficiently the coal-dust hazard.

No. 3 Mine.—James Anderson, overman; David Brown, Roger Girou, Kenneth Kniert, William Verkerk, Brindley Morris, and James Brown, firebosses. This mine continued throughout the year to be the largest producer at the colliery.

The development work to the left off No. 4 Incline, started to open a district toward the outcrop, has made considerable progress in spite of the natural difficulties, namely, thinning of the seam in places and unfavourable roof conditions accompanied by water. The coal in this district, in accordance with the general practice throughout the mine, is dug with compressed-air picks, but radial-punching machines are used in the harder places to cut the coal preparatory to blasting. Generally, because of the friable and contorted coal, undercutting or shearing is not necessary and shot-firing is held to a minimum. The coal is loaded into shaker-conveyers at the faces and is transported by shaker and flight conveyers to the main cross-belt which in turn delivers the coal to the top belt of a series installed on No. 4 Incline. These belts, driven by compressed-air motors, deliver the coal to the loading-point on the main haulage level.

The development work to the left off the slopes is progressing, although it was hampered to some extent by blowouts (reported under "Dangerous Occurrences") during the latter part of the year. The coal in this section, with the exception of the Main slope face, is extremely friable and gives off considerable methane. Here, as in the Main level section, no blasting is required, except in the Main slope.

The faulted ground encountered by the Main haulage level in November, 1948, has persisted, and at the end of the year efforts were still being made to penetrate it to regain the seam. Signs and conditions presented by the fault to date suggest that the strike of the fault closely parallels the strike of the seam.

The mine is ventilated by an aerodyne fan having a rated capacity of 100,000 cubic feet per minute against a resistance equivalent to a water-gauge of 2 inches. Because of the gaseous condition of the slope and Main level sections, it was found necessary, in the latter part of the year, to divide the mine into two splits and also to increase the ventilating horsepower. This being done, a more beneficial and efficient performance of the ventilating unit resulted.

During the year 11,500 pounds of Polar CXL-ite, 23,950 pounds of Polar Monobel No. 4, 3,400 pounds of Polar Monobel No. 14, and 43,228 electric detonators were used at the colliery in coal and rock blasting. No misfired shots were reported.

To overcome the coal-dust hazard, 212 tons of limestone dust was applied to the underground workings of the colliery, including that used in the tamping of shots. To check the efficiency of these applications of inert dust, monthly samples of mine dust were collected throughout the year and analysed; all the samples were above the minimum requirements of incombustible content as set by the Coal-dust Regulations.

Monthly inspections were made by the Miners' Inspection Committees, and a copy of each inspection report was sent to the office of the District Inspector through the courtesy of the committee members. All report books kept at the various mines, in accordance with the "Coal-mines Regulation Act," were examined regularly and were found to be in order.

Michel Colliery.—(49° 114° N.W.) William Chapman, manager; Irving Morgan, senior overman; Walter McKay, afternoon overman; John Whittaker, night shiftboss. Underground operations are under the daily supervision of five overmen, one shiftboss, twenty-four firebosses, and seven shot-lighters.

During the year five mines, not including the strip mine, were active at the colliery, of which "A" East, "A" West, and "A" South mines operated in "A" seam, "B" South mine in "B" seam, and No. 3 mine in No. 3 seam. These mines are operated from one main haulage level, driven in rock, wherein compressed-air locomotives haul the coal and supplies. The coal is brought out in large trips direct to the rotary dump, close to the tunnel portal. From the dump the coal is transported by a belt conveyer to the modern tipple and washery.

"A" East Mine.—William Gregory, overman; Thomas Taylor, Stephen Lazaruk, Harry Sanders, Frank McVeigh, and Robert Barass, Sr., firebosses. This mine, on the eastern limb of the Michel syncline to the left of the main haulage tunnel, is on the retreat. Most of the production comes from the No. 5 slope section and from the extraction of the main pillars above the main east haulage level. As the reserves in the No. 5 slope area are rapidly being depleted, No. 1 slope section outby is being developed to offset this loss of production.

Wherever possible, duckbill loaders and short-wall cutters are used to drive the rooms and splits. The pillars so formed are subsequently extracted by Meco shaker-conveyers, each equipped with a swivel pan. This device allows the top part of the conveyer to be angled along the top part of the pillar, thus making a longer faceline possible on which the working force may be concentrated. In the event of an impending cave the top part of the conveyer and swivel pan are moved back along the split and a new break-through driven to the inby split, leaving a small pillar next to the caving area. This pillar protects the working crew and is usually recovered. In the sections where pillars are drawn, pneumatic picks are usually sufficient to break down the coal, and only an occasional shot is required. The weak roof that is general throughout this mine has proved a handicap to mechanization and requires the closest attention of all concerned to mine the coal with efficiency and safety.

The coal is naturally dusty, and as crushing in the areas of pillar extraction produces much dust, liberal and frequent applications of inert dust have been necessary to mitigate the coal-dust hazard. In general, the ventilation during the year was found to be adequate, but there were occasions when, owing to the deterioration of the return airways, blasting had to be temporarily prohibited in certain working places.

"A" South Mine.—Harry Corrigan, overman; Harry Batchelor and Roger Pasiaud, firebosses. This mine is operating on the Sparwood or western limb of the syncline, where inclinations of 30 degrees and more are usual. The reserves in the No. 4 Raise section were depleted early in the year and all material was subsequently withdrawn. Production is maintained from the No. 1 Raise section outby No. 4 Raise, but the reserves in this area are being rapidly depleted.

In this section, rooms are driven on the strike of the seam, to the right of the raise, to the limit of duckbill-equipped shaker-conveyers. The intervening pillars between rooms are extracted on the retreat. The coal is delivered by the conveyers to the main chute in the raise in which it is transported to the loading-point on the Main South or haulage level, where the mine cars are loaded and the trips made up. These trips are hauled by small compressed-air locomotives to the main gathering parting in the main rock tunnel.

In general, the ventilation during the year was found to be adequate. The coal-dust hazard, ever prevalent, was also effectively guarded against by the frequent applications of inert dust.

No. 3 Mine.—Harry Corrigan, overman; Harry Batchelor and Roger Pasiaud, firebosses. This mine is in the early stages of development and consists of four raises that are to be driven to the western outcrop of the seam to establish the necessary airways before production of coal is started on a large scale. The area of operation of this mine is on the western limb of the Michel syncline at the inby end of the main rock haulage tunnel. The seam, about 5 feet thick, is hard and of good quality, inclines about 35 degrees toward the outcrop, and has a fairly strong shale roof.

The coal is transported by angle chutes and cross conveyers from the faces of the raises to the main chute that delivers it to the loading-point on the North level, where the compressed-air locomotive trips are made up to be hauled to the surface via the main tunnel.

"A" West Mine.—Harry Corrigan, overman; John McInnis, Frederick Simister, Reginald Taylor, Robert Taylor, and James Walsh, Jr., firebosses. The area of operation of this mine, the largest producer at the colliery, is confined at present to the Michel or eastern limb of the syncline in "A" seam.

The main producing section of the mine, No. 2 belt-road, is now on the retreat, as the eastern boundary was reached early in the year. In developing this section, rooms are driven in pairs on the approximate strike of the seam on both sides of the belt-road to a predetermined boundary. When a pair of rooms have reached the boundary, splits are driven from them to the next pair of rooms above, thus forming pillars that are subsequently extracted by the aid of shaker-conveyers, each equipped with a swivel pan. The development work in the rooms and splits is done with short-wall cutters and duckbill-equipped conveyers. Blasting is necessary in the narrow work, but the pillar coal, which is subjected to considerable roof pressure due to the method of mining, is extracted successfully with pneumatic picks, only occasional shots being required.

No. 4 belt-road and counter, off No. 4 Incline above and parallel to No. 2 belt-road, were started early in the year and are progressing rapidly. These roads are being driven to develop a large district toward the northern outcrop of the seam so that production may be maintained when the reserves in the No. 2 belt-road section are depleted.

"B" South Mine (No. 3 Incline and No. 1 Raise Districts).—Abel Hampton, overman; Henry Eberts, Thomas Slee, Frederick Nash, Sidney Hughes, David Thewlis, Benjamin Volpatti, Thomas Krall, Daniel Bobchuk, and Mario Pettoello, firebosses. This mine is on the western or Sparwood limb of the syncline, where inclinations of 30 degrees and more exist. The seam averages between 5 and 6 feet in thickness, is of excellent quality, and has a fairly strong shale roof in most sections, which allows machinery to be used to advantage.

The coal in Nos. 200 and 300 Raise sections is being depleted rapidly. To offset this future loss of production, the No. 1 Raise section, off the main south level inby No. 3 Incline, is being developed rapidly, although progress has been hampered considerably by the lack of positive ventilation. This new section is ventilated by natural means through old No. 4 Raise, and, to overcome the slack periods in the ventilation, a new aerodyne fan is being installed at the opening near the outcrop on No. 4 Raise.

The ventilation, which is natural, in the Nos. 200 and 300 Raise sections was found to be adequate throughout the year. Very little methane is found in these sections, probably because of the high inclination of the seam and its proximity to the outcrop.

Owing to the complete mechanization of coal cutting and haulage, especially the numerous chutes in use, the coal-dust hazard is ever present; frequent and liberal applications of inert dust are required to neutralize efficiently this potential danger.

"B" South Mine (Slope District).—William Gregory, overman; Thomas Owens, James Robson, and William Davey, firebosses. The workings of this slope district lie to the dip off the Main South haulage level, and the bulk of the production comes from the extraction of pillars lying between the slope and the old "B" East mine.

Headings are being driven from No. 10 Right room to intersect the main south level inby No. 1 Raise. These headings will ultimately become slopes which will be used in developing and extracting the coal lying near the basin of the Michel syncline. The coal trips will be hauled up the slope by a hoist to the main level where larger trips will be made up to be hauled to the main tunnel portal by compressed-air locomotives. These slopes are considerably shorter than the present slopes and will allow mining to a greater depth from the main level.

In general, the ventilation during the year was adequate, and only a few occurrences of gas were reported; this gas came from the surrounding gob areas.

During 1949, 2,485 pounds of Polar CXL-ite, 19,750 pounds of Polar Monobel No. 14, 46,000 pounds of Polar Monobel No. 4, and 77,749 electric detonators were used at the colliery in coal and rock blasting. Eight misfired shots were reported.

Monthly examinations were made by the Miners' Inspection Committees. All report books kept at the various mines, in accordance with the "Coal-mines Regulation Act," were examined regularly and were found to be in order.

Michel Strip Mines.—The Erickson strip mine, which became operative on February 5th, 1947, was closed down on October 20th of this year because the overburden had become too thick for economic removal.

The Baldy strip-mine prospect, which was extensively drilled and trenched during the 1948 and the early part of the 1949 seasons, proved to be a deposit of considerable magnitude. The mine came into production on October 21st. The coal is of good quality, although sections of the deposit have inferior coking properties. A surprisingly large percentage of the output is lump coal.

The deposit reaches a thickness of 90 feet in places, and the average ratio of overburden to coal is 1.2 to 1. The coal is hauled by 15-ton capacity trucks about 4½ miles over a company road to the Michel tipple. The road is gravelled and is usually kept in good condition.

Coke Plant.—Early in the year the new battery of sixteen Curran-Knowles by-product ovens was completed and went into immediate production.

NORTHERN INSPECTION DISTRICT.

By E. R. Hughes.

TELKWA (54° 127° N.E.).

Bulkley Valley Collieries, Limited. F. M. Dockrill, managing director; A. H. Dockrill, overman; Robert Gourlay and Hugh Bankhead, firebosses. This property is on Goat Creek, about 7 miles from Telkwa. The market is confined to the district between Prince George and Prince Rupert. Mining operations presently consist only of taking out pillars at the No. 2 mine. The Main slope left counter was driven through a washout and made contact with the seam on the west side of the barren area. However, the expense of driving a second roadway through this ground was considered by the operators to be too costly and further development was suspended. The possibility of recovering the coal beyond the washout from a new surface adit may be considered at a later date. Some surface prospecting was done in the area adjacent to the abandoned No. 1 mine with encouraging results, but further testing will be required to obtain complete information on this area.

A diesel-driven Gardner-Denver compressor, of 360 cubic feet capacity, provides the underground power requirements. The solid coal is cut by post-type punching-machines, and in the broken pillars the coal is blasted from the solid. Polar Monobel No. 4 is used to blast down the machine-cut coal as well as to break down the pillar coal. The coal is hand-loaded into mine cars which are hand-trammed from the faces to sidings off the Main slope and hauled to the surface by a small Canadian Ingersoll-Rand compressed-air hoist. The seam, which dips northwesterly on a pitch of 7 degrees, is 13 feet thick and contains two bands of rock, 2½ and 1½ inches thick. The top 2 feet of coal is left to form the roof.

On the surface the coal is dumped over stationary bar-screens and is separated into four sizes—lump, egg, stoker, and slack. Coal is hauled to the railroad by truck. Bath-house facilities are provided at the mine, and the workmen reside in Telkwa. A bus transports the employees to and from their work daily. At the end of the year twenty-seven men were employed underground and five on the surface.

CARIBOO.

Bowron River (53° 121° N.W.).

Bowron Coal Company, Limited.—Activities during the year were confined to diamond drilling, surface stripping, and building a truck-road into the property. No work was done underground, but preparations were being made to commence such work in the spring of 1950.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1948, pp. 233–240.]

PEACE RIVER (56° 122°).

Peace River Coal Mines, Ltd. Lloyd Gething, managing director; A. D. Chapple, fireboss. The property is on Larry Creek, on the west slope of Portage mountain, at the upper end of Peace River canyon, about 18 miles by road from Hudson Hope. Operations are confined to the development of the Canyon No. 1

mine. The main development consists of a slope driven south 9 degrees west for 178 feet and a crosscut driven west 125 feet from the lower end of the slope to the wall of the Peace River canyon. This crosscut provides drainage and natural ventilation for the present mine workings. Two levels were driven to the southeast a sufficient distance to form a panel of five rooms to the rise. The lower level was driven 710 feet and the upper level 832 feet. The upper level is used as a haulage road and the lower is a drainage adit. The levels were not advanced during the year. No. 6 incline starts from the face of the upper level and has been driven up the full pitch of the seam for a distance of approximately 600 feet to the outcrop. The original haulage-slope location, at the extreme west end of the workings, was found to be unsatisfactory, and a new portal at a more central point was desirable. During December, arrangements were made to change the main haulage from the original slope to No. 6 incline. The new power-house has been built near the portal of No. 6 incline, and it is intended to erect a new tipple at this location.

The seam dips about 3½ degrees southwestward. It is 7 feet 2½ inches thick and contains a 6-inch and a 4½-inch band of clay ironstone. A diesel-driven Gardner-Denver compressor, of 364 cubic feet capacity, provides the underground power requirements, and the coal is cut by a post-type punching-machine. Shot-holes are drilled by a Huwood compressed-air rotary drill. Forty additional mine cars were added to the haulage, and in November a Goodman G-12½ shaker-conveyer was purchased. Pillar-drawing from the first-formed panel group has commenced; the shaker-conveyer was obtained for use in this work. The average monthly production for the first ten months of the year was 388 tons. In November nine men were employed underground and five on the surface.

King Gething Mines.

Quentin F. (King) Gething, operator and fireboss. This property is on the east slope of Portage Mountain, about 12 miles by road from Hudson Hope and 72 miles from Fort St. John. The No. 2 mine, which was started in 1947, was closed in the spring of 1949. A clay-ironstone layer, always present in varying thickness in the seam, was found to be over 2 feet thick at the face of the Main level and the cost became too high to continue mining under such conditions.

As the result of surface prospecting, a new seam was discovered in April on the west half of Lot 1039, about three-quarters of a mile south of the inactive No. 1 and No. 2 mines. An adit was started near where the outcrop was discovered and has been named the King Gething No. 3 mine. The strike of the seam is almost due north and the measures dip easterly on a pitch of 16 degrees. The seam is 8 feet thick, including a varying thickness of clay-ironstone. Where the clay-ironstone is thick and near the floor it is left down, but where it is thinner and higher in the seam it is mined out. The clay-ironstone varies in thickness from 2 or 3 inches to about a foot. The new adit has been advanced 200 feet almost due north on the strike of the seam, and a raise has been driven up 100 feet; this raise will be driven through to the surface to form a second outlet for the mine. The coal is blasted from the solid and is hand-loaded into mine cars and hand-trammed out of the mine to the tipple. Coal production was started in August and in the first three months of operation 574 tons of coal was produced. Nine men were employed in November.

Reschke Coal, Ltd.

J. Reschke, operator; Lawrence Gething, fireboss. This property is on the southern spur of Butler Ridge, about 23 miles by road from Hudson Hope and 83 miles from Fort St. John. Operations are confined to the No. 2 mine. The seam is about 5 feet thick and contains two thin rock bands in the top 6 inches. It pitches about 43 degrees, and the Main level had, on November 23rd, been advanced approximately 850 feet northerly along the strike from the portal. Rooms are driven up the full pitch of the seam from the

Main level. A second surface connection has been started 300 feet up from the Main level and the rooms are driven up to this second level. Ventilation is natural and was found to be sufficient for the present needs of the mine. An air-compressor, driven by a 100-horsepower diesel engine, provides the power for a post-type coal-cutting machine and for drilling the rock floor in the Main level to give height. Coal from the raises is loaded from chutes on the Main level, and the mine cars are hauled out of the mine by a pony.

Another seam of coal, from 2 to 3 feet thick, has been found about 25 feet below the seam now being mined. This lower seam is believed to be excellent coal for railroad use. A cross-measure tunnel was driven from the Main level to connect with the lower seam and permission has been given to develop one raise and a level, so that the quality of the coal may be tested. The average monthly production for the first ten months of the year was 433 tons. In November eight men were employed.

Inspection of Electrical Equipment and Installations at Mines and Quarries.

By L. Wardman.

CONTENTS.

CANADIAN ELECTRICAL CODE, PART V.

The sixth draft of the Canadian Electrical Code, Part V, was completed early in the year and was printed and ready for distribution by August. As was stated in the 1948 Annual Report of the Minister of Mines, the Code was divided into two sections as follows:—

C22.5 No. 1, 1949: Use of Electricity in Metalliferous and Industrial Mineral Mines and Quarries.

C22.5 No. 2, 1949: Use of Electricity in Coal Mines.

Special covers were attached to the British Columbia copies to signify that these sections of the Canadian Electrical Code, Part V, are part of the "Metalliferous Mines Regulation Act" and the "Coal-mines Regulation Act" respectively, and, as such, must be complied with in British Columbia.

The cover for C22.5 No. 1 reads "Canadian Electrical Code, Part V, governing Electrical Installations for Metallurgical Works, Mines and Quarries except as provided for in the Metalliferous Mines Regulation Act."

The cover for C22.5 No. 2 reads "Canadian Electrical Code, Part V, governing Electrical Installations for Mines and Coal-stripping Operations except as provided for in the Coal-mines Regulation Act."

Copies of each section of the Code may be obtained from the General Office, Department of Mines, Victoria, B.C., at a cost of $1 plus 3 per cent. tax.

In the fall of 1948 a Pacific Regional Committee on Part V of the Canadian Electrical Code was formed in British Columbia. This committee consists of the following members:—

S. C. Andrews, chief electrician, Canadian Collieries (Dunsmuir), Ltd.
R. Commons, chief electrician, The Crow's Nest Pass Coal Co., Ltd.
G. Ford, chief electrician, Bralorne Mines, Limited.
W. H. Miller, foreman electrician, The Granby Consolidated Mining, Smelting and Power Company, Limited.
M. A. Thomas, branch electrical engineer, The Consolidated Mining and Smelting Company of Canada, Limited.
C. H. Watson, chief electrician, Britannia Mining and Smelting Co., Limited.
L. Wardman (chairman), Electrical Inspector of Mines, Department of Mines.

In January, 1949, the first meeting of this committee was held in Vancouver, where a clause-by-clause discussion of the Code took place. Many recommendations were made and submitted to the Main Committee on the Canadian Electrical Code, Part V. These were used when the sixth draft was written.

INSPECTIONS AND INVESTIGATIONS.

The following is a summary of the inspections of electrical installations made during 1949 at metalliferous mines, concentrators, coal mines, and quarries.

The number of inspections made during 1949 is as follows:—

	Number inspected.	Number of Inspections made.
Metalliferous mines	28	39
Concentrators or mills	21	33
Coal mines	7	7
Washing plants	1	1
Industrial-mineral mines	1	1
Quarries	6	7
Dredges	2	2
Totals	66	90

In addition to the above, two special visits were made: one with the Chief Inspector to the Tsable River mine to investigate and decide on the type of enclosure for a 500-kva. 2,200–440-volt 3-phase transformer; the other to the Tulameen Collieries to investigate the place where an underground telephone was to be installed and to decide on the type of equipment necessary.

Two metalliferous mines at which electrical equipment will be installed in the future were visited.

There were no dangerous occurrences involving electrical equipment to investigate during the year. Details of two accidents which occurred will be given later.

In the inspection report made out after each inspection, attention is drawn to violations, unsatisfactory conditions, and malpractices which may have been observed.

The following summarizes observations, comments, and recommendations made during 1949.

SUPPLY-STATIONS.

At two properties the transformers were not in an enclosure. At three properties the enclosure gates were not locked. At one property a transformer station of combustible material was located adjacent to other combustible mine buildings. At another property a 500-kva. 2,200–440-volt 3-phase transformer filled with inflammable oil was installed in a combustible building used as a shower and change room.

Transformers shall be either isolated by elevation or be in a suitable enclosure which shall be of fireproof construction if located near other combustible buildings. Transformers, unless insulated with dielectric liquids rated as non-flammable, shall not be mounted on or above combustible roofs or attached to any building not of fireproof construction other than a transformer vault. If transformers filled with flammable dielectric liquid are installed in a building other than a transformer station, the transformers shall be in a fireproof vault. The gate or door to such enclosure, building, or vault shall be kept locked to prevent entry of unauthorized persons.

Switch Gear.

There were four installations of motor branch-circuit switchboards which were without main disconnecting switches. Such switches are necessary to disconnect the buses and branch-circuit switches from the main feeder.

There were five installations of switches of inadequate capacity. These resulted in heating of the switches and necessitated the use of two fuse links per pole. Switches must have a horsepower rating that is at least equal to the horsepower rating of the motor controlled.

One installation had only one safety switch for two motor branch circuits. Normally each motor branch circuit shall have an individual safety switch. Only in special cases is one safety switch allowed for more than one motor.

At four properties free access to switch gear was prevented by machinery, pipe-lines, or refuse. Adequate working space and means of access clear of all obstruction and free from any danger shall be provided and maintained about all electrical equipment.

At one property disconnects were connected so as to leave the blades alive when in the open position. Except in special cases, switches shall be connected so that the blades are not alive when in the open position.

Weak fuse clips and improperly inserted fuses were found. Fuse clips should grip the fuse tightly, or be aided by auxiliary clamps. Knife-blade contacts must be in line or they will spring the clips, resulting in poor contact and consequent heating.

There is room for improvement in the marking of switch gear to indicate which circuits and equipment are controlled. Partially obliterated markings require repainting before they become illegible.

Cables and Wiring.

The general condition of power-cable installations was satisfactory.

Several installations of temporary wiring required replacing with permanent wiring. Temporary wiring may be used only when emergency conditions arise which require equipment to be kept in operation, or for testing. It must be installed so as to present no hazard and shall be replaced with permanent wiring at the first opportunity.

Lighting-circuit Wiring.

Several installations required rewiring to conform to Canadian Electrical Code standards, several installations had overfused branch circuits, and three circuits had fused neutrals.

To prevent the overloading of branch lighting circuits and consequent overfusing, a sufficient number of lighting circuits should be provided. The neutral of grounded neutral lighting systems must not be fused. Fusing the neutral nullifies the protection gained by the use of such a system. All systems in mill-type buildings must be in conduit or, by special permission, in flexible conduit, electrical metallic tubing, or armoured cable.

TRAILING CABLES.

It was observed that temporary splices were generally made to serve in place of permanent splices. The electrical code states that properly made temporary splices may be used to finish a shift, if necessary. At the end of the shift the cable must be permanently spliced and properly vulcanized.

The Canadian Electrical Code, Part V, requires that trailing cables have the grounding conductor incorporated in the cable. Therefore, whenever old cables are replaced by new, the latter should be of this type.

BONDING AND GROUNDING.

The grounding of non-current-carrying metal parts requires improvement. It is usual during an inspection to find several grounding and bonding conductors missing or disconnected. In order to prevent accidental electric shock to persons coming in contact with electrical equipment, non-current-carrying metal parts not naturally grounded must be effectively grounded by an adequate grounding system.

BLASTING-CIRCUITS.

Unlocked blasting gear and supply ends of blasting leads not short-circuited were observed. One installation had a grounding conductor for grounding the blasting leads when the blasting-switch was in the " off " position.

It is essential that blasting-switch gear be kept locked and the key be kept in the possession of the shot-firer in order to prevent inadvertent operation at a time when the circuit is connected.

The supply ends of blasting leads must be kept short-circuited to prevent stray currents, if such should enter the leads, from passing through the caps.

Blasting leads must not be grounded for the following reason: The grounding conductor provides a path for stray current to enter the leads and a grounded cap wire provides a path to earth. As the bare ends of cap wires are rarely taped after being connected, the chance of a connection making good contact with the ground is always possible. Under such conditions, stray current may pass through the grounding conductor, blasting leads, and cap wires, and so cause a premature ignition.

POLARIZED PLUG RECEPTACLES.

The use of polarized plug receptacles has been strongly advised, with the result that several companies have installed them throughout and others have commenced to change over to them.

Polarized plug receptacles reduce the possibility of shock when using portable equipment in that the non-current-carrying metal parts may be grounded and the polarity of the wiring may be maintained.

HOISTS.

Unsatisfactory operation of the overspeed device and the severe application of brakes in the high-speed zone required correcting on three installations.

The overspeed mechanism on hoists should be adjusted to operate at a speed slightly above full operating speed. On hoists provided with air or hydraulic brakes, the linkage for the valves is moved by a cam to give a small or large opening of the valves on the brake-actuating cylinder and thus allow a slow or fast automatic application of the brakes, depending on the position of the shaft conveyance in the shaft. The action is rapid in the retardation zones at the upper and lower limits in the shaft and slower in the full-speed zone to bring the shaft conveyance to a smooth stop. Proper adjustment of the brakes and valve linkage must be maintained to give satisfactory operation at all times.

Locomotives.

The general condition which required correcting on locomotives was defective controller-handle latches. Usually the latch was missing or the spring was broken, but occasionally the operator had rendered the latch inoperative. In the interests of safety it is essential that these latches be kept in effective working order.

One accident was caused this year through not having an effective latch on a locomotive controller handle. A man who was carrying a load stumbled while passing the locomotive and, in reaching out to save himself, accidentally pushed the controller handle, causing the locomotive to roll on to his foot and fracture it. Had the controller handle latch been in effective working order, this accident would not have happened.

Maintenance.

Maintenance at many properties is often neglected until the equipment fails and causes a shut-down which otherwise could have been prevented.

Many workmen with a slight knowledge of electricity, hoping that they can keep the equipment operating, attempt to make repairs themselves rather than call the electrician. One such attempt resulted in the man receiving an eye injury, and he may lose the sight of one eye. He attempted to test, with a 110-volt lamp, a circuit that was actually 440 volts. The lamp exploded, and fragments of glass entered his eye.

The maintenance of electrical equipment should be left to those qualified to do such work.

ELECTRICAL POWER.

Electrical power was used on the surface at thirty-six metalliferous mines and underground at twenty-four of these mines during 1949.

The number of quarries using electrical power is still ten.

There has been no change in the number of coal mines using electrical power. It is used on the surface at seven coal mines and underground at four of these mines. A total of 17,789 horsepower used in combined surface and underground operations is distributed as follows:—

Above Ground.	Average Horsepower.
Compressed air	8,311
Ventilation	1,245
Hoisting	2,066
Haulage	818
Coal washing and screening	2,205
Pumping	488
Coke production	915
Miscellaneous	413
Total	16,461

Underground.	
Haulage	658
Pumping	650
Miscellaneous	20
Total	1,328

MINE ELECTRICAL INSTALLATIONS.

The following paragraphs give a brief general description of new electrical installations and also additions and changes to existing installations. A complete description of electrical installations not mentioned below may be found in previous Reports of the Minister of Mines.

LODE MINES.

Taku River (58° 133° N.W.).

Polaris-Taku (Taku River Gold Mines, Ltd.). A roasting and cyanide plant was installed during the year. The connected load of the roasting plant is 45 horsepower. Lighting is provided through a 200-ampere service and a 12-circuit panel. To shut off the oil in case of fire, an automatic solenoid-operated safety valve was installed. The connected load of the cyanide plant is 65 horsepower. Lighting is provided through a 200-ampere service and a 20-circuit panel. Two of these circuits serve the refinery. A 30-ampere circuit supplies power to the refinery from the cyanide-plant service.

A 20-kw. 440–220/110-volt single-phase oil-filled transformer supplies the lighting circuits for the roaster, cyanide plant, and refinery.

A 25-kva. 440–220/110-volt single-phase dry-core transformer was installed for mill and crusher-plant lighting.

A unit cell driven by a 10-horsepower motor was installed in the mill.

The 750 level transformer-station was completed by the installation of three 37½-kva. 2,300–440-volt single-phase transformers star-connected for 4,000 volts. At the present time these transformers supply only the 750 level pumps. A 4,000-volt cable from the 450 level to the 750 level feeds the transformers.

A new distribution panel was installed at the Polaris station and two 5-horsepower locomotive-battery chargers were transferred from the surface to the 450 level.

Big Bull (The Consolidated Mining and Smelting Company of Canada, Limited). Early in the year, preparations were made to sink a 300-foot shaft. To supply power for a hoist, pumps, and lighting, a 205-horsepower 407-r.p.m. Ruston diesel direct-connected to a 156-kva. 550-volt 3-phase generator was installed. To supply power for lighting when the larger plant is not required, a U.D. 6 International diesel driving a 15-kw. 110–220-volt generator was installed. Compressed air is produced by a 660-cubic-feet-per-minute Ingersoll-Rand compressor driven by a 156-horsepower Ruston diesel. The hoist is a double-drum 42-by-30 Canadian Ingersoll-Rand driven by a 40-horsepower 900-r.p.m. electric motor.

The underground pump is driven by a 25-horsepower 550-volt 3,540-r.p.m. induction motor. Power is supplied to the motor through a No. 6 B. & S. gauge 3-conductor paper-insulated lead-covered steel-wire-armoured cable.

Power is supplied to the mine signals at 110 volts through a 2/12 type S.O. Geoprene jacketed cable.

Alice Arm (55° 129° N.E.).

Torbrit Silver Mines, Limited. An underground service was run from the transformer-station at the old Toric mine buildings to the 1150 and 1000 levels. A distribution centre was installed underground for supplying the lighting circuits, one 30-horsepower slusher, and one 10-horsepower slusher on the 1150 level; and one 15-horsepower pump, one 10-horsepower slusher, and one locomotive-battery charging-station on the 1000 level.

In the mill a flotation circuit was added, using thirteen motors ranging from one-quarter to 7½ horsepower, making a total of 78 additional horsepower.

Bridge River (50° 122° N.W.).

Bralorne Mines, Limited.—A station has been cut on the 2000 level for housing transformers and switch gear to supply power to the 2000 and neighbouring levels. Only two 150-kva. transformers will be installed in open delta at present, but provision is being made for a third when required.

Pioneer Gold Mines of B.C., Limited.

A trolley haulage system, 3,000 feet long, was installed on the 25 level and was put into service in the latter part of the year. A 3-ton Westinghouse trolley locomotive is used for haulage. To supply power for the trolley haulage system and other electrical equipment on the 25 level, a 150-kva. 6,900/440-volt 3-phase askarel-filled transformer was installed. A 2,300-volt overhead power line was built to supply the townsite.

Copper Mountain (49° 120° S.W.).

The Granby Consolidated Mining, Smelting and Power Company, Limited.

Some new equipment was installed and numerous changes were made to the existing electrical installations during the year. A new 2,300-volt 4/0 B. & S. gauge transmission line was built between the main switch-room and the crushing plant and three 75-kva. 2,300–550-volt transformers were installed to serve the 550-volt circuits in the crushing plant. The 2,300-volt switch-room at the crushing plant was rewired and new disconnecting switches were installed. In the crushing plant a new 5½-foot cone crusher, driven by a 200-horsepower 2,300-volt motor, was installed. The conveyer system required for the new cone crusher is driven by two newly installed 25-horsepower motors and one 15-horsepower motor. This system also includes two new vibrating screens driven by two 5-horsepower motors. Ahead of the vibrating screens a 3-kva. magnetic pulley was installed. A complete new 110-volt signal system was installed also.

In the compressor-room a new 10-kw. exciter set was installed for the excitation of the 400-horsepower compressor motor.

On the surface a 2,300-volt line and distribution system was built to supply the new housing site on the Upper Eagle Road.

In the 13 East oreblock two new 50-horsepower scraper hoists and six new 37½-kva. 2,200–440-volt transformers were installed. In the 63 M oreblock two new 37½-kva. 2,300–440-volt transformers were installed. A new power cable was installed from 5 level sub-station to 6 level sub-station, from 6 level sub-station to the 40 oreblock, and to the 6 level portal fan. At the top of the 2960 service manway a 50-horsepower hoist was installed. All underground transformer-stations are now provided with ground detecting devices.

As oreblocks are worked out, the equipment is moved to new oreblocks, and during the year the following changes were made:—

The distribution sub-station on 5 level was transferred to 6 level. A 50-horsepower scraper hoist was moved to 63 M scraper drift. A 50-horsepower scraper hoist and a 40-horsepower ventilation fan were set up in 13 East oreblock. A 50-horsepower scraper hoist was reinstalled in 37A scraper drift. Four 37½-kva. transformers were moved, two to the 40 oreblock station and two to the 13 North oreblock station.

At the Allenby concentrator pumping plant a new 225-horsepower pumping unit was installed.

Hedley (49° 120° S.E.).

Hedley Mascot Gold Mines, Limited.—Operations were suspended at this mine in August.

Nickel Plate (Kelowna Exploration Company, Limited).—One 20-horsepower 3-drum Ingersoll-Rand type 20 MNM-3G scraper hoist was added to the electrical equipment.

Eagle Creek (49° 117° S.E.).

Granite-Poorman (Kenville Gold Mines, Limited).—A flotation circuit was installed in the mill for use when milling customs ore. There are four lead and six zinc cells driven by five 7½-horsepower motors; three pumps driven by three 2-horsepower motors; one conditioner driven by a 2-horsepower motor; and three fractional horsepower motors driving reagent feeders.

SALMO (49° 117° S.E.).

H.B. Mine (The Consolidated Mining and Smelting Company of Canada, Limited). The following electrical equipment was installed for use during development work: A Sullivan air-compressor driven by a 250-horsepower 2,200-volt synchronous motor; a 7½-horsepower motor-generator set for excitation of the compressor motor; a 5-horsepower locomotive-battery charging set; a 10-horsepower fan for mine ventilation; a 15-horsepower pump for camp water-supply; and a 1½-ton Mancha little trammer. Power is supplied by the West Kootenay Light and Power Company from their sub-station at the H.B. townsite. From here the power is transmitted at 2,200 volts, a distance of approximately one-third of a mile, to the H.B. sub-station. This station consists of three 25-kva. 2,200–550-volt power transformers and one 10-kva. lighting transformer.

Jersey (Canadian Exploration, Limited). The Emerald tungsten mine was closed early this year, and the Jersey mine was opened. Ore was quarried on the surface while adits were being driven and stoping commenced. One 100-horsepower air-compressor was moved from the Emerald mine to the Jersey mine for quarrying. An elevated transformer-station consisting of three 25-kva. 2,200–440-volt power transformers and one 5-kva. lighting transformer was built near the compressor-house. Two 20-horsepower scrapers were installed for quarrying. When stoping commenced and quarrying was abandoned, the scrapers were moved to temporary positions underground. The second 100-horsepower compressor was moved to the new compressor-house at this time.

A 440-volt line, 1,500 feet long, was built from the new transformer-station at the compressor-house to the shops at the portal of the main haulage level. The locomotives and battery-charging stations have been moved to the Jersey mine, and in 1950 the tram may be moved.

NELWAY (49° 117° S.E.).

Reeves MacDonald Mines, Limited. Details of the electrical installations were given in the Report of the Minister of Mines for 1948. This year a temporary installation of six 20-horsepower scraper hoists was made in the upper workings of the mine. A 2,200-volt overhead power line was built from the camp to a transformer-station near the portal. Six 25-kva. 2,200–440-volt step-down transformers at this station supply the hoists.

RIONDEL (49° 116° N.W.).

Bluebell (The Consolidated Mining and Smelting Company of Canada, Limited).—A 375-kva. 550-volt Westinghouse generator direct-connected to a 400-horsepower Fairbanks-Morse diesel engine was installed to supply power for the mine and camp. This unit was brought from The Consolidated Mining and Smelting Company's mercury mine at Pinchi Lake. The two Vivian 120-horsepower diesels driving two 75-kva. generators will be kept as stand-by units. Details of other equipment may be found in the Report of the Minister of Mines for 1948.

RETALLACK-THREE FORKS (50° 117° S.E.).

Sheep Creek Gold Mines, Limited, Zincton Unit.—A new electric hoist was installed on the inclined shaft. It is driven by a 30-horsepower 440-volt 800-r.p.m. electric motor. A new 2½-ton Mancha electric mule is in use on the 9 level haulage.

SANDON (49° 117° N.E.).

Carnation (Kelowna Exploration Company, Limited).—To provide power for lighting and battery-charging during development work, a 16-kva. 4-wire 220–110-volt a.c. generator, driven by a 25-horsepower diesel, was installed. Other equipment consists of a 5-horsepower motor-generator set for charging locomotive batteries, a 6-ampere 110-volt tungar rectifier for charging miners' lamps, and a 5-horsepower fan motor.

Violamac Mines (B.C.), Limited.—The camp buildings have been wired for lighting and a small lighting plant will be installed.

WINDERMERE (50° 116° S.E.).

Paradise Mine (Sheep Creek Gold Mines, Ltd.). During the year a mill was built and put into operation. Much of the equipment for the mill was obtained from the Euphrates mill near Nelson. The main units in the mill, with their respective motors, are as follows: Jaw crusher, 25-horsepower motor; conveyer, 1½-horsepower motor; ball mill, 75-horsepower motor; classifier, 3-horsepower motor; jig, 1-horsepower motor; conditioner, 2-horsepower motor; six lead cells, three 3-horsepower motors; six zinc cells, three 3-horsepower motors; lead pump, 2-horsepower motor; zinc pump, 2-horsepower motor; sump pump, 3-horsepower motor; filter, 1-horsepower motor.

Power for the mill is produced by two International diesel-driven electric generating units. One is rated at 200-amperes 440-volts a.c. and the other at 136-amperes 440-volts a.c.

At the mine a 10-kw. 440-volt Palmer generator and exciter unit, belt-driven from the compressor diesel engine, supplies power for lighting the camp, running a grinder and a saw, and for charging batteries.

KIMBERLEY (49° 115° N.W.).

Sullivan (The Consolidated Mining and Smelting Company of Canada, Limited). During the year the installation of the new sink-float plant and accompanying systems was completed, except for the replacement of some temporary installations. The sink-float plant was put into operation in February, 1949, and the underground crushing plant in November, 1949. Below is given a brief description of the electrical work.

The construction of a new step-down sub-station beside the No. 1 hoist room was completed. The bus and switching structure is of steel, and the equipment installed includes three 1,000-kva. oil-immersed self-cooled 69,000–6,900/2,300-volt single-phase transformers, together with an outdoor-type switching kiosk which houses the metering equipment and oil circuit-breaker panel.

This new installation supplies two 600-horsepower 2,300-volt synchronous motors direct-connected to two XVH compressors. This equipment, together with automatic starting gear, is installed in the hoist-room.

In the No. 1 shaft area on the 3500 level a temporary sub-station consisting of three 100-kva. 2,300–575-volt oil-immersed self-cooled transformers and a low-voltage distribution centre was installed. It is planned to replace these transformers as soon as possible with one 300-kva. type L.N.S. 3-phase askarel-filled transformer with a double primary winding suitable for either 6,900- or 2,300-volt supply. Work has commenced on the replacing of the temporary cable installation feeding this sub-station with a permanent cable which is a 3-conductor 4/0 B. & S. gauge varnished-cambric lead-sheathed steel-wire-armoured cable insulated for 8,000 volts ungrounded neutral service. When this replacement is completed, the main power feeder down No. 1 shaft will operate at 6,900 volts.

Two 100-horsepower 550-volt motors were installed—one on the 2850 level to drive a centrifugal pump and one on the 3350 level to drive a ventilation fan.

3902 Conveyer System and Incline.—The control system for the 3902 conveyer system was altered, and wiring additions were made to provide two different control sequences. One sequence is for " ore " hoisting and will use conveyers No. 3 to No. 6, inclusive, while the other sequence is for " float " hoisting and will use conveyers Nos. 1 to 5, inclusive. The existing horn warning system and interlocks were retained but were modified to suit the new requirements.

The installation of a new high-voltage feeder-cable down 3902 incline was commenced. This cable, which will be fed from a panel in the new 3800 crushing-chamber sub-station, will run down to a sub-station in the 33503 winze hoist-room on the 3350 level. A temporary installation of two 250-kva. 2,200–550-volt single-phase oil-filled transformers has been made which will be replaced with one 300-kva. 3-phase 6,900/2,300–575-volt askarel-filled transformer.

3800 Crushing Plant.—To supply the sub-station in the 3800 crushing plant, 2,600 feet of 3-conductor 4/0 varnished-cambric lead-sheathed steel-wire-armoured cable insulated for 8,000-volt ungrounded neutral service was installed down 39-H-1 ventilation raise and along 3821 drift. This cable is now operating at 2,300 volts but will likely, before the end of 1950, be switched over to 6,900-volt operation.

At the 3800 crushing chamber a 1,000-kva. 6,900/2,300–575-volt unit sub-station was installed, which includes Reyrolle metal-clad switch gear on the primary and secondary circuits, totally enclosed high-tension and low-tension buses, and three 333-kva. askarel-filled single-phase transformers.

The motors installed in the crushing plant are a 150-horsepower motor on the jaw crusher, a 250-horsepower motor on the Simons cone crusher, a 100-horsepower motor on the conveyer, and a 75-horsepower motor on the fan. Other equipment includes switch and control gear. This plant commenced operation in November, 1949.

3700 Haulage System (Underground Section).—The installation was completed of one 300-kw. 275-volt d.c. 6,900-volt a.c. Brown Boveri type AL-36-6 automatic mercury-arc rectifier, set at a point approximately 8,500 feet in from the 3700 portal.

The installation was also completed of the trolley and feeder system, consisting of one 350,000 C.M. heavy-duty copper trolley wire jointly suspended from combination hangers with one 500,000 C.M. bare copper feeder cable, and one 1,000,000 C.M. weatherproof copper main feeder cable which is tapped into the foregoing at 500-foot intervals.

Miscellaneous electrical work underground included rewiring the hoisting signal systems in the 3901 winze and 3932 and 3927 raises.

Work was commenced on a permanent sub-station housed in a fireproof enclosure to replace the temporary 2,300–440-volt transformer installations which were on the chute platforms in 3956 and 3915 drifts.

Sullivan Concentrator.

Sink and Float Plant and Project.—The installation of motors and controls in the sink-float plant was completed and put into operation in February, 1949.

The construction of a transformer sub-station at the 3700 portal to step down the 66,000-volt incoming power to 6,900 volts for supplying the three mercury-arc-rectifier sub-stations was completed. This step-down sub-station consists of three 300-kva. 66,000–6,900-volt single-phase transformers protected by disconnects and liquid-filled fuses on the high-tension side, and by an oil circuit-breaker protective feeder panel containing metering equipment on the low-tension side.

The installation of No. 1 and No. 2 mercury-arc-rectifier sub-stations for the 3700 level haulage system was completed. These sub-stations, equipped with 300-kw. Brown Boveri AL-36-6 rectifier sets, are automatic and are paralleled by means of automatic sectionalizing breakers with each other and with the No. 3 unit which is installed underground.

The installation of the trolley system on the surface section of the 3700 haulage system was completed.

Concentrator Sub-station.—New air circuit-breaker switching cubicles are being installed in this sub-station to replace the old oil circuit-breaker feeder panels which were inadequate in meeting short-circuit rupturing-capacity requirements. The new breakers have a rupturing capacity of 75,000 amperes and have current limiting reactors incorporated with them which will limit the maximum possible short-circuit current under all conditions to a value within this rating.

A new feeder cable 450 feet long was installed from the sub-station to the main switch-room in the sink-float plant for 550-volt power-supply to that plant. This is a 3-conductor 1,000,000 C.M. paper-insulated lead-sheathed cable insulated for 1,000-volt service.

Concentrator, General.—A 200-horsepower 550-volt synchronous motor with control panel was installed for driving an air compressor in the south end of the rolls-plant building.

For supplying power to the assay and main office, a 550-volt feeder cable 350 feet long was installed to feed from the rolls-plant distribution centre. This is a 3-conductor 4/0 rubber-insulated lead-covered steel-tape-armoured cable with jute overall and is buried directly in the ground.

A manually operated compensator starter on the 200-horsepower fire-pump motor was replaced by a General Electric automatic type CR-7051-C1A reduced-voltage starter.

Howe Sound (49° 123° N.E.).

Britannia Mining and Smelting Co., Limited. New electrical equipment in the mine consists of one 7½-horsepower Joy double-drum electric hauler, one Mancha trammer, and one 3-kw. Hertner charging unit. Electrical installations at Britannia Beach consist of one 40-horsepower a.c. motor to drive an Ingersoll-Rand vacuum pump and the wiring of the new 4100 mine yard, which includes a portable building framing shed and a combined car-repair and electrical shop for trolley and power.

Duncan (48° 123° N.W.).

Vancouver Island Base Metals, Limited.—Some exploration work was done on this property. Electrical power was used to supply compressed air and unwater the shaft. Three electric pumps fed by temporary cables were used in the shaft.

Texada Island (49° 124° N.W.).

Little Billie (Vananda Mines (1948), Ltd.).—Productive operation of this mine ceased in October, 1949, and only development work is now being done. A description of the equipment is in the Report of the Minister of Mines for 1948.

COAL MINES.

Tsable River (49° 124° N.W.).

Tsable River Prospect Mine (Canadian Collieries (Dunsmuir), Limited). A new tipple, a compressor building, a wash-house, and other buildings were built on this property during the year. All buildings are wired for lighting. A hoist driven by a 500-horsepower 2,200-volt induction motor was installed in the hoist-room at the end of the tipple. A 15-horsepower 440-volt motor is used on the tipple conveyer. In the compressor building a compressor driven by a 500-horsepower 2,200-volt synchronous motor was installed. Motor excitation is provided by a 15-horsepower exciter.

The wash-house is divided into change-room, shower-room, lamp-battery charging-room, and boiler-room. In the boiler-room a 500-kva. 2,200–440-volt transformer and switch gear was installed to supply power for the boiler and for some of the 440-volt motors. In the lamp-battery charging-room there is a 10-horsepower M.G. set for charging lamp batteries.

Nanaimo (49° 123° S.W.).

White Rapids Mine (Canadian Collieries (Dunsmuir), Limited).—A pump driven by a 60-horsepower 440-volt motor was installed in the No. 4 Right Main Dip pumping station.

East Kootenay (49° 114° N.W.).

Michel Colliery (The Crow's Nest Pass Coal Company [Limited]).—A new by-product plant, a coke plant, and a coke-bin were built during the year. A fireproof transformer-station was built at the end of the by-product plant to house the switch gear and three 100-kva. 2,200–220/110-volt transformers which supply power to the new by-product plant. The horsepower used for coke production has increased from 432 to 915 horsepower.

The installation of switch gear in the new switch-room at the power-house is almost completed.

DREDGES.

Princeton (49° 120° S.W.).

Tulameen Dredging Company, Limited.

A Becker-Hopkins 8-inch suction-dredge was built on the Tulameen River near Princeton. Unfortunately the dredge was wrecked beyond repair when the river was in flood in November. Power was produced by a Ford V8 engine driving a 30-kva. 220-volt 3-phase 60-cycle 1,200-r.p.m. generator. The power was distributed from a central switchboard to the following motors: Two 5-horsepower motors on the winch; one 10-horsepower motor on the headline; one 3-horsepower motor on the digging head; one 5-horsepower motor for turning the digging head; one 3-horsepower motor on the screen; one 7½-horsepower motor on the pump.

The dredge was operated from a central control panel on which were mounted push buttons and brake levers.

Cariboo (53° 122° N.W.).

Beavermouth Dredging Company, Limited.—The electrical equipment on the dredge consists of one 50-kva. 440-volt 3-phase 60-cycle generator, two 3-horsepower and one 7½-horsepower pump motors, one 1-horsepower jig motor, one 7½-horsepower conveyer motor, and one 1-horsepower amalgam-barrel motor.

BRITISH COLUMBIA DEPARTMENT OF MINES
LIST OF PUBLICATIONS.

The publications listed are available for distribution except as noted. Recent publications for which no charge is made may be obtained from the Department's offices at Victoria, Vancouver, and Nelson.

PRICES.

A small reserve stock of each Annual Report or Bulletin is set aside; the greater part of each issue is distributed free of charge. When the free stock has been exhausted, copies may be obtained from the reserve stock on payment of the price set. The price for a cloth-bound copy of an Annual Report is $1. The Provincial sales tax of 3 per cent. must be collected on all sales of publications within the Province. If a charge is made, application for the Annual Report or Bulletin should be made to the Department of Mines, Victoria, B.C., and should be accompanied by the proper sum, including the tax.

INDEXES.

Index to Annual Reports of the Minister of Mines of British Columbia for the years 1874 to 1936, inclusive. (By H. T. Nation.) Paper bound, $1; cloth bound, $2.

Index to Annual Reports of the Minister of Mines, 1937–43, and Bulletins Nos. 1–17. (By H. T. Nation.) Paper-bound copies, 50 cents each. Cloth-bound copies, $1 each.

Corrigenda, Index to Annual Reports of the Minister of Mines, 1874–1936.

ANNUAL REPORTS.

For each year the entry "free" or the price charged appears in the following table if the report is available. If neither "free" nor a price is entered, the report for that year is not available for distribution.

Year.	Paper Bound.	Cloth Bound.	Year.	Paper Bound.	Cloth Bound.
1874–1896			1926		
1897	50c.		1927	Free	
1898–1900			1928	Free	$1.00
1901	50c.		1929	Free	
1902–1906			1930	50c.	
1907	50c.		1931	50c.	
1908	50c.		1932		
1909	50c.		1933	Free	1.00
1910	50c.		1934	Free	1.00
1911			1935	50c.	1.00
1912			1936	*	1.00
1913			1937	*	1.00
1914			1938	*	1.00
1915	Free		1939	Free	1.00
1916	Free		1940	Free	1.00
1917	Free		1941	Free	1.00
1918	Free		1942	Free	1.00
1919	Free	$1.00	1943	Free	1.00
1920	Free		1944	Free	1.00
1921	Free		1945	Free	1.00
1922	Free		1946	Free	1.00
1923	Free		1947	Free	1.00
1924	50c.		1948	Free	1.00
1925	50c.		1949	Free	1.00

* Parts A to F, bound separately in paper, are available (free) for the years 1936, 1937, and 1938. Part G, "Inspection of Mines," is not available for these years.

BULLETINS, OLD SERIES.

Bulletin No. 2, 1918: Bumps and outbursts of gas. (By George S. Rice.)
Bulletin No. 2, 1919: The commercial feasibility of electric smelting of iron ores in British Columbia. (By Alfred Stansfield.)
Bulletin No. 2, 1932: Report on McConnell Creek placer area. (By Douglas Lay.)

MISCELLANEOUS.

Special Reports on Coal-mine Explosions. (By George Wilkinson, Thomas Graham, and James Ashworth.) 1918.
Report on Snowflake and Waverley-Tangier Mineral Properties. (By J. D. Galloway.) 1928.
Report on Mineral Properties of the Goldside Mining Company. (By B. T. O'Grady.) 1935.
Elementary Geology applied to Prospecting. (By John F. Walker.) Revised, 1946. 50 cents.
Possibilities for Manufacture of Mineral Wool in British Columbia. (By J. M. Cummings.) 1937.
Lode-gold Deposits of the Zeballos Area. (By J. S. Stevenson.) 1938. Out of print.
Preliminary Investigations into Possibilities for Producing Silica Sand from British Columbia Sand Deposits. (By J. M. Cummings.) 1941.
Iron Ores of Canada: Vol. I, British Columbia and Yukon. (By G. A. Young and W. L. Uglow, Geological Survey, Canada, Department of Mines.) 1926.

BULLETINS, NEW SERIES, STARTING IN 1940.

(Free, except as noted.)

Bulletin No. 1: Aiken Lake Area, North-Central B.C. (By Douglas Lay.) 50 cents.
Bulletin No. 2: Placer-gold Deposits, Wheaton (Boulder) Creek, Cassiar District. (By Stuart S. Holland.) 50 cents.
Bulletin No. 3: Fraser River Tertiary Drainage-history in relation to Placer-gold Deposits. I. (By Douglas Lay.)
Bulletin No. 4: Saline and Hydromagnesite Deposits of British Columbia. (By J. M. Cummings.) 50 cents.
Bulletin No. 5: Mercury Deposits of British Columbia. (By John S. Stevenson.) Out of print.
Bulletin No. 6: Geology of Camp McKinney and the Cariboo Amelia Mine. (By M. S. Hedley.) Out of print.
Bulletin No. 7: Lode-gold Deposits of the Upper Lemon Creek Area and Lyle Creek-Whitewater Creek Area, Kootenay District. (By R. J. Maconachie.) Out of print.
Bulletin No. 8: Preliminary Report on the Bedwell River Area. (By H. Sargent.)
Bulletin No. 9: Molybdenite in British Columbia. (By John S. Stevenson.) Out of print.
Bulletin No. 10: Tungsten Deposits of British Columbia. (By John S. Stevenson and staff of the Department of Mines.) Revised.
Bulletin No. 11: Fraser River Tertiary Drainage-history in relation to Placer-gold Deposits. II. (By Douglas Lay.)
Bulletin No. 12: Reconnaissance in the Area of Turnagain and Upper Kechika Rivers. (By M. S. Hedley and Stuart S. Holland.)
Bulletin No. 13: Supplementary Report on Bedwell River Area. (By H. Sargent.)
Bulletin No. 14: Coal Analyses of British Columbia. (By James Dickson.)
Bulletin No. 15: Hydraulic Mining Methods. (By Stuart S. Holland.) 50 cents.

Bulletin No. 16: Dragline Dredging Methods. (By Stuart S. Holland.)
Bulletin No. 17: An introduction to Metal-mining in British Columbia. (By Officers of the Department.)
Bulletin No. 18: Specimens and Samples—Their Treatment and Use. (By Officers of the Department.)
Bulletin No. 19: The Tuya-Teslin Area, Northern British Columbia. (By K. DeP. Watson and W. H. Mathews.)
Bulletin No. 20: Lode-gold Deposits—
Part II: South-eastern British Columbia. (By W. H. Mathews.) Revised, 1948.
Part III: Central Southern British Columbia. (By M. S. Hedley and K. DeP. Watson.)
Part IV: South-western British Columbia—exclusive of Vancouver Island. (By J. S. Stevenson.) Revised, 1946.
Part V: Vancouver Island. (By J. S. Stevenson.) Revised, 1946.
Part VI: North-eastern British Columbia and Cariboo and Hobson Creek Areas. (By S. S. Holland.) Revised, 1946.
Bulletin No. 21: Notes on Placer-mining in British Columbia. (By Officers of the Department.)
Bulletin No. 22: Geology of the Whitewater and Lucky Jim Mine Areas. (By M. S. Hedley.)
Bulletin No. 23: Calcareous Deposits of the Georgia Strait Area. (By W. H. Mathews.)
Bulletin No. 24: Geology and Coal Resources of the Carbon Creek-Mount Bickford Map-area. (By W. H. Mathews.)
Bulletin No. 25: The Squaw Creek-Rainy Hollow Area. (By K. DeP. Watson.)
Bulletin No. 26: Report on the Stanley Area, Cariboo Mining Division. (By Stuart S. Holland.)
Bulletin No. 27: Geology and Mineral Deposits of the Zeballos Mining Camp, British Columbia. (By John S. Stevenson.)

SPECIAL REPORTS.

Special reports on certain properties were advertised in the Annual Reports 1936 to 1941, inclusive, as available on application. A list of those still available will be supplied on request. The text of a report is either in mimeographed or typewritten form, and ozalid prints can be made of maps or other drawings. Copies of reports still available will be supplied at 10 cents per page of typewritten or mimeographed copy, excepting that the charge for any mimeographed report shall not exceed 25 cents. Additional charges will be made for prints of maps. Requests for these Special Reports, accompanied by the proper sum, should be addressed to the Chief Mining Engineer.

NOTICES *RE* PUBLICATIONS.

Applications are invited from those who wish to receive notices when new publications become available.

MAPS SHOWING MINERAL CLAIMS AND PLACER LEASES.

Maps showing the approximate locations of placer-mining leases and mineral claims held by record may be seen at the Central Records Offices at Victoria and Vancouver. Prints are obtainable on request made to the Chief Gold Commissioner at Victoria, and accompanied by the proper sum. The charges are: Full sheet, $1; half-sheet, 50 cents; quarter-sheet, 25 cents. The sales tax of 3 per cent. is payable on these charges. The maps conform to the reference and mineral-reference maps issued by the Lands Department in size and geographical detail and correspond as to numbers.

PROSPECTORS' SETS.

On request, collections, each consisting of about fifty specimens, including rocks and minerals, are supplied to prospectors and to schools teaching subjects relating to mining or prospecting. Because it is difficult to obtain the material for these sets, only requests from those actively prospecting in the Province and from schools in British Columbia can be considered. A charge of 50 cents plus 2 cents sales tax is made for each set; the price should be remitted with a request addressed to the Chief Mining Engineer.

LIST OF LIBRARIES.

Department publications are being sent to the following Government departments and legislative, university, and public libraries:—

CANADA.

Government departments—

- Department of Mines and Technical Surveys, Ottawa.
- Department of Resources and Development, Ottawa.
- Department of Mines, Halifax, Nova Scotia.
- Department of Lands and Mines, Fredericton, New Brunswick.
- Department of Mines, Quebec, Quebec.
- Department of Mines, Toronto, Ontario.
- Department of Mines and Natural Resources, Winnipeg, Manitoba.
- Department of Mineral Resources, Regina, Saskatchewan.
- Department of Mines and Minerals, Edmonton, Alberta.

Legislative libraries—

- Library of Parliament, Ottawa.
- Legislative Library, Halifax, Nova Scotia.
- Legislative Library, Fredericton, New Brunswick.
- Legislative Library, Quebec, Quebec.
- Legislative Library, Toronto, Ontario.
- Legislative Library, Winnipeg, Manitoba.
- Legislative Library, Regina, Saskatchewan.
- Legislative Library, Edmonton, Alberta.
- Provincial Library, Victoria, British Columbia.

University libraries and museums—

- Dalhousie University, Halifax, Nova Scotia.
- Acadia University, Wolfville, Nova Scotia.
- Laval University, Quebec, Quebec.
- McGill University, Montreal, Quebec.
- Queen's University, Kingston, Ontario.
- Royal Ontario Museum of Geology and Mineralogy, Toronto, Ontario.
- University of Toronto, Toronto, Ontario.
- University of Manitoba, Winnipeg, Manitoba.
- University of Montreal, Montreal, Quebec.
- University of Saskatchewan, Saskatoon, Saskatchewan.
- University of Alberta, Edmonton, Alberta.
- University of British Columbia, Vancouver, British Columbia.

Public libraries—

- Public Library, Halifax, Nova Scotia.
- Public Library, Montreal, Quebec.

Public Library, Toronto, Ontario (Reference Division).
Public Library, Edmonton, Alberta.
Public Library, Calgary, Alberta.
Public Library, New Westminster, British Columbia.
Nelson Municipal Library, Nelson, British Columbia.
Public Library, Prince Rupert, British Columbia.
Public Library, Prince George, British Columbia.
Public Library, Vancouver, British Columbia (Science and Industry Division).
Public Library, Victoria, British Columbia.

ENGLAND.

British Columbia House, Regent Street, London, England.
Canada House, London, England.
Joint Library, Institution of Mining Engineers, Finsbury Circus, London, England.

SOUTH AFRICA.

Public Library, Johannesburg, South Africa.

AUSTRALIA.

Public Library, Sydney, Australia.

UNITED STATES.

Government departments and legislative libraries—
- Library of Congress, Washington 25, D.C.
- The Interior Department Library, Washington 25, D.C.
- United States Geological Survey, Washington 25, D.C.
- California State Division of Mines, Ferry Building, San Francisco, California.
- Oregon State Bureau of Mines, Salem, Oregon.
- Washington State Division of Mines and Geology, Olympia, Washington.
- Idaho State Bureau of Mines, Boise, Idaho.

University and society libraries—
- Columbia University, New York 27, New York (Document Division).
- University of California, Berkeley, California (Document Division).
- Engineering Societies Library, 29 West Thirty-ninth Street, New York, New York.
- State University of Iowa, Iowa City, Iowa.
- Montana School of Mines, Butte, Montana.
- Oregon State College, Corvallis, Oregon.
- University of Washington, Seattle, Washington.
- University of Nevada, Reno, Nevada.

Public libraries—
- New York Public Library, New York, New York.
- Free Library, Philadelphia Zone 3, Pennsylvania.
- Public Library, Boston, Massachusetts.
- Public Library, Los Angeles, California.
- Public Library, San Francisco, California.
- Library Association of Portland, Portland, Oregon.
- Public Library, Seattle, Washington.
- Public Library, Spokane, Washington.

SYNOPSES OF MINING LAWS AND LAWS RELATING TO MINING.

(The complete Acts may be obtained from the King's Printer, Victoria, B.C.)

"DEPARTMENT OF MINES ACT."

The "Department of Mines Act" empowers the Minister of Mines to organize the Department or to reorganize it from time to time to meet changing conditions in the mining industry. It provides for examination and certification of assayers and for the conducting of short courses of lectures in practical geology and mineralogy. The Act also provides for the expenditure of public moneys for the construction, reconstruction, or repair of trails, roads, and bridges to facilitate the exploration of the mineral resources of any mining district, or the operation and development of any mining property.

"MINERAL ACT" AND "PLACER-MINING ACT."

Free Miners' Certificates.

Free miners' certificates must be obtained before any person can prospect for mineral and locate and record mineral claims in British Columbia.

Any person over the age of 18, and any joint-stock company incorporated or registered in British Columbia, may obtain a free miner's certificate on payment of the required fee.

The fee to an individual for a free miner's certificate is $5 for one year. To a joint-stock company having a capital of $100,000, or less, the fee for a year is $50; if capitalized beyond this, the fee is $100. If the company has no stated capitalization, the fee is $100.

The free miners' certificates run from date of issue and expire on the 31st day of May next after its date, or some subsequent 31st day of May (that is to say, a certificate may be taken out a year or more in advance if desired). Certificates may be obtained for any part of a year, terminating on May 31st, for a proportionately less fee. The possession of this certificate entitles the holder to enter upon all lands of the Crown, and upon any other lands on which the right to so enter is not specially reserved, for the purpose of prospecting for minerals, locating claims, and mining.

In the event of a free miner allowing his certificate to lapse, his mining property (if not Crown-granted) reverts to the Crown (subject to the conditions set out in the next succeeding paragraph), but where other free miners are interested as partners or co-owners the interest of the defaulter becomes vested in the continuing co-owners or partners *pro rata*, according to their interests.

Six months' extension of time within which to revive title in mining property which has been forfeited through the lapse of a free miner's certificate is allowed. This privilege is given only if the holder of the property obtains a special free miner's certificate within six months after the 31st of May on which his ordinary certificate lapsed. The fee for this special certificate in the case of a person is $15 and in that of a company $300.

It is not necessary for a shareholder, as such, in an incorporated mining company to be the holder of a free miners' certificate.

"Mineral Act."

All minerals occurring in place are acquired under the "Mineral Act," but limestone, marble, clay, sand, gravel, earth, building or construction stone, coal, petroleum, and natural gas are not considered as mineral.*

* Limestone, marble, etc., are disposed of by lease under the provisions of the "Land Act." Coal is disposed of under the provisions of the "Coal Act" and petroleum and natural gas under the "Petroleum and Natural Gas Act." These Acts are under the administration of the Department of Lands and Forests, Victoria, B.C.

A mineral claim is a piece of land not exceeding 1,500 feet square and fifty-one and sixty-five one-hundredths acres in area. The angles must be right angles unless the boundaries, or one of them, are the same as those of a previously recorded claim.

No special privileges are allowed for the discovery of new mineral claims or districts.

A mineral claim is located by erecting two "legal posts," which are stakes having a height of not less than 4 feet above ground and squared 4 inches at least on each face for not less than a foot from the top. A tree-stump so cut and squared also constitutes a legal post. A cairn of stones not less than 4 feet in height and not less than 1 foot in diameter 4 feet above the ground may also be used as a legal post. Upon each of these posts must be written the name of the claim, the name of the locator, and the date of location. On No. 1 post, in addition, the following must be written: "Initial post. Direction of Post No. 2 [*giving approximate compass-bearing*]. feet of this claim lie on the right and feet on the left of the line from No. 1 to No. 2 posts." If cairns are used, these particulars must be legibly written or inscribed on paper or on other durable material and placed in the cairn within a weather-proof can or other suitable container. Numbered metal identification tags must be attached to both posts at the time of staking, or if cairns are used, tags must be placed in the containers within the cairns.

The location-line between Nos. 1 and 2 posts must be distinctly marked—in a timbered locality by blazing trees and cutting underbrush, and in bare country by monuments of earth or rock not less than 2 feet in diameter at the base, and at least 2 feet high—so that the line can be distinctly seen.

Mineral claims must be recorded in the Mining Recorder's office for the mining division in which they are situate within fifteen days from the date of location, one day extra being allowed for each 10 miles of distance from the recording office after the first 10 miles. If a location is not recorded within the time prescribed in the Act, it is open for relocation, but if the original locator wishes to relocate, he must obtain the written permission of the Gold Commissioner, for which he shall pay a fee of $10. A free miner may at any time abandon a mineral claim by giving notice in writing of his intention to abandon to the Mining Recorder and upon payment of a fee of $10. A free miner can hold, by location, during any period of twelve months, eight mineral claims within a radius of 10 miles, and may acquire others by purchase.

Mineral claims are, until the Crown grant is issued, held practically on a yearly lease, a condition of which is that during such year assessment-work be performed on the same to the value of at least $100, or a payment of such sum be made to the Mining Recorder. Such assessments must be recorded before the expiration of the year, or the claim is deemed abandoned. If, however, the required assessment-work has been performed within the year, but not recorded within that time, a free miner may, within thirty days thereafter, record such assessment-work upon payment of an additional fee of $10. The actual cost of the survey of a mineral claim, to an amount not exceeding $100, may also be recorded as assessment-work. If, during any year, work is done to a greater extent than the required $100, any further sum of $100—but not less—may be recorded and counted as further assessments; such excess work must be recorded during the year in which it is performed. All work done on a mineral claim between the time of its location and recording may be counted as work done during the first period of one year from the recording. As soon as assessment-work to the extent of $500 is recorded and a survey made of the claim, the owner of a mineral claim is entitled to a Crown grant on payment of a fee of $25, and giving the necessary notices required by the Act. Liberal provisions are also made in the Act for obtaining mill-sites and other facilities in the way of workings and drains for the better working of claims.

"PLACER-MINING ACT."

In the "Placer-mining Act" "mineral" is defined as in the "Mineral Act," but includes only mineral occurring in any natural unconsolidated material, excluding mineral in place.

Under the "Placer-mining Act" a free miner may locate, in any period of twelve consecutive months, one placer claim or leasehold in his own name and one placer claim or leasehold for each of three free miners for whom he acts as agent on any separate creek, river-bed, bar or dry diggings. Other placer claims or leaseholds may be acquired by purchase.

PLACER CLAIMS.

Placer claims are of three classes, as follows:—

"Creek diggings": any mine in the bed of any stream or ravine:

"Bar diggings": any mine between high- and low-water marks on a river, lake, or other large body of water:

"Dry diggings": any mine over which water never extends.

Every placer claim shall be as nearly as possible rectangular in form, and marked by four legal posts at the corners.

A placer claim must be recorded in the office of the Mining Recorder for the mining division within which the same is situate, within fifteen days after the location thereof, if located within 10 miles of the office of the Mining Recorder by the most direct means of travel. One additional day shall be allowed for every 10 miles additional or fraction thereof. The number of days shall be counted inclusive of the days upon which such location was made, but exclusive of the day of application for record.

PLACER-MINING LEASES.

Leases of unoccupied Crown lands approximately 80 acres in extent may be granted by the Gold Commissioner of the mining division after location has been made by staking along a "location line" not more than one-half a mile (2,640 feet) in length. In this line one bend, or change of direction, is permitted. Where a straight line is followed two legal posts (*see* under "Mineral Act") only are necessary—namely, an "initial post" and a "final post." Where there is a change of direction a legal post must be placed to mark the point of the said change. The leasehold is allowed a width not in excess of one-quarter mile (1,320 feet), and the locator, both on his "initial post" and in his notice of intention to apply, which is posted at the office of the Mining Recorder, is required to state how many feet are included in the location to the right and how many feet to the left of the location-line.

That section of the Act dealing with the staking of placer-mining leases follows:—

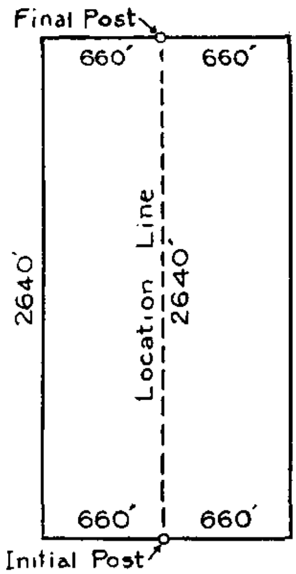
"105. (1) For the purpose of locating a placer leasehold, a line to be known as the 'location-line' shall be marked on the ground by placing a legal post at each end, one post to be known as the 'Initial Post' and the other as the 'Final Post.' The direction of the location-line may change at not more than one point throughout its length, and an intermediate legal post shall be placed at the point at which the direction changes. The total length of the location-line, following its change of direction (if any), shall not exceed two thousand six hundred and forty feet.

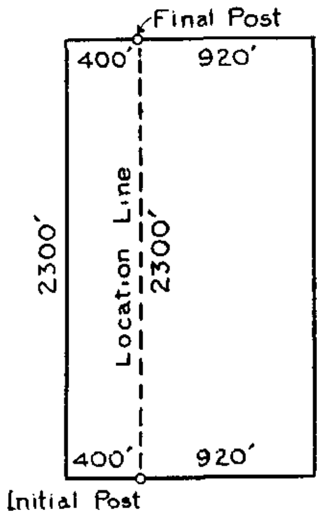
"(2) Upon the initial post and the final post shall be written the words 'Initial Post' and 'Final Post' respectively, together with the name of the locator and the date of the location. On the initial post shall also be written the approximate compass-bearing of the final post, and a statement of the number of feet of the leasehold lying on the right and on the left of the location-line, as viewed from the initial post, not exceeding in the aggregate a width of thirteen hundred and twenty feet, thus: 'Direction of Final Post, . feet of this claim lie on the right and feet on the left of the location-line.' In addition to the foregoing, where there is a change of direction in the location-line as marked on the ground, the number '1' shall be written on the initial post; the number '2' shall be written on the intermediate post; and the number '3' shall be written on the final post. There also shall be affixed to the initial post a notice to the following effect, namely: 'Application will be made under the "Placer-mining Act" for a lease of the ground within this location.'

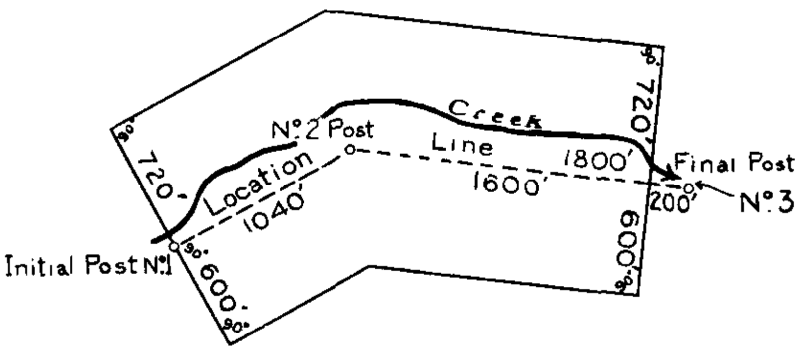
"(3) The location-line shall at the time of location be marked between the legal posts throughout its length so that it can be distinctly seen; in a timbered locality, by blazing trees and cutting underbrush, and in a locality where there is neither timber nor underbrush, by placing legal posts or monuments of earth or stones not less than two feet high and not less than two feet in diameter at the base, so that the location-line can be distinctly seen.

" EXAMPLES OF VARIOUS METHODS OF LAYING OUT PLACER LEASEHOLDS.

"Showing Areas secured with Location-lines of Various Lengths.







"(4) Where, from the nature or shape of the surface of the ground, it is impracticable to mark the location-line of a leasehold as provided by this section, the leasehold may be located by placing legal posts as witness-posts, as near as possible to the location-line, and writing on each witness-post the distance and compass-bearing of some designated point on the location-line from the witness-post; and the distances and compass-bearing so written on the witness-posts shall be set out in the application for the lease and in any lease granted thereon.

"(5) The locator shall, within thirty days after the date of the location, post a notice in Form I in the office of the Mining Recorder, which notice shall set out:—

"(*a*) The name of the intending applicant or each applicant if more than one, and the numbers of their free miners' certificates:

"(*b*) The date of the location:

"(*c*) The number of feet lying to the right and left of the location-line, and the approximate area or size of the ground.

The words written on the initial post and final post shall be set out in full in the notice; and as accurate a description as possible of the ground to be acquired shall be given, having special reference to any prior locations it may join, and the general locality of the ground to be acquired."

At the time of location a metal identification tag must be affixed to the "initial post" and to the "final post," or if cairns are used the tags must be placed in the containers within the cairns.

The annual rental on a placer-mining lease is $30, and the amount to be expended annually on development-work is $250.

Authority also has been given for the granting of special placer-mining leases in locations other than have been defined. Copies of regulations governing the granting of special placer-mining leaseholds may be obtained upon application to the office of the Chief Gold Commissioner, Department of Mines, Victoria, B.C.

For more detailed information the reader is referred to the complete "Placer-mining Act," which may be obtained from the King's Printer, Victoria, B.C.

TABLE OF FEES, "MINERAL ACT" AND "PLACER-MINING ACT."

Individual free miner's certificate, annual fee	$5.00
Company free miner's certificate (capital $100,000 or less), annual fee	50.00
Company free miner's certificate (capital over $100,000), annual fee	100.00
Recording mineral claim	2.50
Recording certificate of work, mineral claim	2.50
Recording abandonment, mineral claim	10.00
Recording abandonment, placer claim	2.50
Recording any affidavit	2.50
Records in "Records of Conveyances" (for each claim or lease)	2.00
For each additional claim or lease in the same document	.50
Filing documents, "Mineral Act"	.25
Filing documents, "Placer-mining Act"	1.00
Recording certificate of work, placer-mining lease	2.50
For Crown grant of mineral rights under "Mineral Act"	25.00
For Crown grant of surface rights of mineral claim under "Mineral Act"	10.00
For every lease under "Placer-mining Act"	5.00

COAL, PETROLEUM, AND NATURAL GAS.

Limestone, marble, etc., are disposed of by lease under the provisions of the "Land Act," coal is disposed of under the provisions of the "Coal Act," and petroleum and natural gas under the "Petroleum and Natural Gas Act." These Acts are under the administration of the Department of Lands and Forests, Victoria, B.C.

"METALLIFEROUS MINES REGULATION ACT."

This Act is designed to provide for the safe working of metalliferous mines, metallurgical works, and quarries. It contains practical regulations which govern the main phases of mining, such as surface arrangements, fire-protection, use and storage of explosives, hoisting, haulage, ventilation, mine-rescue work, etc.

In preparing the present Act, passed in 1948, the former Act was entirely rewritten and rearranged to make it conform to modern mining practice.

In the new Act, provision regarding explosive gases in metal mines has been made. A new rule allows the use of internal-combustion engines of the diesel type underground under conditions which make this form of power unobjectionable.

Provisions have been made for training and maintaining mine-rescue teams at the larger metal-mining centres. The new Act also provides for the appointment of electrical, mechanical, and metallurgical inspectors; for protection of public and private property from damage resulting from mining operations; and for appointing workmen's safety committees.

The Inspectors of Mines are empowered to enter and inspect any part of any mine, metallurgical works, or quarry, and to inspect any plant or equipment, or anything relating to the safety of persons employed in or about quarries, metalliferous mines, or metallurgical works. They are also empowered to require the remedy of conditions affecting the safety of employees, to make provisions safeguarding those employed, and, if need be, to order the closing of a mine or part of a mine, or the stopping of all work connected with it.

"COAL-MINES REGULATION ACT."

This Act, like the "Metalliferous Mines Regulation Act," is designed to provide for safe working conditions by practical regulations.

The Act was completely revised and rewritten in 1948, and several additions and changes were made to bring it into conformity with modern practice. The additions and changes include: Rules providing for precautions against coal-dust underground and in cleaning plants; a new section governing surface coal-stripping operations; revised rules governing electrical installations; and provisions for the use of internal-combustion engines of the diesel type underground, where the equipment and the conditions maintained render this form of power unobjectionable.

The powers of Inspectors under this Act are similar to those provided under the "Metalliferous Mines Regulation Act."

EXPLOSIVES.

Dominion Order in Council No. 2903, requiring a permit to maintain a magazine or purchase explosives on the authority of a Provincial Mines Inspector, has been repealed.

"MINES RIGHT-OF-WAY ACT."

This Act provides for access to mining property. It provides for the obtaining of a right-of-way for any road, railway, aerial, electric, or other tramway, surface or elevated cable, electric or telephone pole-line, chute, flume, pipe-line, drain, or any right or easement of a like nature.

"IRON AND STEEL BOUNTIES ACT."

The Lieutenant-Governor in Council may enter into an agreement with any person whereby the Crown will pay to that person, out of the Consolidated Revenue Fund, bounties on pig-iron and steel shapes when manufactured within the Province, as follows:—

(*a*) In respect of pig-iron manufactured from ore, on the proportion produced from ore mined in the Province, a bounty not to exceed three dollars per ton of two thousand pounds:

(*b*) In respect of pig-iron manufactured from ore, on the proportion produced from ore mined outside the Province, a bounty not to exceed one dollar and fifty cents per ton of two thousand pounds:

(*c*) In respect of steel shapes of commercial utility manufactured in the Province, a bounty not to exceed one dollar per ton of two thousand pounds.

Bounty, as on pig-iron under this Act, may be paid upon the molten iron from ore which in the electric furnace, Bessemer or other furnace, enters into the manufacture of steel by the process employed in such furnace; the weight of such iron to be ascertained from the weight of the steel so manufactured.

Bounty on steel shapes under this Act shall be paid only upon such steel shapes as are manufactured in a rolling-mill having a rated productive capacity per annum of at least twenty thousand tons of two thousand pounds per ton. The total amount of bounties paid under clauses (*a*) and (*b*) is limited to $200,000 in any one year or $2,000,000 in the aggregate; and the total amount of bounties paid under clause (*c*) is limited to $20,000 in any one year or $200,000 in the aggregate.

"INDIAN RESERVES MINERAL RESOURCES ACT."

This Act validates an agreement between the Dominion and the Province whereby mineral rights on Indian reserves, upon surrender by the Indians, shall be administered by the Province, subject to the laws of the Province. A free miner wishing to prospect on Indian reserves must obtain the approval of the Gold Commissioner for the mining division in which the reserve is situated and also of the Indian Agent for such reserve.

"PROSPECTORS' GRUB-STAKE ACT."

In this Act "grub-stake" means money, food supplies, clothing, powder, tools, or any other thing necessary to the business of prospecting. "Prospector" means any person who is a British subject and who is the holder of a valid free miner's certificate; who has been honourably discharged from any of His Majesty's Services or has been resident in the Province during the year preceding any application for a grub-stake.

Information regarding grub-stakes may be obtained from the Department of Mines, Victoria, B.C., or from any Mining Recorder, Mining Engineer, or Inspector of Mines of the Department.

No grub-stake granted to one applicant shall exceed $300 in value in any one year, but the grub-stake may be increased, if an applicant is required to travel to or from the area in which he is to prospect, by an amount sufficient to cover such travelling expenses. The total in no case shall exceed $500 in any year. Applicants are required to identify some of the commoner rocks and minerals.

Provision has been made for the establishment and operation of one or more mining training camps at suitable locations within the Province.

"TAXATION ACT."

(Procedure in applying to lease a Reverted Crown-granted Mineral Claim.)

"147. (1) Where property which consists of a mineral claim has been forfeited to and vested in the Crown under the provisions of this Part, it shall be lawful for the Gold Commissioner for the mining division in which the mineral claim is situate to grant a lease thereof to any person for the term of one year upon payment of the sum of twenty-five dollars, and, upon payment of a further sum of twenty-five dollars, to grant a renewal of the lease for a further term of one year commencing on the expiration of the former lease, but for no longer period.

"(2) No person shall be entitled to hold as lessee under this section more than eight claims in the same mining division at the same time.

"(3) No lease granted under this section shall be transferable.

"(4) Subject to the rights of any person to the surface or a portion of the surface of the mineral claim, the lessee shall, during the continuance of his lease, but no longer, have the right to enter, prospect, and mine upon the claim for all minerals, precious and base, save coal and petroleum, and for that purpose shall have all the rights of a free miner under the 'Mineral Act.'

"(5) Where the Gold Commissioner has granted a lease to any person under this section, he shall forthwith notify thė Surveyor of Taxes, giving the name of the mineral claim, the name of the lessee, and the date of the lease, and the Surveyor of Taxes shall enter the particulars furnished him by the Gold Commissioner in a proper book to be kept by him for that purpose.

"(6) The lessee may at any time before the expiration of his lease apply for and obtain a Crown grant of the mineral claim upon payment of all taxes, costs, expenses, and interest which remained due and unpaid on the mineral claim on the date of its forfeiture to the Crown, together with a sum equal to all taxes and interest which would have accrued due in respect thereof from the date of the lease to the date of the application for a Crown grant had the claim been regularly assessed in like manner as it appeared upon the assessment roll for the year last preceding the date of the forfeiture, and also with a fee of twenty-five dollars for the Crown grant: Provided that if the lessee establishes to the satisfaction of the Gold Commissioner that he has expended upon the claim in mining-development work a sum of not less than two hundred dollars a year during the continuance of the lease, then the payment of the sum in respect of taxes and interest from the date of the lease to the date of application for a Crown grant shall not be required: Provided further that if the lessee is the holder of a number of adjoining mineral claims not exceeding eight, and establishes to the satisfaction of the Gold Commissioner that a sum equal to two hundred dollars a claim of the full number of adjoining mineral claims has been expended upon one or more of the adjoining mineral claims in mining-development work for each year during the continuance of the leases, then the payment of the sum in respect of taxes and interest from the date of the lease to the date of the application for a Crown grant shall not be required.

"(7) The lessee shall be entitled to a Crown grant according to the acreage and description of the claim specified in the original Crown grant thereof under which the claim was held prior to the date of forfeiture, but subject to the prior rights of any other person.

"(8) Where the lessees under this section of a number of adjoining mineral claims, not exceeding eight, file with the Gold Commissioner a notice of their intention to perform on any one or more of the claims all the mining-development work that otherwise might be required in respect of all the claims, and where the lessees thereafter establish to the satisfaction of the Gold Commissioner that a sum equal to two hundred dollars a claim of the full number of the adjoining claims has been expended upon one or more of the adjoining claims in mining-development work for each year during the continuance of the leases, then the payment of the sum in respect of taxes and penalties from the date of each of the leases to the date of the application for a Crown grant shall not be required."

TAXATION OF MINES.

Crown-granted mineral claims are subject to a tax of 25 cents per acre. The tax becomes due on July 2nd in each year, and if unpaid on the following October 31st is deemed to be delinquent.

Mines are subject to a tax at the rate of 4 per cent. on income derived from mining operations.

For further particulars *see* the "Mining Tax Act," also the "Public Schools Act," which are obtainable from the King's Printer, Victoria, B.C.

The Federal Government now collects the income tax for the Provincial Government.

ROYALTIES.

All minerals mined from lands covered by records of mineral claims and placer claims and by placer-mining leases issued after the 1st day of May, 1948, are subject to payment of such royalties as may be fixed by regulation made by the Lieutenant-Governor in Council from time to time. The amounts of royalties to be paid have not yet been set. Properties subject to the payment of royalties are exempt from payment of the 4-per-cent. tax under the "Mining Tax Act."

"FOREST ACT."

In 1939 the "Provincial Parks Act" was repealed and the administration of Provincial parks brought under the "Forest Act." Under this Act the Lieutenant-Governor in Council may constitute any portion of the Province a Provincial park and may also extend, reduce, or cancel any park created before or after the amendment to this Act.

The Act provides for three classes of parks to be known as "A," "B," and "C" Class parks.

Lands included in Class "A" and Class "C" parks are reserved from pre-emption, sale, lease, or licence under the "Land Act" and with respect to mining are so reserved unless the consent of the Lieutenant-Governor in Council is obtained, and then only subject to further provisions of the Act.

No holder of any mineral claim in a Class "A" or Class "C" park may obtain a Crown grant of the surface rights of a mineral claim.

All mineral claims in any Class "A" or Class "C" park shall be subject to such terms and conditions and restrictions, including cutting and use of timber, as the Lieutenant-Governor in Council may from time to time prescribe.

The restrictions on prospecting and mining in Class "A" and Class "C" parks do not apply in the case of Class "B" parks.

Where, in the opinion of the Minister of Lands and Forests, the safety of life and property is endangered through the hazardous condition of the forest-cover or the occurrence or spread of forest fire, the Minister may declare a district closed for travel and prospecting so long as the hazard exists.

LIST OF PRICES CHARGED FOR ACTS.

(Sales, within the Province, amounting to 15 cents or more, are subject to the British Columbia sales tax.)

	Price.
Department of Mines Act	$0.15
Mineral Act	.25
Placer-mining Act	.25
Metalliferous Mines Regulation Act	.50
Coal-mines Regulation Act	.70
Mines Right-of-way Act	.15
Iron and Steel Bounties Act	.15
Indian Reserves Mineral Resources Act	.15
Prospectors' Grub-stake Act	.15
Taxation Act	.75
Forest Act	.80
Greater Vancouver Water District Act	.40
Security Frauds Prevention Act	.30
Coal Sales Act	.15

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