Minister of Mines

PROVINCE OF BRITISH COLUMBIA

ANNUAL REPORT

For the Year Ended 31st December

1951

VICTORIA, B.C.
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1952

BRITISH COLUMBIA DEPARTMENT OF MINES

VICTORIA, B.C.

Hon. J. H. CATES, *Minister.*

JOHN F. WALKER, *Deputy Minister.*

H. C. HUGHES, *Chief Inspector of Mines.*

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HARTLEY SARGENT, *Chief, Mineralogical Branch.*

P. J. MULCAHY, *Chief Gold Commissioner.*

To His Honour CLARENCE WALLACE, C.B.E.,
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 1951 is herewith respectfully submitted.

J. H. CATES,
Minister of Mines.

Minister of Mines' Office,
May, 1952.

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ANNUAL REPORT OF THE MINISTER OF MINES, 1951

Introduction

A Report of the Minister of Mines of the Province of British Columbia has been published each year since 1874.

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 of, 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 at 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 Federal 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" begins with an outline of current and past practice in arriving at quantities and calculating the value of the various products. Substantial changes have been made in compiling and arranging the statistics for the 1951 Report. The changes made and the relationship of present tables to previous ones are outlined on pages 13 and 15. As in previous Reports, the production, employment, and dividend records for the report-year and previous years, and the totals to date, are tabulated in the statistical section.

Review of the Mining Industry in British Columbia, 1951

By Hartley Sargent

The mineral industry has contributed substantially and continuously to the economic strength of British Columbia since mining coal was begun at Nanaimo in 1852. This 1951 Report of the Minister of Mines makes available to the public statistics of mineral production for 100 consecutive years. The total gross value of mineral products to the end of 1951 is more than $2,890,000,000. The value of all mineral products in 1951 was $175,659,591, 11½ per cent higher than in 1948, the previous record year. Thus, in its hundredth year of organized production, the mineral industry of British Columbia has surpassed all previous years in the value of output.

The record total value in 1951 and the high total value of mineral production in recent years are traceable principally to high prices for the metals, silver, copper, lead, and zinc. The average prices for 1951 for copper, lead, and zinc were the highest for any year on record. The price for silver also was high, and the price for each of the four metals was well above the 1950 price. The price for gold was lower than in 1950. The quantities of placer gold, copper, and zinc produced in 1951 were moderately greater than in 1950. The quantities of lode gold, silver, and lead were moderately less than the 1950 quantities. The combined effect of quantity and price resulted in the value for each of the principal metals, except lode gold, being equal to or substantially higher than the 1950 value. The 1951 value for zinc was more than $66,000,000, the all-time record for any metal.

In recent years, lead and zinc have contributed more than three-quarters of the value of all metals and as much as two-thirds of the value of all mineral products. In 1951 substantial increases in the output of silver, lead, and zinc were recorded for the Ainsworth and Vancouver Mining Divisions, in lead and zinc for the Nelson Mining Division, and in zinc for the Skeena and Slocan Mining Divisions; decreases in the production of silver, lead, and zinc were recorded for Fort Steele, and in lead for the Slocan Mining Division. Atlin Mining Division again became a producer of silver and base metals with production of silver, copper, lead, and zinc from the Big Bull and Tulsequah Chief mines. Copper production came principally from the Copper Mountain and Britannia mines, the output of the latter being about 1,000,000 pounds more than in 1950.

Since 1936 the entire copper output of British Columbia has been exported for smelting, refining, and marketing. In 1951 some copper-lead concentrates were shipped to Europe, but the copper concentrates produced at the Britannia and Copper Mountain mines went to Tacoma, Wash. Most of the silver, lead, and zinc mined in British Columbia has, after concentration, gone to the Trail smelter for smelting and refining. In the period from 1948 to 1950 substantial quantities of lead ores and concentrates, and of zinc concentrates from other parts of Canada, from the United States, and from other countries bordering on the Pacific Ocean, have been brought to Trail for smelting and refining. In that period the capacity of the smelter was in excess of the British Columbia output of ores and concentrates. Production of zinc concentrates in British Columbia has increased in the past two years, and in 1951 substantial quantities of zinc concentrates have been exported to the United States and Europe, and some to Japan. The annual report of the Consolidated Mining and Smelting Company for 1951 indicates that most of the refined lead and zinc produced has gone to Canada, the United Kingdom, and the United States, in approximately equal proportions. The same report indicates that two-thirds of the silver refined at Trail was exported, all of it to the United States.

The output of placer gold was somewhat higher in 1951 than in 1950. Most of the placer gold mined in 1951 came from the Noland underground placer mine at Atlin. Scarcity of water for hydraulicking restricted placer-mining in the Cariboo District.

Excepting some 6,000 tons of iron ore shipped to a plant at Wenatchee, Wash., in 1948 and 1949, iron-ore production in British Columbia had been negligible for many years. In 1951, 113,535 tons valued at $790,000 was mined on Vancouver Island and exported to Japan. Production of tungsten was begun late in 1951, but no shipments of tungsten concentrates had been made by the end of the year. Of the by-product metals, greater quantities of antimony, bismuth, and cadmium were produced in 1951, but the recovery of tin was materially less than in 1950.

In the industrial-minerals group the 1951 output of sulphur was greater in quantity and value than the output of any previous year. Exports of pyrite from the Britannia mine contributed materially to the sulphur output. A change in the system of valuing gypsum gives an apparent decrease in value, although the quantity increased materially. The change was initiated by the Dominion Bureau of Statistics, and bases the value on crude gypsum rather than on gypsum products. A decision to bring the chrysotile asbestos deposit on McDame Creek into production has been announced. Work done in 1951 by the Cassiar Asbestos Corporation Limited consisted principally in providing access to the property and further exploration of the asbestos deposit. The total value for structural materials was somewhat greater than in 1950; increases were recorded for several clay products and for cement.

Coal output in 1951 moderately exceeded that of 1950. No. 10 mine, South Wellington, for many years the major coal producer in the Nanaimo-Wellington field, is nearing exhaustion. However, the Bright mine at Cassidy has been equipped for production and yielded about 40,000 tons of coal in 1951, making up for part of the decreased production from No. 10 mine. The Bulkley Valley Colliery increased its output materially in 1951, most of the coal being shipped to the plant of the Columbia Cellulose Company near Prince Rupert.

The number employed in all branches of the mining industry of British Columbia in 1951 was 17,863. Major expenditures by the industry include salaries and wages, $52,561,952; fuel and electricity, $7,283,051; process supplies, $24,724,101; freight and treatment on ores and concentrates of metals, $25,096,743; Federal taxes, $26,818,476; Provincial taxes, $5,037,113; municipal and other taxes, $631,743; levies for Workmen's Compensation, silicosis, and unemployment insurance, $1,956,254. These items amount to $144,109,433. Dividends paid in 1951 amount to $40,921,238.

High prices for lead and zinc have encouraged mining lower-grade ore, reclaiming low-grade ore previously accumulated in dumps and as stope filling, reclaiming tailings from former milling operations, and also mining small orebodies and remnants left when larger orebodies were mined. These operations are being carried on at mines that have been operating for years, at former producers that had been shut down for years, and at properties inactive for many years but not previously in production. High prices have also greatly stimulated search for new orebodies in long-established areas and also in areas where no ore has been mined. Increased price has brought about resumption of tungsten production at the Emerald property south of Nelson, and more recently at the Red Rose property in the Hazelton area, but no shipments of concentrates were made from either property in 1951.

While base-metal and silver mines have benefited from increased metal prices, gold mines have suffered from greatly increased costs without compensating increase in the price of their product. Consequently, several mines have been closed down, and at others the effect has been, in part, to force the mining of higher-grade ore, leaving lower-grade material unmined, and in part to reduce the amount of development and exploration. One gold producer was closed in 1951, leaving five gold mines in operation at the end of the year. The Silbak Premier, for a long time a very important gold-silver mine, continues in operation by virtue of lead and zinc recovered from the ore. Important contributions to the gold output are made by copper mines and by some silver-lead-zinc mines, the ores from which contain significant amounts of gold.

The present period of high prices and of great industrial activity in British Columbia is also one in which large expenditure is being made for mining plants and facilities. At silver-lead-zinc and tungsten mines, eight mills newly built or re-equipped were brought into production in 1951, and several others were being built. A programme that involves very extensive revisions of the lead-smelting and slag-fuming plants at the Trail smelter is well along, and the capacity of the zinc refinery is being increased. The Consolidated Mining and Smelting Company has also begun a large hydro-electric development on the Pend d'Oreille River, and construction of transmission-lines to carry power from West Kootenay hydro-electric plants to Kimberley, that incidentally will also supply the Bluebell mine on the east side of Kootenay Lake. At Kimberley, plants for the production of ammonium-phosphate fertilizer are being built. The British Columbia Cement Company is expanding the capacity of the cement plant at Bamberton by about 50 per cent. Another important item of plant construction is the building of an additional battery of by-product coke-ovens at the Michel Colliery.

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.

In the present Report, extensive rearrangements of tables and of their order have been carried out. The data presented closely parallel those presented in previous Reports, but additional details have been incorporated, and the present order is considered to make more apparent the relationship between summary tables and the tables giving the details summarized. In the present summary tables, quantities as well as values are given for principal products, and the group, miscellaneous metals, has been separated from industrial minerals; full details are given for each year of the latest 10-year period instead of for the latest two years. More complete figures for coal production and for the manufacture of coke and other by-products are presented. The production figures for individual lode-metal mines are now shown in Table XV. In making the rearrangements, it has been found possible to achieve some condensation; however, the data presented provide coverage that is as complete or more complete than under the previous arrangement. Care has been taken to make comparison with previous tables easy. The relationship of the present tables to those used in recent Reports is shown on page 15.

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 Royal Canadian Mint 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, 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 listed on page 16.

Lode Metals, Net Contents

From the total assay contents, the net silver, copper, lead, and zinc 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 on page 16.

Average Metal Prices

In the interests of uniformity the Statistical Bureaux 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, was 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 the data are of interest to the mining industry, Table X is included in the Report to show the total coke produced in the Province, together with by-products, and the values given by the producers. The pre-1926 data have now been reworked and brought into conformity with current practice. Consequently, Table IX lists the full quantity of coal produced and its value as coal, and these figures are incorporated in Table I, that is, in the total gross mine production for the Province. Table X gives the complete data for coke, gas, and by-products manufacture for the period 1895 to 1925, and for each year subsequent to 1925.

Up to and including the year 1947, production was recorded in long tons (2,240 pounds). Beginning in 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 subsequent years, are shown on page 16.

Statistical Tables

(List showing relationship of present to former tables.)

Average Prices Used in Valuing Provincial Production of Gold, Silver, Copper, Lead, Zinc, and Coal

Year	Gold,[1] Crude, Oz.	Gold, Fine, Oz.	Silver, Fine, Oz.	Copper, Lb.	Lead, Lb.	Zinc, Lb.	Coal, Short Ton
	$	$	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
1950	31.29	38.05	80.635 „	23.428 „	14.454 „	15.075 „	6.500
1951	**30.30**	**36.85**	**94.55** „	**27.70** „	**18.4** „	**19.9** „	**6.500**

[1] Unrefined placer gold, average price per ounce, 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 15.

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

TABLE I.—TOTAL MINE PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1951

	Total Quantity	Total Value	Quantity, 1951	Value, 1951
		$		$
Gold—placer crude, oz.	5,145,346	94,410,152	23,691	717,911
„ lode fine, oz.	13,715,340	386,579,055	261,274	9,627,947
Silver oz.	351,391,070	195,924,835	8,215,884	7,768,118
Copper lb.	2,649,979,739	391,447,509	43,249,658	11,980,155
Lead lb.	10,502,671,845	619,837,782	273,456,604	50,316,015
Zinc lb.	7,485,408,688	485,723,810	333,910,764	66,448,242
Miscellaneous metals		47,013,042		5,485,800
Industrial minerals[1]		28,316,344		2,493,840
Sundry miscellaneous metals and minerals (1896–1926)		5,878,783		
Structural materials		147,577,555		10,588,210
Coal[2] tons	131,121,849	488,142,256	1,574,362	10,233,353
Total		2,890,851,123		175,659,591

[1] Includes sulphur: 1916–51—2,310,739 tons, value $21,678,695; 1951—194,874 tons, value $1,840,992.
[2] Coal includes coal used in making coke.

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1951, INCLUSIVE

1852–95 (incl.)	$93,552,273	1924	$48,704,604
1896	7,507,956	1925	61,492,242
1897	10,455,268	1926	67,188,842
1898	10,906,861	1927	60,729,358
1899	12,393,131	1928	65,372,583
1900	16,344,751	1929	68,245,443
1901	19,671,572	1930	55,391,993
1902	17,486,550	1931	34,883,181
1903	17,495,954	1932	28,798,406
1904	18,977,359	1933	32,602,672
1905	22,461,325	1934	42,305,297
1906	24,980,546	1935	48,821,239
1907	25,882,560	1936	54,081,967
1908	23,851,277	1937	74,475,902
1909	24,443,025	1938	64,485,551
1910	26,377,066	1939	65,681,547
1911	23,499,072	1940	75,701,155
1912	32,440,800	1941	78,479,719
1913	30,296,398	1942	75,551,093
1914	26,388,825	1943	65,892,395
1915	29,447,508	1944	54,923,803
1916	42,290,462	1945	63,343,949
1917	37,010,392	1946	71,807,951
1918	41,782,474	1947	113,221,254
1919	33,296,313	1948	152,524,752
1920	35,543,084	1949	133,012,968
1921	28,066,641	1950	148,155,060
1922	35,162,843	1951	175,659,591
1923	41,304,320		
		Total	$2,890,851,123

TABLE III.—QUANTITIES AND VALUE OF MINE PRODUCTS FOR YEARS 1942 TO 1951

Description	1942		1943		1944		1945		1946	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Principal Metals		$		$		$		$		$
Gold—placer, crude oz.	32,904	1,041,772	14,600	462,270	11,433	361,977	12,589	398,591	15,729	475,361
„ lode, fine oz.	444,518	17,113,943	224,403	8,639,516	186,632	7,185,332	175,373	6,751,860	117,612	4,322,241
Silver oz.	9,677,881	4,080,775	8,526,310	3,858,496	5,705,334	2,453,293	6,157,307	2,893,934	6,365,761	5,324,959
Copper[1] lb.	50,097,716	5,052,856	42,307,510	4,971,132	36,300,589	4,356,070	25,852,366	3,244,472	17,500,538	2,240,070
Lead lb.	463,269,005	15,575,104	405,285,476	15,214,417	294,797,469	13,265,886	353,497,689	17,674,884	347,990,146	23,489,335
Zinc lb.	396,857,260	13,536,801	335,137,014	13,405,481	280,356,477	12,055,328	301,737,902	19,431,921	270,718,128	21,143,086
Totals		56,401,251		46,551,312		39,677,886		50,395,662		56,995,052
Miscellaneous Metals										
Antimony lb.	3,041,030	516,975	1,114,166	189,408	1,937,933	281,000	1,679,878	292,635	642,145	96,322
Bismuth lb.	345,223	476,408	407,597	562,484	123,875	154,844	189,815	260,047	234,020	327,628
Cadmium lb.	957,747	1,130,141	613,339	705,780	365,112	401,623	510,432	505,328	632,539	771,698
Indium oz.	471	5,887								
Magnesium lb.	193,727	85,240								
Mercury lb.	1,035,614	2,942,945	1,690,540	4,559,200	735,908	1,210,375				
Platinum oz.	40	1,528	7	270						
Tin lb.	1,237,863	705,582	776,937	450,623	516,626	299,643	849,983	484,490	874,186	480,802
Tungsten (WO_3) lb.	184,186	230,232	521,524	702,385	271,765	236,788	366	331		
Totals		6,094,937		7,170,150		2,584,273		1,542,831		1,676,450
Industrial Minerals										
Arsenious oxide lb.	6,155,751	246,230	2,772,023	27,721						
Barite tons	1,917	16,084	1,924	15,834	12,373	48,007	31,155	45,780	2,728	19,000
Diatomite tons	210	670	40	128	7	190	22	498	40	1,027
Fluorspar tons	1,559	25,498								
Flux (quartz, limestone) tons	63,280	41,460	78,713	140,299	63,443	100,283	45,221	70,266	55,732	71,531
Granules (slate and rock) tons	1,213	16,694	664	11,711	949	17,903	969	16,272	1,116	19,917
Gypsum and products tons	27,414	143,934	27,853	142,176	26,442	103,937	23,718	127,434	40,900	318,500
Iron oxides tons	439	4,604	403	4,836	482	8,200	397	1,985	427	2,135
Magnesium sulphate tons	1,140	38,760								
Mica lb.	580,000	2,800	650,000	3,245	924,000	15,382	1,284,000	17,136	1,616,000	23,420
Sodium carbonate lb.	256	2,048	427	4,697	43	473	286	3,146	210	2,310
Sulphur tons	116,246	1,134,566	104,599	1,039,108	113,374	1,123,868	127,653	1,267,350	126,622	1,258,576
Totals		1,673,348		1,389,755		1,418,233		1,549,867		1,716,416
Structural Materials										
Brick—common No.	4,058,953	77,140	2,736,792	55,508	2,038,193	40,936	3,092,000	80,556	3,300,000	94,000
„ face, paving, sewer No.	202,664	7,450	695,064	21,825	1,182,784	41,495	1,319,743	49,814	2,077,683	84,353
„ firebrick, blocks		219,680		227,594		181,199		217,275		283,317
Clays tons	843	11,467	706	9,706	3,706	17,283	510	7,899	601	8,241
Structural tile, hollow blocks		39,353		27,617		26,527		70,376		105,194
Drain-tile, sewer-pipe, flue-linings		148,179		153,153		165,905		205,883		263,864
Pottery—glazed or unglazed		3,106		2,917				3,245		2,811
Other clay products		2,481		5,485		3,444		2,632		3,611
Cement		1,198,014		1,146,865		1,085,918		1,182,297		1,739,966
Lime and limestone tons	104,856	273,933	128,469	340,988	147,444	421,648	162,334	522,692	159,493	642,912
Rubble, riprap, crushed rock tons	171,574	156,171	108,122	100,996	44,423	40,926	71,949	65,194	154,164	158,446
Sand and gravel		948,662		890,058		935,370		865,557		1,713,138
Stone tons	2,709	58,749	3,084	56,436	2,009	64,794	4,284	127,809	4,354	99,710
Totals		3,144,385		3,039,148		3,025,445		2,535,672		3,486,425
Fuel										
Coal tons	2,170,737	8,237,172	2,040,253	7,742,030	2,165,676	8,217,966	1,700,914	6,454,360	1,639,277	6,220,470
Total value		75,551,093		65,892,395		54,923,803		63,343,949		71,807,951

[1] *Re* value of copper for years 1943–47, inclusive, *see* last paragraph under "Average Metal Prices," page 14.

TABLE III.—QUANTITIES AND VALUE OF MINE PRODUCTS FOR YEARS 1942 TO 1951—*Continued*

Description	1947 Quantity	1947 Value	1948 Quantity	1948 Value	1949 Quantity	1949 Value	1950 Quantity	1950 Value	1951 Quantity	1951 Value
Principal Metals		$		$		$		$		$
Gold—placer, crude .... oz.	6,969	200,585	20,332	585,200	17,886	529,524	19,134	598,717	23,691	717,911
,, lode, fine .... oz.	243,282	8,514,870	286,230	10,018,050	288,396	10,382,256	283,983	10,805,553	261,274	9,627,947
Silver .... oz.	5,707,691	4,109,538	6,718,122	5,038,592	7,636,053	5,669,769	9,507,225	7,666,151	8,215,884	7,768,118
Copper[1] .... lb.	41,783,921	8,519,741	43,025,388	9,616,174	54,856,808	10,956,550	42,212,133	9,889,458	43,249,658	11,980,155
Lead .... lb.	306,400,709	41,884,977	332,996,351	60,072,542	263,580,549	41,645,726	307,122,803	44,391,530	273,456,604	50,316,015
Zinc .... lb.	268,450,926	30,147,039	296,012,941	41,234,603	276,324,451	36,604,700	324,263,778	48,882,765	333,910,764	66,448,242
Totals	....	93,376,750	....	126,565,161	....	105,788,525	....	122,234,174	....	146,140,478
Miscellaneous Metals										
Antimony .... lb.	1,150,463	384,255	310,062	113,173	158,288	61,020	643,540	216,229	1,310,836	622,647
Bismuth .... lb.	284,357	560,183	222,000	444,000	102,913	210,972	162,616	369,138	191,471	451,872
Cadmium .... lb.	547,248	941,266	617,226	1,126,437	665,449	1,364,170	650,540	1,535,274	1,164,933	3,122,021
Indium .... oz.	....	....	....	....	689	1,550	4,952	12,132	582	1,368
Iron ore .... tons	....	....	679	3,735	5,472	27,579	....	....	113,535	790,000
Platinum .... oz.	1	59	242	21,175	99	7,468	111	9,239	22	2,085
Tin .... lb.	714,198	517,794	691,332	688,567	619,117	633,047	796,403	828,259	346,718	495,807
Tungsten (WO_3) .... lb.	496,023	680,792	1,409,297	1,409,297	....	....	281,160	281,160	....	....
Totals	....	3,084,349	....	3,806,384	....	2,305,806	....	3,251,431	....	5,485,800
Industrial Minerals										
Barite .... tons	2,875	26,650	1,632	16,317	1,314	13,145	1,440	17,284	1,248	16,224
Diatomite .... tons	59	1,472	24	817	36	963	4	108	8	223
Flux (quartz, limestone) .... tons	102,918	174,655	83,389	248,977	108,531	213,773	144,325	268,411	144,235	292,100
Granules (slate and rock) .... tons	1,156	19,686	4,958	68,937	5,941	79,661	7,886	104,590	5,727	73,767
Gypsum and products .... tons	67,112	523,298	77,055	546,707	98,977	616,490	92,882	620,108	124,729	263,072
Iron oxides .... tons	58	464	3,386	30,472	2,752	23,301	....	....	....	....
Mica .... lb.	1,808,000	24,240	894,000	9,494	578,000	5,675	456,000	5,533	606,000	7,462
Sodium carbonate .... lb.	163	1,793	....	....	47	517	....	....	....	....
Sulphur .... tons	157,161	1,503,714	144,448	1,409,156	160,435	1,546,798	143,000	1,421,806	194,874	1,840,992
Totals	....	2,275,972	....	2,330,877	....	2,500,323	....	2,437,840	....	2,493,840
Structural Materials										
Brick—common .... No.	4,318,000	122,660	3,810,000	111,300	3,220,000	95,075	3,910,500	103,840	1,720,000	23,982
,, face, paving, sewer .... No.	1,232,812	64,849	2,584,752	129,268	509,560	24,793	1,974,380	54,503	3,127,888	153,575
,, firebrick, blocks	....	389,899	....	392,458	....	135,391	....	254,262	....	380,742
Clays .... tons	11,428	9,675	5,673	32,922	6,500	22,339	6,706	32,264	14,786	60,255
Structural tile, hollow blocks	....	158,276	....	116,513	....	145,512	....	191,016	....	171,481
Drain-tile, sewer-pipe, flue-linings	....	361,975	....	597,541	....	265,098	....	428,418	....	410,206
Pottery—glazed or unglazed	....	3,476	....	5,138	....	5,176	....	5,860	....	4,695
Other clay products	....	9,332	....	9,611	....	9,676	....	11,335	....	10,393
Cement	....	1,896,772	....	2,441,304	....	3,029,425	....	3,088,296	....	3,311,439
Lime and limestone .... tons	151,671	714,126	209,453	1,177,632	179,400	1,295,087	221,454	1,133,776	241,723	1,251,327
Rubble, riprap, crushed rock .... tons	222,044	216,873	896,780	839,780	1,112,272	916,841	1,164,049	990,257	972,178	1,145,072
Sand and gravel	....	1,828,919	....	3,060,535	....	3,967,132	....	3,723,487	....	3,355,693
Stone .... tons	19,835	119,971	3,579	54,220	2,287	44,345	26,758	188,675	4,837	309,350
Totals	....	5,896,803	....	8,968,222	....	9,955,890	....	10,205,989	....	10,588,210
Fuel										
Coal .... tons	1,923,573	8,587,380	1,809,018	10,854,108	1,917,296	12,462,424	1,542,404	10,025,626	1,574,362	10,233,353
Total value	....	113,221,254	....	152,524,752	....	133,012,968	....	148,155,060	....	175,659,591

[1] *Re* value of copper for years 1943–47, inclusive, *see* last paragraph under "Average Metal Prices," page 14.

TABLE IV.—MINERAL PRODUCTION VALUE, 1895–1951

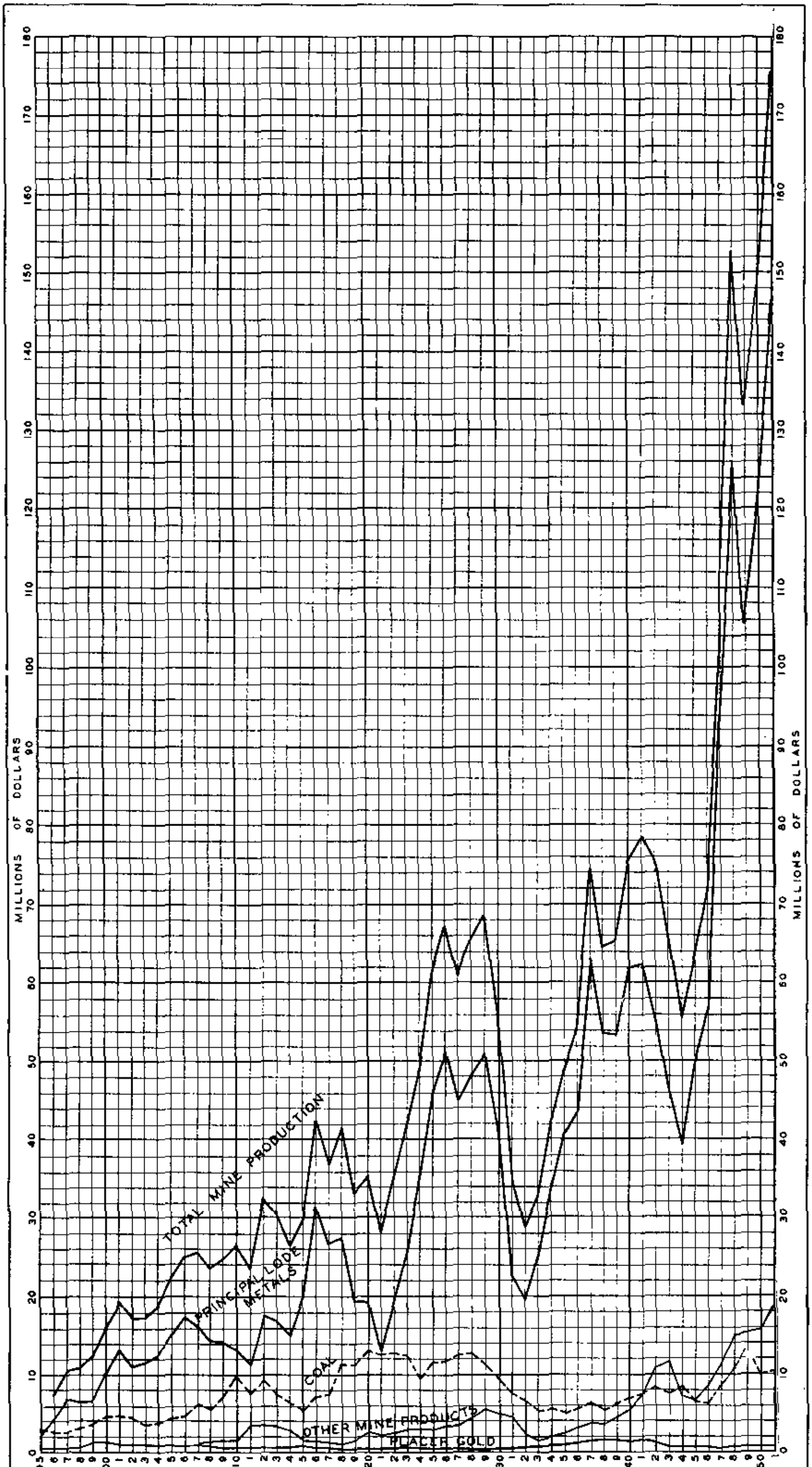

TABLE V.—LODE-MINE PRODUCTS, 1913–51

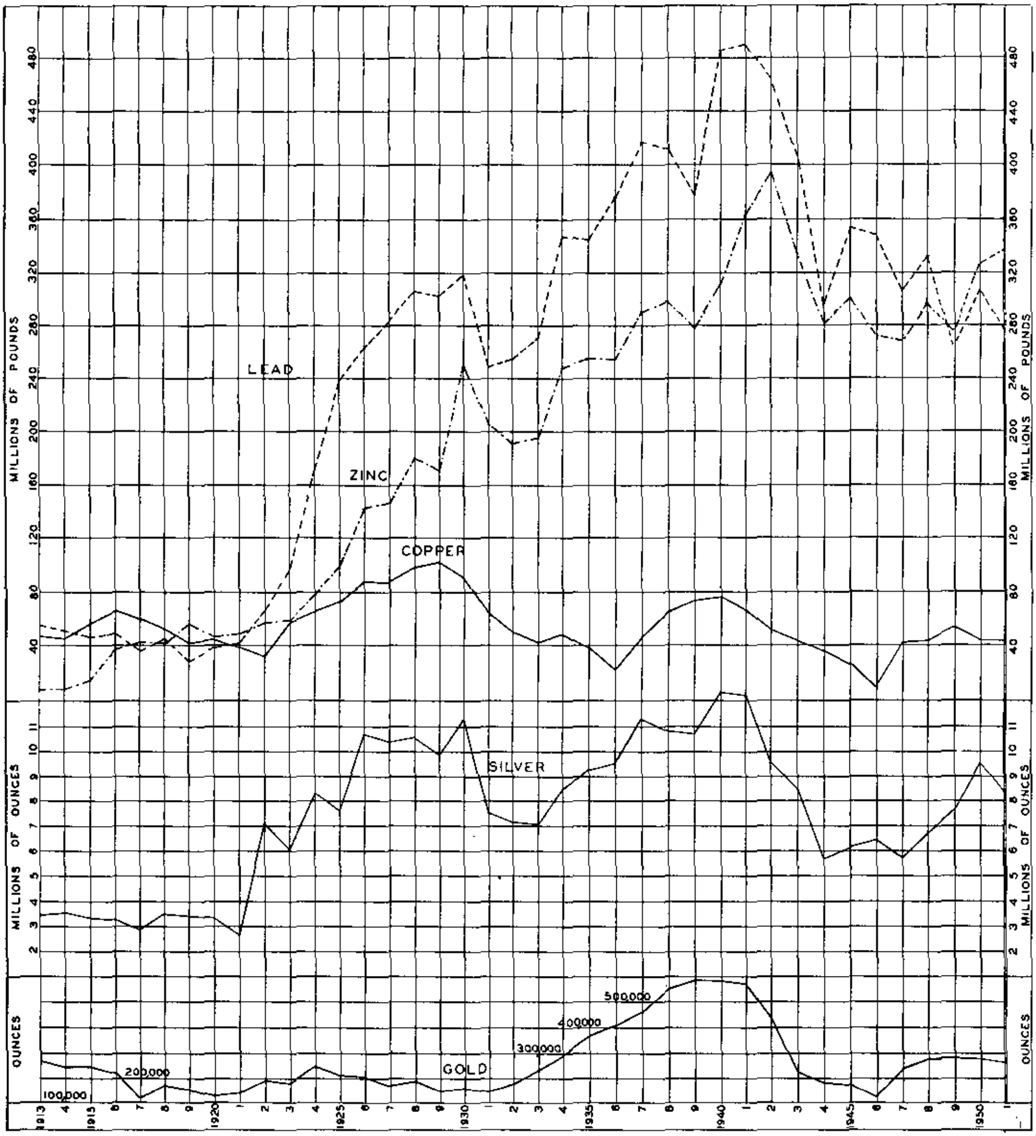

TABLE VI.—PRODUCTION OF PRINCIPAL METALS, 1858–1951

Year	Placer Gold		Gold		Silver		Copper		Lead		Zinc		Total Value
	Quantity[1]	Value	Quantity[2]	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
	Oz.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
1858–86, incl.	3,105,775	52,798,364											52,798,364
1887	40,810	693,709			17,690	17,331			204,800	9,216			720,256
1888	36,280	616,731			79,780	75,000			674,500	29,813			721,544
1889	34,640	588,923			53,192	47,873			165,100	6,498			644,294
1890	29,080	494,436			70,427	73,948							568,384
1891	25,280	429,811			4,500	4,000							433,811
1892	23,500	399,526			77,160	66,935			808,420	33,064			499,525
1893	20,950	356,131	1,170	23,404	227,000	195,000			2,135,023	78,996			653,531
1894	23,850	405,516	6,252	125,014	746,379	470,219	324,680	16,234	5,662,523	169,875			1,186,858
1895	28,330	481,683	39,270	785,400	1,496,522	977,229	952,840	47,642	16,475,464	532,255			2,824,209
1896	32,000	544,026	62,259	1,244,180	3,135,343	2,100,689	3,818,556	190,926	24,199,977	721,384			4,801,205
1897	30,210	513,520	106,141	2,122,820	5,472,971	3,272,836	5,325,180	266,258	38,841,135	1,390,517			7,565,951
1898	37,840	643,346	110,061	2,201,217	4,292,401	2,375,841	7,271,678	874,781	31,693,559	1,077,581			7,172,766
1899	79,110	1,344,900	138,315	2,857,573	2,939,413	1,663,708	7,722,591	1,351,453	21,862,436	878,870			8,096,504
1900	75,220	1,278,724	167,153	3,453,381	3,958,175	2,309,200	9,997,080	1,615,289	63,358,621	2,691,887			11,348,481
1901	57,060	970,100	210,384	4,348,605	4,396,447	2,462,008	27,603,746	4,446,963	51,582,906	2,010,260			14,237,936
1902	63,130	1,073,140	236,491	4,888,269	3,917,917	1,941,328	29,636,057	3,446,673	22,536,381	824,832			12,174,242
1903	62,380	1,060,420	232,831	4,812,616	2,996,204	1,521,472	34,359,921	4,547,535	18,089,283	689,744			12,631,787
1904	65,610	1,115,300	222,042	4,589,608	3,222,481	1,719,516	35,710,128	4,578,037	36,646,244	1,421,874			13,424,335
1905	57,020	969,300	238,660	4,933,102	3,439,417	1,971,818	37,692,251	5,876,222	56,580,703	2,399,022			16,149,464
1906	55,790	948,400	224,027	4,630,639	2,990,262	1,897,320	42,990,488	8,288,565	52,408,217	2,667,578			18,432,502
1907	48,710	828,000	196,179	4,055,020	2,745,448	1,703,825	40,832,720	8,166,544	47,738,703	2,291,458			17,044,847
1908	38,060	647,000	255,582	5,282,880	2,631,389	1,321,483	47,274,614	6,240,249	43,195,733	1,632,799			15,124,411
1909	28,060	477,000	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	14,668,141
1910	31,760	540,000	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	13,768,731
1911	25,060	426,000	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	11,880,063
1912	32,680	555,500	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	18,218,266
1913	30,000	510,000	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	17,700,838
1914	33,240	565,000	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	15,790,061
1915	45,290	770,000	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	20,762,149
1916	34,150	580,500	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	32,063,514
1917	29,180	496,000	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	27,284,474
1918	18,820	320,000	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	27,910,278
1919	16,850	286,500	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	20,036,998
1920	13,040	221,600	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	19,665,965
1921	13,720	233,200	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	13,153,598
1922	21,690	368,800	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	19,600,657
1923	24,710	420,000	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	25,767,062
1924	24,750	420,750	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	35,958,997
1925	16,476	280,092	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	46,480,227

[1] Ounces of crude gold. [2] Ounces of fine gold.

Table VI.—Production of Principal Metals, 1858–1951—*Continued*

Year	Placer Gold		Gold		Silver		Copper		Lead		Zinc		Total Value
	Quantity[1]	Value	Quantity[2]	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
	Oz.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
1926	20,912	355,503	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	51,863,534
1927	9,191	156,247	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	45,133,329
1928	8,284	143,208	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	48,425,033
1929	6,983	118,711	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	51,293,570
1930	8,955	152,235	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	41,067,630
1931	17,176	291,992	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	22,827,565
1932	20,400	395,542	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	20,095,777
1933	23,928	562,787	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	25,569,924
1934	25,181	714,431	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	34,610,361
1935	30,929	895,058	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	41,492,627
1936	43,389	1,249,940	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	44,916,392
1937	54,153	1,558,245	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	64,471,028
1938	57,759	1,671,015	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	55,548,348
1939	49,746	1,478,492	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	55,000,590
1940	39,067	1,236,928	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	63,197,067
1941	43,775	1,385,962	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	63,601,981
1942	32,904	1,041,772	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	56,401,251
1943	14,600	462,270	224,403	8,639,516	8,526,310	3,858,496	42,307,510	4,971,132[3]	405,285,476	15,214,417	335,137,014	13,405,481	46,551,312
1944	11,433	361,977	186,632	7,185,332	5,705,334	2,453,293	36,300,589	4,356,070[3]	294,797,469	13,265,886	280,356,477	12,055,328	39,677,886
1945	12,589	398,591	175,373	6,751,860	6,157,307	2,893,934	25,852,366	3,244,472[3]	353,497,689	17,674,884	301,737,902	19,431,921	50,395,662
1946	15,729	475,361	117,612	4,322,241	6,365,761	5,324,959	17,500,538	2,240,070[3]	347,990,146	23,489,335	270,718,128	21,143,086	56,995,052
1947	6,969	200,585	243,282	8,514,870	5,707,691	4,109,538	41,783,921	8,519,741[3]	306,400,709	41,884,977	268,450,926	30,147,039	93,376,750
1948	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	126,565,161
1949	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	105,788,525
1950	19,134	598,717	283,983	10,805,553	9,507,225	7,666,151	42,212,133	9,889,458	307,122,803	44,391,530	324,263,778	48,882,765	122,234,174
1951	23,691	717,911	261,274	9,627,947	8,215,884	7,768,118	43,249,658	11,980,155	273,456,604	50,316,015	333,910,764	66,448,242	146,858,388
Totals	5,145,346	94,410,152	13,715,340	386,579,055	351,391,070	195,924,835	2,649,979,739	391,447,509	10,502,671,845	619,837,782	7,485,408,688	485,723,810	2,173,923,143

[1] Ounces of crude gold. [2] Ounces of fine gold. [3] *Re* value of copper for years 1943–47, inclusive, *see* last paragraph under "Average Metal Prices," page 14.

Table VIIa.—Summary of Production, 1950 and 1951, by Mining Divisions

Mining Division	Year	Gold—Placer Quantity[1]	Gold—Placer Value	Principal Lode Metals	Miscellaneous Metals	Industrial Minerals	Structural Materials	Coal Quantity	Coal Value	Total
		Oz.	$	$	$	$	$	Tons	$	$
Ainsworth	1950			1,029,037			13,940			1,042,977
	1951			2,381,871			7,850			2,389,721
Alberni	1950	24	751	8,525			28,428			37,704
	1951			19,596			61,392			80,988
Atlin	1950	12,181	381,153	1,265,231			245			1,646,629
	1951	17,681	535,789	742,810			1,000			1,279,599
Cariboo	1950	1,718	53,758	1,483,000		5,533	129,408			1,671,699
	1951	1,396	42,303	1,519,403		7,462	77,921			1,647,089
Clinton	1950	1	31				693			724
	1951	7	212							212
Fort Steele	1950	22	688	81,413,038	3,242,192	24,096	135,011	1,049,960	6,824,740	91,639,765
	1951	21	636	93,377,676	4,229,135	22,578	85,953	1,141,942	7,422,623	105,138,601
Golden	1950			1,575,052		41,561	221,237			1,837,850
	1951			2,267,756		99,724	17,971			2,385,451
Greenwood	1950	5	157	692,281		38,899	38,401			769,738
	1951			832,435		36,850	14,512			883,797
Kamloops	1950	22	688	179		571,735	251,265			823,867
	1951	10	303			156,994	330,382			487,679
Lillooet	1950	82	2,566	4,306,308			70,352			4,379,226
	1951	18	545	4,368,497	3,325		46,045			4,418,412
Nanaimo	1950	6	188	124,286		107,584	1,370,638	449,394	2,921,061	4,523,757
	1951			335,934	790,000	141,857	1,484,243	396,684	2,578,446	5,330,480
Nelson	1950	7	219	6,357,669			167,895			6,525,783
	1951	9	273	10,044,965	138,323		110,215			10,293,776
New Westminster	1950	4	125				2,012,328			2,012,453
	1951	12	364			7,135	2,268,596			2,276,095
Nicola	1950						2,624	1,145	7,443	10,067
	1951						12,387	899	5,843	18,230
Omineca	1950	969	30,321	1,464,308			70,827	12,563	81,659	1,647,115
	1951	205	6,212	1,806,415			57,212	27,697	180,030	2,049,869
Osoyoos	1950			1,836,421		121,928	21,316			1,979,665
	1951			1,832,952		113,393	86,250			2,032,595
Peace River	1950	21	657				5,717	12,558	81,627	88,001
	1951	2	61				42,976	3,119	20,794	63,831
Quesnel	1950	3,031	94,842	1,575		108	4,568			101,093
	1951	4,286	129,879	1,792		223	2,360			134,254
Revelstoke	1950	5	156	29,042			53,868			83,066
	1951						60,376			60,376
Similkameen	1950	745	23,312	6,433,284	9,239		104,111	16,784	109,096	6,679,042
	1951	6	182	7,499,037	2,085		41,772	3,941	25,617	7,568,693
Skeena	1950	231	7,228	3,596,459			82,840			3,686,527
	1951	5	152	3,907,325			212,149			4,119,626
Slocan	1950			2,550,997			800			2,551,797
	1951			3,543,624	37,223		6,750			3,587,597
Stikine	1950	60	1,877				795			2,672
	1951	23	697				98			795
Trail Creek	1950			534,955		1,375,310	45,541			1,955,806
	1951			468,722		1,410,000	64,393			1,943,115
Vancouver	1950			6,933,123		151,086	1,489,373			8,573,582
	1951			11,005,924	285,709	497,624	1,629,163			13,418,420
Vernon	1950			687			80,233			80,920
	1951	10	303	733			34,250			35,286
Victoria	1950						3,803,535			3,803,535
	1951			183,010			3,831,994			4,015,004
Totals	1950	19,134	598,717	121,635,457	3,251,431	2,437,840	10,205,989	1,542,404	10,025,626	148,155,060
	1951	23,691	717,911	146,140,477	5,485,800	2,493,840	10,588,210	1,574,362	10,233,353	175,659,591

[1] Crude gold.

Note.—Full details for placer gold and for coal are given in this table. The columns headed "Principal Lode Metals," "Miscellaneous Metals," "Industrial Minerals," and "Structural Materials" give the total value only, details being set forth in Tables VIIb, VIIc, VIId, and VIIe.

Table VIIb.—Production of Principal Lode Metals, 1950 and 1951, by Mining Divisions

Division	Year	Quantity	Gold—Lode		Silver		Copper		Lead		Zinc	
			Quantity[1]	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		Tons	Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$
Ainsworth	1950	89,619	120	4,566	95,679	77,151			2,415,435	349,127	3,968,110	598,193
	1951	112,063	331	12,197	192,313	181,832			6,147,168	1,131,079	5,310,369	1,056,763
Alberni	1950	30	220	8,371	110	89			449	65		
	1951	124	527	19,420	186	176						
Atlin	1950	95,667	33,228	1,264,325	1,123	906						
	1951	44,509	15,567	573,644	25,885	24,474	121,804	33,740	190,788	35,105	381,141	75,847
Cariboo	1950	101,269	38,879	1,479,346	4,531	3,654						
	1951	109,132	41,110	1,514,903	4,759	4,500						
Clinton	1950											
	1951											
Fort Steele	1950	2,680,962			4,482,000	3,614,061			279,180,000	40,352,677	248,400,000	37,446,300
	1951	2,542,751	2	74	3,141,437	2,970,229			236,609,542	43,536,156	235,533,753	46,871,217
Golden	1950	57,332			55,067	44,403			4,452,116	643,509	5,884,843	887,140
	1951	58,238	10	368	110,353	104,339			5,209,527	958,553	6,052,741	1,204,496
Greenwood	1950	8,645	294	11,187	690,316	556,636			391,079	56,527	450,623	67,931
	1951	14,349	272	10,023	708,207	669,610			354,522	65,232	440,050	87,570
Kamloops	1950	90			75	60			762	110	58	9
	1951											
Lillooet	1950	258,625	112,588	4,283,973	27,699	22,335						
	1951	245,914	117,795	4,340,746	29,351	27,751						
Nanaimo	1950	10,300	1,719	65,408	5,021	4,049	234,035	54,829				
	1951	23,356	4,265	157,165	13,387	12,657	599,681	166,112				
Nelson	1950	369,433	7,869	299,416	64,435	51,957			9,751,913	1,409,542	30,492,565	4,596,754
	1951	496,670	781	28,780	48,653	46,001			12,961,693	2,384,952	38,116,746	7,585,232
New Westminster	1950											
	1951											
Nicola	1950											
	1951											
Omineca	1950	21,104	1,958	74,502	880,472	709,969			1,654,710	239,172	2,923,150	440,665
	1951	22,646	1,531	56,417	882,684	834,578			1,935,882	356,202	2,810,140	559,218
Osoyoos	1950	126,462	47,805	1,818,980	9,292	7,493	40,003	9,372	3,466	501	498	75
	1951	122,955	48,848	1,800,049	10,452	9,882	83,108	23,021				
Peace River	1950											
	1951											
Quesnel	1950	8	1	38	731	589			6,562	948		
	1951	7	1	37	669	633			6,081	1,119	13	3
Revelstoke	1950	562	2	96	8,484	6,841			112,030	16,193	39,351	5,932
	1951											
Similkameen	1950	1,749,964	8,475	322,474	173,424	139,840	25,486,468	5,970,970				
	1951	1,740,896	8,043	296,385	164,200	155,251	25,433,994	7,045,216	6,449	1,187	5,013	998
Skeena	1950	209,513	17,067	649,399	2,391,766	1,928,600			3,971,546	574,047	2,948,012	444,413
	1951	188,130	6,812	251,022	2,156,180	2,038,668			4,194,371	771,764	4,250,609	845,871
Slocan	1950	142,719	177	6,735	451,279	363,889			4,184,153	604,777	10,451,715	1,575,596
	1951	182,134	143	5,270	470,761	446,104			3,531,131	649,728	12,279,005	2,443,522
Stikine	1950											
	1951											
Trail Creek	1950	1,743	147	5,593	72,966	58,836	1,830,177	428,774	281,445	40,680	7,108	1,072
	1951	1,265	293	10,797	60,881	57,563	1,306,681	361,951	204,942	37,709	3,528	702
Vancouver	1950	858,942	13,431	511,050	92,540	74,620	14,621,450	3,425,513	714,497	103,273	18,697,628	2,818,667
	1951	796,566	14,619	538,710	180,034	170,222	15,619,717	4,326,661	2,034,202	374,293	28,120,795	5,596,038
Vernon	1950	11	3	114	215	173			2,640	382	117	18
	1951	12	8	295	430	407	40	11	109	20		
Victoria	1950											
	1951	9,754	316	11,645	15,062	14,241	84,633	23,443	70,197	12,916	606,861	120,765
Totals	1950	6,782,912	283,983	10,805,553	9,507,225	7,666,151	42,212,133	9,889,458	307,122,803	44,391,530	324,263,778	48,882,765
	1951	6,711,471	261,274	9,627,947	8,215,884	7,768,118	43,249,658	11,980,155	273,456,604	50,316,015	333,910,764	66,448,242

[1] Fine gold.

Table VIIc.—Production of Miscellaneous Metals, 1950 and 1951, by Mining Divisions

Division	Year	Antimony[1] Quantity	Antimony[1] Value	Bismuth[1] Quantity	Bismuth[1] Value	Cadmium[1] Quantity	Cadmium[1] Value	Indium Quantity	Indium Value
		Lb.	$	Lb.	$	Lb.	$	Oz.	$
Fort Steele	1950	643,540	216,229	162,616	369,138	650,540	1,535,274	4,952	12,132
	1951	**1,303,836**	**619,322**	**191,471**	**451,872**	**992,823**	**2,660,766**	**582**	**1,368**
Lillooet	1950	......	......	......	......	......	......	......	......
	1951	**7,000[3]**	**3,325**	......	......	......	......	......	......
Nanaimo	1950	......	......	......	......	......	......	......	......
	1951	......	......	......	......	......	......	......	......
Nelson	1950	......	......	......	......	......	......	......	......
	1951	......	......	......	......	**51,613**	**138,323**	......	......
Similkameen	1950	......	......	......	......	......	......	......	......
	1951	......	......	......	......	......	......	......	......
Slocan	1950	......	......	......	......	......	......	......	......
	1951	......	......	......	......	**13,889**	**37,223**	......	......
Vancouver	1950	......	......	......	......	......	......	......	......
	1951	......	......	......	......	**106,608**	**285,709**	......	......
Totals	1950	643,540	216,229	162,616	369,138	650,540	1,535,274	4,952	12,132
	1951	**1,310,836**	**622,647**	**191,471**	**451,872**	**1,164,933**	**3,122,021**	**582**	**1,368**

Division	Year	Iron Ore Quantity	Iron Ore Value	Platinum Quantity	Platinum Value	Tin[2] Quantity	Tin[2] Value	Tungsten (WO_3) Quantity	Tungsten (WO_3) Value	Totals
		Tons	$	Oz.	$	Lb.	$	Lb.	$	$
Fort Steele	1950	......	......	......	......	796,403	828,259	......	......	2,961,032
	1951	......	......	......	......	**346,718**	**495,807**	......	......	**4,229,135**
Lillooet	1950	......	......	......	......	......	......	......	......	......
	1951	......	......	......	......	......	......	......	......	**3,325**
Nanaimo	1950	......	......	......	......	......	......	......	......	......
	1951	**113,535**	**790,000**	......	......	......	......	......	......	**790,000**
Nelson	1950	......	......	......	......	......	......	281,160[4]	281,160	281,160
	1951	......	......	......	......	......	......	......	......	**138,323**
Similkameen	1950	......	......	111	9,239	......	......	......	......	9,239
	1951	......	......	**22**	**2,085**	......	......	......	......	**2,085**
Slocan	1950	......	......	......	......	......	......	......	......	......
	1951	......	......	......	......	......	......	......	......	**37,223**
Vancouver	1950	......	......	......	......	......	......	......	......	......
	1951	......	......	......	......	......	......	......	......	**285,709**
Totals	1950	......	......	111	9,239	796,403	828,259	281,160	281,160	3,251,431
	1951	**113,535**	**790,000**	**22**	**2,085**	**346,718**	**495,807**	......	......	**5,485,800**

[1] Recovered at Trail smelter, principally from concentrates originating in Fort Steele Mining Division and in part from other mining divisions.

[2] Recovered from Sullivan mine, Fort Steele Mining Division.

[3] Estimated content of ore shipped to England.

[4] 1950 sales of products accumulated before February, 1949.

Table VIId.—Production of Industrial Minerals[1], 1950 and 1951, by Mining Divisions

Division	Year	Barite		Diatomite		Fluxes (Limestone, Quartz)		Granules		Gypsum and Products		Mica		Sulphur		Totals
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
		Tons	$	Tons	$	Tons	$	Tons	$	Tons	$	Lb.	$	Tons	$	$
Cariboo	1950											456,000	5,533			5,533
	1951											**606,000**	**7,462**			**7,462**
Fort Steele	1950									12,048	24,096					24,096
	1951									**11,289**	**22,578**					**22,578**
Golden	1950	1,440	17,284							9,711	24,277					41,561
	1951	**1,248**	**16,224**							**33,400**	**83,500**					**99,724**
Greenwood	1950					38,899	38,899									38,899
	1951					**36,850**	**36,850**									**36,850**
Kamloops	1950									71,123	571,735					571,735
	1951									**80,040**	**156,994**					**156,994**
Nanaimo	1950					85,856	107,584									107,584
	1951					**89,104**	**141,857**									**141,857**
New Westminster	1950															
	1951							**892**	**7,135**							**7,135**
Osoyoos	1950					19,570	121,928									121,928
	1951					**18,281**	**113,393**									**113,393**
Quesnel	1950			4	108											108
	1951			**8**	**223**											**223**
Trail Creek	1950													137,531	1,375,310	1,375,310
	1951													**141,000**	**1,410,000**	**1,410,000**
Vancouver	1950							7,886	104,590					5,812	46,496	151,086
	1951							**4,835**	**66,632**					**53,874**	**430,992**	**497,624**
Totals	1950	1,440	17,284	4	108	144,325	268,411	7,886	104,590	92,882	620,108	456,000	5,533	143,343	1,421,806	2,437,840
	1951	**1,248**	**16,224**	**8**	**223**	**144,235**	**292,100**	**5,727**	**73,767**	**124,729**	**263,072**	**606,000**	**7,462**	**194,874**	**1,840,992**	**2,493,840**

[1] No value shown for experimental shipments of pyrophyllite from Semlin Siding, Kamloops Mining Division, and talc from Armstrong, Vernon Mining Division.

TABLE VIIE.—PRODUCTION OF STRUCTURAL MATERIALS, 1950 AND 1951, BY MINING DIVISIONS

Division	Year	Cement	Lime and Limestone	Building-stone	Rubble, Riprap, and Crushed Rock	Sand and Gravel	Brick (Common)	Face, Paving, and Sewer Brick	Fire-bricks, Blocks	Clays	Structural Tile (Hollow Blocks), Roof-tile, Floor-tile	Drain-tile and Sewer-pipe	Pottery (Glazed or Unglazed)	Other Clay Products	Division Total
		$	$	$	$	$	$	$	$	$	$	$	$	$	$
Ainsworth	1950					13,940									13,940
	1951					7,850									7,850
Alberni	1950					28,428									28,428
	1951					61,392									61,392
Atlin	1950					245									245
	1951					1,000									1,000
Cariboo	1950				49,055	80,353									129,408
	1951				2,340	75,581									77,921
Clinton	1950					693									693
	1951														
Fort Steele	1950				5,564	129,447									135,011
	1951				7,509	78,444									85,953
Golden	1950					221,237									221,237
	1951					17,971									17,971
Greenwood	1950				22,017	16,384									38,401
	1951				536	13,976									14,512
Kamloops	1950				129,091	122,174									251,265
	1951				160,648	169,734									330,382
Lillooet	1950				30,813	39,539									70,352
	1951				3,119	42,926									46,045
Nanaimo	1950		1,029,448	144,000	1,772	120,668	74,750								1,370,638
	1951		1,131,630	252,000	730	99,883									1,484,243
Nelson	1950			5,000	9,016	153,879									167,895
	1951			13,000	8,032	89,183									110,215
New Westminster	1950		69,893		363,366	784,996	15,000	52,823	187,195	24,902	129,640	384,513			2,012,328
	1951		81,793		373,307	763,768	22,000	151,125	324,552	55,485	118,769	377,792		5	2,268,596
Nicola	1950				134	2,490									2,624
	1951				2,062	10,325									12,387
Omineca	1950				385	70,442									70,827
	1951				1,783	55,429									57,212
Osoyoos	1950				3,400	17,916									21,316
	1951			2,600	19,000	64,650									86,250
Peace River	1950				43	5,674									5,717
	1951				208	42,768									42,976
Quesnel	1950					4,568									4,568
	1951					2,360									2,360
Revelstoke	1950				7,150	46,718									53,868
	1951				3,100	57,276									60,376
Similkameen	1950				23,727	80,384									104,111
	1951				3,000	38,772									41,772
Skeena	1950		12,610		52,794	17,136				300					82,840
	1951		37,904		31,584	140,661				2,000					212,149
Slocan	1950				800										800
	1951					6,750									6,750
Stikine	1950				70	725									795
	1951				20	78									98
Trail Creek	1950			800	1,250	43,491									45,541
	1951			4,800		59,593									64,393
Vancouver	1950			36,710	270,352	1,092,297	2,870	1,680	67,067	7,062				11,335	1,489,373
	1951			36,000	528,015	991,368	1,982	2,450	56,190	2,770				10,388	1,629,163
Vernon	1950		10,175	2,165	17,726	50,167									80,233
	1951			950	79	33,221									34,250
Victoria	1950	3,088,296	11,650		1,732	579,496	11,220				61,376	43,905	5,860		3,803,535
	1951	3,311,439				430,734					52,712	32,414	4,695		3,831,994
Totals	1950	3,088,296	1,133,776	188,675	990,257	3,723,487	103,840	54,503	254,262	32,264	191,016	428,418	5,860	11,335	10,205,989
	1951	3,311,439	1,251,723	309,350	1,145,072	3,355,693	23,982	153,575	380,742	60,255	171,481	410,206	4,695	10,393	10,588,210

Table VIII.—Production (Total Quantity and Value) of Placer Gold[1] and of Principal Lode Metals, by Mining Divisions, to End of 1951

Division	Gold—Placer[1]		Gold—Lode		Silver		Copper		Lead		Zinc		Division Totals
	Quantity[3]	Value	Quantity[4]	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
	Oz.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
Ainsworth	212	5,690	4,666	142,082	7,113,861	4,405,319	10,175	1,201	137,407,731	8,306,557	57,828,813	3,924,998	16,785,847
Alberni	1,607	32,908	299,640	11,218,749	160,717	77,175	2,233,880	335,145	112,888	4,473	......	......	11,668,450
Atlin (1898)[1]	697,576	16,311,444	250,677	8,927,130	88,247	62,624	204,965	45,689	300,733	42,141	381,141	75,847	25,464,875
Cariboo (1858)[1]	1,935,751	39,716,085	758,038	27,795,552	84,181	45,882	......	......	2,815	371	492	16	67,557,906
Clinton	10,014	238,628	23,388	827,260	31,564	14,214	57,548	5,905	193	7	......	......	1,086,014
Fort Steele	17,264	400,583	2,534	57,038	173,573,450	90,812,977	28,592	6,193	9,600,429,122	568,963,351	6,578,522,268	412,284,906	1,072,525,048
Golden	467	11,213	84	1,955	1,639,687	1,034,662	57,378	10,590	115,457,382	6,452,934	141,475,761	8,085,065	15,596,419
Greenwood	4,049	94,964	1,087,380	23,460,733	26,749,715	14,548,592	441,226,021	70,504,065	11,533,981	702,917	11,841,032	664,436	109,975,707
Kamloops	14,473	341,070	47,852	1,607,821	298,108	176,782	6,400,908	1,177,415	369,523	20,851	409,228	26,072	3,350,011
Lillooet (1874)[1]	90,964	1,867,539	2,364,004	83,220,382	618,923	326,891	400	41	62,463	2,542	......	......	85,417,396
Nanaimo	611	14,162	77,851	1,791,525	548,378	323,644	21,596,511	3,531,737	......	......	......	......	5,661,068
Nelson	3,203	80,509	1,303,375	40,993,966	4,354,512	2,397,576	5,685,261	889,008	82,110,884	7,061,035	106,175,214	15,346,712	66,768,806
New Westminster	11,413	238,186	4,311	110,307	13,529	6,072	26,489	6,379	28,425	1,119	12,755	481	362,544
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	50,805	1,352,191	13,589	380,901	4,530,615	3,308,702	6,126,209	1,345,688	10,464,394	1,042,705	11,389,471	1,474,707	8,904,894
Osoyoos	190	4,142	1,426,729	42,663,160	556,271	360,097	2,585,693	338,081	256,679	8,106	6,570	355	43,373,941
Peace River	4,152	96,079	......	......	......	......	......	......	......	......	......	......	96,079
Quesnel (1858)[1]	632,659	13,260,785	218	7,871	1,926	1,521	82	17	15,772	2,561	13	3	13,272,758
Revelstoke	5,867	127,438	24,906	652,885	2,865,601	1,159,417	6,277	909	10,648,516	458,828	507,421	28,457	2,427,934
Similkameen	9,712	238,689	143,943	4,953,938	3,409,854	1,892,142	480,908,479	71,561,656	245,026	10,193	69,390	3,614	78,660,232
Skeena	4,366	98,860	2,378,430	59,725,077	55,495,058	32,623,663	657,349,349	98,012,119	48,205,250	3,308,523	9,241,622	1,422,368	195,190,610
Slocan	150	3,596	7,126	183,749	42,362,857	25,954,958	219,318	42,287	312,792,862	16,580,421	320,270,432	24,116,687	66,881,698
Stikine	45,744	1,143,881	114	4,120	204	146	......	......	5,810	1,048	......	......	1,149,195
Trail Creek[2]	848	24,176	2,606,389	55,646,325	3,556,419	2,044,827	124,933,207	19,183,349	18,313,095	892,056	158,015,410	5,305,661	83,096,394
Vancouver	182	5,306	369,772	11,607,698	4,162,742	2,380,802	821,558,395	118,462,874	12,029,805	942,186	85,365,445	11,668,200	145,067,066
Vernon	2,181	57,601	5,223	176,048	8,668	4,636	654	100	11,828	1,139	7,015	726	240,250
Victoria	620	15,453	37,397	807,235	795,994	438,329	21,293,260	3,171,610	210,097	19,848	3,568,709	283,923	4,736,398
Totals	3,545,310	75,785,830	13,246,161	377,198,422	333,288,179	184,527,967	2,593,059,026	388,738,288	10,360,250,411	614,916,381	7,485,408,688	484,723,800	2,125,890,688

[1] 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.

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

[3] Crude gold.

[4] Fine gold.

TABLE IX.—QUANTITY AND VALUE OF COAL PER YEAR TO DATE[1]

Year	Tons (2,000 Lb.)	Value	Year	Tons (2,000 Lb.)	Value
1836–85	3,392,492	$9,468,557	1919	2,698,022	$11,975,671
1886	365,832	979,908	1920	3,020,387	13,450,169
1887	462,963	1,240,080	1921	2,877,995	12,836,013
1888	548,017	1,467,903	1922	2,890,625	12,880,060
1889	649,410	1,739,490	1923	2,848,146	12,678,548
1890	759,517	2,034,420	1924	2,226,037	9,911,935
1891	1,152,589	3,087,291	1925	2,737,607	12,168,905
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	1,054,337	2,824,687	1929	2,521,402	11,256,260
1896	1,005,548	2,693,961	1930	2,113,586	9,435,650
1897	1,017,680	2,734,522	1931	1,912,501	7,684,155
1898	1,330,622	3,582,595	1932	1,719,172	6,523,644
1899	1,513,664	4,090,227	1933	1,416,516	5,375,171
1900	1,780,776	4,744,530	1934	1,508,741	5,725,133
1901	1,894,544	5,016,398	1935	1,330,524	5,048,864
1902	1,838,621	4,832,257	1936	1,508,048	5,722,502
1903	1,624,742	4,332,297	1937	1,618,049	6,139,920
1904	1,887,981	4,953,024	1938	1,466,559	5,565,069
1905	2,044,931	5,511,861	1939	1,655,217	6,280,956
1906	2,126,965	5,548,044	1940	1,867,966	7,088,265
1907	2,485,961	7,637,713	1941	2,018,635	7,660,000
1908	2,362,514	7,356,866	1942	2,170,737	8,237,172
1909	2,688,672	8,574,884	1943	2,040,253	7,742,030
1910	3,515,944	11,108,335	1944	2,165,676	8,217,966
1911	2,573,444	8,071,747	1945	1,700,914	6,454,360
1912	3,388,795	10,786,812	1946	1,639,277	6,220,470
1913	2,879,251	9,197,460	1947	1,923,573	8,587,380
1914	2,426,399	7,745,847	1948	1,809,018	10,854,108
1915	2,209,290	7,114,178	1949	1,917,296	12,462,424
1916	2,783,849	8,900,675	1950	1,542,404	10,025,626
1917	2,686,561	8,484,343	1951	1,574,362	10,233,353
1918	2,887,170	12,833,994			
			Totals	131,121,849	$488,142,256

[1] Includes coal used in making coke, *see* Table X and discussion under "Fuel," page 14.

TABLE X.—COKE AND BY-PRODUCTS PRODUCTION FOR YEARS 1895 TO 1925[1] AND 1926 TO 1951

Year	Coal Used in Making Coke (Short Tons)		Coke Made in Bee-hive Ovens (Short Tons)		Coke Made in By-product Ovens (Short Tons)		Coke Made in Gas Plants (Short Tons)		Total Coke Made (Short Tons)		Gas Sold and Used	Tar Produced	Other By-products[2]	Total Production Value of Coke Industry
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value				
		$		$		$		$		$	$	$	$	$
1895–1925	7,955,795	25,673,600	4,920,457	25,673,600	....	....	....	....	4,920,457	25,673,600	....	....	....	25,673,600
1926	299,839	1,338,565	105,227	795,841	42,209	244,469	42,468	221,600	189,904	1,261,910	1,009,613	50,035	45,772	2,367,330
1927	269,482	1,290,760	95,281	595,504	35,900	327,215	39,464	178,682	170,645	1,101,401	1,222,379	44,402	18,080	2,386,262
1928	210,207	940,668	68,734	429,590	32,322	263,781	41,711	187,882	142,767	881,253	1,313,407	45,313	14,036	2,254,009
1929	226,363	950,243	75,426	574,279	33,339	308,867	46,573	214,732	155,338	1,097,878	1,461,445	61,084	39,203	2,659,610
1930	225,325	1,002,684	73,708	558,801	31,904	298,004	45,751	232,917	151,363	1,089,722	1,547,092	65,770	11,935	2,714,519
1931	211,334	924,279	73,248	548,550	27,717	236,537	41,836	210,470	142,801	995,557	1,541,454	66,506	32,603	2,636,120
1932	151,750	710,432	33,090	247,615	25,436	217,221	44,645	237,174	103,171	702,010	1,589,656	54,771	14,109	2,360,546
1933	107,400	554,152	6,097	44,813	24,263	213,750	34,156	214,454	64,516	473,017	1,473,433	45,610	3,666	1,995,726
1934	141,384	571,167	24,840	154,105	23,512	213,653	51,184	198,217	99,536	565,975	1,439,287	43,939	4,756	2,053,957
1935	127,776	494,492	27,066	160,565	14,911	109,684	46,111	160,694	88,088	430,943	1,430,057	44,876	3,081	1,908,957
1936	125,810	436,595	34,009	191,843	....	....	48,859	138,787	82,868	330,630	1,422,783	38,872	....	1,792,285
1937	166,124	570,250	48,393	277,726	....	....	59,141	330,821	107,534	608,547	1,746,047	46,698	....	2,401,292
1938	176,877	623,649	54,602	315,294	....	....	58,643	345,790	113,245	661,084	1,770,839	44,324	....	2,476,247
1939	171,242	569,945	50,153	286,491	7,196	37,015	55,395	325,435	112,744	648,941	1,768,977	44,108	....	2,462,026
1940	184,160	577,706	37,845	220,211	29,124	151,931	60,726	303,421	127,695	675,563	1,810,083	54,379	3,060	2,543,085
1941	235,809	717,584	64,707	392,473	86,656	467,440	8,378	43,758	159,741	903,671	1,925,270	63,569	1,716	2,894,226
1942	255,862	866,795	66,824	439,464	96,428	608,521	6,528	54,307	169,780	1,102,292	2,165,888	86,113	22,028	3,376,321
1943	260,334	983,910	42,766	291,843	43,895	274,402	93,714	647,482	180,375	1,213,727	2,453,592	96,249	18,321	3,781,889
1944	212,883	1,439,891	36,966	301,201	47,401	347,245	88,430	565,393	172,797	1,213,839	2,562,610	56,476	19,046	3,851,971
1945	230,868	1,211,584	13,464	117,369	59,098	434,876	91,682	577,479	164,244	1,129,724	2,721,690	83,828	20,756	3,955,998
1946	251,954	1,441,415	20,542	178,556	53,525	423,025	101,094	648,297	175,161	1,249,878	3,079,009	88,947	53,097	4,470,931
1947	284,049	1,682,602	44,517	427,330	59,638	531,114	91,755	579,635	195,910	1,538,079	3,390,713	124,885	25,780	5,079,457
1948	235,297	1,440,415	47,461	559,735	57,112	630,390	57,678	455,096	162,251	1,645,221	4,520,886	153,130	19,489	6,338,726
1949	323,899	1,979,138	66,407	690,045	89,268	1,018,288	67,449	496,933	223,124	2,205,266	4,148,124	194,728	27,406	6,575,524
1950	333,955	2,027,470	23,703	269,728	127,477	997,200	92,704	686,871	243,884	1,953,799	4,298,161	277,138	27,944	6,557,042
1951	332,416	1,949,117	32,598	387,796	138,051	1,552,764	72,215	571,161	242,864	2,511,721	4,263,754	277,786	22,132	7,075,393
Totals	13,708,194	52,969,108	6,188,131	35,130,368	1,186,382	9,907,392	1,488,290	8,827,488	8,862,800	53,865,248	58,076,249	2,253,536	448,016	114,643,049

[1] *See* foot-note with Table IX—Coal Production.

[2] "Other by-products" includes ammonium sulphate, $52,492; ammonia liquor, $103,850; light oils, $16,571; motor fuel, $7,009; naphthalene, $4,077; creosote, $34; benzol (thinning), $312; solvent naphtha, $644; cinders, $238,081; pitch, $5,131; sulphuric acid, $6,658; tar-paint, $2,330; and miscellaneous, $10,827.

TABLE XI.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1951

Lode-gold Mines[1]

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	16,325,450
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[2]
Goodenough (leasers)	Ymir	Gold	13,731
Hedley Mascot Gold Mines Ltd.	Hedley	Gold	1,290,553
Island Mountain Mines Ltd.	Wells	Gold	1,518,274
I.X.L.	Rossland	Gold	134,025
Jewel-Denero	Greenwood	Gold	11,751
Kelowna Exploration Co. Ltd. (Nickel Plate)	Hedley	Gold	2,040,000
Kelowna Mines Hedley Ltd.	Hedley	Gold	240,000[3]
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[4]
Privateer Mine Ltd.	Zeballos	Gold	1,914,183
Queen (prior to Sheep Creek Gold Mines Ltd.)	Sheep Creek	Gold	98,674
Relief Arlington Mines Ltd. (Second Relief)	Erie	Gold	308,000[2]
Reno Gold Mines Ltd.	Sheep Creek	Gold	1,433,640[2]
Sheep Creek Gold Mines Ltd.	Sheep Creek	Gold	3,384,375[5]
Silbak Premier Mines Ltd.	Premier	Gold	2,375,000[4]
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[2]
Miscellaneous mines		Gold	108,623
Total, lode-gold mines			$73,702,837

[1] The gold-copper properties of Rossland are included in this table.
[2] Includes " Return of Capital " distributions.
[3] Former Kelowna Exploration Company Limited; changed in January, 1951.
[4] 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.
[5] In recent years, company revenue has included profits from operation of the Lucky Jim zinc-lead mine.

TABLE XI.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1951—*Continued*

Silver-Lead-Zinc Mines

Company or Mine	Locality	Class	Amount Paid
Antoine	Rambler	Silver-lead-zinc	$10,000
Base Metals Mining Corporation Ltd. (Monarch and Kicking Horse)	Field	Silver-lead-zinc	586,143[1]
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
Capelia	New Denver	Silver-lead-zinc	5,500
Consolidated Mining and Smelting Co. of Canada, Ltd.	Trail	Silver-lead-zinc	309,088,834[2]
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	1,319,733
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[3]
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[4]	Sandon	Silver-lead-zinc	1,267,600
Silver Standard Mines Ltd.	Hazelton	Silver-lead-zinc	750,453
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			$322,358,434

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

TABLE XI.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1951—*Continued*

Copper Mines

Company or Mine	Locality	Class	Amount Paid
Britannia M. & S. Co.[1]	Britannia Beach	Copper	$15,588,806
Canada Copper Corporation	Greenwood	Copper	615,399
Cornell	Texada Island	Copper	8,500
Granby Cons. M.S. & P. Co.[2]	Copper Mountain	Copper	28,859,704
Marble Bay	Texada Island	Copper	175,000
Hall Mines	Nelson	Copper	233,280
Miscellaneous mines		Copper	261,470
Total, copper mines			$45,742,159

[1] 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.

[2] 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
Bulkley Valley Collieries Ltd., Telkwa	6,000
Crow's Nest Pass Coal Co. Ltd., Fernie	14,731,558
Canadian Collieries (D.) Ltd.	506,934
Total	$31,244,492

Miscellaneous, Structural, and Placer Gold

Various	$4,373,655

Aggregate of All Classes

Lode-gold mining	$73,702,837
Silver-lead-zinc mining and smelting	322,358,434
Copper mining	45,742,159
Coal-mining	31,244,492
Miscellaneous, structural, and placer gold	4,373,655
Total	$477,421,577

TABLE XI.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1951—*Continued*

Dividends Paid Yearly, 1917–51, Inclusive

Year	Amount Paid	Year	Amount Paid
1917	$3,269,494	1936	$10,513,705
1918	2,704,469	1937	15,085,293
1919	2,494,283	1938	12,068,875
1920	1,870,296	1939	11,865,698
1921	736,629	1940	14,595,530
1922	3,174,756	1941	16,598,110
1923	2,983,570	1942	13,627,104
1924	2,977,276	1943	11,860,159
1925	5,853,419	1944	11,367,732
1926	8,011,137	1945	10,487,395
1927	8,816,681	1946	15,566,047
1928	9,572,536	1947	27,940,213
1929	11,263,118	1948	37,672,319
1930	10,543,500	1949	33,651,096
1931	4,650,857	1950	34,399,330
1932	2,786,958	1951	40,921,238
1933	2,471,735		
1934	4,745,905	Total	$414,532,533
1935	7,386,070		

Dividends Paid during 1950 and 1951

	1950	1951
Bralorne Mines Ltd.	$498,800	$498,800
Britannia Mining and Smelting Co. Ltd.	771,135	2,314,784
Bulkley Valley Collieries Ltd.		6,000
Canadian Collieries (D.) Ltd.	168,978	112,676
The Consolidated Mining and Smelting Co. of Canada, Ltd.	31,121,647	36,035,666
The Crow's Nest Pass Coal Co. Ltd.	248,472	248,472
The Granby Consolidated Mining Smelting and Power Co. Ltd.	483,085	225,116
Highland-Bell Ltd.	156,586	156,586
Island Mountain Mines Ltd.	52,536	52,536
Kelowna Exploration Co. Ltd.	300,000	
Kelowna Mines Hedley Ltd.		240,000
Sheep Creek Gold Mines Ltd.	150,000	206,240
Silver Standard Mines Ltd.	150,091	600,362
Others	298,000	224,000
Totals	$34,399,330	$40,921,238

TABLE XII.—SALARIES AND WAGES, FUEL AND ELECTRICITY, AND PROCESS SUPPLIES, 1951

Class	Salaries and Wages	Fuel and Electricity	Process Supplies
Lode-mining	$40,305,776	$5,011,492	$19,260,434
Placer-mining	288,617	34,272	84,975
Coal-mining	5,853,004	350,957	969,762
Miscellaneous metals and industrial minerals	2,601,079	355,927	3,521,853
Structural materials industry	3,513,476	1,530,403	887,077
Totals, 1951	**$52,561,952**	**$7,283,051**	**$24,724,101**
Grand totals, 1950	42,738,035	6,775,998	17,500,663
Grand 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[1]	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, 1935–51	$482,760,516	$87,912,547	$161,722,444

[1] Estimated.

NOTE.—The above figures, compiled from returns 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 XIII.—Lode-metal Mines—Tonnage, Number of Mines, Net and Gross Value of Principal Metals,[4] 1901–51

Year	Tonnage[1]	Number of Shipping Mines	Number of Mines Shipping over 100 Tons	Gross Value as Reported by Shipper[2]	Freight and Treatment	Net Value to Shipper[3]	Gross Value of Lode Metals Produced[4]
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
1950	6,782,912	112	58	108,864,792	22,113,431	86,751,361	121,635,457
1951	**6,711,471**	**119**	**64**	**142,590,427**	**25,096,743**	**117,493,684**	**146,140,477**

[1] Does not include mercury nor tungsten ores, iron ores, or silica (flux).
[2] Data not collected before 1937.
[3] Previous to 1937 the shipper reported "Net Value at Shipping Point," no indication being given as to how the net value was computed. From 1937 on the shipper has reported "Gross Value," from which deduction of freight and treatment gives "Net Value."
[4] Gross value as represented by valuing gold, silver, copper, lead, and zinc at yearly average prices.

TABLE XIV.—AVERAGE NUMBER EMPLOYED IN THE MINING INDUSTRY, 1901–51

Year	Placer-mining	Lode-mining			In Concentrators	In Smelters	Coal-mining			Structural Materials		Miscellaneous	Total[1]
		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
1950	327	3,399	2,415	5,814	1,259	3,759	1,745	516	2,261	1,916	616	660	16,612
1951	**205**	**3,785**	**3,695**	**7,480**	**1,307**	**4,044**	**1,462**	**463**	**1,925**	**1,783**	**628**	**491**	**17,863**

[1] 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 XV.—Lode-metal Producers in 1951

Property or Operator	Location of Mine	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Contents: Gold	Silver	Copper	Lead	Zinc	Cadmium
Ainsworth Mining Division			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
August Fraction	Woodbury Creek	Dr. L. D. Besecker, Kaslo	47	Crude ore		62		4,850	2,902	
Ayesha	Ainsworth	T. Lane, Ainsworth	6	Crude ore		21		798	1,178	
Black Fox	Keen Creek	Ainsworth Base Metals Ltd., Vancouver	192	Zinc concentrates, 36 tons		382		900	36,900	
Black Prince	Ainsworth	Dennis G. White, Nelson	4	Crude ore		16		479	9	
B.N.A.	Kaslo Creek	W. E. Newton and L. V. Newton, Penticton	7	Crude ore		1,162		1,584	1,910	
Cork-Province	Keen Creek	Base Metals Mining Corp. Ltd., Vancouver	19,796	Lead concentrates, 506 tons; zinc concentrates, 2,221 tons	14	31,344		690,658	2,357,167	20,382
Charleston	Retallack	Slocan Charleston Mines Ltd., Seattle	642	Lead concentrates, 15 tons; zinc concentrates, 35 tons		1,603		22,760	41,178	
Daisy Bell	Ainsworth	Woodbury Mines Ltd., Ainsworth	37	Crude ore		391		17,394	7,739	
Dixie	Woodbury Creek	Dr. L. D. Besecker, Kaslo	1	Crude ore		7		500	200	
Early Bird	Ainsworth	W. C. Robinson, Ainsworth	3	Crude ore		12		1,339	729	
Highland	Ainsworth	Crude — E. Meyer and B. Sterna, Ainsworth; tailings—F. J. Dumas, *Ainsworth*	80	Crude ore, 64 tons; tailings, 16 tons		1,088		58,915	7,102	
Highlander	Ainsworth	Yale Lead & Zinc Mines Ltd., Ainsworth	36,355	Lead concentrates, 2,249 tons; zinc concentrates, 376 tons	27	56,946		3,113,685	490,778	
Jackson	Retallack	Selkirk Mining Co. Ltd., Vancouver	902	Crude ore, 4 tons; lead concentrates, 6 tons; zinc concentrates, 139 tons	1	841		5,812	230,568	
Budweiser	Woodbury Creek	Kaslo Base Metals Ltd., Vancouver	3	Crude ore		6		411	576	
Kootenay Florence	Ainsworth	Ainsmore Mines Ltd. and Western Mines Ltd., Ainsworth	17,984	Lead concentrates, 976 tons; zinc concentrates, 687 tons	5	23,473		1,311,010	645,401	2,784
Carey Fraction (Lakeshore)	Ainsworth	T. Lane and J. Matthews, Ainsworth	11	Crude ore		47		4,003	1,903	
Laurier	Ainsworth	W. Glasspoole and T. Lane, Ainsworth	9	Crude ore		93		2,872	1,717	
Moonstone	Ainsworth	R. M. Robinson, Nelson	1	Crude ore		20		662	81	
Montezeuma	Keen Creek	Kootenay Belle Gold Mines Ltd. Vancouver	36	Tailings		419		3,538	13,533	
Motherlode	Blaylock	G. E. McCready, Kaslo	3	Crude ore		492		3,836	189	
Nameless Fraction	Woodbury Creek	C. A. McLeish and W. McCulloch, Kaslo	1,248	Crude ore		1,975		141,247	105,401	
Nicolet	Ainsworth	A. Dosenberger, Ainsworth	6	Crude ore		17		2,121	1,403	
Pilot Bay	Pilot Bay	G. L. Green and J. Asher, Nelson	—	Tailings; lead concentrates, 23 tons; zinc concentrates, 517 tons		2,004		45,538	524,211	
Scranton	Woodbury Creek	Scranton Cons. Mining Co. Ltd., Ainsworth	1,135	Crude ore	254	15,357		346,956	329,933	
Spokane	Ainsworth	T. Hawes and J. E. Hawes, Ainsworth	39	Crude ore		569		37,699	4,757	
Star	Ainsworth	D. H. Norcross, Nelson	466	Crude ore	13	3,293		82,927	76,730	
Glacier-Surprise	Howser	J. Gallo and L. Disereau, Lardeau	976	Crude ore	15	29,403		17,564	17,506	
Utica	Kaslo Creek	Utica Mines (1937) Ltd., Kaslo	95	Ore from dump		158		1,579	5,423	

TABLE XV.—LODE-METAL PRODUCERS IN 1951—*Continued*

Property or Operator	Location of Mine	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Contents					
					Gold	Silver	Copper	Lead	Zinc	Cadmium
Ainsworth Mining Division—Continued			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Vigilant	Woodbury Creek	J. A. Cooper, Ainsworth	1,220	Crude ore	1	3,699		229,289	109,249	
Winona Boon	Jackson Basin	L. N. Garland, Retallack	7	Crude ore		670		7,579	1,975	
Whitewater	Retallack	Retallack Mines Ltd. (Kootenay Belle Gold Mines Ltd.), Retallack	30,152	Lead concentrates, 219 tons; zinc concentrates, 1,135 tons		33,475		280,071	1,190,439	
Alberni Mining Division										
Privateer	Zeballos	Privateer Mine Ltd. and lessees, Zeballos	199	74 tons ore and 25 tons clean-up	460	172				
Spud Valley	Zeballos	Spud Valley Gold Mines Ltd., Vancouver	125	Bullion and concentrates (clean-up)	67	19				
Atlin Mining Division										
Atlin-Ruffner	Atlin	Atlin-Ruffner Mines (B.C.) Ltd., Vancouver	44	Crude ore	9	5,343		36,197	5,829	
Polaris-Taku	Tulsequah	Polaris-Taku Mining Co. Ltd., Vancouver	20,700	Bullion; gold concentrates, 1,899 tons	14,583	647				
Big Bull and Tulsequah Chief	Tulsequah	Tulsequah Mines Ltd., Trail	23,765	Zinc concentrates, 402 tons; copper-lead concentrates, 422 tons	975	20,408	126,024	164,633	568,231	
Cariboo Mining Division										
Cariboo Gold Quartz	Wells	Cariboo Gold Quartz Mining Co. Ltd., Vancouver	69,842	Bullion	24,374	2,383				
Island Mountain	Wells	Island Mountain Mines Co. Ltd., Vancouver	39,290	Bullion	16,736	2,377				
Fort Steele Mining Division										
Estella	Wasa	Estella Mines Ltd., Vancouver	8,600	Lead concentrates, 343 tons; zinc concentrates, 1,053 tons		6,222		405,872	1,248,056	
Judylu	Fort Steele	J. M. Falkins, Cranbrook	25	Crude ore		59		5,333	246	
Society Girl	Moyie	Society Girl Mining Syndicate, Vancouver	914	Crude ore		1,438		112,471	11,622	
Sullivan	Kimberley	Cons. Mining & Smelting Co. of Canada, Ltd., Trail	2,533,212	Lead concentrates, 162,314 tons; zinc concentrates, 248,677 tons		3,197,829		248,539,001	275,833,444	
Golden Mining Division										
Not known	Spillimacheen	G. W. Edwards, Spillimacheen	1	Crude ore		25		395	98	
Giant Mascot	Spillimacheen	Giant Mascot Mines Ltd., Spillimacheen	18,262	Lead concentrates, 3,000 tons		36,562		3,211,651	295,483	
Monarch and Kicking Horse	Field	Base Metals Mining Corp. Ltd., Field	24,806	Lead concentrates, 622 tons; zinc concentrates, 3,962 tons		14,752		1,031,613	4,225,501	
Paradise	Invermere	Sheep Creek Gold Mines Ltd., Vancouver	15,169	Lead concentrates, 1,104 tons; zinc concentrates, 2,710 tons		61,266		1,240,055	2,584,225	
Greenwood Mining Division										
Albion	Greenwood	Mines Management Corp Ltd. and Granville Mines Corp. Ltd., Nelson	88	Crude ore	20	114		446	332	

Dynamo	Greenwood	Dynamo Mining Syndicate, c/o M. M. Butorac, Trail	36	Crude ore		188		10,804	3,127	
Gold Drop (Jim Group)	Greenwood	Jim Group Syndicate, Beaverdell	3	Crude ore	1	17		689	188	
Highland-Bell	Beaverdell	Highland-Bell Ltd., Vancouver	14,162	Lead concentrates, 683 tons; zinc concentrates, 430 tons	229	717,414		355,309	507,857	4,417
Not known	Beaverdell	Delbert Hood	3	Crude ore		148		183	449	
Providence	Greenwood	Wanke & Johnson and Kleman & Twombley, Greenwood	26	Crude ore	22	4,618		2,074	2,166	
Silver Dollar	Beaverdell	N. Puhaty, Vancouver	1	Crude ore		12		304	246	
Zamora	Rock Creek	G. E. White, Oliver	30	Crude ore		148		3,426	2,894	
Lillooet Mining Division										
Bralorne	Bridge River	Bralorne Mines Ltd.	168,194	Bullion; gold concentrates, 3,672 tons	79,593	21,500				
Pioneer	Bridge River	Pioneer Gold Mines of B.C. Ltd., Vancouver	77,720	Bullion	38,202	8,215				
Nanaimo Mining Division										
Vananda	Vananda	Vananda Mines (1948) Ltd., Vancouver	23,356	Crude ore	4,265	14,092	631,243			
Nelson Mining Division										
Alice	Creston	R. Welloff and S. Maines, Creston	20	Crude ore		303		17,638	135	
Arlington	Erie	B. Golac and A. H. Shrieves, Erie	[1]250	Lead concentrates, 15 tons	35	119		1,630	2,807	
Bayonne	Tye	Bayonne Leasers, Tye	96	Crude ore	65	312		5,041	1,725	
Cricket	Kuskanook	Bainbridge Mining Partnership, Boswell	3	Crude ore		36		623	47	
Delaware	Creston	F. E. Crawford, Creston	11	Crude ore		85		5,002	56	
Dundee	Ymir	Burgess Bros. & Lundgren; J. Rankin and E. Emilson, Ymir	460	Crude ore	215	2,648		79,053	96,940	
Gold Belt	Sheep Creek	Gold Belt Leasing Syndicate, Sheep Creek	88	Crude ore	92	135				
Granite Poorman	Taghum	Lessee, H. Cooper from Kenville Mines Ltd., Nelson	15	Crude ore	10	40				
Jersey Zinc	Salmo	Canadian Exploration Ltd., Salmo	197,064	Lead concentrates, 5,051 tons; zinc concentrates, 18,959 tons		12,258		7,406,438	21,202,540	163,324
Lakeview	Sanca	Mrs. K. C. Timmons, Boswell; Glenn L. Carpenter, Sanca	86	Crude ore	1	554		26,665	47,652	
Protection (Goodenough)	Ymir	D. Cesaretti, Nelson; James Turk and Frank Padulo, Ymir; Pacific Mining Services Ltd., Vancouver	259	Crude ore	109	1,564		31,014	33,515	
Queen Mine	Sheep Creek	Sheep Creek Gold Mines Ltd., Nelson	22	Clean-up material and assay office buttons	199	93		169	793	
Reeves MacDonald	Remac	Reeves MacDonald Mines Ltd., Vancouver	298,162	Lead concentrates, 4,518 tons; zinc concentrates, 22,238 tons		30,745		6,044,119	23,408,833	159,889
Spokane	Bayonne	K. K. Laib, Bayonne	46	Crude ore	24	471		16,446	924	
Sun	Fortynine Creek	W. Rozan and R. Gauthier, Nelson	15	Crude ore	25	9		87	87	
Yankee Girl	Ymir	O. W. Gowing, Ymir	69	Tailings	6	289		10,125	22,112	
Omineca Mining Division										
Cronin Babine	Smithers	Cronin Babine Mines Ltd., Vancouver	61	Crude ore from old dump	3	2,009		28,195	35,632	
Emerald Glacier	Burns Lake	Emerald Glacier Mines Ltd., Montreal, Que.	1,658	Crude ore, 66 tons; lead concentrates, 111 tons; zinc concentrates, 246 tons	6	8,356		163,511	180,179	

[1] Estimated.

TABLE XV.—LODE-METAL PRODUCERS IN 1951—*Continued*

Property or Operator	Location of Mine	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Contents					
					Gold	Silver	Copper	Lead	Zinc	Cadmium
Omineca Mining Division—Continued			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Lake Surprise	Smithers	Lake Surprise Mines Ltd., Smithers	3	Crude ore	6	12	......	120	334	......
Silver Standard	Hazelton	Silver Standard Mines Ltd., Vancouver	20,858	Lead concentrates and zinc concentrates, 4,593 tons	1,516	889,849	......	1,845,945	2,977,490	41,997
Osoyoos Mining Division										
Fairview	Oliver	Cons. Mining & Smelting Co. of Canada, Ltd., Trail	18,281	Silica flux	......	......	......	......	......	......
Iota (Islay B)	*Hedley*	*K. G. Ewer and William Hegan, Penticton*	40	*Crude ore*	2	*480*	......	*4,681*	*1,031*	......
Nickel Plate	Hedley	Kelowna Mines Hedley Ltd., Hedley	115,488	Bullion; gold concentrates, 6,388 tons (including Oregon mine production)	48,846	10,354	146,112	......	......	......
Oregon (French)	Hedley	Kelowna Mines Hedley Ltd., Hedley	7,427	Included in Nickel Plate	......	......	......	......	......	......
Quesnel Mining Division										
Bear Group	China Mountain	H. C. Miller, Likely	7	Crude ore	1	683	......	6,401	15	......
Similkameen Mining Division										
Copper Mountain	Copper Mountain	Granby Cons. M.S. & P. Co. Ltd., Copper Mountain	1,740,876	Copper concentrates, 54,006 tons	7,947	172,331	25,974,054	......	......	......
Silver Hill	*Tulameen*	*Silver Hill Mines Ltd., Vancouver*	20	*Crude ore*	......	478	......	*6,787*	5,898	......
Skeena Mining Division										
W. Murray	*Stewart*	*W. Murray, 792 Powell St., Vancouver*	560	*Clean-up material from dock*	6	*8,508*	*1,746*	*7,997*	*168*	......
Premier Border	Premier	Premier Border Gold Mining Co. Ltd., Vancouver (operated by Silbak Premier Mines Ltd.)	13,781	Lead concentrates, 1,042 tons; zinc concentrates, 1,387 tons	1,072	29,518	......	1,307,543	1,537,464	11,530
Silbak Premier	Premier	Silbak Premier Mines Ltd., Vancouver	54,063	Lead concentrates, 1,770 tons; zinc concentrates, 3,714 tons	5,710	103,260	......	2,266,832	3,709,699	24,993
Silver Tip	Stewart	Silver Tip Gold Mines Ltd., Victoria	15	Crude ore	5	996	......	4,073	5,351	......
Torbrit	Kitsault River	Torbrit Silver Mines Ltd., Toronto, Ont.	119,711	Lead concentrates, 2,678 tons; silver bullion	19	2,051,190	......	833,425	122,593	......
Slocan Mining Division										
Altoona	Sandon	Kootenay Belle Gold Mines Ltd., Vancouver	4,228	Lead concentrates, 66 tons; zinc concentrates, 326 tons	......	5,027	......	66,377	319,077	......
Bosun	Silverton	Santiago Mines Ltd., Vancouver, and lessee, *N. Strebchuk, New Denver*	318	Crude ore	......	3,201	......	6,613	39,165	......
Carnation	Sandon	E. H. Petersen, Sandon	2	Crude ore	......	153	......	2,132	276	......
Discovery Fraction	Sandon	E. H. Petersen, Sandon	2	Crude ore	......	367	......	3,336	153	......
Elkhorn	Sandon	Kootenay Belle Gold Mines Ltd., Vancouver	3,033	Lead concentrates, 11 tons; zinc concentrates, 67 tons	......	1,068	......	14,510	67,259	......
Galena Farm	Silverton	Mills, Pengelly & Cooper, Silverton	418	Crude ore	......	625	......	15,039	36,254	......

Hope No. 2	Lemon Creek	W. Foster, Slocan City	12	Crude ore		25		618	1,607	
Monitor	Three Forks	Kootenay Belle Gold Mines Ltd., Vancouver	2,836 [2]6,972	Lead concentrates, 118 tons; zinc concentrates, 305 tons		24,045		87,891 3,499	196,990 7,612	
Noonday	Slocan Lake	G. W. Lyon and associates, Silverton	49	Crude ore	1	1,028				
Ottawa	Springer Creek	Harrison Drilling & Exploration Co. Ltd., Noranda, Que.	318	Crude ore	1	85,748				
Palmita	Sandon	C. Higgins, Sandon	2	Crude ore		180		3,253	47	
Rambler (tailings)	Retallack	Kootenay Belle Gold Mines Ltd., Vancouver	27,038	Zinc concentrates, 450 tons		16,411		49,545	426,634	3,705
Richmond Eureka	Sandon	Kootenay Belle Gold Mines Ltd., Vancouver	1,265 [2]10,187	Lead concentrates, 150 tons; zinc concentrates, 871 tons		25,604		176,118	897,354	
Ruth Hope	Sandon	Kootenay Belle Gold Mines Ltd., Vancouver	[2]7,206	Lead concentrates, 75 tons; zinc concentrates, 262 tons		13,748		94,586	272,219	
Silverleaf	Springer Creek	E. Kline and R. Stedile, Nelson	2	Crude ore		147		850	940	
Silver Ridge	Sandon	Silver Ridge Mining Co. Ltd., Sandon	335	Crude ore		708		10,995	6,056	
Silversmith	Sandon	Carnegie Mines of British Columbia Ltd., Montreal, Que.	265	Crude ore		1,077		7,153	41,518	
Speculator	Springer Creek	G. L. Clark and C. R. Stolz, Spokane, Wash.	17	Crude ore		209		883	844	
Van Roi	Silverton	Van Roi Consolidated Mines Ltd., Silverton	2,404	Lead concentrates, 217 tons; zinc concentrates, 302 tons	9	42,598		196,024	745,076	1,779
Violamac	Silverton	Violamac Mines (B.C.) Ltd., New Denver	6,089	Crude ore, 892 tons; lead concentrates, 640 tons; zinc concentrates, 365 tons	98	125,871		1,706,158	805,412	2,355
Standard, Enterprise, Mammoth	Silverton	Western Exploration Co. Ltd., Silverton	17,860 [2]7,287	Lead concentrates, 545 tons; zinc concentrates, 2,906 tons	26	91,440		657,315	3,161,645	12,145
White Hope	Slocan City	J. J. McDonell, Slocan City	23	Crude ore	1	204		6,772	7,991	
Lucky Jim (Zincton)	Zincton	Sheep Creek Gold Mines Ltd., Vancouver	83,934	Lead concentrates, 712 tons; zinc concentrates, 6,761 tons	7	40,989		606,275	7,369,341	42,336
Trail Creek Mining Division										
Bluebird	Rossland	Lovitt Mining Co. Ltd., Rossland	94	Crude ore	3	1,108		3,267	3,850	
Casino Redcap	Trail	Todd P. Voiken, Trail	6	Crude ore	2	8		142	59	
Midnight	Rossland	J. Cooper *et al.*, lessees, Rossland	41	Crude ore	234	114				
Vancouver Mining Division										
Britannia	Britannia Beach	Britannia Mining & Smelting Co. Ltd., Britannia Beach	796,566	Copper concentrates, 30,149 tons; zinc concentrates, 34,418 tons; pyrite concentrates, 45,082 tons	14,619	188,036	15,948,027	3,940,205	33,380,937	159,793
Vernon Mining Division										
Skookum	Vernon	Victor Volpatti, Port Kells	12	Crude ore	8	430	40	219		
Victoria Mining Division										
Twin J	Duncan	Vancouver Island Base Metals Ltd., Toronto, Ont.	9,754	Lead concentrates, 49 tons; zinc concentrates, 692 tons; copper concentrates, 214 tons	316	15,554	86,773	85,757	713,954	2,629

[2] Tailings.

Table XVI.—Lode-metal Mines Employing an Average of Ten or More Men during 1951[1]

Name of Mine or Operator	Days Operating		Tons		Average Number Employed	
	Mine	Mill	Mined	Milled	Mine	Mill
Shipping Mines						
Cork-Province (Base Metals Mining Corp. Ltd.)	365	257	19,796	19,796	57	6
Highlander (Yale Lead & Zinc Mines Ltd.)	281	260	27,887	36,355	72	13
Kootenay Florence (Ainsmore Consolidated Mines Ltd.)	270	270	13,300	13,300	20	3
Kootenay Florence (Western Mines Ltd.)	92	92	4,684	4,684	15	1
Whitewater (Kootenay Belle Gold Mines Ltd.)	360	360	13,424	30,152	81	44
Atlin-Ruffner Mines (B.C.) Ltd.	200	......	44	......	15	......
Polaris-Taku Mining Co. Ltd.	77	77	20,700	20,700	31	3
Big Bull and Tulsequah Chief (Tulsequah Mines, Ltd.)	244	152	23,765	23,765	132	16
Cariboo Gold Quartz Mining Co. Ltd.	304	364	69,842	69,842	182	16
Island Mountain Mines Co. Ltd.	280	365	39,290	39,290	125	11
Estella Mines Ltd.	282	59	9,200	8,600	100	2
Sullivan (Cons. M. & S. Co. of Canada, Ltd.)	248	248	2,533,212	2,533,212	1,525	464
Giant Mascot Mines Ltd.	313	211	18,262	18,262	71	6
Monarch and Kicking Horse (Base Metals Mining Corp. Ltd.)	275	150	24,806	24,806	62	5
Paradise (Sheep Creek Gold Mines Ltd.)	329	355	15,169	15,169	40	8
Highland-Bell Ltd.	273	273	14,162	14,162	44	7
Bralorne Mines Ltd.	365	365	168,194	168,194	443	20
Pioneer Gold Mines of B.C. Ltd.	*360*	*365*	*77,720*	*77,720*	*220*	*14*
The Argonaut Co. Ltd.	179	126	262,618	242,618	188	([2])
Vananda Mines (1948) Ltd.	311	......	23,356	......	34	......
Jersey (Canadian Exploration Ltd.)	336	335	197,064	197,064	588	29
Reeves MacDonald Mines Ltd.	279	351	298,162	298,162	155	19
Cronin Babine Mines Ltd.	360	......	61	......	24	([3])
Emerald Glacier Mines Ltd.	76	76	1,724	1,724	25	5
Silver Standard Mines Ltd.	279	350	28,790	20,858	75	15
Nickel Plate (Kelowna Mines Hedley Ltd.)	279	364	115,488	115,488	154	65
Fairview (Cons. M. & S. Co. of Canada, Ltd.)	365	......	18,281	......	16	......
Copper Mountain (Granby Cons. M.S. & P. Co. Ltd.)	357	357	1,794,882	1,740,876	676	212
Premier Border (operated by Silbak Premier Mines Ltd. on behalf of Premier Border Gold Mining Co. Ltd.)	......	......	13,781	13,781	......	......
Silbak Premier Mines Ltd.	292	292	54,063	54,063	174	11
Torbrit Silver Mines Ltd.	320	320	119,711	119,711	123	25
Lucky Jim (Zincton) (Sheep Creek Gold Mines Ltd.)	280	306	83,934	83,934	79	10
Ottawa (Harrison Drilling and Exploration Co. Ltd.)	*365*	......	*318*	......	*15*	......
Van Roi Consolidated Mines Ltd.	365	97	2,404	2,404	68	2
Violamac Mines (B.C.) Ltd.	365	260	6,089	5,197	35	7
Western Exploration Co. Ltd. (Standard, Enterprise, and Mammoth)	300	234	17,860	25,147	62	24
Britannia Mining and Smelting Co. Ltd.	283	273	796,566	796,566	649	233
Twin J (Vancouver Island Base Metals Ltd.)	365	229	9,754	9,754	43	5
Non-shipping Mines						
Bluebell (Cons. M. & S. Co. of Canada, Ltd.)	......	......	......	......	106	......
Hamil Silver Lead Mines, Ltd.	......	......	......	......	10	......
Berens River Mines Ltd.	......	......	......	......	13	......
Emerald Tungsten (Canadian Exploration Ltd.)	......	......	......	......	79	......
H.B. (Cons. M. & S. Co. of Canada, Ltd.)	......	......	......	......	59	......
American Standard Mines Ltd.	......	......	......	......	11	......
Glacier Gulch Mining Co. Ltd.	......	......	......	......	12	......
Dorreen Mines Ltd.	......	......	......	......	14	......
Sil-Van Consolidated Mining & Milling Co. Ltd.	......	......	......	......	19	......
Western Uranium Cobalt Mines Ltd.	......	......	......	......	66	......
Columbia Lead and Zinc Mines Ltd.	......	......	......	......	21	......
Mastodon Zinc Mines Ltd.	......	......	......	......	66	......
Sunshine Lardeau Mines Ltd.	......	......	......	......	14	......
Trout Lake Mines Ltd.	......	......	......	......	14	......
Carnation (Kelowna Mines Hedley Ltd.)	......	......	......	......	11	......
Cody-Reco Mines Ltd.	......	......	......	......	27	......
Wayside (L.A.P.) Mining Co. Ltd.	......	......	......	......	17	......

[1] 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.
[2] Included in mine total.
[3] Work principally construction. Ore from old stockpile.

Departmental Work

OFFICES

The Department of Mines, except for the Analytical Branch, moved into new quarters in Victoria in 1951. The Minister, Deputy Minister, Administration Branch, Mining Recorder for the Victoria Mining Division, Central Records Office, Inspection Branch, Mineralogical Branch, reference library, and microscope laboratories are established on the fourth floor of the Douglas Building. Exhibits from the mineral museum have been moved to floor cases on the main and fourth floors and to wall cases on the fourth floor. The lapidary shop and equipment and specimen storage rooms are on the basement floor.

The Analytical Branch is remaining in the Mineral Museum Building on Superior Street. Rearrangements in that building are relieving the crowded laboratories and providing more convenient quarters for the Branch.

In Vancouver the British Columbia Central Records Office, the offices of the Mining Recorder and of the Inspector and Resident Engineer are now accommodated at 300 West Pender Street in a suite of offices shared with officers of the Canadian Geological Survey and other officers of the Department of Mines and Technical Surveys.

ADMINISTRATION BRANCH

The Administration 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. 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 342 and 343.

Central Records Offices (Victoria and Vancouver)

The transcripts of all recordings made in Mining Recorders' offices throughout the Province are sent to the office of the Chief Gold Commissioner in Victoria twice each month, and include the names of lessees of reverted Crown-granted mineral claims. These records and maps showing the approximate positions of mineral claims held by record and of placer-mining leases may be consulted by the public during office hours at Victoria and at the office of the Gold Commissioner at Vancouver, 300 West Pender Street. The maps conform in geographical detail, size, and number to the reference and mineral reference maps issued by the Department of Lands, and the approximate positions of mineral claims held by record and of placer-mining leases are plotted from details supplied by the locators. Provision has been made to supply the general public, on request to the office of the Chief Gold Commissioner, with copies of the maps.

Gold Commissioners and Mining Recorders

The locations of the offices and the names of the Gold Commissioner, Mining Recorder, and Sub-Recorder for each mining division are given in a table on pages 342 and 343.

Mining Divisions Amalgamated since 1949

Date	Mining Divisions Amalgamated	New Name	Mining Recorder's Office
Oct. 1, 1949	Revelstoke and Lardeau	Revelstoke	Revelstoke.
Dec. 1, 1949	Kamloops and Ashcroft	Kamloops	Kamloops.
Apr. 1, 1951	Skeena and Portland Canal	Skeena	Prince Rupert.
Mar. 1, 1952	Stikine and Peace River	Liard	Victoria.

Mining Laws and Laws Related to Mining

Synopses of mining laws and of laws related to mining appear on page 333. The titles of the various Acts and the price charged for each are listed on page 342. Upon payment of the price a copy of any Act may be obtained from the office of the Chief Gold Commissioner, or from the office of any Gold Commissioner, or from the Queen's Printer, Victoria.

Purchasing of Gold

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 pay cash for clean placer gold and purchase dirty placer gold and amalgam on a deferred-payment basis. The scheme was established during the depression years to give the individual miner the best possible price for his gold, and this has been realized in that the total price paid has been almost exactly the same as the receipts from the Royal Canadian Mint. In the first seven years of operation the number of lots purchased averaged more than 1,400 a year; since then the number has averaged less than 100. The amounts paid for gold purchased under this scheme to the end of 1951 total $312,992. In 1951 forty-six lots of gold were purchased for $1,940; the rate per ounce was $31.

Gold Commissioners' and Mining Recorders' Office Statistics, 1951

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	203	6	1	......	512	391	14	56	169	......	1	......	......	$1,315.75	$8,398.75	$9,714.50
Alberni	90	3	1	......	84	198	1	17	33	......	11	2	......	631.25	4,741.00	5,372.25
Atlin	147	3	1	......	185	54	6	41	7	7	6	184	24	1,288.75	6,818.80	8,107.55
Cariboo	315	10	8	......	99	187	......	23	7	3	40	314	49	3,155.00	18,530.05	21,685.05
Clinton	38	......	1	......	102	164	......	10	......	2	1	16	3	171.25	1,561.00	1,732.25
Fort Steele	186	......	2	4	269	153	42	49	26	......	8	26	2	850.25	4,683.23	5,533.48
Golden	96	4	......	......	118	266	7	34	17	......	......	1	......	792.75	6,275.25	7,068.00
Greenwood	132	......	5	......	154	110	6	17	79	3	4	5	......	652.50	3,883.50	4,536.00
Kamloops	298	1	7	10	581	280	6	88	52	3	4	3	10	1,395.00	7,490.00	8,885.00
Lillooet	170	7	1	1	269	453	14	45	23	......	4	32	3	1,487.00	4,220.45	5,707.45
Nanaimo	168	3	1	......	143	95	......	33	60	......	......	3	1	935.25	2,689.50	3,624.75
Nelson	430	7	13	6	584	681	40	123	65	3	3	2	......	3,083.75	16,761.50	19,845.25
New Westminster	211	4	4	15	330	263	......	30	7	2	2	19	4	1,408.25	3,278.25	4,686.50
Nicola	29	......	1	......	116	137	......	21	......	......	3	2	......	160.50	1,257.50	1,418.00
Omineca	490	6	4	......	896	789	10	171	48	3	14	82	16	2,691.50	18,249.00	20,940.50
Osoyoos	150	2	4	1	117	47	37	6	7	......	......	......	......	842.75	2,200.25	3,043.00
Peace River	42	......	......	......	20	48	......	1	......	......	......	2	7	122.75	217.50	340.25
Quesnel	281	10	3	2	120	158	......	15	......	6	26	171	30	2,210.00	5,749.75	7,959.75
Revelstoke	130	3	......	......	307	133	......	76	67	......	29	9	52	649.50	8,094.75	8,744.25
Similkameen	143	3	5	......	326	56	4	36	6	2	15	16	15	1,029.75	3,346.50	4,376.25
Skeena	208	3	2	......	416	321	......	241	143	......	2	......	2	1,284.25	9,006.00	10,290.25
Slocan	173	1	......	......	259	209	......	38	......	11	......	4	24	863.75	5,010.60	5,874.35
Stikine	133	1	2	......	315	180	......	65	......	......	5	17	15	911.00	4,647.50	5,558.50
Trail Creek	98	2	1	......	43	15	......	7	8	2	1	......	......	591.00	592.00	1,183.00
Vancouver	1,183	121	21	6	111	163	......	11	25	......	......	3	......	16,474.50	3,084.75	19,559.25
Vernon	189	2	......	9	138	77	......	17	......	1	1	8	......	969.25	1,016.00	1,985.25
Victoria	199	9	2	8	92	60	......	7	7	......	7	1	......	1,531.00	1,324.78	2,855.78
Totals for Province, 1951	5,932	211	90	62	7,706	5,688	187	1,278	856	48	187	922	257	$47,498.25	$153,128.16	$200,626.41
Totals for Province, 1950	5,158	182	74	99	3,182	5,607	143	707	351	46	234	882	280	39,203.50	126,376.48	165,639.98

ANALYTICAL AND ASSAY BRANCH

By G. C. B. Cave, Chief Analyst

During 1951 the chemical laboratory in Victoria issued reports on 1,812 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 the 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) a test for radioactivity. The laboratory reports were distributed in the following manner amongst prospectors who were not grantees, prospectors who were grantees under the "Prospectors' Grub-stake Act," and Departmental engineers:—

	Samples and Specimens	Mineralogical Determinations	Spectrographic Analyses	Assays
Prospectors (not grantees)	1,112	928	1,014	2,070
Prospectors (grantees)	255	216	245	561
Departmental engineers	445	18	199	1,580
Totals	1,812	1,162	1,458	4,211

Proximate analyses and calorific determinations were made on three samples of coal.

Work for other departments included seven chemical analyses on agricultural materials and one toxicological analysis for the Department of Agriculture; one spectrographic analysis for the Department of Trade and Industry; two chemical analyses and one spectrographic analysis for the Department of Lands and Forests; one examination for solids and suspended matter in water for the Department of Public Works; and the identification of the dyestuff in two samples of gasoline for the Taxation Branch of the Department of Finance.

For the Purchasing Commission, specification analyses were carried out on twelve samples of soap, eleven samples of textiles, and one sample of plated pipe.

For the Attorney-General's Department and the Royal Canadian Mounted Police, seventy-one cases of a chemico-legal nature were undertaken; they involved the scientific examination and analysis of 264 individual exhibits. Of the seventy-one cases, thirteen involved the analysis for narcotics under "The Opium and Narcotic Drug Act," fifteen involved the analysis of liquids for their alcohol content, thirteen required toxicological analyses for possible poisons in viscera, and seven required the determination of the alcohol content of blood. The remaining twenty-three cases were of a different and diversified nature, requiring in general the examination of materials such as paint, glass, textile fibres, and wood. Expert evidence was presented in Courts of Law on thirteen occasions.

For the British Columbia Research Council, one complete spectographic analysis was made on an alloy; and for the Physics Department of the University of British Columbia, three such analyses were made.

For the Coal, Petroleum and Natural Gas Commission, a very extensive programme of spectrographic analysis was conducted; in all, 102 samples of coal ash were analysed quantitatively for all their metallic constituents.

* A reasonable number of specimens are examined, and a reasonable number of samples are assayed, without charge, for a prospector who makes application for free assays and who satisfies the Chief Analyst that prospecting is his principal occupation during the summer months. A form for use in applying for free assays may be obtained from the office of any Mining Recorder.

One analysis for the nitrate content of water and one toxicological analysis were made on samples submitted through the Vancouver Division of Laboratories of the Provincial Board of Health, and one complete spectrographic analysis was made for the Pacific Naval Laboratory of the Department of National Defence.

A total of forty-six lots of placer gold, amounting to 62.5892 ounces and representing purchases from individual placer-miners, was received from Gold Commissioners.

Provincial Government examinations for certificates of competency and licence to practise assaying in British Columbia were held in May. Of seven candidates who sat for examination in May, one passed the entire examination, two were granted supplemental examinations in wet assaying, three failed in the entire examination, and one failed a supplemental examination in wet assaying. In December one candidate sat for a supplemental examination in wet assaying and was granted a pass.

INSPECTION BRANCH

Organization and Staff

Inspectors and Resident Engineers

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

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.

J. A. Mitchell supervises the Department's programme as regards roads and trails, and grub-stakes.

Instructors, Mine-rescue Stations

Peter Kemp	Nanaimo Station.†
Arthur Williams	Cumberland Station.
Thomas H. Cunliffe	Princeton Station.
Joseph J. Haile	Fernie Station.
H. W. Aitchison	Nelson Station.

Board of Examiners for Coal-Mine Officials

H. C. Hughes, Chairman	Victoria.
Robert B. Bonar, Secretary	Victoria.
E. R. Hughes, Member	Princeton.

R. B. Bonar, E. R. Hughes, and the Inspectors for the district in which an examination is being held form the Board for granting certificates of competency to coal-miners. In the absence of the Inspector, the mine-rescue instructor is authorized to act in his stead.

An Inspector is empowered to grant provisional certificates to coal-miners for a period not exceeding sixty days between regular examinations.

* See notes under "Staff Changes."
† Closed September 14th, 1951.

Staff Changes

On May 1st, 1951, J. H. Bennett was transferred to Prince Rupert to replace F. J. Hemsworth, who was transferred to the East Kootenay District, with headquarters at Cranbrook.

On January 15th, 1952, H. N. Curry was appointed Inspector and Resident Engineer at Cranbrook to replace F. J. Hemsworth, who resigned on November 5th, 1951. Herbert N. Curry was born on September 22nd, 1913, at Windsor, N.S., and received his elementary- and high-school education there. He graduated from the Nova Scotia Technical College in 1937 with the degree of B.Sc. in mining engineering. Following graduation he spent the next five years as engineer at various gold-mining properties in Nova Scotia, Ontario, and British Columbia. From September, 1942, to the time of his appointment to the staff of the British Columbia Department of Mines, he worked for the Hudson Bay Mining and Smelting Company, at Flin Flon, Man., as stope engineer, the Nova Scotia Department of Mines as Deputy Inspector, and Britannia Mining and Smelting Company as mine foreman.

On April 30th, 1952, J. W. Patterson was appointed Inspector and Resident Engineer at Prince Rupert to replace J. H. Bennett, who resigned on March 10th, 1952. John W. Patterson was born at Medicine Hat, Alta., on May 14th, 1921. He received his elementary- and high-school education at Mendham, Sask., and Bobcaygeon, Ont. After serving ~~one~~ year with the R.C.A.F. as navigator, he entered the University of Toronto in 1946, graduating in 1949 with the degree of B.A.Sc. in mining geology. From October, 1949, to the time of his appointment to the British Columbia Department of Mines as Inspector of Mines, Mr. Patterson served with the Howe Sound Exploration Company Limited, at Snow Lake, Man., as engineer and shiftboss.

MINERALOGICAL BRANCH

Field work by officers of the Mineralogical Branch consists principally of geological mapping and 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 Mineralogical Branch supplies information regarding mineral deposits and the mineral industry, in response to inquiries received in great number. The activities of the Branch also 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.

Staff

Engineers on the permanent staff of the Mineralogical Branch are classified as Assistant Geologists, Associate Geologists, Geologists, or as Mineral Engineers—Grade 1 or Grade 2. They are engineering graduates with postgraduate training in geology.

On December 31st, 1951, the staff of the Mineralogical Branch was as follows:—

H. Sargent	Chief of Mineralogical Branch.
M. S. Hedley	Geologist.
S. S. Holland	Geologist.
J. M. Black	Associate Geologist.
G. E. P. Eastwood	Associate Geologist.
W. R. Bacon	Mineral Engineer—Grade 1.
J. W. McCammon	Mineral Engineer—Grade 1.
A. F. Shepherd	Assistant Geologist.
J. T. Fyles	Assistant Geologist.
G. G. L. Henderson	Assistant Geologist.
H. W. Nasmith	Assistant Geologist.
A. Sutherland Brown	Assistant Geologist.

K. S. Crabtree	Draughtsman.
W. Player	Lapidary.
Mrs. C. E. Browne	Clerk-Stenographer.
Mrs. C. E. Fletcher	Secretary.
Miss L. Primrose	Clerk-Stenographer.

Mr. Shepherd acts as office engineer and librarian. Dr. Hedley has directed the editing of the 1951 Annual Report of the Minister of Mines and edited the section on lode-mining. The section on placer-mining was edited by Dr. Holland, and the section on structural materials and industrial minerals was edited by Mr. McCammon. Mrs. Browne acted as editorial assistant and Miss Primrose as assistant librarian.

Staff Changes

M. C. Robinson, who had been on leave of absence doing postgraduate work, resigned in April to accept an appointment with Transcontinental Resources Limited.

G. E. P. Eastwood, who graduated in geological engineering at the University of Saskatchewan in 1944 and was awarded a Ph.D. in geology at the University of Minnesota in 1950, joined the staff in February, 1951, as Acting Associate Geologist.

W. R. Bacon was on leave of absence in the winter of 1950–51 and is again on leave of absence for the winter of 1951–52 doing postgraduate work in geology at the University of Toronto.

J. T. Fyles was on leave of absence in the winter of 1950–51 continuing postgraduate work in geology at Columbia University.

G. G. L. Henderson was on leave of absence in the winter of 1950–51 continuing postgraduate work at Princeton University.

H. W. Nasmith joined the staff as Assistant Geologist in June. He graduated from the University of British Columbia in geological engineering in May, 1950, and after working for the Department on ground-water studies in the summer of 1950 went to Washington University in St. Louis, where he was awarded the M.A. degree in geology in June, 1951.

A. Sutherland Brown, who graduated in geological engineering from the University of British Columbia in May, 1950, and spent the academic year 1950–51 doing postgraduate work in geology at Princeton University, worked as senior assistant under Dr. Holland in the summer of 1951. He was appointed Assistant Geologist in the autumn and was granted leave of absence to continue his postgraduate studies.

Field Work

W. R. Bacon completed field work in an area on the mainland coast, tributary to Pender Harbour and Seechelt Inlet, where he began geological mapping in 1950.

J. M. Black mapped an area on Kitsault River upstream from the Torbrit property and extended previous mapping of the property to include the recent workings. In September he mapped an area on the Telkwa River, including the workings of Bulkley Valley Collieries Limited, and examined the property of Copper Ridge Silver Zinc Mines Limited east of Telkwa. On this property, which was formerly known as the Cassiar Crown, zinc-copper mineralization is being explored.

G. E. P. Eastwood began a programme of detailed mapping in the southern part of the Ainsworth camp.

J. T. Fyles began mapping in the Salmo-Pend d'Oreille River area. This work is a detailed study of the belt in which silver-lead-zinc replacement deposits occur in limestone.

G. G. L. Henderson continued mapping near Windermere in an area that includes Windermere Creek and extends southerly across the Kootenay River.

M. S. Hedley examined properties in the East Kootenay District and visited the parties doing mapping for the Department in the East Kootenay, Ainsworth, and Salmo area. Dr. Hedley also made examinations at the Rock Creek bridge-site and the Trans-Canada Highway site near Martel to advise the Department of Public Works concerning location problems.

S. S. Holland completed a detailed structural study of an area that includes Yanks Peak and the Cariboo Hudson property in the Cariboo District. In September A. Sutherland Brown, who had been assisting Dr. Holland, did preliminary work with a view to extending the detailed study northwesterly towards Wells. In the same period Dr. Holland visited properties at Camborne and Ferguson in the Lardeau area.

J. W. McCammon made brief examinations of numerous industrial-mineral deposits and made more detailed examinations of a talc deposit near Armstrong, the asbestos deposit on McDame Creek, and the gypsum deposit at Falkland. Field work during the season included collecting additional data for Bulletin 30, Clay and Shale Deposits in British Columbia (now published), and collection of shale for testing its suitability for bloating.

H. W. Nasmith made several brief studies of ground-water and engineering geology problems and devoted most of his time in the field to studies of ground-water possibilities in the Pineview district near Prince George and in an area north of Elk Lake on Saanich Peninsula.

J. S. Stevenson spent about a month in the Bridge River district completing field work for a bulletin on that area, for which the field work had been begun before he left our staff to join the staff of the Department of Geology of McGill University.

GRUB-STAKING PROSPECTORS

Each year since 1943 the Department of Mines has provided assistance to prospectors who were able to qualify. During 1951 the maximum grub-stake of $300 was provided, usually in two instalments. An amount up to $200 was added where necessary for travelling expenses to enable the grantee to reach the prospecting area.

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
1950	26,800	78	226	95
1951	19,385	63	255	137

Samples and specimens received from grub-staked prospectors are identified, spectrographed, assayed, and tested for radioactivity.

One discovery made in 1951 was immediately optioned by a large mining company. Deals were made during the year on at least two other properties which grub-staked prospectors had discovered in previous years and on which they were working in 1951. References to other discoveries of possible interest may be found in the following notes which cover briefly the activities of most of the prospectors grub-staked during 1951.

Atlin Mining Division

In the Atlin area two men prospected a serpentine belt where the existence of chrysotile asbestos has been known for some time and located an occurrence of short-fibre asbestos. The discoverer of the B.W.M. group, described in the 1950 Annual Report, continued to prospect in the Taku River area.

Liard Mining Division

In the McDame Creek area four men were prospecting. One sent in several samples suggesting the possibility of a base-metal zone. Another sent in a very interesting report describing occurrences of chromite, asbestos, beryl, tin, the more common base metals, and coal.

Two men spent the entire season in the Shaft Creek area due south of Telegraph Creek. They found some copper mineralization.

Skeena Mining Division

Prospecting continued in the vicinity of the Torbrit mine at Alice Arm, and on ground adjacent to Clearwater Creek, Upper Kitsault River, Power Creek, Black Mountain, west fork of Kitsault River, and Glacier Creek. Geological conditions are interesting and some high-grade float was discovered.

At the west end of Lakelse Lake (Coldwater Creek), on Granite Creek, and on the east side of Thornhill Mountain, some inconclusive work was done. Although a large area near the headwaters of Williams Creek was investigated thoroughly without success, the geological conditions seem to warrant further prospecting.

Work in the Dean Channel area resulted in the staking near tide-water of ground covering zinc replacement in limestone.

Omineca Mining Division

Near Usk a small amount of prospecting was done on rough terrain on Bornite Mountain, where further work is warranted.

Also, close to Usk, some inconclusive prospecting was done in the Legate Creek valley, where an effort was made to relocate outcrops discovered thirty years ago.

South of Burns Lake, on Francois and Tchesinkut Lakes, a short time was spent prospecting the lake-shores without success.

One man spent two months prospecting the creek valleys on the north side of the southeast end of Morice Lake. Some interesting float was found.

Flint Creek area near Hazelton received a little attention, but nothing was found to encourage further work.

Northwest of Takla Lake and close to the old Bralorne mercury camp, west of Silver Creek, some excellent work was done on a wide mineralized zone. Samples from open-cuts and trenching have assayed well in silver.

Some work was done in the Gaffney Creek and Manson Creek areas. This included stripping on a gold-quartz lead.

Near Nina Lake, about 8 miles north of Germansen Landing, prospecting was done along and in the vicinity of an argillite-limestone contact which as far north as the Osilinka River has been found to be mineralized. Excellent work was done, and discoveries made in this and previous years have created a great deal of interest in the area.

Lillooet Mining Division

Some prospecting was done in the area between Duffy Lake and Harrison Lake, but no report on this work was received.

Kamloops Mining Division

Considerable prospecting has been done within a radius of 20 miles of Ashcroft during the past few years, and some interesting finds have been made. None of these, however, has so far proved commercial, but the possibilities of this area have not been exhausted.

On the east side of Adams Lake, across from Agate Bay, some work was done on narrow well-mineralized sections of altered sediments. Considerable float was found in an area in which the geology is somewhat similar to that on the Adams Plateau, a short distance to the east, where exploratory work had been done. Some further prospecting work was done on the west side of Adams Lake and in the Deadman Creek area.

Revelstoke Mining Division

A small area 12 miles west of Revelstoke on the Columbia River watershed was prospected for a short time without success. The Standard Basin-Keystone Mountain area on the west side of Downie Creek was gone over thoroughly, but no new discoveries were made.

Vancouver Mining Division

Near Garibaldi on the Pacific Great Eastern Railway prospecting close to the Cheakamus River resulted in the discovery of small showings of zinc replacement in limestone.

New Westminster Mining Division

Some work was done on the lower edges of the Anderson River valley east of Boston Bar. No discoveries have been made so far. Logging-roads are making the area more accessible each year.

Similkameen Mining Division

A few barren-looking quartz veins were found in the Snass Creek area about 5 miles from the Hope–Princeton Highway and extending over to Dewdney Mountain and the headwaters of the Tulameen River. Some of these veins were opened up and sampled, but with negative results.

The Siwash Creek area, in the Upper Tulameen River district, has been prospected for several seasons, but nothing of interest has been found.

West of Princeton inconclusive work has been done on Grasshopper Mountain, Olivine Mountain, Britton Mountain, Railroad Creek, and Kelly Creek, in which general area some scattered oxidized zones showing copper stain have been discovered.

Slocan Mining Division

The ground surrounding and between Lemon, Chapleau, and Gold Creeks was given a little attention early in the season without success.

Fort Steele Mining Division

Extensive work, both trail-cutting and prospecting, was done in the area adjoining the junction of Lake Creek and Skookumchuk Creek. Nothing of interest was found, but the possibilities in this general area have not been exhausted.

Some work was also done in the Perry Creek area, where two claims were staked on geologically interesting ground.

Considerable work has been done on both sides of Wild Horse Creek, embracing an area of about 75 square miles. The geology in this area seems favourable, but no new finds of importance have been made.

Vancouver Island

Alberni Mining Division

Some prospecting was done along Lime Creek and at the headwaters of Kaouk River in the Zeballos area. Interesting deposits of magnetite, galena, and copper carbonate were explored.

Further work was done on Muchalat Arm (Gold River) and over an area extending from the mouth of Irving River (Sidney Inlet) up to Irving Lake and across to Silverado Creek. This work indicated that more prospecting is warranted.

Nothing of apparent interest was found around Nootka Island, Tahsis Canal, Little Zeballos River, Slattery Bay, or McBride Bay despite careful field work.

Nanaimo Mining Division

A small amount of prospecting was done in the Parksville area following up spotty occurrences of copper sulphides.

Victoria Mining Division

Prospecting in the Cowichan Lake area failed to bring to light anything of interest.

Prospectors were also grub-staked to prospect in the Hudson Hope, Chilcotin, Nicola, Sooke, Harrison Lake, the east side of Kootenay Lake in the vicinity of Crawford Bay, and in Kettle River areas.

Men who failed to send in reports or sent in unsatisfactory reports will not receive further assistance.

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

MUSEUMS

The Department has a large exhibit of mineral and rock specimens in the Douglas Building, Victoria; 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 330.

The collection of specimen material in Victoria, accumulated in a period of nearly sixty years, has been moved from the Mineral Museum Building on Superior Street to floor cases on the first and fourth floor of the Douglas Building and to wall cases on the fourth floor. The collection includes specimens from many of the mines and prospects in the Province, and also specimens of type rocks and special minerals from British Columbia and elsewhere.

British Columbia material has been donated by property-owners and collected by officers of the Department of Mines. Some of the other material has been purchased from distributers, and other valued specimens or groups of specimens have been donated or loaned to the museum. Grateful acknowledgment is made of the following gifts and loans received by the museum in the past few years:—

- From Mrs. W. A. Carlyle, from the collection of W. A. Carlyle, Provincial Mineralogist 1896–98, asbestos (chrysotile), galena with malachite, and specimens of primary and secondary copper minerals.
- From Major C. A. Moon, hausmannite from Lake Crescent, Wash.
- From the estate of W. P. D. Pemberton, some 160 specimens of type rocks and 200 mineral specimens.
- From T. A. Rickard, specimens including kimberlite, banket—gold-bearing conglomerate, amethystine quartz, native gold, native silver, native copper, gold-silver tellurides, cuprite, azurite, malachite, and chrysocolla.
- From Mrs. M. Soule, specimen of carnelian.
- From F. P. Newcome, donations and specimens on loan, including boulder of magnetite; mercury ore, Horse Heaven mine; polished "Thunder-egg" agates, iridescent obsidian, cross-section of shin bone of a dinosaur, and cross-section of a tooth of elephas primigenus.

PUBLICATIONS

Annual Reports of the Minister of Mines, bulletins, and other publications of the Department, with prices charged for them, are listed on pages 327 to 329.

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 331.

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 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 329. 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 THE DEPARTMENT OF MINES AND TECHNICAL SURVEYS, CANADA

The Provincial Department's Inspector and Resident Engineer, the Gold Commissioner and Mining Recorder for the Vancouver Mining Division, and the officers of the Federal Geological Survey 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 Federal and Provincial mining publications, a reference library, a display of rocks and minerals, and a central records office.

* The office was moved in February, 1952, to 300 West Pender Street.

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 Federal Government Departments of Mines and Technical Surveys and of National Defence.

Aircraft in the service of the Federal and Provincial Governments have flown over virtually the whole of British Columbia to obtain vertical air photographs. Information on the type of air photographic coverage and on topographic mapping of various types to the end of 1951 is included in the Annual Report of the Deputy Minister of Lands for 1951. In that Report coverage by air photographs and by topographic maps is indicated on a series of base maps which also show the reference grid and the lettering and numbering system by means of which reference to any part of the Province may be made.

In 1951 the Topographic Division of the British Columbia Department of Lands and Forests had five survey parties in the field, obtaining control for standard topographic maps at a scale of 1 mile to the inch with 100-foot contours. After four regular parties had returned, a fifth party went into the field for a month. The five parties obtained control for nineteen and one-half map-sheets with a controlled area of 6,500 square miles, an increase of 35 per cent over the 1950 output. Three other parties were in the field on triangulation and completed approximately 290 miles of main triangulation comprising twenty quadrilaterals. They closed two gaps in the main net, which will allow several circuits to be recomputed and balanced.

Topographical surveys by the Federal Government agencies in British Columbia in 1951 were performed by the Topographical Survey of the Surveys and Mapping Branch, Department of Mines and Technical Surveys, and the Army Survey Establishment of the Department of National Defence. These two agencies continue to work in close co-operation and together, during 1951, completed the field work for forty-one 1-mile sheets and four 4-mile sheets.

Also, under one party from the Army Survey Establishment, field work was completed on the 4-mile map-sheet 93 O. A large part had been covered by previous surveys; the work done in 1951 consisted in identifying control points on air photographs and establishing additional control.

Interim maps showing planimetry, based on air photographs and existing ground control, are compiled by the map compilation division of the Air Survey Division of the Surveys and Mapping Service of the British Columbia Department of Lands and Forests. 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 Federal 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.

Department of Mines and Technical Surveys

The Canadian 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 in 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 of Canada in British Columbia, 1951

J. D. Aitken commenced geological mapping of the Atlin area (longitude 132° to 134°, latitude 59° to 60°).

J. E. Armstrong continued geological mapping of the Vancouver North area (longitude 123° to 123° 30′, latitude 49° 15′ to 49° 30′); commenced geological mapping in the New Westminster area (longitude 122° 30′ to 123°, latitude 49° to 49° 15′); continued general supervision of geological mapping and study of the Pleistocene deposits and ground-water supply in the Vancouver-New Westminster region; and assisted at intervals in the work of the Provincial soils surveys and British Columbia Department of Agriculture.

W. L. Brown completed mapping the Pleistocene geology of Surrey Municipality and about one-third of Langley Municipality in the New Westminster map-area (longitude 122° 30′ to 123°, latitude 49° to 49° 15′), and obtained data on ground-water conditions. Visits were also made to other parts of the Province to investigate their ground-water resources and extent of the glacial overburden.

W. E. Cockfield assisted soil-survey parties on Pleistocene geology in the Kootenay and Elk River valleys. He also conducted ground-water surveys for other Government departments in the Terrace and Vanderhoof areas and visited several mining properties to obtain information for other Government departments.

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

R. de Wit studied exposed sections of Devonian and Mississippian sedimentary formations on either side of Peace River west of Hudson Hope.

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

Hans Frebold completed a stratigraphic and palæontological study of the Jurassic system as represented by the Fernie group of the southern Rocky Mountains.

* In February, 1952, the office was moved from 808–810 West Hastings Street to 300 West Pender Street.

J. G. Fyles continued mapping of the Pleistocene geology and a study of ground-water conditions in the Horne Lake area (longitude 124° 30′ to 125°, latitude 49° 15′ to 49° 30′), Vancouver Island, and extended this work into the adjoining Parksville area (longitude 124° to 124° 30′, latitude 49° 15′ to 49° 30′).

H. Gabrielse continued geological mapping of the McDame area (longitude 128° to 130°, latitude 59° to 60°).

L. H. Green studied wallrock alteration of the lead-zinc deposits in the limestones of the Salmo area.

E. Hall continued his work at Columbia River dam-sites, examining and correlating drill cuttings and cores for the Federal Water and Power Bureau.

J. A. Jeletzky continued detailed stratigraphic studies of the fossiliferous Mesozoic and Tertiary formations along the west coast of Vancouver Island between Kyuquot village west of Kyuquot Sound and St. Patrick Beach on the southeast shore of Flores Island west of Clayoquot Sound.

A. G. Jones completed geological mapping of the Revelstoke area (longitude 118° to 119°, latitude 50° to 51°).

E. D. Kindle examined mineral deposits in the vicinity of Hazelton and Smithers preparatory to issuing a revised edition of his memoir on the mineral resources of these areas (Memoir 223).

G. B. Leech continued geological mapping of the St. Mary Lake area (longitude 116° to 116° 30′, latitude 49° 30′ to 49° 45′).

H. W. Little was engaged in a detailed investigation of the tungsten deposits of the Nelson district, particularly those of selected areas near Salmo.

D. K. Norris is engaged, in co-operation with other scientists on behalf of the Department of Mines and Technical Surveys, in a detailed and systematic study of the character and distribution of stresses in the Crowsnest Pass collieries.

J. E. Reesor continued geological mapping of the Dewar Creek area (longitude 116° to 116° 30′, latitude 49° 45′ to 50°).

J. A. Roddick continued geological mapping of the Coquitlam area (longitude 122° 30′ to 123°, latitude 49° 15′ to 49° 30′).

W. S. Shaw made a detailed investigation of the Princeton and Tulameen coalfields.

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

Publications of the Geological Survey

The following reports relating to British Columbia published by the Geological Survey were received by the British Columbia Department of Mines during 1951:—

- Paper 50-26: Preliminary Map, Vancouver North (East Half), British Columbia, by J. E. Armstrong.
- Paper 51-4: Ymir Map-area, British Columbia, by A. L. McAllister.
- Paper 51-10: Canadian Deposits of Uranium and Thorium, by A. H. Lang.
- Bulletin 18: Contributions to the Palæontology and Stratigraphy of the Jurassic System in Canada, by Hans Frebold.
- Memoir 259: Geology of Northeastern British Columbia, by F. H. McLearn and E. D. Kindle.
- Map 1008A: Mineral Map of British Columbia.
- Map 1010A: Ashcroft-Kamloops, Lillooet and Yale Districts, British Columbia.

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 pertaining to British Columbia received in 1951 include tabular pamphlets dealing with coal mines, gold mines, stone quarries, petroleum refineries, and milling plants in Canada, and the reports listed below:—

Mines Branch No. 830: The Canadian Mineral Industry in 1949.

Memorandum Series 110: The Chemical Determination of Thorium in Its Ores.

Memorandum Series 113: Survey of the Copper Resources of Canada.

Memorandum Series 114: The Determination of Uranium in Ores, Fluorophotometric Method.

Memorandum Series 115: Radioassay of Uranium Ore with the Geiger Type Equilibrium Counter.

Memorandum Series 116: The Utilization of Low Grade Domestic Chromite.

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 1951, on British Columbia ores:—

Investigation No.	Title
MD2727.	Flotation Tests on Three Samples of Silver-Lead-Zinc Ore from the Paradise Mine, Invermere, B.C.
MD2740.	Microscopic Examination of Ore and Mill Products from the Silver Standard Mines Limited, New Hazelton, British Columbia, and Flotation Tests on the Ore to Determine the Effect of Pulp Temperature on the Flotation of the Sphalerite in Particular.
MD2748.	Concentration Tests on a Sample of Mill Tailing from Highland-Bell Limited, Beaverdell, British Columbia, for Additional Recovery of Silver Values.
MD2757.	Jigging and Flotation Tests on a Silver-Lead-Zinc Ore from Trout Lake Mines, Ltd. (Nettie L), near Ferguson, B.C.
MD2759.	Concentration Tests on a Lead-Zinc Ore from the Mastodon Mine, Revelstoke, British Columbia.

Metal-mining (Lode)

CONTENTS

Notes on Metal Mines—*Continued*

DRAWINGS

GENERAL REVIEW

The quantity of ore mined, the quantity of each metal and its value, the average number employed, for 1951 and preceding years, and other data are tabulated under "Statistics," in the section that begins on page 13. Table No. XV, replacing former Table XXI, lists the production of individual properties and gives the name and address of the owner or agent of each producing property. Formerly the production of individual properties was incorporated in the property descriptions. The statistical tables are listed on page 15.

During 1951 there were increases above the 1950 average prices of all metals except gold. Prices were, for the most part, stabilized after a general upsurge in the second half of 1950, but there were minor changes. The average price of zinc set a new record, and that of copper advanced to near the all-time record of 1916–17. The unit price of tungsten ore soared from $20 in mid-1950 to $65 by February, 1951.

Gold, silver, copper, lead, and zinc produced at British Columbia lode mines in 1951 had a gross value of $145,422,567. The total quantity of ore mined amounted to 6,711,471 tons and came from 119 mines, of which sixty-four produced 100 tons or more. The average number employed in the lode-mining industry in 1951, including mines, concentrators, and smelters, was 12,831.

In 1951 thirty-two mills were operated. New mills brought into production included those at the Arlington, Cork Province, Dorreen, Emerald Tungsten, Estella, Silver Giant, Van Roi, and Highlander mines. Only five mills were operated at gold mines. Sink-float plants were incorporated in the Van Roi and Highlander mills, one was added to the Western Exploration mill, and a sink-float plant was built near Sandon to treat dump ore. Five mills accepted ore on a custom basis. At the end of 1951, mills were being built at the Bluebell, Kootenay King, Mastodon, Noble Five, Rocher Deboule, and Wayside properties.

Some of the zinc concentrates submitted to the Trail smelter in 1951 contained "soluble silica" in excess of the tolerable limit. This was particularly evident in certain concentrates from the Slocan district, and milling of some Slocan ores was deferred for a time on this account. However, by modification in the flotation treatment it was found possible to reduce the "soluble silica" to the acceptable point.

Zinc concentrates were exported in some volume to plants in the United States, Japan, and Europe. Zinc concentrates from the Estella mine, containing some cobalt, which is undesirable in an electrolytic refinery, were exported to a retort plant in Oklahoma.

The Trail smelter recorded custom receipts of 8,954 tons of crude ore from properties in British Columbia. It also recorded the receipt of 33,358 tons of lead concentrates and 71,138 tons of zinc concentrates. Shipments to the Tacoma smelter included the copper concentrates from the Britannia and Copper Mountain and Twin J mines and the gold-bearing concentrates from the Bralorne and Nickel Plate mines. Tacoma also received crude ore from the Little Billie. Lead concentrates produced in British Columbia were shipped to Trail, with the exception of those from Silbak Premier, which went to East Helena. Nearly all zinc concentrates went to Trail, but some lots were shipped to American smelters. Lead-copper concentrates from Tulsequah Mines went to Hamburg, Germany.

The high prices of silver, lead, and zinc were responsible for increased activity in mining and exploration. Most of this activity was in the West Kootenay. South of Nelson the Jersey and Reeves MacDonald mines increased their output. Major development work started on the H.B., and much diamond drilling was done on several properties; the Jack Pot, Oxide, and Last Chance groups were bought by New Jersey Zinc after favourable drilling results were obtained on the Jack Pot. The Bluebell at Riondel was almost ready for production at the end of the year. Exploration in the Ainsworth, Slocan, and Lardeau camps was expanded, and in the last named the Spider was reported to have sufficient ore to warrant a mill. Exploration was increased in the general vicinity of Hazelton, and development at the Duthie (Sil-Van) was particularly successful. In the East Kootenay the Silver Giant and Estella mines were brought into production and a mill at Kootenay King was almost completed. At Tulsequah the Big Bull and Tulsequah Chief mines were brought into production, using the Polaris-Taku mill after the Polaris-Taku mine was closed.

Thirty years after major production ceased, exploration was again active in the Phoenix camp on the former Granby and other holdings. Geochemical and geophysical prospecting was done on areas largely obscured by overburden.

The sharp rise in the price of tungsten ore led to activity at the Emerald and Red Rose properties. At the former, the Canadian Government bought the Emerald and Dodger ore areas developed during World War II and built a mill, mining and milling being done by Canadian Exploration for the Government account. A major extension of the Dodger tungsten zone was found on company ground and proved to be of first-rank importance; development of it started late in 1951. At the Red Rose, mine and mill were ready for production at the end of 1951.

Iron ore was produced in quantity for the first time. Magnetite ore at Upper Quinsam Lake was mined and concentrated, and a total of 113,535 tons was shipped to Japan. Exploration was undertaken of several other deposits on Vancouver Island and Texada Island.

Innovations in metal-mining technique include the strip-mining operation at the Sullivan mine. Overburden and waste rock as much as 150 feet thick were removed from about 2,000,000 tons of near-surface ore in an operation which lasted a year. Ore is now being mined by quarrying methods and is transferred by truck to a 500-foot raise driven from the 3900 level. The first diesel locomotive used in British Columbia metal mines was in operation at the H.B. The new tungsten development at the Jersey mine is being laid out for diesel-powered loading and haulage.

The construction of a transmission-line linking the West Kootenay hydro-electric plants with Kimberley was well under way. Work started on construction by The Consolidated Mining and Smelting Company of a power dam on the Pend d'Oreille River at Waneta. These developments will greatly increase the power potential of both East and West Kootenay.

Construction of a road linking the Lardeau with Kaslo was started.

NOTES ON METAL MINES

ATLIN*

Fourth of July Creek (59° 133° N.W.)

Silver-Lead-Zinc

Atlin Ruffner Mines (B.C.) Limited Company office, 302 Bay Street, Toronto; mine office, Atlin. H. T. Steers, manager. Capital: 3,000,000 shares, $1 par value. The property is about 10 miles up Fourth of July Creek from the highway joining Atlin to the Alaska Highway. Several adits were driven on the property in the past, most of the work being done prior to 1933. In May, 1951, the present company started a programme of development. The road to the property was improved, camp buildings were rehabilitated, and an assay office was installed. Four of the old adits were reopened and two raises were driven. Surface stripping was done with a bulldozer. Geological mapping, sampling, and some diamond drilling were done. Work was suspended in January, 1952, but the company planned to resume development work in a few months. The number of men employed averaged nineteen.

Production: Ore shipped, 44 tons. Gross content: Gold, 7 oz.; silver, 5,343 oz.; lead, 36,197 lb.; zinc, 5,829 lb.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1925, pp. 115–117.]

Boulder Creek (59° 133° N.E.)

Tungsten

Black Diamond (Black Diamond Tungsten Limited) J. A. Willcox, manager. This company was formed by Trans-continental Resources Limited to develop the property at the head of Boulder Creek, about 10 miles northeast of Atlin. The claims are between 4,000 and 5,500 feet elevation. The company reports that the property comprises fifty-two claims and fractions. Several vein zones contain the tungsten mineral wolframite, but only No. 5 zone is at present being developed. Stripping by bulldozer in the summer gave encouraging results so a winter camp was built. Two prefabricated steel buildings were erected above timber-line, and equipment for underground work was taken in. It is proposed to drift on No. 5 vein zone.

The road up Boulder Creek was extended by the company to the camp. The average number of men employed was fifteen.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1950, pp. 72–73.]

TURNAGAIN RIVER (59° 128° S.E.)*

Copper

Burden (The Consolidated Mining and Smelting Company of Canada, Limited).—This property is on Hidden Valley Creek, a tributary of Turnagain River, 10 miles east of the south end of Deadwood Lake. Five men were employed from June 15th to August 15th in geological mapping and surface trenching. The company dropped its option.

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* By J. H. Bennett.

TAKU RIVER (58° 133° N.W.)*

Gold

Polaris-Taku (Taku River Gold Mines Ltd.)

Company office, 111 Bank of Nova Scotia Building, Vancouver. W. B. Milner, president. This mine was closed on March 18th, 1951. The roaster treated concentrates for a short time thereafter. The mill and camp were leased to The Consolidated Mining and Smelting Company of Canada, Limited. In 1951, 7,778 tons of ore was broken and 20,700 tons of ore was milled. Development work totalled 80 feet. The average number of men employed was seventy.

Gold-Silver-Copper-Lead-Zinc

Big Bull, Tulsequah Chief (Tulsequah Mines, Limited)

This company, a subsidiary of The Consolidated Mining and Smelting Company of Canada, Limited, was formed in 1951 to combine the Big Bull and Tulsequah Chief mines into one operation. The company rented the Polaris-Taku mill and camp and altered the mill to treat the gold-silver-copper-lead-zinc ore from the two mines. The camp is served by aircraft from Juneau all year, and by barge up Taku River during the summer. Since shipments can only be made by barge, a large amount of concentrates accumulates during the winter.

The mill began operation at the end of July and in October was treating 200 tons a day, six days a week. The number of employees at the mill and two mines was 195. J. C. MacLean was superintendent in charge of operations.

Big Bull.—H. R. Hammond, mine superintendent. This mine is on the northern side of Taku River. It is about 5 miles by road from the mill and on the opposite side of Tulsequah River which is crossed on a long bridge built on pile trestles. All workmen live at the mill camp and are transported to and from the mine by bus.

The mine is developed by an adit level and a shaft. Production started at the end of July, and from then until the end of 1951, 22,639 tons of ore was produced. Most of the ore came from a surface open pit and from the ore dump and was hauled by truck to the mill. The road to the mill was improved during the summer.

Underground, 2,060 feet of development work was done, comprising 119 feet of drifting and crosscutting, 1,414 feet of raising, and 457 feet of subdrifting. A total of 1,497 feet of diamond drilling was done. When the property was visited in October, preparation of one stope for production was nearly complete. A sump with a reinforced-concrete dam was constructed close to the shaft and just below the bottom level.

Tulsequah Chief.—R. Douglas, mine superintendent. This mine is on the east bank of Tulsequah River about 4 miles north of the mill. In 1951 pile trestle bridges were built across the three channels of the river near the mine, and a road was built between mine and mill. In October this work was still in progress; when finished it is planned that the mine crew live at the mill camp and be transported to the mine by bus.

Development work done was a shaft raise started from the main or 5400 level, and driven 183 feet by the end of the year. It is proposed to raise this shaft about 1,100 feet. Other work on the shaft included 12 feet of sinking and 55 feet of stations. Development also included 978 feet of drifting and crosscutting, 588 feet of raising, and 80 feet of subdrifting. The 5400 adit was extended 457 feet. A total of 3,998 feet of diamond drilling was done.

Production amounted to 1,126 tons of ore from development headings. Ore from this mine is to be hauled to the mill by truck.

Silver-Lead-Zinc

Erickson-Ashby (The Consolidated Mining and Smelting Company of Canada, Limited).—This property is on the south side of Taku River, opposite the Big Bull mine.

* By J. H. Bennett.

Three men were employed for about three weeks in geological examination and mapping of the property. The company plans a diamond-drilling programme in 1952.

PORTLAND CANAL*

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; A. Kirby, Jr., mine superintendent. The company continued to mine and mill ore from its own property and from the Premier Border property. Diamond drilling and development work in the Silbak Premier mine discovered more small orebodies. Development and production in 1951 were as follows:—

	Silbak Premier	Premier Border
Drifting, raising, and crosscutting	3,459 feet	1,911 feet
Diamond drilling	23,618 feet	6,608 feet
Ore milled	54,063 tons	13,781 tons

The major item of development was a shaft which is to be sunk from No. 6 level to a depth of 350 feet, and which will allow the extraction of ore from Premier Border ground below No. 6 level. Preliminary work on this shaft was started in October, and the job is expected to be finished in April, 1952.

The average number of men employed was 185, of which eighty were underground.

Indian Mines (1946) Ltd. Company office, 705 Credit Foncier Building, Vancouver. The Indian mine is about 2 miles north of the Silbak Premier camp. The ore is to be mined by Silbak Premier and will be brought to the Premier mill by aerial tramway. The tramway was finished in November, 1951, but no ore was mined during the year.

Silver-Lead-Zinc

Silver Tip (Silver Tip Gold Mines Limited) Company office, 211 Pemberton Building, Victoria. George Winkler, managing director. This property is about 21 miles north of Stewart and about 1½ miles north of the old Big Missouri camp. In 1951 a tractor-road was built from Big Missouri to the Silver Tip cabin. Eight men were employed from July to October under the direction of W. R. Tooth. The main drift on the May P.J. vein was extended 38 feet by hand-mining, and the old Armstrong drift was extended 8 feet. On surface, 600 feet of diamond drilling was done. Sixteen tons of ore was shipped from an outcrop above and to the east of the portals. Although the May P.J. vein has been traced to a point near this outcrop, it may not be part of that vein.

Production: Ore shipped, 16 tons. Gross content: Gold, 5 oz.; silver, 996 oz.; lead, 4,073 lb.; zinc, 5,351 lb.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1947, p. 82; 1950, p. 77.]

Bear River (55° 129° N.W.)

Gold-Silver-Lead-Zinc

Dunwell (Frontier Mines Limited).—Some surface work was done on this property. When visited in September, the road from the mill to the mine had been brushed out and some of the buildings had been rehabilitated. Two men were employed at that time, with A. Sinclair in charge.

* By J. H. Bennett.

Tungsten-Gold-Copper

Stewart Canal Gold Mines Limited

This property is across Bear River from Stewart. Reported plans for work did not materialize. In the lowest adit, which is about 45 feet long, interesting amounts of scheelite were observed. This adit, including a crosscut 10 feet long near the face, is in skarn that is mineralized with scheelite and molybdenite.

Glacier Creek (55° 129° N.W.)

Silver-Lead-Zinc

Blue Grouse

This group of two claims is owned by John Lehto, of Stewart. The claims are between the middle and south forks of Glacier Creek, about 1 mile east of the workings of the former Black Hill Mining Company. The cabin is at an elevation of about 4,500 feet and is about 8 miles by trail from the old Dunwell mill. The trail has been good, but is in poor repair.

An adit has been driven by hand about 100 feet on a vein a little more than 1 foot wide. The vein strikes about north 35 degrees east and dips northwestward at 75 degrees. It contains quartz, carbonates, a little pyrite, and is well mineralized with galena and sphalerite. A sample taken near the face across a vein width of 1.1 feet assayed: Gold, trace; silver, 54 oz. per ton; lead, 6.7 per cent; zinc, 7.8 per cent.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1938, pp. B 20–B 23.]

Marmot River (55° 129° N.W.)

Silver-Lead-Zinc

Marmot Lead and Zinc Mines Limited

V. Allen, president. Capital: 3,000,000 shares, $1 par value. In September this company commenced work on a group of claims recorded in the name of Owen McFadden, of Stewart. The claims are on the north fork of Marmot River, and the showing is a short distance upstream from the Green Point angle station on the old Porter Idaho tram-line. This point is on the east side of the river, about 4 miles by wagon-road and trail from the Marmot River dock.

An adit was started in a rusty zone about 20 feet wide that contains some galena and sphalerite. Work under the direction of J. McBeth consisted of 120 feet of drifting and 20 feet of crosscutting. About eight men were employed. Work was stopped in November for the winter, but the company plans additional work on the property in 1952.

ALICE ARM (55° 129°)*

Upper Kitsault Valley Area

Introduction.—This report describes the geology and mineral occurrences of an area in the Skeena Mining Division from which there has been considerable production of silver, mostly from the Toric and Dolly Varden mines. There are numerous silver prospects, and others in which lead, gold, or copper are of economic interest. Lead and a small proportion of zinc are recovered from the Toric mine, now also known as the Torbrit mine. During two and a half months of 1951, the writer, with two assistants, mapped the geology of an area of about 22 square miles, examined the mines and prospects, and sampled many of the prospects.

A topographic map of the area, published in 1921 by the Geological Survey of Canada on a scale of 1 inch to 3,000 feet, was enlarged to a scale of 1 inch to 750 feet for use by the writer as a base map. Topographic detail of the enlarged map was corrected by pace and compass traverses, barometric readings, and examination of aerial

* By J. M. Black.

photographs which were available for the southern part of the area. Figure 1 shows the topography and geology.

Location and Access.—The part of the Kitsault Valley mapped includes both slopes for about 1½ to 2 miles from the river and extends from 12½ miles north of the river mouth for about 7 miles to the foot of the glacier at which the river heads.

Alice Arm, the nearest community, is a small settlement at the head of the inlet of the same name and at the mouth of the Kitsault River. Alice Arm is about 100 miles north of Prince Rupert and is reached weekly by vessels of Union Steamship Company Limited sailing from Vancouver and Prince Rupert. A weekly aeroplane service is maintained between Prince Rupert and Alice Arm. A hotel is open, but the only store in the settlement was closed in the spring of 1951.

From Alice Arm a motor-road in good condition extends up the valley 17 miles to the Toric mine. Beyond the mine a tractor-road continues about 5 miles to a hydro-electric plant near the mouth of Clearwater Creek, one of the major tributaries of the Kitsault River. Parts of the tractor-road in the valley bottom are covered with water during spring and autumn freshets, but light 4-wheel-drive vehicles can usually be driven to the power plant in July and August. From the main road and the tractor-road, trails lead up the valley slopes to most of the prospects. The trails in fair or good condition are shown on Figure 1.

History.—Prospecting started in upper Kitsault Valley early in the century, and by 1913 many claims had been located, including those of the Dolly Varden property. Exploration of this property in the next few years was successful in indicating a considerable tonnage of ore, and a railway was built from Alice Arm to the property. The railway reached the Dolly Varden in 1919, but the cost of construction was so much in excess of the estimated cost that the property was turned over to the railway construction company, who operated the mine from 1919 until 1921, when it was closed.

During the period the railway was being built and the Dolly Varden was being operated, much exploratory work was done on other prospects, but following a decline in the price of silver in 1921 interest in the area waned and exploration was curtailed. However, exploration of the Toric property continued, and a mill to concentrate the ore was built in 1928. The property was acquired in 1929 by Britannia Mining and Smelting Co. Limited, and a programme of exploratory diamond drilling was started, but because of the fall in price of silver in 1930, the property was closed.

From 1930 until 1946 little work was done in the area, but in 1946 a new company, controlled by Mining Corporation of Canada, acquired the Toric and started to build the motor-road up the valley; a new mill was built and production started early in 1949. Two prospects were being explored in 1951—the Galena by diamond drilling and the Vanguard by underground development.

The gross contents of ore and concentrates from the properties in the area to the end of 1951 are set forth in the following table:—

Property	Tons	Gold	Silver	Lead	Zinc	Copper
		Oz.	Oz.	Lb.	Lb.	Lb.
Dolly Varden	36,854	1	1,364,847	2,047	....	420
Homestake	9	36	52	140	668	1,320
North Star	112	....	2,838	....	....	....
Torbrit	351,651	47	5,821,393	2,181,778	344,164	....
Totals	388,626	84	7,189,130	2,183,965	344,832	1,740

Previous Work.—The properties have been described in the Annual Reports of the British Columbia Minister of Mines for the years in which they were developed. The geology of the area has been described by Hanson in publications of the Geological Survey of Canada. The Summary Report for 1921 contains a brief description of the geology of the Upper Kitsault area and reports on some of the properties, and Memoir 175, published in 1935, contains a regional description and an account of most of the properties in the area.

General Description.—The area includes the upper part of the Kitsault Valley, the valleys of minor tributaries, and the lower parts of several major tributary valleys. About half the length of the valley below the main fork is in easily eroded bedded rocks, and the bottom of the valley is as much as half a mile wide, with a fairly uniform gradient of about 13 per cent. Elsewhere the river crosses resistant massive rocks in which a narrow canyon has been eroded and the gradient is irregular and averages about 19 per cent. The river above the main fork and all tributaries have steeper gradients and in many places have falls and cascades. The larger tributaries have cut deep canyons but the lesser streams flow in canyons only slightly incised. The main valley slopes are steep and rock bluffs are common.

The Kitsault glacier at the head of the river is a lobe of the Cambria icefield and is wasting, the front having receded more than 3,000 feet in thirty years. A tributary glacier, that thirty years ago joined the main glacier, has also wasted, and its front is now more than 1,000 feet from the Kitsault glacier. Both glaciers have become much thinner. The area uncovered is comparatively free of debris.

Glacial striæ are found on many of the ridges, and ice appears to have moved southwestward across the area. No evidence of glacial action is seen in the lower parts of the valleys, and for this reason it is believed that the lower parts of many of the valleys have been deepened since withdrawal of the ice.

The valley slopes are steep up to an altitude of about 3,000 feet, above which the slopes rise gently to rounded ridges and rolling highlands. The topography west of the river is rugged, and east of the river is somewhat less so. The highest point in the area is west of the river and is about 5,000 feet in altitude.

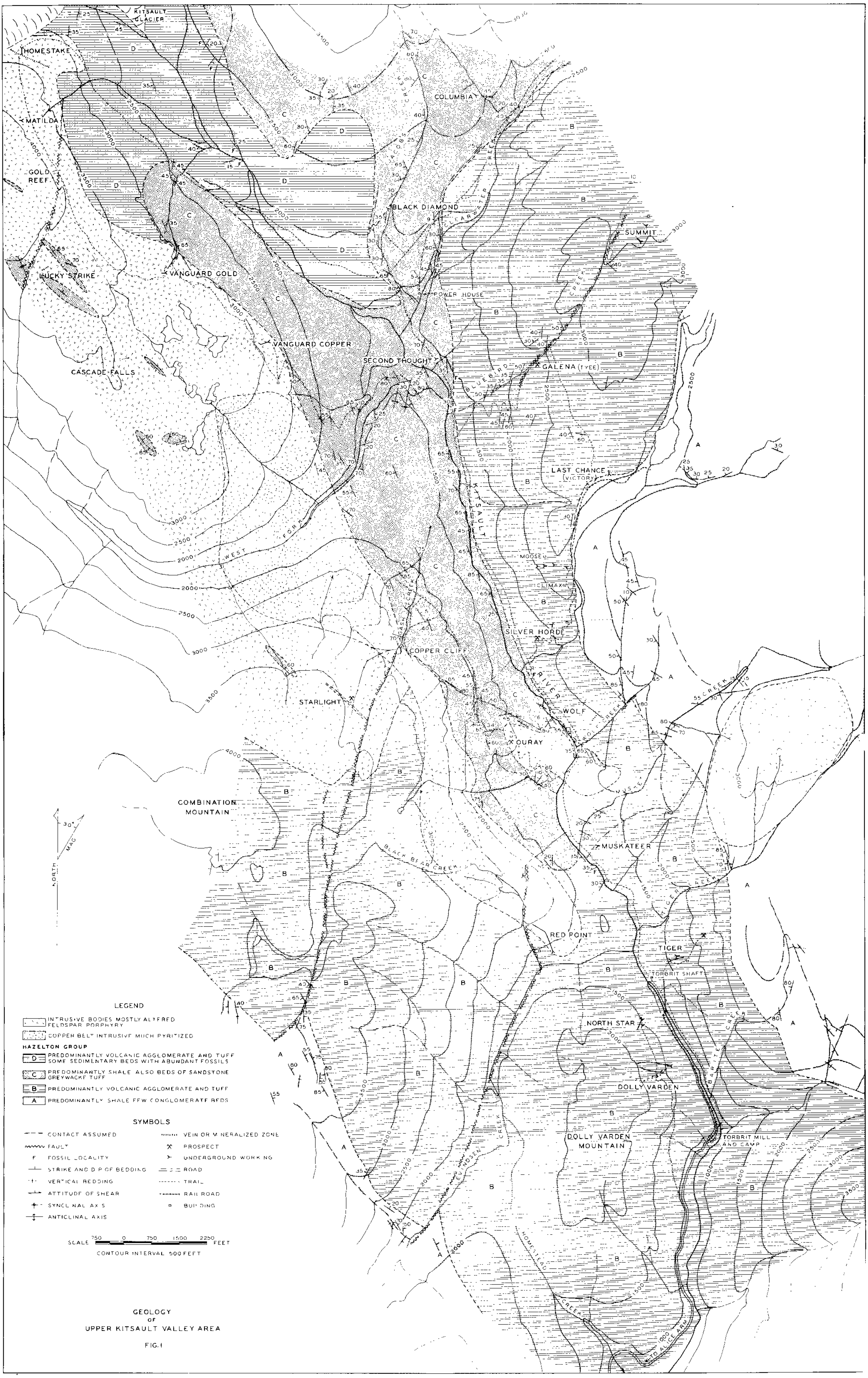
Evindsen Creek and the west fork of Kitsault River, the two largest tributaries from the west, head in glaciers. Trout and Clearwater Creeks, the largest tributaries from the east, head in lakes and are clear streams. A hydro-electric installation on Clearwater Creek now develops 1,500 horsepower, and if the maximum potential were developed a larger plant could be installed. During 1920 water from Trout Creek was diverted southward half a mile to Wolf Creek to generate power in a hydro plant near the mouth of Wolf Creek, but the plant was operated for only a few days.

Much of the area is covered with a thin layer of overburden. Bedrock is exposed on ridges, on steep slopes, and in canyons. The area is heavily timbered up to an altitude of about 3,000 feet. Some of the trees, mostly spruce, attain a good size, but many are rotten at the core.

General Geology.—The area is underlain by sedimentary and volcanic rocks and by intrusive rocks that may be closely related to the volcanic rocks. The sedimentary and volcanic rocks are part of the Hazelton group of Jura-Cretaceous age and have been subdivided into two sedimentary formations, A and C, and two volcanic formations, B and D.

The sedimentary rocks are in three main areas and in numerous smaller areas. Those in areas in the southwest and southeast are believed to be of equivalent age and are referred to as Formation A, the oldest in the area. The correlation is based partly on lithology and partly on structural relationships. The sedimentary members in the northeast and central part of the map-area are named Formation C; they rest on volcanic rocks of Formation B and are believed to be younger than the members of Formation A.

Formations A and C are similar in lithology and colour. Most of the beds of both formations are thin-bedded shales, and most of the rest of the formations consist of sandstone, greywacke, tuff, and limestone. Almost all the beds are dark grey to black. Conglomerates are fairly common in the upper part of Formation A, but none were seen in Formation C. The conglomerates have a preponderance of shale pebbles, but one



GEOLOGY OF UPPER KITSAULT VALLEY AREA

FIG. 1

conglomerate near the top of Formation A has cobbles as much as 8 inches in diameter of marble, quartzite, and tuff.

Metamorphosed sedimentary rocks including slates and quartzites in several small areas in the northwest part of the area are included in Formation C because of their location. It is probable that Formation C, and not Formation A, may once have extended over the whole of the northern part of the area. Most of the rocks in the northwestern areas are altered and bleached, and generally only faint traces of bedding indicate their sedimentary origin. The beds are brittle and shatter readily into sharp angular fragments.

The base of Formation A is outside the map-area and was not seen. In a few examples of graded bedding the changes in grain size indicate that the tops of the beds face towards the volcanics of Formation B, which therefore overlies Formation A. The presence of some tuffaceous beds near the top of Formation A proves that volcanic material was being deposited in the same body of water as the sedimentary material, and it is inferred that the contact between Formations A and B is conformable.

Formation B includes most of the volcanic rocks of the area and consists of fragmental rocks of generally massive habit and green, grey, red, and purple in colour. The changes are gradational, and the colour outlines are generally irregular and not related to bedding or to any other recognizable structure. The fragments are angular or rounded and are as much as a foot in diameter. They differ little from the matrix and in most cases are not discernible, except as a result of the combined effects of alteration and weathering. Thin sections reveal that the fragments consist of igneous rock such as feldspar, hornblende, and augite porphyries, and that the matrix is tuffaceous and apparently differs little in composition from the fragments.

Alteration has changed the phenocrysts of feldspar, hornblende, and augite to sericite, chlorite, and carbonate, and much iron has been introduced. The effect has not been uniform and generally appears to accentuate the slight difference between fragment and matrix. The outer parts of many fragments are slightly different in colour from the inner parts and also from the surrounding matrix.

The rocks of Formation B are as a rule hard, massive, and competent, but they include near the base some schistose rocks which are more completely altered than the rest of the formation. Schistose rocks exposed in a belt along Homestead Creek, the north-flowing course of Evindsen Creek, and in a band extending from Evindsen to Black Bear Creeks, unlike most of the rocks of the formation, are yellow and rusty. A few outcrops of similar rocks near Black Bear Creek suggest that the belt continues beyond Evindsen Creek as far as Black Bear Creek. The schistosity is approximately parallel in strike to Homestead Creek and to the contact between Formations A and B. Bedding planes, possibly closely spaced in this part of the formation, could have afforded easy access to solutions that produced intense alteration so that schistosity could readily develop. The reason for the absence of similar rocks in the same relative position above the base of the formation east of the river is unknown.

There are many tuff beds within the formation, and in Bluebird Creek valley a series of beds contain much sedimentary material, including argillites, greywackes, tuffs, and some volcanic agglomerate. The beds are exposed near the creek for about half a mile, starting at a point about 1,000 feet east of Kitsault River. Their extent away from the creek is not known, and for this reason they are not mapped separately.

Beds of limy and gritty tuff containing fossils of marine fauna occur near the top of Formation B. The fauna have not been identified.

Formation C overlies Formation B and outcrops over much of the northeastern part of the area. The contact between Formations B and C exposed along Clearwater Creek is disconformable, inasmuch as the sedimentary beds occupy hollows on the surface of the volcanic rocks. Elsewhere the contact between Formations B and C is not exposed, but there is no apparent discordance of attitude between the members of the two formations.

Another group of volcanic rocks with overlying sediments occurs near Kitsault River in the northern part of the area and is included in Formation D. The volcanic members are similar to those of Formation B, but since, as far as is known, Formation D overlies Formation C, which in turn overlies Formation B, it appears that the two formations are not equivalent. The volcanic part of the series seems to grade gradually into sedimentary beds which are similar to the gritty tuffs at the top of Formation B but contain much more fossil fauna, principally belemnites. The contact between Formations C and D is not exposed but is believed to be unconformable.

Intrusive rocks are widely distributed in the northwest part of the area and in one area to the east. They range in composition from feldspar porphyry to augite porphyry and, like the volcanic rocks, have been much altered, with the result that they are now very similar in appearance to those rocks. The intrusives, with the exception of those of the Copper Belt, are not differentiated on Figure 1 because of the difficulty of distinguishing in the field between the several varieties.

Many of the bodies may be sill-like or in some other way related to structures of the sedimentary rocks. The sedimentary rocks in the northwest are in roof pendants that have at least one long dimension and appear to be remnants of intersill masses.

The Copper Belt is an intrusive body or bodies of feldspar porphyry which, like the other intrusive bodies, is much altered but contains more pyrite than others and weathers to a characteristic yellow rusty colour. Much silica has been introduced and, in places, chalcopyrite.

Dykes are common. Many are lamprophyric, but some are like the larger intrusive masses. The lamprophyre dykes are younger than the mineral deposits and weather readily, with formation at the surface of rounded fragments that look like cobbles. The lamprophyre dykes commonly occur in belts, as east of the Copper Belt in upper Black Bear Creek, and in the western part of the Toric mine.

Structure.—Formation A is the oldest, and since rocks of this formation occur on both sides of the valley, with younger rocks occupying a central position, it appears that the formations are folded into a syncline.

The beds near the contact between Formations A and B dip at moderate to steep angles, mostly towards the contact but some away from it. The irregularity of attitude near the contact is attributed to folds and faults in the thin-bedded rocks at the contact with the massive formation.

The attitude of the few beds seen in the massive part of Formation B is not sufficient to outline the structure. However, the attitudes of beds exposed in Bluebird Creek and of those at the top of the formation near Kitsault River indicate that the beds are on the east limb of the syncline. The west limb has been largely obliterated by the numerous intrusives.

Similarly, Formation C, along Kitsault River, appears to be on the east limb of a major syncline of which only remnants of the west limb remain in the northwest part of the area. Formation C has also been folded internally into several lesser folds.

Near the axis of the major syncline, where Formation C rests on Formation B, the beds dip 20 to 30 degrees northward, indicating a northward plunge of 20 to 30 degrees for the syncline at that point. The direction of plunge is confirmed by the shape of the area underlain by rocks of Formation C, the considerable increase in width of the formation near Clearwater Creek suggesting that the plunge increases towards the north.

Hanson considered that the similarity between Formations A and C indicated that they were parts of one formation and for that reason concluded that the members of the Hazelton group were folded into two anticlines and a central syncline. However, the writer believes that Formation B lies between Formations A and C, and that the Hazelton group is folded into one major syncline which strikes north-northwestward and plunges in the same direction.

The contact between the beds of Formation C and the Copper Belt is to a large extent conformable to the bedding, but at several places the attitude of the contact is quite different from that of the beds. Some of the beds at the contact have been crumpled and some have been faulted.

The area is much faulted, and faults are common in the underground workings. On most the amount of movement is only a few feet or a few tens of feet. Faults may be more common in the massive rocks of Formations B and D than in Formations A and C.

On the Dolly Varden property the mineralized zone is offset by many northerly striking faults, and Dolly Varden Mountain is crossed by many steep-sided draws which probably follow the traces of northerly striking faults.

Some major faults strike northeastward. The courses of many of these faults are marked by creeks in prominent valleys. Evindsen Creek for much of its length seems to follow a fault which appears to displace the contact between Formations A and B about 700 feet horizontally. The vertical displacement is not known. Towards the northeast, near the Copper Belt, the projected trace of the same fault is marked only by a draw. It is possible that much of the movement on the Evindsen Creek fault took place before intrusion of the Copper Belt rocks and that movement after the intrusion was on a lesser scale. The straightness of the surface trace indicates that the fault dips steeply.

A similar fault, with an apparent horizontal displacement of about 1,200 feet, is followed by the upper part of Black Bear Creek. Most of the movement on this fault also probably took place before emplacement of the intrusive bodies because numerous dykes crossing the valley are only slightly offset. The continuation of the fault could not be traced, but it appears to split and several subparallel draws, each of which may follow the trace of a split, cross the eastern part of Combination Mountain.

In the central and upper part of Bluebird Creek valley a fault follows the creek, and a quartz vein as much as 20 feet wide occurs in the fault zone. The vein has been traced along the same general strike beyond the head of Bluebird Creek to the outlet of Clearwater Lake, outside the map-area, a total distance of about 2 miles. This indicates that the fault probably continues for the same distance at least, and is consequently a major fault. It is possibly the continuation of one of the splits of the fault followed by upper Black Bear Creek.

Another northeasterly fault cuts across the ridge north of the west fork. It is probable that numerous topographic breaks extending northeastward across Combination Mountain mark the surface traces of other northeastward-striking faults.

Mineral Occurrences.—Quartz veins are common throughout the area. Many are a fraction of an inch wide, but some are several feet wide. In many, vugs contain quartz crystals with well-terminated ends, though the crystals are as a rule less than an inch long. Most of the veins contain no other minerals.

The mineral occurrences in the area may be grouped as follows:—

(1) Quartz-barite-jasper replacement deposits containing sulphides and native silver in Formation B and some near-by intrusives.
(2) Deposits containing chalcopyrite in the Copper Belt.
(3) Quartz-carbonate veins containing minor amounts of sulphides in Formation C.
(4) Veins and replacement zones containing sulphides and gold in the intrusives and roof pendants of the northwest part of the map-area.

Group (1) includes the Toric and Dolly Varden orebodies and numerous prospects in which silver minerals predominate. Galena and sphalerite are recovered from the Toric ore and are important in some of the prospects. As a rule the deposits are about 10 to 20 feet wide, but some are much wider, and the Toric deposit is as much as 100 feet wide. Some of the deposits have nearly parallel walls and are like veins; others which have walls that depart considerably from parallelism are like replacement deposits. Regardless of form, the deposits were probably formed by similar processes and largely by replacement. The difference in form may be attributed to differences in the breaks or faults which must have localized the replacing solutions, with vein-like deposits forming along simple fractures and the irregular deposits forming in complex fracture zones.

The mineralogy of the deposits is distinctive, inasmuch as barite, jasper, and spherules of marcasite are common and many of the surface showings contain abundant manganese oxides. Quartz is the most abundant gangue mineral and is generally accompanied by carbonate. Pyrite is abundant, and chalcopyrite and tetrahedrite are present in minor amounts. Silver minerals, including native silver, are present as a rule only in small amounts but are sufficiently abundant to make parts of some deposits of ore grade. Vugs containing quartz crystals with well-terminated ends are common. Many of the deposits consist largely of gangue minerals and of horses of country rock and contain relatively minor amounts of the metallic minerals.

Banding is a notable feature of these deposits. The contrasting bands consist of different minerals; of the same mineral but of different colours; or of the same minerals but in different proportions, dimensions, arrangement, or orientation. The bands range in thickness from paper thin to several feet. The very thin ones consist of dark and light quartz and in cross-section appear as a series of curving segments similar to the banding generally described as colloform. The bands as a rule are parallel to the nearest contact of the deposit.

Another notable feature is the preponderance of gangue as compared to metallic minerals. In some parts of the Dolly Varden deposit pyrite is abundant, but this is exceptional, and in most deposits metallic minerals are present in minor amounts. Native silver, if present, occurs as a rule in tiny flakes, and the appearance of the mineralization is not a reliable guide to the silver content.

Galena as a rule is present in only small amounts in most of the deposits. There is a tendency for galena to be more abundant in deposits such as the Wolf and Climax which are in the northern part of the area. The Galena is included in the group because galena predominates and there are no gangue minerals in the ore. Galena mineralization on the Galena property occurs beside a quartz vein which contains a very small amount of sulphides, and apparently the normal association of gangue and ore minerals was obstructed. If the galena had been deposited in fractures in the quartz, the deposit would have been very similar to the others of this group.

Sphalerite is generally less common than galena, and some deposits do not contain any. However, some bands containing abundant sphalerite occur in the North Star and on the lowest level of the Dolly Varden.

Unoxidized sulphides occur at or within a few inches of the surface in all the deposits. Manganese and iron oxides are present as a coating as much as a few inches thick on parts of some of the deposits.

The attitude of many of the deposits cannot be determined because the walls are poorly defined and irregular. However, the attitudes of developed deposits are known. Many of the deposits, including the Wolf, Silver Horde, Galena, and parts of the Toric and Dolly Varden, strike between northeast and east-northeast; others, including the Muskateer, Moose, Climax, and parts of the Toric and Dolly Varden, strike between northwest and west-northwest. The two most important deposits, the Toric and Dolly Varden, are arcuate in outline, with the ends of the arcs striking northwestward and northeastward and the central part of each, in which most of the ore is found, striking westward. Some of the deposits are vertical, but most of them dip steeply northward.

Most of the margins are ill defined, and the deposits grade into the walls. It is apparent that the deposits could have formed by replacement of the walls of fracture zones, and because of the replacement the fractures followed by the mineralizing solutions are not recognizable. Some of the contacts are faulted, but some of the movement on most contact faults is demonstrably younger than the mineralization. Some of the deposits are cut by faults, on most of which at least some of the movement is post-mineral.

It is apparent that linear deposits could have developed along fracture zones in which mineralizing solutions could circulate readily, but it is not apparent how deposits that are arcuate in form could have developed. However, no other localizing condition is evident. If beds that were particularly susceptible to replacement were present, some evidence of them should be found, but in the absence of such beds it must be concluded that the arcuate deposits also formed by replacement along fracture zones.

Most of the deposits are found in the northwestern part of Formation B and near-by intrusives adjacent to the overlying sedimentary rocks of Formation C. The reason for the localization of deposits within Formation B is not known, but it is possible that at the time of mineral deposition Formation C extended southward over a greater area than it does now and confined the circulation of mineralizing solutions to the rocks below it, that is to Formation B.

The Toric and Dolly Varden oreshoots are in parts of the deposits relatively close to the projected extension of the major synclinal axis, and the parts of these deposits farther from the axis are lower in grade. It is possible that ore formation was favoured by nearness to the synclinal axis.

The deposits included in this group are as follows: Climax, Dolly Varden, Victory, Muskateer, Moose, North Star, Ouray, Silver Horde, Summit, Tiger, Toric, Galena, and Wolf.

Group (2) includes silicified zones with abundant disseminated pyrite and a minor amount of chalcopyrite. Such zones differ little from the Copper Belt rocks in general and evidently are zones of more intense alteration. Some of them are many feet wide, but their boundaries are not defined so their size and attitude are not apparent. The amount of chalcopyrite present, except in small lenses, is only a small fraction of 1 per cent. The three deposits of this group on which underground work has been done are the Combination, Red Point, and Copper Cliff; the latter two have been diamond drilled.

However, the only deposits that have been explored in the Copper Belt are those naturally exposed on bluffs and steep canyon slopes. Prospecting might locate other occurrences in which chalcopyrite is present in greater proportions.

Veins of group (3) on which some work has been done are in Formation C. Most of them are bedded, or nearly so, and follow contortions of the bedding. The veins are sparsely mineralized with pyrite and minor amounts of other minerals. The deposits of this group are the Columbia, Black Diamond, and Syndicate.

The mineral occurrences in the northwest part of the area include a variety of deposits and are listed together as group (4), not because of mineralogical similarities, but because they are geographically grouped and occur in intrusive bodies or near the contacts of intrusive bodies.

On the Vanguard and Homestake properties the most important metals are copper and gold. On other properties sphalerite is fairly abundant and stibnite occurs on one. Some are veins and others are irregular replacement deposits along what may have been fault zones. Some zones consist mostly of fragments or horses of country rock with minor amounts of vein matter. An erratic distribution of gold suggests that native gold may be present. The deposits included in this group are the Lucky Strike, Gold Reef, Starlight, Vanguard, and Homestake.

[References: *Geol. Surv., Canada,* Sum. Rept., 1921, pp. 7–22; Mem. 175, 1935.]

Gold

Homestake (British Lion Mines Limited) Company office, Suite 84, 535 Granville Street, Vancouver. A. F. Smith, manager. Capital: 10,000 preferred shares, $10 par value; 20,000 common shares, $10 par value. The company has a one-quarter interest in the ownership of the Homestake property of four Crown-granted claims (Lots 3975 to 3978) and two Crown-granted fractional claims (Lots 3979, 3980). The other three-quarters interest in the property is part of the estate of C. F. Welch.

The claims are half a mile to 1 mile west of the foot of Kitsault glacier and are between 2,800 and 3,500 feet altitude on a fairly steep slope. Some of the surface is covered with morainal material, mostly boulders, but much of the surface is bare or has only a thin soil covering. Most of the property is above timberline. A pack-trail that is the continuation of the main valley trail leads to two cabins at about 2,800 feet altitude and continues across the property.

Extensive rusty outcrops found before 1916 were explored by open-cuts and trenches. In 1919 Mineral Claims Development Company Limited optioned the property but did little work. Consolidated Homestake Mining and Development Company Limited took an option on the property in 1921 and started a crosscut adit, but relinquished the option after two years of development work. In 1934 the property was acquired by the present owners, who have done some exploratory work in most years up to the present. In 1939 a shipment of 8.8 tons of selected ore contained: Gold, 36 oz.; silver, 52 oz.; lead, 140 lb.; zinc, 668 lb.; copper, 1,320 lb.

The property is underlain by altered feldspar porphyry and by other altered rocks not identified. Some of the altered rocks may be roof pendants of volcanic origin. The rocks are green and locally are referred to as greenstone. Pyrite is abundant.

A zone comprising several subparallel faults and intervening wallrock has been mineralized. It dips between 50 degrees and 80 degrees northeastward and has been followed for 700 feet. As a rule the limits of the zone are indefinite, but for most of its length it is about 20 feet wide, and at one point it is about 40 feet wide. A segment of the zone at a point about 360 feet southeast of cut T1 (*see* Fig. 2) is displaced about 200 feet eastward south of a fault. Southeastward from the fault sparse mineralization can be followed for several hundred feet, but less work has been done on this part of the zone and, although it appears to be wider than it is to the northwest, it cannot be definitely outlined. The projected extension of the zone to the northwest is covered by glacial ice.

In general, mineralization is sparse. Quartz, carbonate, and minor amounts of barite and sulphides occur in veins, pockets, and lenses, and are disseminated in the walls of the faults. Massive mineralization is restricted to pockets or lenses a few feet wide. Pyrite is the most abundant sulphide; chalcopyrite is present as a rule in small amounts; sphalerite and galena occur erratically and are less abundant; some of the surface showings have a coating of manganese oxides. Younger faults in the zone cut the mineralization.

A second zone similar to the main one is north of it and strikes westward towards it, but junction of the two zones is not exposed. The northern zone is sparsely mineralized and contains little chalcopyrite, galena, and sphalerite.

The showings were sampled in 1934 and 1938 by J. T. Mandy,* and the assays are tabulated on page 86. Most of the assays show comparatively low grade, but some samples, assaying considerably higher than the others, came from open-cut T1, and the selected ore that contained more than 4 ounces of gold per ton also came from this cut.

At cut T1 the mineralized zone includes abundant lenticular bodies of sulphides, chiefly pyrite and chalcopyrite. The most intensely mineralized part of the zone is about 15 feet wide. The writer took five samples in sequence across the zone from the hangingwall to the footwall. In these the gold is approximately proportional to the amount of copper, and it is probable that much of the gold is associated with chalcopyrite, the only copper mineral noted. Some of the gold may be present as native gold.

The main zone has been explored by three adit levels—the Myberg, Gerhardi, and Smith. A drift on the upper level, the Myberg, has been driven along the zone about 15 to 20 feet below the surface. Lenses of sulphide mineralization are cut in the drift and some crosscuts from it, but the gold and copper content of samples taken on this level is considerably less than that of samples from open-cut T1.

* *Minister of Mines, B.C.*, Ann. Rept., 1934, p. B 17; 1938, pp. B 9–B 12.

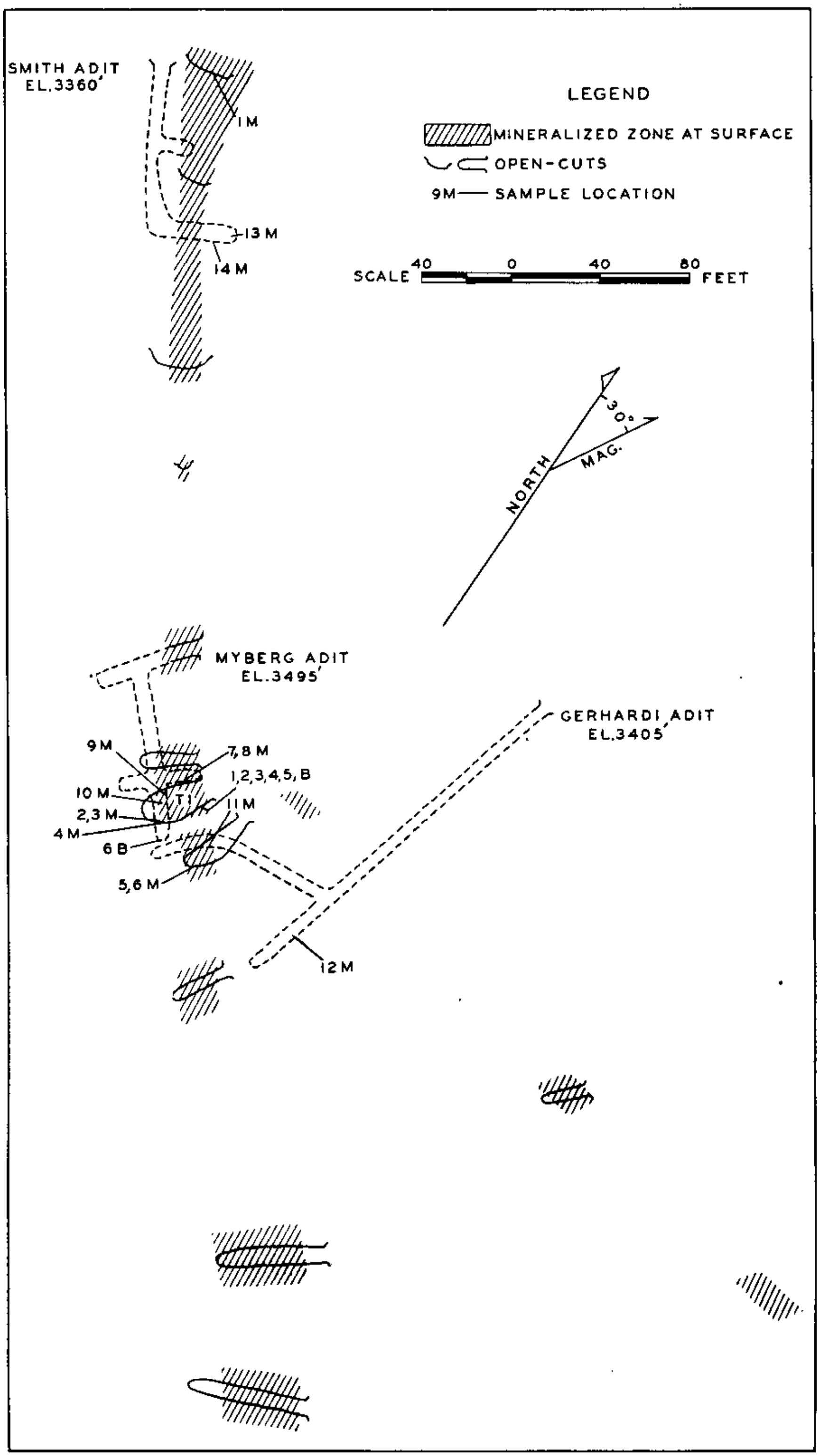


Fig. 2. Plan of Homestake workings.

Workings on the Gerhardi level, about 90 feet lower, also cut the main zone, but in them chalcopyrite is sparse and the gold and copper content of samples is low. The northern zone, also crossed by the Gerhardi crosscut, is about 50 feet wide but is only sparsely mineralized, and the only sulphide present in appreciable amounts is pyrite. Samples taken from the main zone on the Smith level are also low grade.

The assay results are tabulated below. Samples marked " M " were taken by Mandy and those marked " B " by the writer.

Sample No.	Width	Gold	Silver	Copper	Lead	Zinc
Surface Samples	Feet	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent	Per Cent
1 M	21.7	Trace	1.0	*Nil*	Trace	0.2
2 M	27.0	0.30	1.2	3.9	*Nil*	3.5
3 M	27.0	0.80	2.6	3.0	Trace	4.5
4 M	2.5	1.10	0.9	0.9	*Nil*	0.3
5 M	24.0	0.04	0.4	0.2	*Nil*	3.0
6 M	24.0	0.10	0.4	*Nil*	0.3	3.0
	Inches					
1 B[1]	28.0	0.40	0.6	3.2	Trace	*Nil*
2 B	44.0	0.02	0.2	0.5	Trace	Trace
3 B	34.0	1.16	0.9	2.4	Trace	Trace
4 B	38.0	0.01	*Nil*	0.2	Trace	*Nil*
5 B[2]	28.0	1.21	2.8	3.0	0.5	Trace
Underground Samples						
Myberg level—	Feet					
6 B	3.5	Trace	0.4	Trace	Trace	Trace
7 M	16.0	0.26	0.1	0.7	*Nil*	*Nil*
8 M	4.2	0.16	0.4	0.5	*Nil*	Trace
9 M	8.8	Trace	3.8	*Nil*	0.4	1.8
10 M	2.8	Trace	1.0	*Nil*	Trace	0.2
Gerhardi Level—						
11 M	4.0	Trace	Trace	Trace	*Nil*	*Nil*
12 M	1.5	0.06	2.5	0.5	*Nil*	Trace
Smith level—						
13 M	3.0	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*
14 M	10.8	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*

[1] Hangingwall section.
[2] Footwall section.

The surface showings and the underground workings and the location from which samples have been taken are indicated on Figure 2.

According to A. F. Smith, at the end of the 1951 prospecting season mineralization in which sphalerite and galena are abundant was uncovered along the projected extension of the main zone to the southeast.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1938, pp. B 7–B 12 (J. T. Mandy); 1947, p. 95 (J. M. Black).]

Gold Reef No. 1, Progress (Matilda, Gold Reef)

The Gold Reef No. 1 claim and the Progress Nos. 1 to 8 claims belong to A. F. Smith, of Vancouver. The Progress claims are partly a relocation of the Matilda and Gold Reef properties. The claims are southwest and south of the foot of the main valley glacier. A trail that continues past the Vanguard and another from the Homestake both lead to the showings. Several old branch trails lead to the workings found, which are above timberline between 3,500 and 4,500 feet altitude. Snow filled some of the gullies and cuts in mid-August, and one adit was not found.

Claims were located here in 1916. In 1924 the Kitsault River Mining and Development Company Limited was formed, and in 1925 and 1927 drove an adit. Since then little has been done, and many of the claims were permitted to lapse. The ground is underlain by intrusives of a considerable range of composition that have been non-uniformly altered; consequently, they have an irregular patchy appearance. Pyrite is abundant and most of the outcrops are rusty. The intrusive rocks have been sheared and, where shears are closely spaced, vein matter has been introduced and mineralized zones have formed.

A mineralized zone exposed by two open-cuts, between 4,070 and 3,970 feet altitude, strikes west-northwestward. At the upper cut it is about 20 feet wide and consists of numerous carbonate stringers, disseminated pyrite, pockets of resinous sphalerite, and minor amounts of galena. At the lower cut, about 100 feet east of the upper, there is a quartz lens 8 feet wide dipping 65 degrees northward. The lens becomes narrower in both directions along its strike. The central part contains abundant sphalerite and some galena, but near the margins sulphides are sparse. A sample taken across a width of 30 inches of the central part of the lens assayed: Gold, trace; silver, 1.0 oz. per ton; lead, 3.9 per cent; zinc, 12.8 per cent. Another sample taken across a width of 66 inches of the sparsely mineralized margins of the lens assayed: Gold, trace; silver, *nil;* lead, trace; zinc, 1.6 per cent.

About 10 feet below the lower cut and 25 feet northeast of it an adit has been driven westward about 30 feet, and two crosscuts have been driven southwestward 17 and 15 feet respectively towards the projected extension of the lens exposed at the surface. Only very sparse mineralization was encountered.

A few veins in the southern part of the property, probably on the Gold Reef No. 1 claim, are about 1 foot wide. They consist of quartz, carbonate, pyrite, and minor amounts of chalcopyrite, galena, and sphalerite. One showing at 3,900 feet altitude consists of a vein about 1 foot wide in a fault zone. The vein, which strikes westward, is covered with as much as 6 inches of black earthy manganese oxides.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1925, pp. 75, 76.]

Lucky Strike, Cascade Falls, Sunnyside

The Lucky Strike claim is owned by W. McLean, of Prince Rupert, and the Cascade Falls and Sunnyside claims are owned by J. Hauber, of Alice Arm. They are north of the west fork of Kitsault River, with the Lucky Strike claim about half a mile north of the other two. Several workings in the general area are probably on one or other of the three claims, although the claim posts were not found.

The claims are on top of the ridge between the main Kitsault River and the west fork. The slope up from the two streams is steep to about 3,000 feet altitude, above which the ground slopes gently to 4,000 feet. On the gentle slope are numerous hollows, some of which contain ponds.

The claims are reached from the Vanguard property, the trail to which leaves the main valley trail a short distance north of the mouth of the west fork. Beyond the Vanguard no trails leading to the showings were found, but the area is only sparsely timbered and travel is easy.

The claims were first located some time before 1922, and in that year considerable exploratory work was done, including the driving of an adit. Work was done in succeeding years, but little since 1934. Much of the work was on natural exposures and included little trenching.

The area is underlain by intrusive bodies and elongate roof pendants. The strike of the beds in the roof pendants is northwestward as a rule, parallel to the general trend of the pendants. Some of the intrusives are sheared, and parts of some pendants are sheared parallel to the bedding. Vein matter has been introduced along some of the shears which constitute northwestward-striking vein zones. Most of the vein zones are less than 1 foot wide and contain only sparse sulphide mineralization.

Some fractures in the intrusive bodies, not parallel to the contacts, have had vein matter introduced as veins and disseminated in the walls of the veins. The mineralized zones so formed are as much as several feet wide and contain a considerable proportion of sulphides.

The main mineralized zone found on what is believed to be the Lucky Strike claim is exposed in an open-cut at 3,850 feet altitude. In the cut a quartz and carbonate vein about 2 feet wide strikes northeastward and dips steeply, and contains a moderate proportion of sphalerite and some pyrite, tetrahedrite, and galena. In the south wall rusty carbonate and sparse sphalerite and galena replace the wallrock for as much as 3 feet from the vein. An adit driven about 25 feet towards the zone stops a few feet short of the projected extension.

Sample No. 1, taken across the vein, and Sample No. 2, taken across the mineralization in the wall, assayed:—

Sample No.	Length	Gold	Silver	Copper	Lead	Zinc
	Inches	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent	Per Cent
1	27	0.02	8.6	0.7	0.8	6.6
2	30	0.01	Trace	Trace	0.2	0.9

Another mineralized zone at 4,250 feet altitude near the edge of the map-area is possibly on the same claim. The zone, which strikes westward and dips steeply north, is about 1 foot wide and includes several stringers. One stringer about 2 inches wide consists largely of stibnite, galena, tetrahedrite, pyrite, and sphalerite.

The main zone found on the two southerly claims strikes west-southwest and dips steeply. It consists of two mineralized sections 34 inches and 24 inches wide separated by 28 inches of unreplaced intrusive rock. The mineralized sections consist of quartz and carbonate veinlets containing pyrite, sphalerite, chalcopyrite, and galena. Two samples taken across the zone assayed:—

Sample No.	Length	Gold	Silver	Copper	Lead	Zinc
	Inches	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent	Per Cent
1	34	0.10	5.2	1.2	0.8	4.6
2	24	0.02	3.2	0.6	0.8	3.2

Several other mineralized zones on the southern part of the ridge top strike between southwest and northwest. Each is less than 2 feet wide, and each as a rule contains only a small proportion of vein material; the grade was estimated to be lower than that of the sampled zones.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1922, pp. 57–58.]

Copper-Gold

Vanguard

The Vanguard and four other recorded claims held by M. Peterson, of Alice Arm, are on the west slope of Kitsault Valley, north of the west fork. The workings are nearly 1 mile north of the west fork and are between 2,750 and 3,300 feet altitude, where the slope changes from steep to moderate.

A pack-trail leaves the main Kitsault trail a short distance above the mouth of the west fork and extends to a cabin at 2,750 feet altitude near the main workings; the trail continues to another cabin beyond the claims at about 3,750 feet altitude. Below the lower cabin the slope is well timbered, but above it trees are small and sparse.

Copper showings were found on the property shortly after prospectors entered the area, and by 1927 the showings had been explored by numerous open-cuts and by two adits. In 1927 the property was optioned, and a crosscut adit was driven below the main showing. The option expired the same year, but the owners continued exploration. A gold showing was found, about 1925, higher up the slope and farther north, and surface work was done on this and near-by showings. In 1947 a crosscut adit was started about 180 feet lower than the main gold showing and is currently being continued.

The showings are in strongly altered intrusives, some of which are feldspar porphyry. Shale beds of Formation C outcrop a few hundred feet to the east.

Numerous shears in the intrusives strike northwestward. In places the shears are closely spaced, and some of the shear zones so formed are sparsely mineralized with pyrite and chalcopyrite. At the copper showings, in fault zones subparallel to the shears, are veins and lenses of mineralization composed of massive pyrite and chalcopyrite and minor amounts of quartz and barite. At the surface are several lenses of mineralization a few feet wide. These pinch in a distance of a few feet to widths of a few inches or are cut off by faults crossing them at a low angle.

The copper showings have been explored by three adit levels. No. 1 adit crosscut at 2,850 feet altitude is driven southeastward 90 feet, and 50 feet from the portal crosses a nearly vertical quartz and carbonate stringer. A drift has been driven 50 feet northwestward following the stringer which in this distance widens to a vein which is 6 feet wide and well mineralized. A sample across 70 inches in the drift face assayed: Gold, 0.01 oz. per ton; silver, 2.6 oz. per ton; copper, 7.9 per cent. At the face of the crosscut 90 feet from the portal is a second vein zone. This one is sparsely mineralized, and a sample taken across it where it is 48 inches wide assayed: Copper, 0.1 per cent.

No. 3 adit level is 90 feet lower than No. 1 and consists of a crosscut 240 feet long, at the end of which there is a drift 90 feet to the northwest and two short crosscuts to the southwest. In these workings is a vein zone as much as 10 feet wide which dips at a moderate angle to the southwest; it has been followed for 110 feet. It consists of veins of quartz and carbonate separated by pyritized wallrock. Pyrite and chalcopyrite occur in the veins and in irregular lenticular masses between them. Post-mineral faults cross the veins at small angles. In general, chalcopyrite is present in small amounts only but is more abundant in the northwest part of the exposed length. The writer took four samples near the southeast end of the exposed length and two from near the northwest end. James* took two samples—one near the southeast and the other at the northwest face. The assays are tabulated below.

Sample No.	Length	Gold	Silver	Copper
	Inches	Oz. per Ton	Oz. per Ton	Per Cent
Southeast part of zone—				
1[1]	70	0.03	0.6	0.1
2[2]	50	0.03	0.9	0.6
3[1]	38	0.02	1.2	1.7
4[2]	66	0.01	0.5	0.3
5 (James)	60	Trace	4.2	3.0
Northwest part of zone—				
6	60	0.01	4.8	7.4
7	60	Trace	2.0	0.8
8 (James)	72	Trace	1.6	1.0

[1] Hangingwall section.
[2] Footwall section.

Another zone is crossed 160 feet from the portal of No. 3 adit and consists of several quartz stringers separated by unreplaced wallrock. No chalcopyrite was noted.

It is impossible to correlate the mineralized zones at the surface and underground without additional development work; it is probable that there are three or four subparallel zones.

No. 2 adit, 475 feet southeast of and 100 feet lower than No. 1, has been driven under a lens of pyrite and chalcopyrite mineralization. Sparse mineralization, including a minor amount of chalcopyrite, is seen in a short drift 30 feet from the portal.

The main gold showing is exposed in an open-cut at about 3,350 feet altitude and about 4,000 feet west-northwest of No. 3 adit; the cut trends northeast, but it is not apparent whether this is along or across the trend of the mineralization. The mineralization, which consists of quartz, carbonate, and minor amounts of pyrite, chalcopyrite, galena, and sphalerite, replaces intrusive rock and is without well-defined walls. Trenches northwest of the cut do not expose similar mineralization. In a trench 130 feet southeast of the cut, similar quartz and carbonate mineralization occurs, but no sulphides are

* *Minister of Mines, B.C.*, Ann. Rept., 1928, p. 88.

present. Four samples were taken across the mineralization in the main cut, in sequence from southwest to northeast; one sample was taken from the trench to the southeast. These assayed as follows:—

Sample No.	Length	Gold	Silver
	Inches	Oz. per Ton	Oz. per Ton
1	56	0.90	0.9
2	76	0.22	0.3
3	76	2.79	1.4
4	60	0.14	Trace
Southeast Trench			
5	60	*Nil*	Trace

A zone about 300 feet to the east and about 100 feet lower consists of altered intrusive rock, quartz, pyrite, chalcopyrite, and minor amounts of galena. It is about 6 feet wide, dips steeply to the southwest, and has been explored by an adit driven 40 feet westward. A sample taken across the zone where it is 76 inches wide assayed: Gold, 0.06 oz. per ton; silver, 0.3 oz. per ton; copper, 2.1 per cent.

A zone of slight shearing is exposed about 200 feet east of and about 90 feet lower than the last described. This zone consists of pyritized intrusive rock, numerous quartz veinlets, and a few lenses, less than 1 inch wide, of sphalerite, galena, and chalcopyrite. The general trend of the veinlets is to the northwest. The limits of the zone have not been exposed, but it is at least 80 feet wide. An adit driven 80 feet westward penetrates the zone but does not cross it. Samples of this mineralization were taken by the writer in 1947. The highest assay obtained from nine samples was: Gold, 0.02 oz. per ton; silver, 0.2 oz. per ton; from a sample taken across a width of 40 inches.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1918, pp. 65, 66; 1928, pp. 88, 89; 1947, pp. 95, 96. *Geol. Surv., Canada,* Sum. Rept., 1928, Pt. A, pp. 48, 49.]

Silver

Columbia, Black Diamond

The Columbia and Black Diamond claims have lapsed. The showings on which they were located are northwest of Clearwater Creek, near two creeks draining into Clearwater Creek from the north. The Columbia showings are at about 2,500 feet altitude, and the Black Diamond showings are at about 2,000 feet altitude. Trails branching from the main valley trail a few hundred yards north of Clearwater Creek have not been in use for many years. The showings were found in 1918, and an adit was driven on each claim.

The showings are in an area underlain by Formation C. Most of the beds are thin black shale, but beds of dark-grey greywacke are common. Most of the beds dip northward at moderate to low angles.

The Columbia showing is a quartz vein as much as 6 feet wide which strikes northwestward and dips steeply. The vein contains a considerable proportion of shaly inclusions and a little pyrite. A drift adit 135 feet long is caved.

The Black Diamond showing is a quartz stringer zone which strikes northwest and is as much as 15 feet wide. No sulphides were noted in an adit driven 75 feet along the zone.

[Reference: *Geol. Surv., Canada,* Mem. 175, pp. 56, 59.]

Syndicate (Second Thought)

Claims of the Second Thought property have lapsed. The ground is now part of the Syndicate group of claims owned by S. Uruski, of Alice Arm, and part of Corporation Fraction owned by H. Bapty, of Alice Arm. The workings found are on the Syndicate Fraction No. 2. The ground is on the east slope of Kitsault Valley south of Clearwater Creek, near the point where a trail leading to the Vanguard and other properties leaves the main valley trail. The workings are between 1,300 and 1,400 feet altitude, near the base of a well-timbered slope.

A crosscut adit was driven in 1918 to explore two veins. Work was continued in 1919, 1920, and 1921; in 1924 a drift was driven a few feet on a vein exposed in the crosscut. Since then little work has been done.

The ground is underlain by thin shaly beds near the base of Formation C. Most of the beds strike northward and dip westward but locally are crumpled and faulted.

Two exposures 100 feet apart may be parts of a single northward-striking vein or of two subparallel veins. The vein matter dips between 15 and 30 degrees westward, in part conformable to the bedding. The vein exposures are as much as 4 feet wide and consist of quartz and many fragments of argillite. A small amount of pyrite and very small specks of an unidentified mineral, possibly argentite, occur in the southern exposure; a sample taken across a width of 4 feet assayed: Gold, trace; silver, 7.0 oz. per ton.

An adit driven 70 feet eastward under the unmineralized northern exposure crossed two veins below the surface. The wider of the two veins, 15 feet from the portal, is 1 foot wide and has been drifted on for 20 feet. The second vein, 50 feet from the portal, is a few inches wide. Both veins contain numerous argillaceous inclusions; no sulphides were noted.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1921, p. 51.]

Summit

The ground formerly covered by the Summit claims is now open. It is on the broad top of the ridge between Kitsault Valley and a gently rolling plateau that extends eastward from the map-area between Clearwater and Trout Creeks. The workings are between 2,900 and 3,000 feet altitude and are southeast of a small draw that extends northeastward and is aligned with the upper part of Bluebird Creek.

A trail up Bluebird Creek can be followed across the bare top of the ridge to a cabin at the edge of a small lake at 2,900 feet altitude. Another route to the area is by trail northward along the ridge from the upper cabin on Trout Creek trail to Bluebird Creek and thence by the Bluebird trail to the property. Two adits were found a short distance south of the cabin, and numerous trenches in the area near the cabin.

Several veinlets were explored by an adit driven in 1919. Thereafter, prospecting was carried on, mostly by trenching, in 1922 and 1924, 1930 to 1934, and 1949–50.

The area is underlain by fragmental rocks of Formation B that have been fractured. In the fractures are a great many veinlets with a great variety of attitudes, though many of them strike northeastward. Most of them are less than an inch wide, and none, including those explored by the adits, are more than a few inches wide. The veinlets are composed of quartz, carbonate, chlorite, pyrite, and minor galena and sphalerite. Some are composed largely of sulphides and chlorite.

An adit about 700 feet south of the cabin has been driven 170 feet northwestward and crosses several veinlets, but fewer than are exposed at the surface. Another adit, about 200 feet south of the cabin, driven 20 feet westward does not cross any veinlets.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1930, pp. 97–98.]

Silver-Lead

Galena (Tyee)

The Galena and Galena No. 2 claims are part of the estate of W. McFarlane, which is administered by the Toronto General Trusts Corporation. An adjoining claim, the Galena No. 1, is owned by G. Bruggy, of Victoria. The claims were formerly part of the Tyee group.

The main showings on the claims are on the east slope of Kitsault Valley on the southeast bank of Bluebird Creek, between 2,300 and 2,650 feet altitude. They are mostly on the Galena claim but probably extend on to the Galena No. 1 claim. Another showing at 2,050 feet altitude is in the bed of a small creek that flows towards Bluebird

Creek from the southeast. The showings are reached by a trail from the main valley or by one from Trout Creek.

Galena mineralization was found on the property in 1929, and during the next five years a series of trenches was dug and a short adit was driven. Recently the trenches have been cleaned out and others dug. Transcontinental Resources Limited optioned the property in 1951, put down eight diamond-drill holes, and then relinquished the option.

Kitsault glacier at the head of Kitsault River.

Massive volcanic agglomerate is overlain near the showings by thin-bedded tuffs and shales. The contact between the massive and the bedded rocks is gradational. The bedded rocks dip gently or moderately to the northwest. Some of the bedded rocks and some of the massive ones have been sheared parallel to the bedding planes.

A fault near the contact and about parallel to it is occupied by a quartz vein. This vein, named the Bluebird, is more resistant to erosion than the other rocks and is a prominent feature of the property. It is as much as 20 feet wide and consists of white and grey quartz, inclusions of wallrock, and a small amount of sulphides, chiefly pyrite and galena. The walls of the vein are grooved and slickensided. The vein strikes northeastward and dips to the northwest, approximately parallel to the bedding. It can be followed down the creek to about 2,150 feet altitude, where it fingers into several bedded stringers. It is not continuously exposed but has been followed for 2 miles up the Kitsault Valley slope and down towards the outlet of Clearwater Lake, a proved length much greater than that of any other vein in the area.

The showings are within 50 feet of the footwall of the vein and comprise numerous sulphide veinlets, most of which are less than an inch wide and consist of fine-grained galena, pyrite, and small flakes of native silver. The veinlets strike northeastward and appear to dip towards the northwest about parallel to the bedding and to the Bluebird vein. The veinlets are separated by pyritized wallrock and, with the intervening rock, constitute a zone of mineralization as much as 14 feet wide. Individual veinlets are exposed for lengths of about 2 feet in the bottoms of trenches. Mineralization occurs for a length of more than 500 feet, although continuity for this distance has not been demonstrated.

Twelve trenches have been dug 10 to 50 feet southeast of the creek, in a distance of 500 feet. Four of the trenches do not reach bedrock, and in two others there is no mineral or only a few oxidized stringers. Samples were taken in four trenches—Nos. 1, 3, 5, and 8—No. 1 being the trench farthest upstream. One sample was taken across the mineralization in trench 1 and trench 8. Four samples were taken in sequence from west to east in trench No. 3, and three were taken in the same sequence in trench No. 5. The results are tabulated below:—

No.	Location	Width	Silver	Lead
		Inches	Oz. per Ton	Per Cent
1	Trench No. 1	14	56.4	18.7
2	Trench No. 3	34	14.0	10.7
3	Trench No. 3	46	56.0	10.0
4	Trench No. 3	48	18.7	2.8
5	Trench No. 3	36	30.0	16.4
6	Trench No. 5	22	8.7	4.3
7	Trench No. 5	29	6.2	5.8
8	Trench No. 5	36	20.3	22.5
9	Trench No. 8	26	59.7	3.0

The silver in most of the samples is proportional to the amount of lead. However, the high silver content in sample No. 9 is due to the presence of native silver. The gold assay in all the samples was trace or *nil.* Estimates of the zinc content based on spectrographic analysis indicate that there is less than 0.5 per cent zinc in any of the samples and that in most the zinc content is about 0.1 per cent.

The lower showing, at 2,050 feet altitude, is on the face of a bluff in the bank of a small creek. It is a veinlet or lens a few inches wide consisting mostly of galena. A sample selected from the veinlet assayed: Silver, 91.4 oz. per ton; lead, 47.0 per cent.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1933, pp. 49–50; 1948, pp. 75–76.]

Silver

Victory (Last Chance, Chance)

The Victory property of three claims is owned by M. Donald, of Alice Arm. It is north of Trout Creek and 3,000 to 5,000 feet east of the Kitsault River. A pack-trail up Trout Creek valley leads to a cabin at about 2,550 feet altitude and to the showings a few hundred feet beyond the cabin between 2,700 and 2,800 feet altitude. The ground slopes gently, and the only outcrops are on a slight ridge that trends westward. The claims were formerly named Last Chance and Chance.

Mineralization was found before 1918. Several open-cuts were made, and in 1919 four holes were drilled. In 1921 a crosscut adit was started and was driven at intervals until about 1930. Since 1930 little work has been done.

The rocks are massive altered fragmentals of Formation B, close to the contact with underlying shaly beds of Formation A. Two subparallel mineralized zones, a northern and a southern about 100 feet apart, are partly exposed in open-cuts. It is reported that the mineralization had been traced for 700 feet, but now the northern zone is exposed in only two trenches about 100 feet apart and the southern one in one trench.

The northern zone is about 20 feet wide, strikes westward, and dips steeply. It consists of quartz, much of which is finely banded, inclusions of the country rock, carbonate, barite, pyrite, marcasite, and small amounts of argentite, and is coated with manganese and copper stains. A sample selected from the exposed parts of the zone in the eastern trench assayed: Gold, trace; silver, 20.8 oz. per ton.

The southern zone also strikes westward and is much like the northern zone in appearance, but it contains hematite and a minor amount of galena. It is about 8 feet wide. A sample selected from the exposed parts assayed: Gold, trace; silver, 14.6 oz. per ton.

Several hundred feet to the west and approximately on the projection of the two zones a trench partly exposes a zone covered with manganese and iron oxides. The walls of the zone are not exposed, so the attitude could not be determined. The zone consists of quartz, carbonate, country rock, and abundant pyrite. A sample selected from representative mineralization, including oxidized material, assayed: Gold, 0.01 oz. per ton; silver, 7.6 oz. per ton.

Of four holes drilled towards the zones from a point south of and lower than the surface showings, it is reported by Clothier* that core from two horizontal holes included mineralization similar to that at the surface, but that core from two holes drilled downward from the same point did not contain much mineralization.

A crosscut adit driven a few hundred feet west of the main showings is caved. It was driven north 10 degrees west for about 120 feet, and M. Donald reports that it did not encounter any mineralization.

[Reference: *Geol. Surv., Canada,* Mem. 175, pp. 57, 58.]

Moose

This property consists of four Crown-granted claims (Lots 1241 to 1244) owned by R. C. McCorkell, of Vancouver, and one fractional claim owned by R. L. Clothier, of Vancouver. The property is on the ridge between Kitsault River and Trout Creek, and in part extends eastward across Trout Creek valley. The showings are between 2,000 and 2,500 feet altitude, near the top of the steep Kitsault slope. A trail, now almost obliterated, branches from the Trout Creek trail near the Silver Horde cabin and leads to the lowest working, about one-third of a mile to the north.

Mineralization was discovered in 1916, and exploration was carried out by trenching and a drift adit. In 1920 Moose Group Mining Company Limited optioned the property and drove a lower adit before dropping the option in 1921. Little has been done since then.

The property is underlain by fragmental volcanics of Formation B. Mineralization is exposed at several points between the lowest adit at 2,000 feet altitude and an open-cut

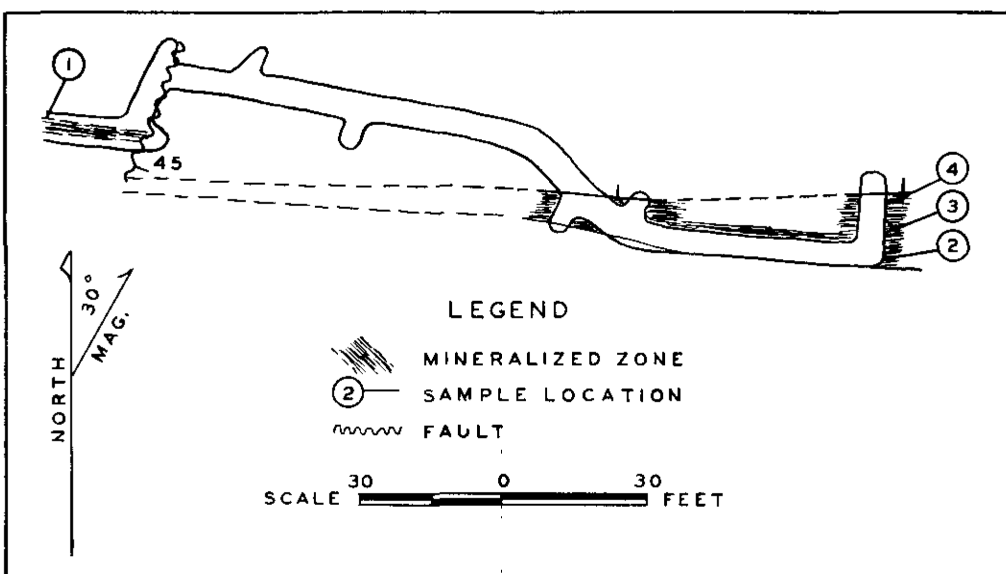


Fig. 3. Plan of Moose lowest adit.

* *Minister of Mines, B.C.,* Ann. Rept., 1923, p. 59.

about 500 feet to the east at about 2,400 feet altitude, but it has not been demonstrated that all the exposures are part of a single mineralized zone. The open-cuts are now sloughed, so little can be seen except that mineralization was once exposed.

The slope below 2,000 feet and above 2,400 feet is covered with talus and overburden, and mineralization has not been traced more than the 500 feet distance, but it is nearly aligned with the Climax zone, which is on the east slope of the ridge, about 250 feet to the east.

An upper adit at about 2,350 feet altitude is reported to have been driven 100 feet along a mineralized zone but is inaccessible, as is a shorter adit at 2,100 feet altitude. A lower adit driven 200 feet eastward at an altitude of 2,000 feet is accessible.

A mineralized body with poorly defined walls is seen near the portal and in the inner section of the lower adit. It has been offset by several cross-faults and, as indicated on Figure 3, may be continuous, south of the main drift, between the exposed sections. The body is composed largely of quartz and of carbonate, barite, hematite, pyrite, marcasite, galena, tetrahedrite, and specks of argentite. The quartz is in fine dark and light bands, many of which are curved. The other minerals present in minor amounts are also arranged to some extent in bands. The body strikes eastward and dips steeply to the north and appears to have formed by replacement along a fault zone.

The body is 3 feet wide at the portal of the adit; a sample taken across it assayed: Gold, trace; silver, 12.3 oz. per ton. Three samples taken across a width of 15 feet in the innermost crosscut assayed:—

Sample No.	Width	Gold	Silver	Lead
	Inches	Oz. per Ton	Oz. per Ton	Per Cent
2	56	0.01	9.3	Trace
3	56	Trace	8.3	Trace
4	70	Trace	4.8	0.4

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1923, p. 59.]

Climax

This property, consisting of two Crown-granted claims (Lots 941 and 942), is owned by T. W. Falconer and J. Larsen, of Alice Arm, and W. Fraser, of Prince Rupert. It extends across the canyon of Trout Creek, about half a mile from Kitsault River. The showings are between 2,300 and 2,400 feet altitude on the east slope of the ridge between Trout Creek and Kitsault River and are reached by an old trail from the main Trout Creek trail. A cabin near the main trail is still standing. Beginning in 1918 the claims were prospected by trenching. An adit was driven in 1925 and 1926, but since then little has been done and the trenches are partly sloughed.

The property is underlain by hard, massive agglomerate of Formation B. A mineralized zone about 20 feet wide strikes west-northwestward and dips steeply. The proven length from the highest trench to the adit is about 200 feet. The walls are irregular and indefinite, the zone apparently having been formed by replacement, possibly along a fault or shatter zone. Some manganese oxides are present at the surface. The zone is composed largely of quartz with a small proportion of carbonate, barite, pyrite, marcasite, and galena and sphalerite which occur as a rule in streaks or bands. The zone is 21 feet wide in a crosscut within the adit; four samples taken across it successively from north to south assayed:—

Sample No.	Width	Gold	Silver	Lead	Zinc
	Inches	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent
1	56	Trace	1.0	0.4	Trace
2	56	Trace	2.9	1.1	0.8
3	56	0.01	6.8	3.3	0.6
4	84	0.01	13.2	1.6	2.8

This zone, which is similar to others in Formation B, has about the same attitude as and is nearly aligned with a similar zone on the Moose property.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1925, p. 76. *Geol. Surv., Canada,* Mem. 175, p. 58.]

Copper

Copper Cliff

Four Crown-granted Copper Cliff claims have reverted to the Crown, and of these, two (Lots 3807 and 3808) have been leased by S. Uruski, of Alice Arm. The claims are near the top of the west slope of Kitsault River valley on a fairly steep hillside into which several small streams have cut narrow canyons. The showings are at about 2,500 feet altitude in the canyon of Gash Creek, almost 2 miles north of Evindsen Creek, and are reached by a trail from the east bank of Kitsault River. The last part of the trail is little used.

Prominent rusty bluffs attracted the attention of the first prospectors, and several claims were located before 1913. In 1916 a crosscut adit was started on the southeast side of the canyon and several drill-holes were put down on the northwest side. The adit had been driven about 150 feet by 1927, but the results were disappointing and little work has been done in recent years.

The showings are in the Copper Belt intrusive close to the contact with shaly beds of Formation C. At the contact the shaly beds are crumpled and the intrusive is sheared. Pyrite is abundant in the intrusive, and the weathering of the pyrite has given a rusty colour to the canyon exposures, making them readily visible from the east slope of Kitsault Valley.

Several open-cuts on both walls of the canyon expose quartz veinlets and a small proportion of disseminated chalcopyrite. The limits of the mineralization are not apparent. The amount of chalcopyrite present is estimated to be less than 1 per cent, and the amount of copper is probably not more than one-quarter of 1 per cent. The adit, driven 190 feet to the south, encountered no chalcopyrite.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1918, pp. 66, 67.]

Silver

Starlight

The ground formerly covered by this group of claims is now open; it is at the north end of Combination Mountain. The ground slopes gently and is crossed by numerous narrow draws. The showings are at about 3,500 feet altitude.

In this area of altered intrusive bodies, mostly feldspar porphyries, there are several roof pendants. These are shaly and slaty, elongate, and strike northwestward. Though they are as a rule only 10 to 20 feet wide, some can be traced for several hundred feet. Weak shear zones in some of them parallel to their length have been silicified and pyritized, but ore sulphides were not seen. At one shear partly exposed by an old trench, pyrite is abundant, and a selected sample from it assayed: Gold, 0.03 oz. per ton; silver, 0.2 oz. per ton.

Silver Horde

This group of three Crown-granted claims and one fraction (Lots 3802 to 3805) is owned by A. Davidson, G. Anderson, and A. D. York, all of Alice Arm. It is on the east slope of Kitsault River valley and extends from the river up the steep east slope on both sides of Trout Creek canyon for about 2,000 feet.

The main valley trail follows close to the lower limit of the claims. The trail up Trout Creek valley also crosses the claims and passes a cabin at about 1,780 feet altitude. From the cabin a poor trail goes to a showing north of Trout Creek, upon which an adit has been driven at 1,550 feet altitude. Some reported showings south of Trout Creek were not found.

The Silver Horde claims were located in 1915 on the projected strike of the Wolf zones. A mineralized showing was found by trenching south of Trout Creek, and the property was optioned in 1918 by The Granby Consolidated Mining, Smelting and Power Company Limited. Eight holes were put down by diamond drilling, and it is reported that parts of the core assayed from 4.5 to 13 ounces of silver per ton,* but the option was dropped. Showings north of Trout Creek were explored from 1924 to 1930 by open-cuts and an adit, but in recent years no work has been done.

Two sparsely mineralized silicified zones are exposed in trenches partly overgrown. One zone beside Trout Creek trail at about 1,300 feet altitude strikes about north 20 degrees east. It is a few feet wide at least and contains spherules of marcasite and some galena.

A second zone is exposed at about 1,550 feet altitude a few hundred feet west of the cabin. It is similar to the zone exposed lower down the slope and strikes north 40 degrees east and dips 65 degrees southeastward. It is about 5 feet wide. A sample taken across the full width of the zone assayed: Gold, trace; silver, 6.1 oz. per ton; lead, 0.9 per cent. An adit 30 feet lower driven eastward 100 feet penetrates under the surface showing but does not cross any similar mineralization. Several faults are crossed in the adit, and the zone presumably is displaced along these faults.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1924, p. 55. *Geol. Surv., Canada,* Mem. 175, pp. 78, 79.]

Wolf

This property includes four Crown-granted claims (Lots 3794 to 3797) owned by Victor Spencer, of Vancouver. The claims are on the east slope and bottom of Kitsault Valley about one-quarter of a mile south of Trout Creek. The slope is fairly steep; most of it is covered with a good growth of timber, and outcrops are scarce. The main valley trail crosses the claims, but trails to the various showings are overgrown. An old camp on the Kitsault River has largely collapsed.

A wide mineralized zone was found in 1915. The claims were optioned the same year by the company developing the Dolly Varden property, and an adit was driven. The company bought the claims in 1916, did several thousand feet of diamond drilling, and closed the property in 1920. Britannia Mining and Smelting Co. Limited optioned the property in 1929 and did 2,320 feet of diamond drilling but allowed the option to lapse in 1930. Since that time no work has been done.

The property is underlain by massive volcanic rocks of Formation B, except at Kitsault River, where there are shales of Formation C. Two replacement deposits, or veins, forming bluffs were found by the writer. These correspond to two of four veins reported by Hanson.† The other two presumably are on the lower part of the slope. The deposits found correspond to those numbered 1 and 3 by Hanson.

The lowest outcrop of what is presumed to be the deposit numbered 1 is a bluff at about 1,420 feet altitude about 800 feet east of the old camp. The deposit, which strikes northeastward, can be traced up the slope about 150 feet to another bluff at 1,600 feet altitude. The walls are not exposed at the lower bluff, but the deposit is at least 20 feet wide and consists of quartz, barite, pyrite, and a very little ruby silver. A sample taken across the full exposed width of 20 feet assayed: Gold, trace; silver, 20.8 oz. per ton. An adit driven at 1,360 feet altitude is caved, but Clothier‡ reported the deposit in the adit to be more than 60 feet wide.

Another prominent bluff, about 500 feet to the north and at about 1,480 feet altitude, is formed by a replacement deposit which corresponds to the description given for vein No. 3. The zone is at least 15 feet wide, but the walls are not exposed at the bluff. It consists of dark-grey quartz, barite, pyrite, spherules of marcasite, limonite, galena, and

* *Minister of Mines, B.C.,* Ann. Rept., 1930, p. 97.
† *Geol. Surv., Canada,* Mem. 175, p. 87.
‡ *Minister of Mines, B.C.,* Ann. Rept., 1918, p. 57.

fairly abundant oxides of manganese. Three samples were taken which assayed as follows:—

Sample No.	Width	Remarks	Gold	Silver	Lead
	Feet		Oz. per Ton	Oz. per Ton	Per Cent
1	15	Mostly oxidized material	Trace	6.1	2.8
2	15	Mostly unoxidized material	Trace	8.5	5.6
3	----	Quartz and galena selected	Trace	14.2	26.0

The deposit strikes northeastward and is reported to have been traced by trenching for several hundred feet, but trenches on the slope above the bluff are partly filled and overgrown. The highest trench found is less than 200 feet from the bluff. The zone at this trench, which is at about 1,600 feet altitude, is 11 feet wide and consists of banded dark and light quartz, pyrite, galena, and ruby and native silver. A sample taken across the 11-foot width exposed assayed: Gold, trace; silver, 18.6 oz. per ton.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1916, pp. 52, 77; 1928, pp. 85, 86. *Geol. Surv., Canada,* Sum. Rept., 1921, Pt. A, p. 18.]

Ouray and Velvet

The ground formerly covered by these claims is now open. It is on the west slope of Kitsault Valley, about 2,000 to 3,000 feet north of Evindsen Creek on a slight rise above the general slope. The showings are at about 1,500 feet altitude and about 1,000 feet west of Kitsault River. A pack-trail leads from the main Kitsault trail to a cabin near the showings and continues on towards the Copper Cliff group. The showings were discovered in 1914 and were explored by trenching.

The showings are in a feldspar porphyry body that is much altered and contains abundant pyrite. They are near the northwestern end of the body, near its contact with shaly beds of Formation C. In the vicinity of the showings the intrusive body is sheared, with shear planes striking northeastward and dipping to the southeast.

A northeastward striking zone about 12 feet wide is abundantly coated with oxides of manganese. The zone consists of quartz and unreplaced wallrock and contains abundant pyrite, marcasite in distinctive cylindrical forms, and small amounts of chalcopyrite, sphalerite, and galena. A sample taken across the zone assayed: Gold, 0.2 oz. per ton; silver, 1.3 oz. per ton; lead, 0.4 per cent; zinc, 0.4 per cent; copper, 0.7 per cent.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1935, pp. B 24, B 25.]

Copper

Red Point, Combination, Racehorse, Dan Patch

The only one of these properties now in good standing is the Red Point, which includes four Crown-granted claims (Lots 3809, 3810, 3818, and 3819) owned by Torbrit Silver Mines Limited. The Combination claims (once named Combine) and the Racehorse claims have lapsed. The Dan Patch (Lot 3825) has reverted to the Crown. The lapsed and reverted claims adjoined the Red Point claims on the north.

The ground extends north of Evindsen Creek, mostly east of Black Bear Creek, on the ridge between Kitsault River and Black Bear Creek. The ground rises from 1,400 feet altitude near Evindsen Creek to about 3,500 feet altitude at the most northerly claim, the Dan Patch, about a mile northwest of the mouth of Evindsen Creek. The ridge top and the slopes are very irregular, and bare bluffs and knolls are separated by narrow steep-sided draws trending northeastward. A little-used pack-trail leads from the Kitsault River to the lowest working on the Red Point, beyond which it is indistinct.

Prominent rusty bluffs attracted the attention of early prospectors, and by 1913 the several properties had been located. In 1916 three diamond-drill holes were put down on the Red Point, and by the same year underground work had been done on the other properties. Little work has since been done, apart from some activity on the Red Point in 1927.

The ridge is underlain by Copper Belt intrusive rock containing much pyrite and locally a small proportion of chalcopyrite. On the Red Point, chalcopyrite is present in surface exposures in amounts so scanty that the distribution and limits of the mineralization cannot readily be ascertained. On the other properies farther up the slope there is more chalcopyrite in definite silicified zones, but the amount is still small. One such zone which strikes northwestward and dips steeply to the southwest contains more sulphides than was seen in the others. A sample taken by the writer at 2,950 feet altitude across a partial width of 6 feet 6 inches assayed: Gold, trace; silver, 0.6 oz. per ton; copper, 0.8 per cent. The hangingwall is not exposed.

The several workings on these properties are hard to find because the trails leading to them have not been used for many years. Most of the workings are not extensive and consist of adits about 20 to 30 feet long, but the main crosscut adit on the Red Point, at about 1,400 feet altitude, contains about 1,000 feet of workings (*see* Fig. 1). This adit is reported to be in fair shape, but it was not entered because of deep water at the portal. According to a report* the first 590 feet of the adit was driven north 20 degrees west and the last 430 feet north 60 degrees west. In other reports it is mentioned that a short drift was driven near the portal, but that no mineralization of probable ore grade was encountered.

On a bluff about 350 feet higher than the adit, sparse chalcopyrite mineralization has been explored by two adits 10 to 20 feet long. These did not encounter mineralization of higher grade than that which is exposed at the surface. An exposure between these adits and the main adit contains sparse disseminated mineralization including minor amounts of galena. Sparse chalcopyrite mineralization is present on the dumps of several trenches, now caved, which are east of the upper adits.

Another adit at 2,130 feet altitude (*see* Fig. 1) is partly collapsed at the portal. It follows a zone striking south 25 degrees west that contains a very small amount of chalcopyrite.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1916, pp. 80–82; 1930, p. 96. *Geol. Surv., Canada*, Sum. Rept., 1921, Pt. A, p. 20.]

Silver

Muskateer

This property, consisting of six Crown-granted claims (Lots 4066 to 4071), is assessed in the name of E. Meredith, care of R. Brown, Seattle, Wash., and of C. Z. Fry, of Seattle, Wash. The property extends from the Kitsault River for about half a mile up the steep slope of the valley to about 2,500 feet altitude, mostly on the north side of Tiger Creek. The main valley trail crosses the lower claims. The ground was explored between 1916 and 1922 by trenches and an adit.

The property is underlain by massive members of Formation B. Crossing these rocks are ill-defined mineralized zones that possibly were formed by replacement along faults or fracture zones.

An adit about 300 feet east of the main valley trail is at about 1,140 feet altitude. Near the portal in the banks of a small creek are several trenches, two of which expose mineralization coated with manganese oxides. The attitude and width of the deposits are not apparent.

Several mineralized bodies (*see* Fig. 4) are seen in the adit. The mineralization consists of quartz, carbonate, barite, hematite, pyrite, marcasite, galena, and sphalerite

* *Minister of Mines, B.C.*, Ann. Rept., 1930, p. 96.

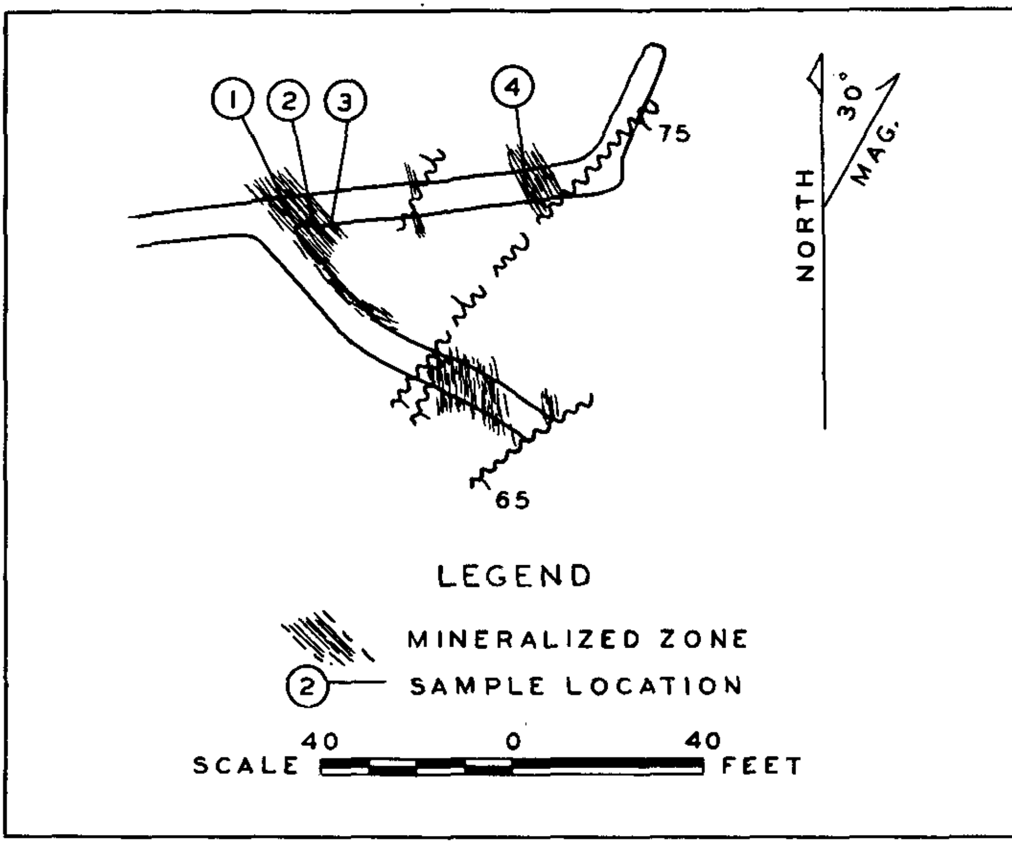


Fig. 4. Plan of Muskateer adit.

in banded veins and irregular pockets separated by unreplaced wallrock. The most westerly body in the crosscut strikes southeastwards and dips steeply towards the northeast; it is about 7 feet wide and contains a higher proportion of sulphide mineralization than the others. Three samples taken across it successively from west to east assayed:—

Sample No.	Width	True Width	Gold	Silver	Lead	Zinc
	Inches	Inches	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent
1	30	24	Trace	7.3	1.3	1.2
2	30	24	Trace	2.3	0.6	2.7
3	48	38	Trace	2.5	0.4	Trace

This zone appears to pinch out towards the southeast. A body similar in appearance is about 80 feet east of the portal. A sample (4) taken across a width of 6 feet assayed: Gold, trace; silver, 14.3 oz. per ton; lead, 0.6 per cent; zinc, trace. A body near the face of the drift is very sparsely mineralized.

Several faults strike northeastward and dip steeply. One fault clearly displaces two of the mineralized bodies, but the amount of displacement is unknown.

About half a mile northeast of the adit, several outcrops consist of quartz, carbonate, barite, and a small proportion of hematite and pyrite. The outcrops are aligned in a north-northeasterly direction for about 500 feet. They may represent a single zone, but continuity between outcrops has not been demonstrated, and they may be parts of several zones striking in the same general direction. Some of the outcrops are as much as 10 feet across. A chip sample, including material from several outcrops, assayed: Gold, trace; silver, 1.1 oz. per ton.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1920, pp. 47, 48. *Geol. Surv. Canada,* Mem. 175, p. 74.]

Tiger

This property of two Crown-granted claims and one Crown-granted fractional claim (Lots 3613 to 3615) is owned by Britannia Mining and Smelting Co. Limited and adjoins the property of Torbrit Silver Mines Limited. The claims are on the steep east slope of Kitsault Valley between 1,300 and 3,000 feet altitude, and the lowest working, at 1,510 feet altitude, is reached by a poor trail that leaves the main valley trail just above the Toric mine.

The property was explored by trenching from 1916 to 1919, when a crosscut adit was driven. In 1920 nine diamond-drill holes were put down to explore the zone, and according to Clothier* assays ranging from 60 to as high as 300 ounces of silver per ton were obtained over widths as great as 5 feet. In the next few years the adit was extended, and in 1928 and 1929 Utility Mines (Number One) Limited drove two other adits. The property has been closed since 1930.

Only one trench at 2,250 feet altitude was found, although others are probably overgrown. A collapsed cabin was found at 1,750 feet altitude, but the upper adit, reported to be near the cabin, was not found. The two lower adits at 1,510 and 1,650 feet altitude were examined.

Northward-striking replacement deposits occur in massive green agglomerates and tuffs of Formation B. The trench at 2,250 feet altitude exposes a deposit composed of bands of dark and light quartz and fairly abundant pyrite and marcasite.

The adit at 1,650 feet altitude is driven as a crosscut 90 feet eastward and encounters near the face a replacement deposit about 15 feet wide, striking northward and dipping steeply eastward. The deposit contains considerable pyrite, some hematite, and small specks of a silver mineral, probably argentite. Three samples taken successively from west to east across the full width of the zone assayed:—

Sample No.	Width	Gold	Silver
	Inches	Oz. per Ton	Oz. per Ton
1	69	*Nil*	2.2
2	60	*Nil*	2.6
3	48	*Nil*	3.8

The lower adit at 1,510 feet altitude is driven as a crosscut 360 feet eastward; a branch 230 feet from the portal extends 140 feet to the northeast. A mineralized zone crossed by both branch and crosscut strikes north 15 degrees east and dips steeply eastward. It is about 7 feet wide in the branch and a few inches wide at the crosscut 40 feet to the south. The zone consists of silicified agglomerate with abundant quartz veinlets, hematite, pyrite, and a minor amount of sphalerite. Two samples taken across the zone from footwall to hangingwall assayed:—

Sample No.	Width	True Width	Gold	Silver
	Inches	Inches	Oz. per Ton	Oz. per Ton
1	69	43	*Nil*	4.2
2	67	41	*Nil*	4.3

* *Minister of Mines, B.C.,* Ann. Rept., 1926, p. 89.

Spectrographic analysis of the five samples taken from this property indicated the presence of as much as 5 per cent of manganese, but no manganese mineral was recognized at the time of sampling.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1927, p. 76; 1928, pp. 87, 88. *Geol. Surv., Canada,* Mem. 175, p. 82.]

Toric (Torbrit Silver Mines Ltd.) Registered office, 309 Royal Bank Building, Vancouver; executive office, 350 Bay Street, Toronto. J. A. H. Paterson, president; G. B. Tribble, manager; A. M. Cormie, mine superintendent; R. W. Burton, mill superintendent. Capital: 3,000,000 shares, $1 par value. The company is a subsidiary of Mining Corporation of Canada. The property consists of twelve Crown-granted claims and four recorded fractional claims. The mine is east of Kitsault River, but the property extends westward across the Kitsault Valley and across Evindsen Creek valley.

Development work included 1,896 feet of drifting on levels, 278 feet of drifting in stopes, 123 feet of raising, 1,282 feet of stope raising, and 302 feet of shaft sinking. A total of 1,745 feet of diamond drilling was done. Work was done on the 17 miles of road to Alice Arm, and some improvements were made to the mine buildings. The number of employees ranged from 140 to 180.

Production: Ore milled, 119,711 tons. Flotation concentrates amounting to 2,687 tons were shipped to the Trail smelter, and additional silver amounting to 341,458 ounces was sold as bullion. Gross content of concentrates and bullion shipped: Silver, 2,051,190 oz.; lead, 833,425 lb.; zinc, 122,593 lb.

The property was described in the Annual Report of the Minister of Mines for 1948, and subsequent developments have been described in the Reports for 1949 and 1950. The following notes are supplementary to the 1948 description.

The mill was originally designed to recover the silver in a cyanide circuit because most of the silver in the old workings appeared to occur in the metallic state. The silver recovery, however, was less than expected, and it was found that much of the silver is present in silver sulphides, mostly ruby silver, and is not recoverable by cyanidation. Flotation cells were consequently added to the mill circuit in 1949 soon after the mill began operating, and now most of the silver is recovered with galena and sphalerite in a bulk concentrate which is shipped to the lead plant at the Trail smelter. The native silver recovered by cyanidation is refined and shipped as bullion. The milling capacity is between 350 and 400 tons per day.

The mine is developed by three adit levels at approximately 1,300, 1,150, and 1,000 feet elevation. Much of the ore between the 1300 and 1150 levels has been mined, and most of the ore currently being produced comes from below the 1150 level. All the ore is dropped to the 1000 level, which is the main haulageway. A shaft has been sunk 302 feet below the 1000 level, and from it two levels are being driven 102 and 205 feet below the 1000 level.

The ore occurs in shoots in a replacement deposit consisting of quartz, carbonate, barite, hematite, pyrite, galena, sphalerite, chalcopyrite, native and ruby silver, and probably other silver minerals, and masses of unreplaced or partly replaced wallrock. The walls of the deposit are massive agglomerate and tuff, grey, green, red, or purple in colour and slightly schistose. The minerals in the deposit are arranged in bands that are subparallel to the contacts and to the schistosity in the walls.

Much of the information in the 1948 Report concerning the shape, extent, attitude, and grade was obtained from a study of diamond-drill cores. The generalized outlines so determined are approximately correct, but mining has revealed more detailed information about the oreshoots and has permitted examination of parts of the deposit hitherto inaccessible. Parts of the deposit believed to be below ore grade have proved minable and other parts believed minable have proved to be below ore grade. As a rule the oreshoots are less regular than was anticipated, but the amount of ore mined is about equal to the expected tonnage.

Some other notable features of the deposits and the oreshoots are:—

(1) The oreshoots as a rule apex abruptly below the surface. This is a definite indication that they formed from ascending solutions and not descending solutions. The original discovery is on one of the few shoots that extends to the surface.

(2) An oreshoot tends to dip less steeply near its apex than in the main body of the shoot, and the grade of ore in the apex tends to be slightly higher than in the main body of the shoot.

(3) The deposit becomes wider at depth. The width increases because bodies in the hangingwall join the main body like branches coming into a main trunk.

(4) The oreshoots finger out towards the west and the east.

(5) The deposit plunges 25 degrees along a line striking north 65 degrees west.

The banding is parallel to the contact of the deposit, and even where the deposit apexes abruptly, the bands curve conformably with the contact. One apex was carefully examined, and no fault or break of any sort was seen to extend from the deposit into the wallrock. Presumably, if breaks along which solutions circulated existed at the time of mineralization, they died out below the apex, and replacement did not extend far beyond the limits of any single break.

The curvature of banding within the apex areas is similar to the curvature of folded strata, and this fact and the lack of fractures have led to the belief* that the deposit was formed by replacement of closely folded strata within the otherwise massive volcanic rocks. Masses of unreplaced rock within the deposit, however, are similar to the wallrock and, like it, lack evidence of bedding. All outcrops near the deposit and those within half a mile of it are also massive. There is no evidence that Formation B in or near the mine included any closely folded beds or any beds particularly susceptible to replacement. Therefore, it is probable that replacing and mineralizing solutions were guided in their passage through the rock by fractures and not by folded strata. The reason for marked curvature of banding within the deposit is not clear.

A series of lamprophyre dykes crosses the wallrock and the replacement deposit. These dykes, which range from a few inches wide to as much as 10 feet wide, strike north-northeastward and as a rule dip steeply to the northwest. The dykes are closely spaced and form a belt 140 feet wide. They are similar in appearance and attitude to, and are nearly aligned with, dykes that form a belt of unknown breadth on the North Star property.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1948, pp. 71–75.]

North Star

The Crown-granted North Star claim (Lot 3634) is owned by G. Anderson and G. Pearson, of Alice Arm; O. Evindsen, of Ceepeecee; and K. L. Eik, of Hitchcock, Sask. It is on the steep west slope of Kitsault River valley, north of the Dolly Varden property. The workings are between 1,490 and 1,660 feet altitude and are reached by a poor trail from the Dolly Varden. Although the slope is steep, outcrops are scarce.

The prospect was discovered in 1916. In 1918 an adit was driven, and in 1919 Alice Arm Silver Mining Company Limited was formed to develop the property. A second adit was driven and some ore was shipped by 1922. A third, lower adit was driven in 1928 and 1929. Since then the property has been closed.

Production: Ore shipped, 112 tons. Metal content: Silver, 2,838 oz.

* *C.I.M.M.* Bull. Vol. 44, No. 470, p. 399.

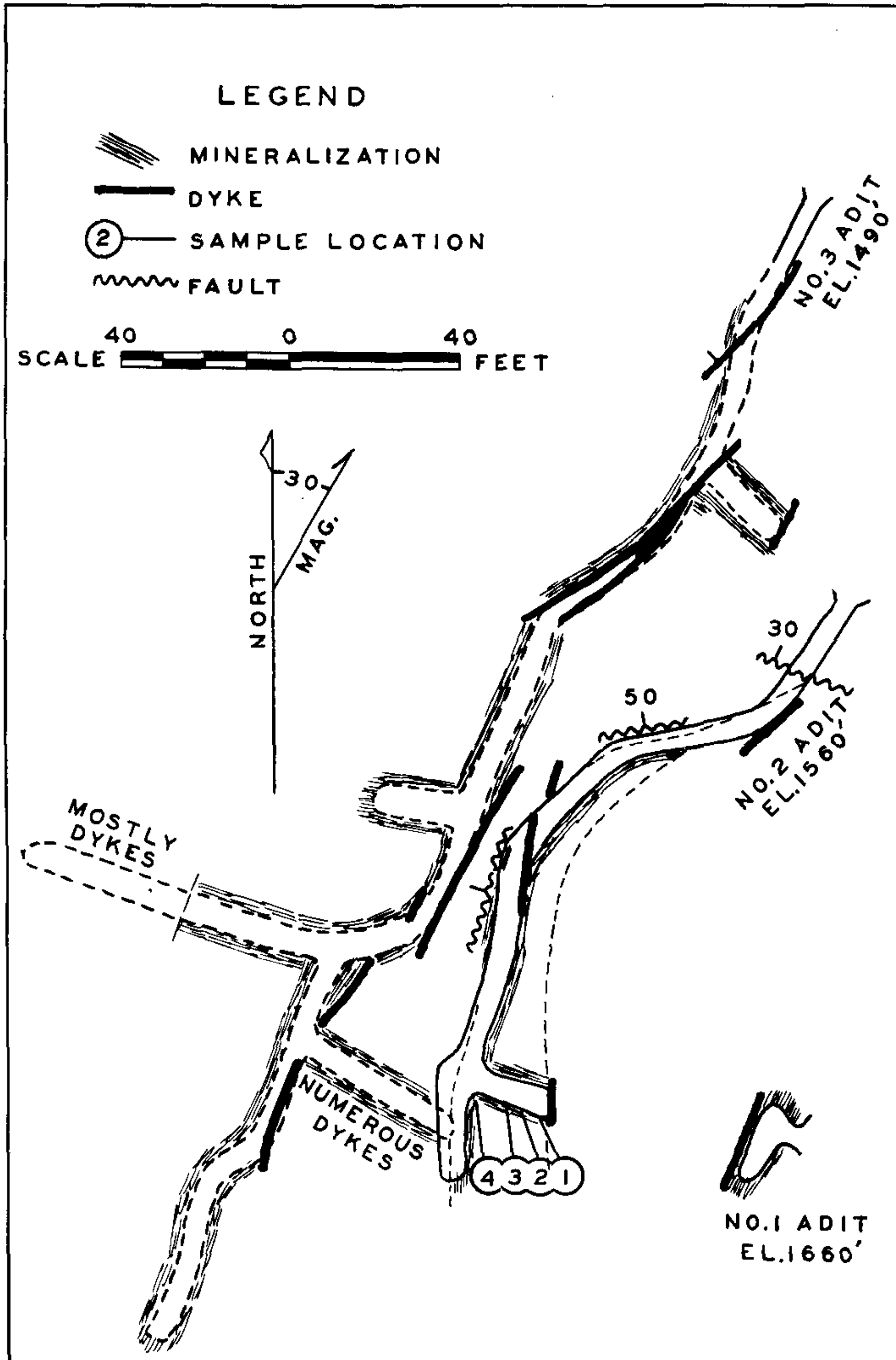


Fig. 5. Plan of North Star workings.

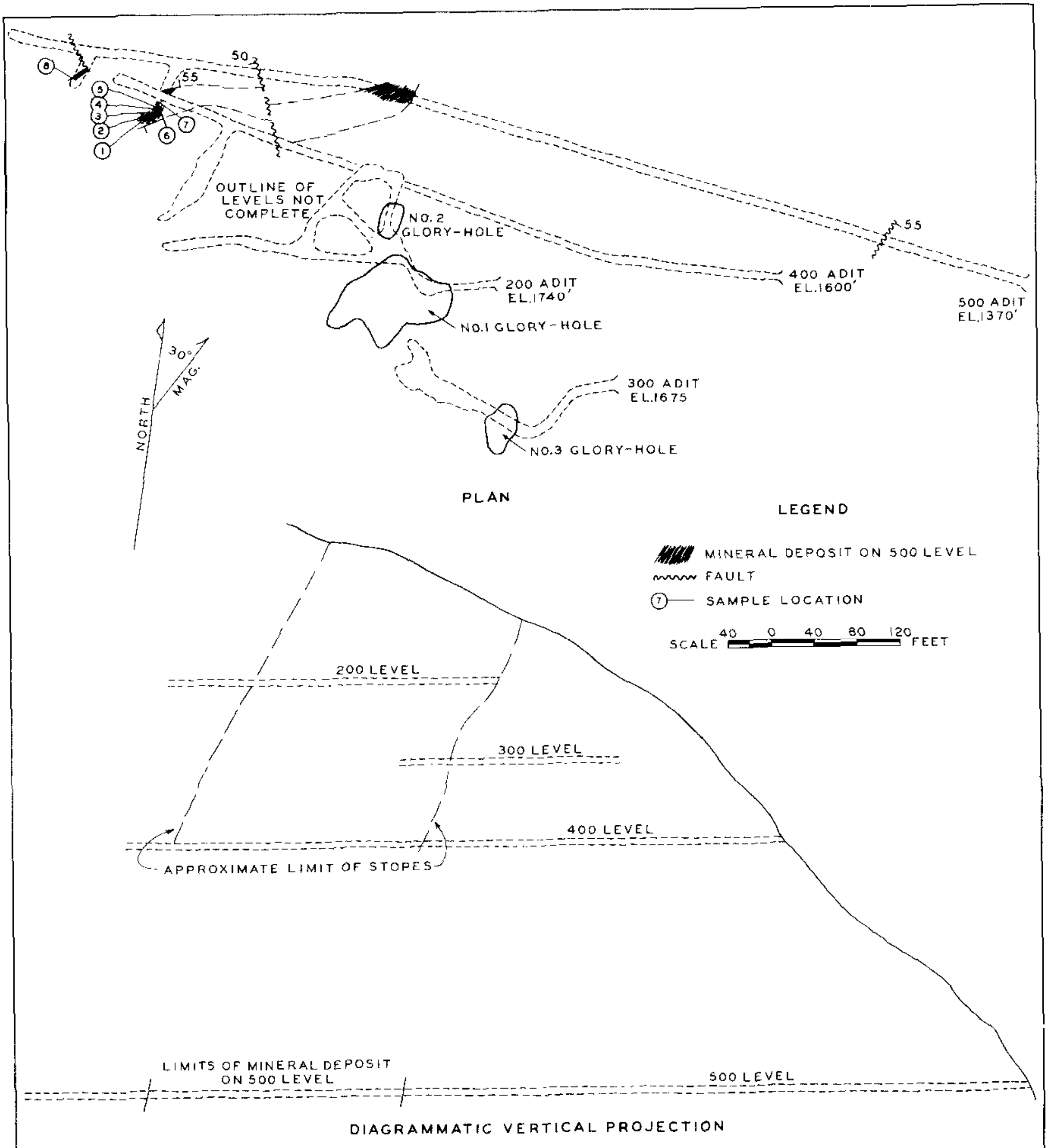


FIG. 6 DOLLY VARDEN MINE WORKINGS. PLAN AND PROJECTION

The claim is underlain by massive agglomerate and tuff of Formation B cut by lamprophyre dykes. The volcanic rocks are grey, green, and purple and are much altered.

A complex zone which strikes between northward and northeastward and dips to the northwest has been explored by three adits. On the lowest adit, 170 feet lower than the upper adit, it has been followed for 140 feet. The zone ranges in width from a few feet to more than 80 feet and is without well-defined walls. It comprises numerous veins, dykes, and wallrock and is cut by several faults. The veins, dykes, and faults are subparallel. Vein matter is largely quartz and pyrite, but barite, marcasite, galena, and sphalerite are present in appreciable amounts, and minor ruby silver and argentite were noted. Replacement, chiefly by pyrite, is extensive in the wallrock within the zone. The ore sulphides are most abundant in No. 1 adit (*see* Fig. 5), but some were seen in No. 2 adit. Only pyrite was noted in No. 3 adit.

Some of the dykes are post-mineralization in age, and the other dykes may be of the same age. In places development has been stopped at a dyke wall, but possibly the limit of mineralization has not been reached. If the dyke at which development stopped is post-mineralization in age, mineralization probably occurs beyond the dyke. Most of the dykes are a few feet wide. The faults cut the dykes and the mineralization.

In No. 1 adit are lenses a few inches wide containing galena, sphalerite, ruby silver, and argentite. The zone in No. 2 adit is sparsely mineralized. Near the portal it is a few feet wide, but at a crosscut near the face a width of 23 feet is exposed. In the eastern part of the zone at the crosscut, pyrite was the only sulphide noted, but in the western part sphalerite and galena are also present. Four samples taken across the zone successively from east to west at the crosscut assayed:—

Sample No.	Width	Gold	Silver	Lead	Zinc
	Feet	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent
1	6	*Nil*	*Nil*	....	..
2	5	Trace	*Nil*	....	..
3	5	Trace	3.8	0.4	1.6
4	7	*Nil*	36.7	0.6	4.9

The zone in No. 3 adit is more than 80 feet wide, but only pyrite was noted in it; much of it consists of dykes.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1928, p. 86.]

Dolly Varden

This property, of seven Crown-granted claims (Lots 3192 to 3198), is owned by Victor Spencer, of Vancouver. It is on the steep west slope of Kitsault Valley and on the top of Dolly Varden Mountain, between 1,000 and 2,200 feet altitude. The Toric mine road crosses the southeast part of the property, and from it a pack-trail leads to the old camp at 1,600 feet altitude. The buildings have collapsed.

The claims were located in 1910 and were the first recorded in the area. About 1915 the finding of very rich silver mineralization was followed by extensive surface and underground exploration. Construction of a railway from Alice Arm was started in 1917, but the cost so exceeded the estimate that before the railway was completed in 1919 the property had been acquired by the construction company. A tramway was built from the upper levels to the railway and ore was shipped, but the mine was closed in 1920. A 500-horsepower hydro-electric plant using water from Trout and Wolfe Creeks was installed in 1920 on the Wolf property, but the plant was operated for only a brief period. The mine was reopened in 1921, and some ore was shipped, but it was again closed. The property was leased in 1935, and selected ore was shipped in that year and in 1937, 1938, 1939, and 1940.

The ore was shipped directly to smelters. The metal content is as follows:—

Period	Tons	Gold	Silver	Lead	Copper
		Oz.	Oz.	Lb.	Lb.
1919	6,709	.	423,952	Not determined	Not determined
1920	28,037	. .	831,638	„ „	„ „
1921	1,874	. .	45,648	„ „	„ „
1935–40	234	1	63,609	2,047 in 222 tons	420 in 222 tons
Totals	36,854	1	1,364,847	2,047	420

The average silver content was 37 ounces per ton. A small amount of ore from the surface, possibly about 200 tons, contained about 1,000 ounces of silver per ton, but most of the ore shipped prior to 1935 contained about 32 ounces per ton, while that shipped in 1921 contained 24.5 ounces per ton. According to an estimate by Hanson* the combined percentage of lead and zinc in the ore shipped was less than 2 per cent.

The property is underlain by massive members of Formation B, including grey, green, and purple agglomerates and tuffs. The rocks are much altered and contain abundant pyrite. Numerous lamprophyre dykes strike northward.

The ore was mined from a vein-like deposit that has an arcuate outline. It strikes southeastward, eastward, and northeastward and dips northward. It has been traced from about 1,600 feet altitude on the east slope of Dolly Varden Mountain for half a mile across the top and down to about 2,000 feet altitude on the west slope. The western two-thirds of the deposit is exposed only in a few bluffs and trenches but is similar in appearance to the eastern part, which is well exposed.

The upper part of the deposit has been displaced at numerous northward-striking faults. Most of these have a right-hand movement; some have a left-hand movement. Locally, other faults separate the deposit from the walls.

The deposit ranges in width from a few feet to as much as 30 feet. It is composed largely of quartz but also consists of unreplaced fragments of wallrock, carbonate, barite, pyrite, and relatively small amounts of galena, sphalerite, chalcopyrite, tetrahedrite, native silver, ruby silver, and argentite. Much of the quartz is white and glassy, but some is dark grey to black. Throughout most of its length the deposit contains very small amounts of ore minerals, if any, but one section about 200 feet long has been found to contain sufficient silver to be of ore grade.

The ore at the surface contained abundant plates of native silver. Some of the plates were several inches across, and some of the surface ore contained more than 1,000 ounces of silver per ton. A short distance below the surface, native silver was uncommon and the grade of ore mined was much lower, as low as about 20 ounces of silver per ton. No similar occurrence of very high-grade ore has been found in the map-area, although several deposits containing native silver are known. The restricted occurrence of the very rich ore suggests that it was the lowest part of an enriched zone that remained after glacial and post-glacial erosion had removed the upper part.

The surface ore was mined in three glory-holes. Underground development was by five adit levels and several sublevels. The two lowest adits were driven beneath the ore zone. The three upper levels are not accessible, but a description of the zone in the upper workings and the results of sampling the surface showings and some of the upper levels is given by Mandy.†

On the 500 level a quartzose deposit about 25 feet wide is cut (*see* Fig. 6). The deposit, which strikes southwestward, consists of banded dark and light quartz, light-coloured carbonate, abundant pyrite, sphalerite, galena, and minor chalcopyrite. It appears to be the downward extension of the deposit mined on the upper levels. The

* *C.I.M.M.* Trans. Vol. XXV, 1922, p. 216.

† *Minister of Mines, B.C.*, Ann. Rept., 1936, pp. B 35–B 38.

northern contact dips northward, and the southern contact dips southward. Seven samples taken across the zone from south to north assayed as follows:—

Sample No.	Length	Approximate True Width	Gold	Silver	Lead	Zinc
	Inches	Inches	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent
1	56	40	*Nil*	Trace	0.1	1.4
2	46	32	*Nil*	Trace	([1])	1.0
3	78	55	*Nil*	1.4	0.4	2.0
4	48	35	*Nil*	0.8	0.2	3.0
5	60	43	*Nil*	1.6	([1])	3.5
6	58	41	*Nil*	0.1	0.1	4.5
7	74	53	*Nil*	0.9	1.4	13.0

[1] Not determined.

A subparallel zone cut in a crosscut 80 feet to the west is 3 feet wide. A sample (No. 8) taken across it assayed: Gold, *nil;* silver, 0.1 oz. per ton; lead, 0.3 per cent; zinc, 0.4 per cent.

The lowest adit, about 370 feet lower than the 500 adit, was driven 35 feet westward but did not reach any mineralization.

Only a few widely spaced faults were noted on the two lower levels. This is in marked contrast with the upper levels, on which many faults displace the deposit.

Several lamprophyre dykes seen in the western part of 400 level strike north-northeastward. These dykes may be part of a belt of dykes that extends through the North Star property and possibly continues to the Toric property.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1917, pp. 45, 46. *Geol. Surv., Canada,* Sum. Rept., 1921, Pt. A, pp. 16, 17.]

Ruby

This Crown-granted claim (Lot 4210), owned by R. C. McCorkell, of Vancouver, is on the east slope of the Kitsault River valley, north of Barite Creek. A little-used trail that starts near the portal of the upper adit of the Toric mine leads to old trenches between 1,800 and 1,900 feet altitude.

In 1919 and 1920 a mineralized zone was explored by trenches and an adit. The trenches are now overgrown and the adit, which is reported to be about 100 feet long, was not found.

According to Hanson, a deposit as much as 8 feet wide and sparsely mineralized with pyrite could be followed for 350 feet.

[Reference: *Geol. Surv., Canada,* Sum. Rept., 1921, Pt. A, pp. 15–16.]

UPPER ILLIANCE RIVER (55° 129° N.E.)*

Silver-Lead-Zinc

Silver Bell (Silver Flint Mines Limited)

This company was formed by Transcontinental Resources Limited to carry out work on the Bell and Silver Bell claims optioned from Oscar Flint, of Alice Arm. The claims are 15 miles up Illiance River from Alice Arm. Supplies for the camp were dropped from an aircraft. Four men under Geddes M. Webster worked on the property for six weeks, trenching on the Flint and Collins zones. The option on the property was dropped.

OBSERVATORY INLET (55° 129° S.W.)*

Copper

Anyox (The Consolidated Mining and Smelting Company of Canada, Limited).— Detailed geological surface mapping was continued. Three men were engaged in this work for about two months.

* By J. H. Bennett.

GIBSON ISLAND (53° 130° N.E.)*

Copper-Lead-Zinc

Gibson Girl (Gibson Girl Mines Limited) Company office, 844 West Hastings Street, Vancouver. K. J. Springer, president. Capital: 3,500,000 shares, $1 par value. This property is on Gibson Island, about 25 miles south of Prince Rupert. Surface work has been done on it at various times from 1913 to 1931, and encouraging copper, lead, and zinc mineralization has been found along a contact between limestone and schist. In 1951 Gibson Girl Mines Limited did a little more than 5,000 feet of diamond drilling on two mineralized zones. Six men were employed from June to early October. K. Sanders was geologist on the property.

USK (54° 128° N.E.)*

Copper

Nicholson Creek Mining Corporation Mine office, Usk. W. D. Galbraith, manager. Surface and underground diamond drilling was done on this property, and surface prospecting by open-cuts and stripping. The drilling totalled 1,459 feet. The company reports that the results of the work were encouraging, and that underground work is planned for 1952.

DORREEN (54° 128° N.E.)*

Gold-Copper-Lead-Zinc

Fiddler (Dorreen Mines Ltd.) Company office, 744 West Hastings Street, Vancouver. Alex Mackenzie, president; J. D. Boulding, manager. Capital: 1,500,000 shares, 50 cents par value. The mine camp is on Knauss Creek, about 5 miles west of Dorreen by road; the mine workings are about half a mile from the camp. Most of the work done during the year was on surface. The road from Dorreen was improved, and the mill was completed. A bunk-house, change-house, cook-house, office, garage, and assay office were built. A small tram-line, 2,600 feet long, was built between the mine and the mill.

The mill of 50-tons-a-day capacity is unique in the Province at the present time, inasmuch as all the machines are run by individual water-wheels. The compressor and the tram-line are also operated by water-wheels. The tram-line buckets each carry about 130 pounds of ore.

The mill and tram-line were finished before the company did any underground work of consequence. Work was then commenced, and some development muck was put through the mill, which operated part of the time throughout October and November, but no concentrates were shipped.

The principal underground work done in past years was a drift about 275 feet long and two raises on the vein. The vein is bedded in argillite and dips at about 25 degrees. The vein is of mining width at the portal and is up to 3 feet wide for the first 50 feet of the drift. It is narrower in the rest of the drift and is also narrow in the raises. In the greater part of the workings it is less than 1 foot wide. A sample was taken on the main, No. 1, level, about 85 feet from the portal; the vein was 11 inches wide at this point and appeared typical. The sample assayed: Gold, 0.39 oz. per ton; silver, 1.3 oz. per ton; copper, 0.2 per cent; lead, 2.0 per cent; zinc, 0.7 per cent. In places the vein contains small concentrations of galena and sphalerite.

Underground work done by the company consisted of 353 feet of drifting and 100 feet of raising. A drift was collared close to the portal of No. 1 level and at the same elevation, and it was driven to follow a deflection of the vein along a large dyke. It is reported that some ore was found in this drift. Another drift was driven on the vein 50 feet vertically above No. 1 level. It was planned to continue underground work through the winter.

* By J. H. Bennett.

From twenty to thirty men were employed until winter set in, when the number decreased to about fourteen. P. E. Peterson was manager until early in November and was then replaced by J. D. Boulding.

[Reference: *Geol. Surv., Canada,* Mem. 212, p. 41.]

HAZELTON*

Silver-Lead-Zinc-Gold-Cadmium

Silver Standard Mines Limited (55° 127° S.W.) Company office, 602 West Hastings Street, Vancouver; mine office, New Hazelton. William Dunn, superintendent. Capital: 3,500,000 shares, 50 cents par value. The mine was worked for 279 days in 1951. A total of 28,790 tons of ore was mined, 7,932 tons of which was sorted out as waste in the mill, and 20,858 tons was milled. Most of the production came from No. 6 vein.

The development work done underground is tabulated below:—

	Feet		Feet
Drifting	78.5	Shaft raising	72.5
Subdrifting	303	Rope raise	76
Raising	858	Shaft crosscutting	58
Shaft sinking	479		

About 43,000 cubic feet of rock was removed in cutting shaft pockets and stations.

Diamond drilling totalled 1,103 feet underground and 1,208 feet on surface.

The shaft was started from the 1300 level, between No. 4 and No. 6 veins. At the end of 1951 only 30 feet of sinking remained to complete the 500-foot shaft. Levels will be established off the shaft at intervals of about 150 feet.

On surface, No. 6 vein was stripped with a bulldozer, and an excellent section of ore was uncovered. This was later found to extend to a depth of 100 feet. An oreshoot near the surface was found in No. 8 vein as well.

The mill operated 95.8 per cent of the possible operating time. Recovery in the mill was reported to be 96.8 per cent of the gross value of the ore.

A new power-house was built, and some new machinery was installed. Several small bunk-houses were constructed of plywood.

Silver-Lead-Zinc

Lead King (Crown Silver Lead Mines Limited) (55° 127° S.E.) Company office, 525 Seymour Street, Vancouver. Capital: 4,000,000 shares, no par value. This company was formed by Transcontinental Resources Limited to develop the properties formerly known as the Leadsil and Lead King. These are on Nine Mile Mountain, about 14 miles from Hazelton. The company reports that it holds fifty-two claims, and has under option the Barber Bill group of eighteen claims.

Work was started on April 30th and continued until October 22nd. Several miles of the old Nine Mile Mountain road was reconditioned, and in August a jeep could travel over this road for about 9 miles, about 2½ miles short of a tent camp. Surface work was done on a number of narrow veins. The company reports that the mineralized sections are high grade but narrow and erratic. Further work is planned in 1952.

J. A. Willcox was in charge of the work on the property. Ten men were employed.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1950, pp. 82, 96–98.]

American Boy (American Standard Mines Limited) (55° 127° S.W.) Company office, 1009 Credit Foncier Building, Vancouver; mine office, Hazelton. L. B. Gatenby, manager. Capital: 3,000,000 shares, $1 par value. Surface prospecting was carried on during 1951. In September two small but high-grade pockets of silver-lead-zinc ore were found at the junctions

* By J. H. Bennett.

of two veins with a fault. A small shaft was sunk by hand on one of these outcrops and was 7 feet deep in December. A sample taken across the 15-inch vein half-way down the shaft assayed: Gold, 0.02 oz. per ton; silver, 45.9 oz. per ton; lead, 23.4 per cent; zinc, 11.9 per cent.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1950, pp. 95–96.]

National Explorations Limited

(55° 127° S.W.) Company office, 789 West Pender Street, Vancouver. C. W. Nash, president; G. L. Oates in charge of exploration. Capital: 3,000,000 shares, no par value. This company holds a large block of claims, some southwest and some northeast of the Silver Standard property. Diamond drilling was done in 1951 to explore the anomalies found the previous year by geophysical prospecting. Most of the drilling was done from a camp about 1 mile southwest of the Silver Standard camp. Some quartz veins were found, but no intersections contained economic mineralization.

Copper-Tungsten-Gold-Silver-Cobalt

Rocher Deboule (Western Uranium Cobalt Mines Limited)

(55° 127° S.W.) Company office, 604 Hall Building, Vancouver. James Mackee, president. Capital, 3,000,000 shares, $1 par value. The Rocher Deboule mine is on Rocher Déboulé Mountain, about 11 miles by road from Skeena Crossing. A road leads up the valley of Juniper Creek to the mine camp at an elevation of about 4,000 feet. Work was first started on the property in 1911 by Rocher Deboule Copper Co., of Salt Lake City. In 1914 Montana Continental Development Company, of Butte, Mont., leased the mine for two years, and in 1915 shipped 17.000 tons of ore to the Granby smelter at Anyox. In 1916 Rocher Deboule Copper Co. took over the mine and shipped 16,800 tons of ore. More shipments were made in the following two years, but all mining was stopped in October, 1918. Production from April, 1915, to October, 1918, was 39,833 tons of ore containing 4,214 ounces of gold, 62,865 ounces of silver, and 5,746,306 pounds of copper. In 1929 Aurimont Mines Limited optioned the property and shipped 72 tons of hand-sorted ore that assayed: Gold, 0.14 oz. per ton; silver, 40 oz. per ton; copper, 4 per cent. Some work was done in 1930 by Hazelton Copper Mines Limited. The property was then inactive until 1950.

Western Uranium Cobalt Mines Limited was formed in 1949 to work on the Victoria property, which is described in detail in the Annual Report of the British Columbia Minister of Mines for 1949. In 1950 the Rocher Deboule property was acquired by the company. The two properties are adjoining and are now held as one unit. The total number of claims so owned is reported to be fifty, of which thirty-one are Crown-granted and nineteen are held by record.

The company started work on the property in the summer of 1950. The portal of the lowest adit, which was completely covered by a slide, was opened, the levels above were cleaned out and retimbered where necessary, some buildings were erected, and a surface incline railway was built from the elevation of the lowest adit to the upper workings at 5,150 feet elevation. The road from Skeena Crossing was widened to allow truck haulage.

The mine workings are on two parallel veins known as the No. 2 and No. 4. The No. 2 vein is developed on two levels—the 1200 level at 4,167 feet elevation and the 1000 level at 4,428 feet elevation. The No. 4 vein, from which most of the production came, is developed on three levels—the 500 level, connected by winze to the 300 level at 5,150 feet elevation, and the 100 level at 5,302 feet elevation. The workings on No. 4 vein below 300 level are flooded.

The No. 2 vein strikes slightly north of east and dips to the north at from 35 to 60 degrees. It lies in a fissure in granodiorite. Movement along the vein fissure is indicated by the presence in the vein of crushed granordiorite.

The vein is continuous in drifts on both the 1000 and 1200 levels, but near the east end of 1200 level is offset to the left by the Juniper fault. The width of the vein ranges from a few inches to 5 feet; in general, it is less than mining width. In several places, however, copper mineralization was seen to extend into the walls, particularly into the footwall.

The drifts enter sedimentary rocks at the western ends of the workings. The vein narrows in these rocks, and mineralization decreases westerly from the contact of the granodiorite. Quartz is the predominant gangue mineral, calcite is common, and black hornblende is present in most of the vein.

The vein is mineralized with chalcopyrite, pyrrhotite, pyrite, galena, sphalerite, tetrahedrite, scheelite, and molybdenite. Cobalt bloom derived from safflorite is common.

The No. 4 vein is parallel to No. 2 vein and has about the same dip. Its projected position down dip to the 1200 level is approximately 2,000 feet north of No. 2 vein on that level. Much of the vein in the accessible workings is stoped out. It is from here that crude ore was shipped from 1915 to 1918. The workings below the 300 level are flooded, and nothing is known of the vein there.

Little underground work has been done by the company, except for rehabilitation of workings. In 1951 about 180 feet of crosscut was driven easterly on the 300 level. On the 1200 level 85 feet of drifting was done on a vein in the granodiorite, about 400 feet from the portal.

On surface a camp was finished, including office, warehouse, bunk-houses, cook-house, school, and shops. At the end of the year the mill building was nearly completed, but no machinery was installed. About 3 miles up the mine road from Skeena Crossing a large power-house was built, and considerable work was done on a dam and pipe-line to provide hydro-electric power. In order to supply power for the Red Rose, a large diesel engine was installed in the power-house to drive a 1,250-kva. generator. Early in December electric power was transmitted to the Rocher Deboule camp and to the Red Rose property.

The number of employees ranged from thirty-five to sixty. R. L. Bater is manager and M. W. Jasper resident geologist. A. L. Clark, of San Mateo, Calif., is managing director, and Walter Stephen, of Seattle, Wash., mill consultant.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1914, pp. 185–188; 1916, pp. 106–109; 1918, p. 111. *Geol. Surv., Canada*, Mem. 223, pp. 50–55.]

Tungsten

Red Rose (Western Uranium Cobalt Mines Limited) (55° 127° S.W.) Company office, 604 Hall Building, Vancouver; mine office, Skeena Crossing. James Mackee, president. Capital: 3,000,000 shares, $1 par value. The Red Rose mine is on Rocher Déboulé Mountain, about 11 miles from Skeena Crossing. The road to the mine branches from the Rocher Deboule mine road at a point about 9 miles from Skeena Crossing. The company leased the mine from The Consolidated Mining and Smelting Company of Canada, Limited, and started rehabilitation of the mine and camps in May. At the mill camp, which is about 4,000 feet in elevation, the mill was rebuilt and machinery installed. Other buildings were repaired, and three houses and one bunk-house were built. The aerial tram-line from the mine to the mill was rebuilt and put into operation. At the mine camp, which is above 5,500 feet elevation, the buildings were repaired, water-lines were laid, and machinery was installed. The mine was opened, and a large amount of ice was removed. The lowest level on which the mine had been worked in the past was the 500 level. The company did a little drifting on the 800 level, approximately 300 feet below the 500 level, and established the existence of scheelite ore at the lower horizon.

The mill was ready for operation by mid-December, and by the end of the year a small amount of scheelite concentrate had been produced in the process of testing and adjusting the mill machinery. The company expected steady production in 1952.

Silver-Lead-Zinc

Brunswick (Skeena Silver Mines Ltd.) (55° 127° S.W.) Company office, 904 Hall Building, 789 West Pender Street, Vancouver. Capital: 1,500,000 shares, 50 cents par value. W. F. McGowan, manager. This company was formed in 1951 to work on the property formerly known as the Brunswick, about three-quarters of a mile up the valley from the Red Rose camp. When visited in December, one building had been erected. Mining machinery was to be brought in shortly, and it was planned to do underground work during the winter. Two men were employed.

SMITHERS*

Silver-Lead-Zinc

Lorraine (54° 126° N.W.) This property is on the eastern slope of Hyland Mountain at 5,000 feet elevation and higher. It is reached by about 5 miles of rough trail from the new road to the Cronin Babine Mines camp. Work was done during the summer by American Yellowknife Gold Mines Limited. Stripping, trenching, sampling, and geological mapping were done under the direction of Murray J. Piloski, geologist. The company reports some drill intersections of good grade representing widths of 10 to 30 inches, but the option was dropped because of the indicated lack of tonnage.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1946, p. 88.]

Cronin (Cronin Babine Mines Limited) (54° 126° N.W.) Company office, 744 West Hastings Street, Vancouver; mine office, Smithers. R. L. Clothier, managing director; C. F. Medhurst, manager. Capital: 3,000,000 shares, $1 par value. The property is on Cronin Mountain, and the main camp is about 35 miles from Smithers by road. The company was engaged in repairing and building a road until the end of October, when construction work was started at the camp. The cook-house was extended, and two bunk-houses, two warehouses, and shops were built. Preliminary work was done on the foundations for mill and power-house.

No mining was done, but rehabilitation of the mine was started late in the year. The average number of men employed was thirty.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1949, pp. 94–98.]

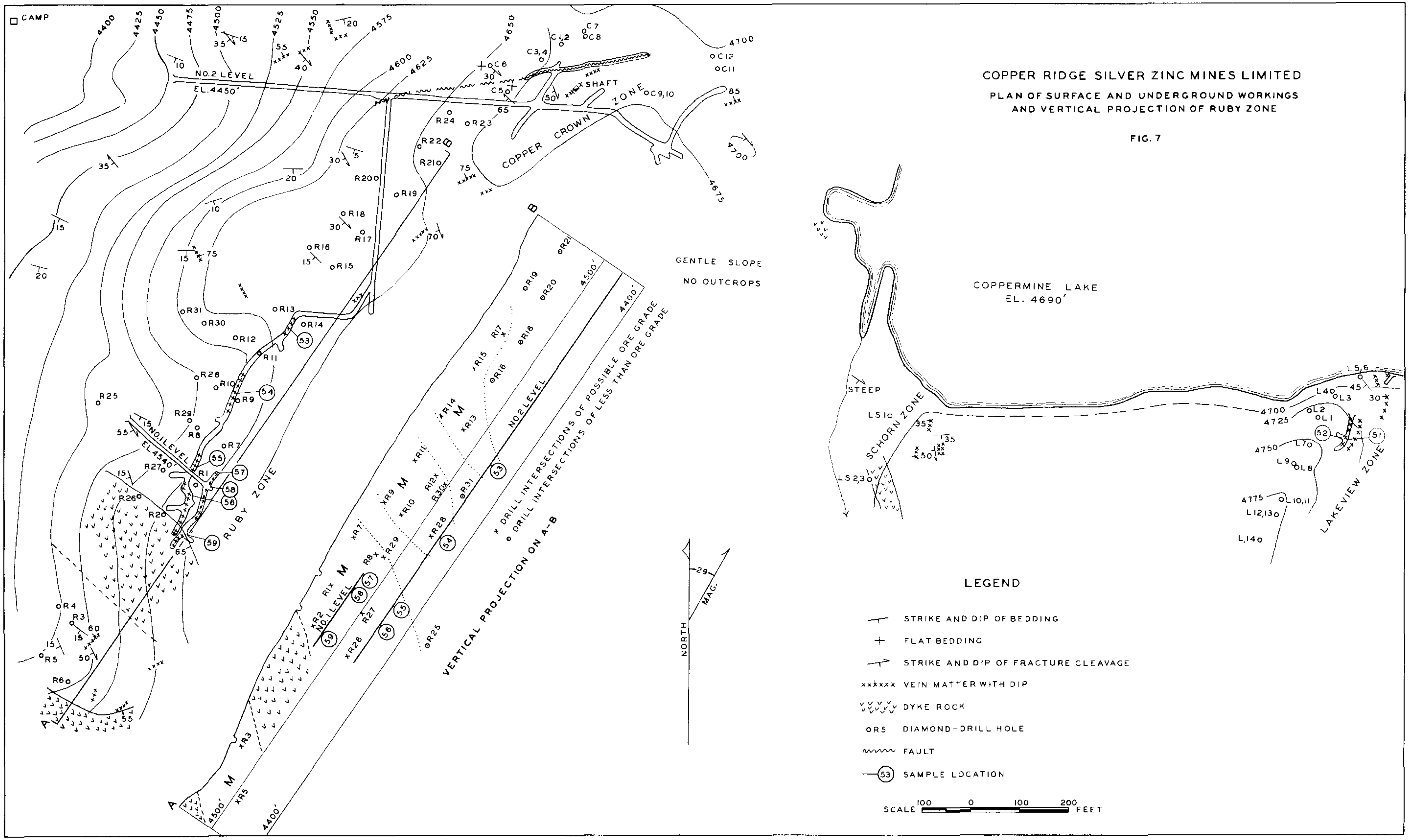
Hyland Basin.—(54° 126° N.W.) This property, at the head of Cronin Creek, was optioned by American Yellowknife Gold Mines Limited. Trenching and mapping were done. The work proved discouraging, and the option was dropped.

Gold-Silver-Lead-Zinc

Duthie, Mamie, Sil-Van (Sil-Van Consolidated Mining and Milling Company Ltd.) (54° 127° N.E.) Company office, 602 West Hastings Street, Vancouver; mine office, Smithers. C. H. Macdonald, mine superintendent. Capital: 3,500,000 shares, no par value. Underground development work was continued throughout the year. In both the Mamie and the Canary-Hummingbird workings the results of the work were very satisfactory, and the company planned to build a mill and start production in 1952. On the Mamie group 807 feet of drifting and crosscutting was done on the 4400 level, and 458 feet on the 4250 level. Raising amounted to 395 feet. The company reports that the average width of the ore developed is about 2 feet.

* By J. H. Bennett.

Correction, Figure 7, for sample number read second digit, e.g., for 53 read 3.


COPPER RIDGE SILVER ZINC MINES LIMITED
PLAN OF SURFACE AND UNDERGROUND WORKINGS
AND VERTICAL PROJECTION OF RUBY ZONE
FIG. 7
CAMP
NO. 2 LEVEL
EL. 4450'
NO. 1 LEVEL
EL. 4540'
SHAFT
COPPER CROWN ZONE
RUBY ZONE
SCHORN ZONE
LAKEVIEW ZONE
COPPERMINE LAKE
EL. 4690'
GENTLE SLOPE
NO OUTCROPS
STEEP
VERTICAL PROJECTION ON A-B
× DRILL INTERSECTIONS OF POSSIBLE ORE GRADE
⊙ DRILL INTERSECTIONS OF LESS THAN ORE GRADE
NORTH
MAG.
29°
LEGEND
STRIKE AND DIP OF BEDDING
FLAT BEDDING
STRIKE AND DIP OF FRACTURE CLEAVAGE
VEIN MATTER WITH DIP
DYKE ROCK
OR5 DIAMOND-DRILL HOLE
FAULT
53 SAMPLE LOCATION
SCALE 100 0 100 200 FEET

In the Canary-Hummingbird workings 1,912 feet of drifting and crosscutting was done on two levels, and 505 feet of raising. On the 4100 level the company reports an oreshoot 760 feet long with an average width of 2 feet.

Glacier Gulch Mining Co. Ltd. (54° 127° N.E.) Company office, 2671 West Broadway, Vancouver. H. W. Agnew, *mine manager.* Capital: 1,500,000 shares, 50 cents par value. On the south side of Glacier Creek a raise was driven 250 feet from the bottom level and a crosscut driven from the top of the raise to surface. A hoist was installed at the camp-site, and a cableway erected to carry supplies up to the portal of the crosscut. About 600 feet of crosscutting was done on the property. On the north side of the creek, 500 feet of diamond drilling was done.

Work was stopped about the middle of August. Up to this time an average number of fifteen men was employed under J. McBeth. Work was resumed about November 1st, with a crew of six men under the direction of H. W. Agnew. Up to mid-November no ore had been found in the underground workings.

TELKWA (54° 126° N.W.)*

Gold-Silver-Lead-Zinc

Free Gold (Lake Surprise Mine Limited).—Some work was done by this company on the property formerly known as the Free Gold group. It is on the eastern slope of Dome Mountain, about 25 miles east of Telkwa. The company built about 11 miles of road and opened the underground workings for mapping and sampling. A. Munro was in charge of the work.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1938, pp. B 15–B 20.]

Zinc

Cassiar Crown, Lakeview (Copper Ridge Silver Zinc Mines Limited)† Registered office, 850 West Hastings Street, Vancouver. E. D. H. Wilkinson, secretary; B. I. Nesbitt, consulting geologist; J. S. Ives, engineer-in-charge at property. Capital: 3,000,000 shares, 50 cents par value. In the summer of 1951 control of the company was acquired by Transcontinental Resources Limited. The nine claims of the Lakeview and Cassiar Crown groups (Lots 6471 to 6477, 6284, and 7254) reverted to the Crown and are now leased by A. B. Goodridge and Frank Cooke and associates. It is reported that Copper Ridge Silver Zinc Mines Limited has an agreement to buy from the lessees the nine claims when they are Crown-granted. The company owns an additional twenty-four located claims north, northeast, and east of the leased claims.

The property is west of the gently rounded top of Grouse Mountain, at the south end of the Babine Range. It is between 5 and 6 miles northeast of Walcott, a station on the northern line of the Canadian National Railway, and is reached by a branch road that leaves the highway 16 miles southeast of Telkwa, the nearest community with hotel and stores. The branch road extends eastward to the foot of Grouse Mountain and up to the camp, a distance of 3 miles. The road has many steep grades, and only vehicles with 4-wheel drive can climb it successfully. The property is between 4,100 and 4,800 feet altitude, a little below timberline, and is sparsely timbered with jack pine.

Exposures of chalcopyrite and sphalerite were found on Grouse Mountain in 1914; a chalcopyrite showing (now known as the Copper Crown) was explored by a shaft, and a sphalerite showing (now known as the Lakeview) was explored by an adit. In 1915 numerous trenches were dug and other mineral occurrences were found. In 1916 a crosscut adit (No. 2 or 4450) was started to explore the ground about 200 feet below the

* By J. H. Bennett, except as noted.
† By J. M. Black.

bottom of the Copper Crown shaft. By 1917 the adit had been driven about 1,000 feet, but mineralization similar to the surface showing was not encountered. In 1920 exploratory drifts were driven from the inner end of the adit. In 1924 and 1925 a second adit was driven on the Lakeview showings.

Sometime before 1923 an adit crosscut (No. 1 or 4540) was driven under sphalerite occurrences known as the Ruby zone, and a drift exposed a shoot with abundant sphalerite. In 1926, after a camp comprising a two-story bunk-house, cook-house, and office was built, a drive on No. 2 level was started to the south to explore the ground below No. 1 level. Work was stopped in 1927 after the objective had been reached and a raise had been driven up to No. 1 level. At that time, drifts and crosscuts totalled 3,700 feet and shaft and raises 160 feet.

In 1951 the present company was formed, the camp was repaired, and a core-shed and an additional bunk-house were erected. An old wagon-road from the highway was improved, and now it is possible to drive up to the property in light 4-wheel-drive vehicles. The portals of No. 1 and No. 2 adit levels were cleaned out and retimbered, and diamond drilling from surface stations was started. At the time of examination 9,000 feet of diamond drilling had been done. The company was planning to continue drilling in the winter from underground stations.

The properties have been described in the Annual Reports of the British Columbia Minister of Mines for the years during which they were developed. The area near the property was mapped in 1915 by J. D. MacKenzie for the Geological Survey of Canada.

The writer examined the property during five days in September. A plane-table survey was made on a scale of 1 inch to 100 feet, tying in the collars of the drill-holes, portals of the workings, and surface exposures.* Some samples were taken in the underground workings, and the cores from some of the holes were logged; most of the mineralized portions of the cores had been entirely removed for assay.

The rocks of the area are thin-bedded massive sedimentary rocks of the Hazelton group cut by numerous dykes, mostly of intermediate composition. The sedimentary rocks are grey and green tuffs, sandstones, argillites, and volcanic breccias, and all gradations between the four main types, with tuffaceous members predominating. Some beds are limy. The volcanic breccias contain angular volcanic fragments as much as half an inch across. The breccias are quite distinctive in appearance, but they may not be of much value as marker beds because some are lenticular. In some of the beds, belemnites and other fossil fauna occur.

The sedimentary rocks dip to the south, except in the southwest part of the area mapped, where they dip to the southwest and west. Generally the beds dip 15 degrees or less, and near Copper Crown shaft they are nearly flat.

Fracture cleavage is fairly well developed in the thin beds of the series—namely, those about an inch thick. The fractures are generally about an inch apart, strike northwestward, and dip at moderate angles to the southwest. The attitude is about the same as that of the several dykes that were observed. The fractures are generally only a few feet long, and few continue into massive beds.

The larger dykes are indicated on Figure 7. The two dykes at the southwest corner are each about 200 feet wide. Both are feldspar porphyry with feldspar phenocrysts as much as 4 inches long, and both dip at moderate angles to the southwest. Other dykes have much the same attitude and composition. Some lamprophyre dykes a few feet wide are exposed underground.

There are numerous faults. On many of them there seems to have been a displacement of only a few inches or a few feet, but the fault followed on No. 2 level for more than 500 feet may represent considerable displacement.

* The altitude of Copper Mine Lake, determined in 1951 by the Topographic Division of the Department of Lands, is 4,690 feet, and this altitude, which is higher than that shown on previously published maps of the area, was used as the datum for the plane-table survey.

Mineralization is exposed in the underground workings, in numerous trenches and cuts, and in the core from many diamond-drill holes. However, most of the higher-grade sections of core had been removed for assay.

Many veins, most about an inch wide but a few several feet wide, cut the sedimentary rocks. Single veins can be followed for a few tens of feet, but many pinch out in a few feet. Most of the veins strike northeastward to eastward, and a few strike northwestward; practically all dip steeply. The vein material consists of quartz, calcite, sphalerite, pyrite, chalcopyrite, and minor amounts of galena. The proportion of sulphides to gangue minerals in general is high, and sulphides constitute more than 50 per cent of many of the veins. Some veins are closely spaced and form what may be considered as ill-defined vein zones.

Sulphides also occur disseminated in the rocks near the veins, most commonly in volcanic breccias. Sphalerite is the predominant sulphide in the disseminated mineralization, but other sulphides are present in smaller amounts.

Most of the work has been done on the Ruby zone and on its continuation, the Copper Crown zone. Four other zones—the Lakeview, Schorn, Eureka, and Cariboo—have been prospected, but most of the work has been done on the Lakeview. The Eureka and Cariboo zones were not examined.

Figure 7 shows the collars of diamond-drill holes at the time of examination. All but three holes were drilled southeastward and eastward. Holes C9, C10, and L5 were drilled towards the northwest. The footage drilled at the time of examination included: Ruby zone, 4,557 feet in thirty-one holes; Copper Crown zone, 2,134 feet in twelve holes; Schorn zone, 308 feet in three holes; Lakeview zone, 1,545 feet in fourteen holes; Eureka zone, 306 feet in three holes; and Cariboo zone, 187 feet in two holes; a total of 9,037 feet.

Ruby Zone.—The Ruby zone, comprising many subparallel veins, is partly exposed in a few trenches and open-cuts, in drifts on Nos. 1 and 2 levels, and in core from numerous holes drilled through it. The zone strikes northeastward and dips about 70 degrees to the northwest, although many individual veins in the zone dip less steeply.

In the Ruby zone, sphalerite is the most abundant sulphide. The location of samples taken on Nos. 1 and 2 levels is shown on Figure 7, and the assays are tabulated below:—

Sample No.	Width	Gold	Silver	Copper	Zinc
No. 2 Level	Inches	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent
3	18	Trace	1.7	0.9	13.1
4	36	*Nil*	0.5	0.2	7.0
5	80	Trace	0.5	0.2	5.3
6	68	Trace	0.5	1.4	11.6
No. 1 Level					
7	40	Trace	1.4	0.6	5.9
8	48	0.01	4.5	1.2	22.2
9	60	Trace	4.5	1.8	15.5

At the main open-cuts, several feet of rusty vein material and wallrock are exposed. What appears to be the footwall dips northwestward at about 70 degrees. In the cut above drill-hole R2 the vein material is cut off by the feldspar porphyry dyke. A few other trenches show mineralization, but most of the zone is not exposed at the surface.

On No. 1 level, several feet of vein material is exposed for most of the length of the drift. On No. 2 level, three lenses are exposed, the widest being as much as 8 feet.

The central of the three lenses exposed on No. 2 level is as much as 4 feet wide and consists of a vein as much as 2 feet wide and several narrower veins. Directly above this lens the Ruby zone has been cored by three holes—R9, R10, and R28—drilled in one vertical plane, and the core from these holes together with the exposures on the level afford information on the vertical continuity of the zone at a section where mineralization of possible ore grade occurs.

The width of mineralization cored by the three holes R9, R10, and R28 exceeds the width exposed in No. 2 level below, which suggests that the drift may not expose the full width of the zone. The complete core from drill-hole R28 was available, and a 23-foot length between footage 127 and footage 150 includes many veins. This length of core contains a vein 6 inches wide, a vein 2 inches wide, twenty-four veins about 1 inch wide, about twenty narrower veins in a 2-foot length of core, and 1 foot of disseminated mineralization, largely sphalerite. The vein matter includes a large proportion of sphalerite. The veins are not uniformly spaced and tend to be closer together near the central part of the 23-foot length. In the rest of the core from hole R28 there are many other more widely spaced veins.

The core from hole R28 may not be representative of the Ruby zone in grade, but it does indicate the nature of the zone and the number, width, and spacing of veins within it. The Ruby zone is a multi-vein zone in which the veins are relatively closely spaced in a central part.

The better-mineralized portions of the core from drill-holes R9 and R10 had been removed, but apparently in each core two well-mineralized sections were separated by some relatively low-grade material. In R10, 15- and 16-foot lengths of core were separated by 6 feet of low-grade material, and in R9, 4- and 11-foot lengths were separated by 4 feet of low-grade material. The average width of the zone between the outside limits of the better-mineralized sections, as shown by the three cores, is about 25 feet. The grade, including the low-grade material, as determined by the company assays, is about 5 per cent combined zinc and copper and about half an ounce of silver per ton. The zinc exceeds the copper in a ratio of between 10 and 20 to 1.

The information available from the drill-holes and workings was compiled on the vertical longitudinal projection *AB* (*see* Fig. 7). The best-mineralized sections of cores, within the areas designated by *M*, are of possible ore grade and would probably contain at least 5 per cent combined zinc and copper and half an ounce of silver per ton across a width of at least 3 feet. Cores outside the outlined areas do not contain enough vein material to constitute possible ore. The distinction between material of probable ore grade and that probably below ore grade is based on observation, sampling, and partly on the results of sampling by the management.

Mineralization of economic importance is in three shoots with a feldspar porphyry dyke dividing the southwest shoot. The shoots appear to rake southwestward, but the rake could not be determined with certainty.

The Ruby zone has not been followed to the southwest on lower ground. However, some of the best-mineralized portion of the Ruby zone should apex at a slight concavity in the slope of the mountain, and this suggests that low ground along the strike may be the best place to prospect for additional shoots.

Copper Crown Zone.—Towards the northeast the Ruby zone is known as the Copper Crown zone. A vein with abundant massive chalcopyrite is exposed at the Copper Crown shaft, and near-by trenches disclose other veins in which chalcopyrite is more abundant than sphalerite. The long crosscut on No. 2 level was driven to explore the ground below the chalcopyrite showings, but in the drifts driven from the crosscut only a few veins are exposed and in general are sparsely mineralized.

The veins of the Copper Crown zone strike east-northeast and apparently diverge so that the width of the mineralized zone is greater than that of the Ruby zone. The wider spacing of the veins has resulted in a lowering of average grade of the zone.

Schorn Zone.—The Schorn zone at the surface comprises several nearly parallel veins, each a few inches wide, in which sphalerite is the most abundant sulphide. From an examination of diamond-drill cores it appears that the veins in the Schorn zone are lenticular and that the zone is narrower and not as well mineralized as the Ruby zone.

Lakeview Zone.—At the Lakeview showing, two nearly parallel zones are exposed and a drift adit has been driven on each. Faults, some of which are nearly parallel to the zones, cut the mineralized zones in both adits. In the eastern adit, several sparsely mineralized quartz stringers are exposed. In the western adit the maximum width of mineralization exposed is 9 feet 5 inches. Samples from this width assayed as follows:—

Sample No.	Width	Gold	Silver	Copper	Zinc
	Inches	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent
1[1]	67	Trace	6.1	2.5	25.1
2[2]	46	Trace	1.9	0.9	11.2

[1] Footwall section of mineralization.
[2] Hangingwall section of mineralization.

Some of the cores show mineralization of probable ore grade, but others do not. The mineralization was not correlated with either the eastern or western zone and may represent a zone resulting from the two coming together to form one zone. Gouge and broken rock from numerous faults are present in several of the cores, and it is possible that the lack of mineralization may be partly the result of displacement along fault planes.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1916, pp. 126, 127; 1925, p. 141. *Geol. Surv., Canada,* Sum. Rept., 1915, pp. 65–67 and figure facing p. 64.]

TOPLEY (54° 126° N.E.)*

Gold-Silver-Zinc

Topley Richfield (Topley Mining Syndicate).—Company office, 602 West Hastings Street, Vancouver. R. H. Wilson, president. This syndicate was formed in April, 1951, to deal with mining properties in the Topley area. Four claims covering the main workings of the old Topley Richfield mine were optioned from R. W. Innes, and twelve claims were recorded. Stripping, sampling, and mapping were done on parts of two claims.

TAHTSA LAKE (53° 127° N.E.)*

Silver-Lead-Zinc

Emerald (Emerald Glacier Mines Limited)

Mine office, Burns Lake. John W. Scott, manager. Capital: 1,000,000 shares, no par value. This property is on Sweeney Mountain, about 3 miles from the road built to Tahtsa Lake by Aluminum Company of Canada Limited. Work was done on the property from 1927 to 1931 by The Consolidated Mining and Smelting Company of Canada, Limited. Three adits were driven, at elevations of approximately 6,400 feet, 6,000 feet, and 5,400 feet, but there was no production. Late in February, 1951, the present company began to establish camp at the orginal camp-site and started underground work early in May.

The excellent road built by the Aluminum Company was of great benefit to the mine. The mine road is steep, but it is used by large trucks and is passable for cars in summer.

Underground development work consisted of 400 feet of drifting and crosscutting, 150 feet of raising, and 1,100 feet of diamond drilling. Mining started in a stope about 240 feet long on the 6400 level, and about 1,700 tons of ore was shipped. Ore was trucked from the mine to an ore-bin by the main road, where it was reloaded and hauled to Burns Lake, a distance of 104 miles. The ore was shipped to the Kenville mill at Nelson for treatment. Shipments started late in August and were discontinued about the end of the year because of the difficulty of keeping the mine road open in winter. Development work was planned on both levels for the winter.

* By J. H. Bennett.

Lead Empire (Lead Empire Syndicate).—The claims of this group are about halfway between Tahtsa Lake and Kidprice Lake. In 1951 a trail was built 21 miles to the property from a point near Twinkle Lake on the new road built by Aluminum Company of Canada. Some stripping and trenching were done on the showings, and a cabin was built on the trail about 5 miles from the property. The work continued from July to October, with J. H. Tustin in charge of as many as fifteen men.

OMINECA (56° 125° S.E.)*

Kennco Explorations, (Canada) Limited

The company reports that an area of about 1,000 square miles was prospected in the vicinity of Sustut and Bear Lakes. Trenching, and geological and biogeochemical work were done on claims held by Ernest and Gordon Davies on Osilinka River. On the Dorothy property on Duckling Creek, biogeochemical work was done to test this method of prospecting ground on which mineralized areas were known from previous work.

Lead

Beveley (The Consolidated Mining and Smelting Company of Canada, Limited).—Work was continued on this lead prospect near Osilinka River. Nine men were employed from June 15th to September 15th. About 1,100 feet of diamond drilling was done. The company reports that drilling was very difficult in this ground.

FINLAY RIVER (57° 124° S.W.)†

Copper

Copper King and Extension

The copper showings on the Copper King are one of several occurrences of copper mineralization lying in the Rocky Mountains north of the Peace River. The showings were located in the early thirties as the Wedge and Protection groups, and at that time some surface and a small amount of underground exploration was done.

Currently the Copper King Nos. 1 to 8 claims are held by Carl Noel, c/o Belmont Hotel, Vancouver, and the Extension Nos. 1 and 2 by Mort Teare, of Finlay Forks.

The copper showings are at an elevation of about 5,000 feet on the north side of Pesika Creek, about 20 miles east of the Finlay River. Pesika Creek is a large stream that joins the Finlay River from the east just north of Deserters Canyon. The trail into the property branches from the Moodie Trail, on the east side of the Finlay River, about 2¼ miles north of Deserters Canyon. From there it runs along the south side of Pesika Creek for about 7 miles then crosses to the north side. The site of an old bridge is about half a mile upstream from the ford. The trail then runs along the north side of the creek and crosses the north fork, a swift bouldery creek, about 15 miles from the Finlay. The camp-site on Pesika Creek is about 21 miles by trail from the Finlay River. From the camp-site a trail leads uphill to the northeast to an old cabin, elevation 4,900 feet, at the showings.

The showings are on the southwestern side of a northwesterly trending ridge that is largely underlain by limestone and calcareous slates striking north 40 degrees west. The rocks are closely folded and well cleaved. The axial plane cleavage dips steeply to the northeast.

Copper mineralization occurs in a huge quartz vein that is at least 5,000 feet long and may in places be more than 100 feet wide. Vein quartz can be seen in natural exposures and a few trenches for about 3,000 feet northwest of the cabin and for at least 2,000 feet southeast of the cabin. It is reported that the vein extends farther downhill

* By J. H. Bennett.
† By S. S. Holland.

to the southeast. The quartz exposures are not continuous, and the vein appears to vary in width from a few feet to possibly 100 feet or more and to be essentially parallel to the strike of the surrounding rocks.

The quartz vein appears to be a zone of numerous narrow reticulating quartz veinlets which have partly or completely silicified the host rock. In places there may be 25 feet or more of quartz; in others the same width may consist of numerous narrow quartz veinlets in rock that is only partly silicified.

At the cabin a 12-foot adit has been driven part way across the vein. It exposes fine-grained grey limestone crossed by narrow ankerite stringers and quartz veinlets in an irregular pattern. The rock contains a very small amount of disseminated chalcopyrite. The vein at this point is about 75 feet wide.

About 1,000 feet northwest of the cabin the total vein width is about 100 feet. There a small amount of copper staining along fractures in the quartz is to be seen, and along the northeast wall 6 to 12 inches of quartz, well mineralized with chalcopyrite, is estimated to contain about 5 per cent copper.

From the cabin, at an elevation of about 4,900 feet, the ground rises to about 5,200 feet on the vein about 2,300 feet to the northwest. At that point the vein is 25 feet wide and only slightly stained with malachite. An open-cut 100 feet farther northwest exposes 6 to 12 inches of pyrite and chalcopyrite mineralization, from which a sample of selected material assayed: Copper, 4.0 per cent. There is no copper mineralization in an open-cut on the vein 25 feet farther north.

The vein is exposed in a small creek 300 feet farther northwest and in several open-cuts near it. One open-cut exposes about 10 feet of vein quartz, of which 18 inches is well mineralized with chalcopyrite which appears to replace silicified limestone preferentially. A sample of selected well-mineralized material assayed: Copper, 6 per cent. It is estimated that the 10-foot width of vein would contain less than 5 per cent copper.

The vein continues uphill to the northwest beyond the creek for about 200 feet. In the farthest open-cut it is 3 feet wide and considerably stained with malachite. In the northwesternmost 700 feet of vein there are several places where copper mineralization of good grade is exposed. Unfortunately no continuity of mineralization is established nor is there any structural explanation for the localization of the copper mineralization.

To the southeast of the cabin the vein is exposed at intervals in natural outcrops for about 2,000 feet. Near the southeastern end at elevation 4,600 feet the vein is about 125 feet wide. There an adit 17 feet long was driven just below a small area of copper mineralization that is exposed on surface. The portal is caved and the adit is inaccessible. The dump at the portal contains a ton or so of well-mineralized quartz, from which a selected sample assayed: Copper, 5.3 per cent. Near the adit the copper mineralization covers an area of a few tens of square feet and has no continuity, even though the vein extends farther downhill to the southeast. There is no other copper mineralization known southeast of the cabin.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1930, p. 151.]

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; A. Shaak, general manager; M. Guiget, mine superintendent; W. A. Wall, mill superintendent. Capital: 2,000,000 shares, $1 par value. The Cariboo Gold Quartz mine is half a mile south of the town of Wells, which is 51 miles by road from Quesnel on the Pacific Great Eastern Railway.

* By J. E. Merrett.

New development work comprised 2,771 feet of drifting, 2,948 feet of crosscutting, 2,816 feet of raising, and 33,504 feet of diamond drilling.

The Tailings zone, west of No. 1 shaft, again supplied most of the ore. In this area the new 2100 level encountered two new vein zones containing better ore. At the end of December this level was being extended westerly towards Island Mountain Mines property and towards the projected extension of the replacement orebody mined on 2000 level in this zone.

Lesser amounts of ore were obtained from the No. 1, Rainbow, and Goldfinch zones. In the Rainbow zone a new body of replacement ore was discovered above 1400 level, and a large quartz orebody was mined in 1500-5c stope in the footwall of the Rainbow member.

In the Rainbow zone of the No. 2 shaft area, sections of the mine were rehabilitated for mining between 1500 and 1900 levels. To facilitate this development, connections were made between Nos. 1 and 2 shaft areas on 1700 and 1900 levels.

In the Goldfinch zone, near the B.C. shaft, mining was suspended on the 52 vein. Stopes on the 53 vein were extended above 1400 level.

Most of the ore from the quartz veins was mined by cut-and-fill methods, the remainder being mined by shrinkage stoping. In the replacement stopes the ore was removed by longwall advance stoping followed by filling. In general mining practice, increased use was made of scrapers for moving both ore and waste and of light-weight drills using tungsten-carbide tipped drill steel for drilling.

An expanded exploratory diamond-drill programme began early in 1951, chiefly at the Rainbow-Baker contact in the Tailings, No. 1, and Rainbow zones. Some new ore occurrences were located by this work.

An effort was made to increase the amount of ore milled, and in September the cyanide mill treated more than 200 tons per day.

On the average 200 men were employed, of whom 119 were employed underground.

Island Mountain Mines Company Limited

Company office, 744 West Hastings Street, 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 of New York, owns claims on the south and southeast slopes of Island Mountain and operates Island Mountain mine lying immediately west of Wells. The claims are adjoined to the south, east, and north by holdings of Cariboo Gold Quartz Mining Company Limited.

Development work comprised 3,538 feet of drifting and crosscutting, 1,134 feet of raising, and 9,352 feet of diamond drilling. This work was distributed on all levels from 3625 level to 2550 level. Waste fill was mined on the Mid Lake level which lies above the 4000 or main level.

Extensive exploration, particularly on the bottom or 2550 level and on the 2700 level, disclosed some new quartz veins in the vicinity of the Mosquito fault zone, west of the shaft.

Ore is obtained from replacement bodies which are mined by longwall advance stoping, and from quartz veins which are mined principally by cut-and-fill methods.

During 1951 the cyanide mill treated 109 tons of ore per day.

On the average, 123 men were employed, of whom seventy-six were employed underground.

Cariboo-Hudson Gold Mines (1946) Limited

Company office, Royal Bank Building, Vancouver; mine office, Barkerville. W. B. Burnett, president: R. R. Rose, manager; E. Hansen, superintendent. Capital: 3,000,000 shares, $1 par value. This company was refinanced in September by Empire Mining Syndicate, which syndicate took up an option on 500,000 shares of treasury stock. This property, near the headwaters of Cunningham Creek, approximately 27 miles southeast of Wells, by road, was reopened in November with the intention of mining scheelite. A crew of eight men reconditioned the camp and, at the end of December, was reopening the lower road to the adit in which tungsten ore occurs.

QUESNEL LAKE (52° 120° N.W.)*

Tungsten

Cariboo Scheelite

The Cariboo Scheelite Nos. 1 to 8 claims are held by R. R. Smith, of Likely. The claims are at Limestone Point on the north arm of Quesnel Lake and are about 45 miles by boat from Likely. Scheelite was first found at Limestone Point by Otto Baer, of Likely, in 1941. The Cariboo Scheelite No. 1 claim, located in August, 1950, covers the original scheelite discovery.

Limestone Point stands out prominently on the west side of the north arm of Quesnel Lake. It is underlain by a bed of light-grey to white limestone, possibly 200 feet thick, which extends northwestward from the lake in a succession of bluffs. The limestone appears to be underlain by about 50 feet of grey garnetiferous schist overlying light-grey to white sericitic quartzite. The rocks strike north 20 degrees west and dip about 30 degrees east. The limestone is possibly the southeastern extension of Barkerville limestone mapped by Lang north of Little River.

Northwest of Little River the Barkerville limestone is now known to occupy a major anticlinal structure and to underlie the Richfield formation. It is possible, therefore, that the limestone bed at Limestone Point may be overturned and that it occupies a similar structural position.

The limestone bed extends away from the lakeshore in a line of vertical bluffs 50 to 75 feet high and about 200 feet above the level of the lake. From the foot of the bluffs a talus pile composed of material that has broken and fallen from them extends downward towards the lake. Scheelite occurs in many of the limestone boulders of the talus material and also in the face of the bluffs themselves. Two small open-cuts were dug in the talus, and in the higher cut, about 150 feet above the lake, a large limestone block, well mineralized with scheelite, is exposed. A grab sample of material from this boulder assayed: Tungstic oxide, 4.5 per cent.

Small areas, streaks, and clusters of scheelite grains are to be seen at numerous places along the bluffs. There is no known spot as well mineralized as the rich boulder, nor was any structural feature observed that might serve to localize the mineralization.

The limestone is cut by numerous narrow reticulating quartz veinlets which have partly silicified the adjoining rock, and all scheelite mineralization appears to accompany quartz veinlets.

The occurrence of scheelite at Limestone Point should serve to focus the attention of prospectors on limestone belts in the Quesnel Lake area for replacement mineralization of this type.

BLUE CREEK (51° 122° S.E.)†

Gold

Elizabeth, Yalakom (Bralorne Mines Limited)

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. Work began in April when the road was reopened. The drift on No. 9 vein was extended 338 feet to a total length of 363 feet. This work developed two small ore blocks. An underground diamond-drill hole, collared at a point approximately 200 feet from the portal, was extended 442 feet in a southerly direction and intersected a mineralized dyke containing no gold.

* By S. S. Holland.
† By J. E. Merrett.

A crew of eight men was employed until October 1st, when work was suspended for the winter.

BRIDGE RIVER (50° 122° N.W.)*

Gold

Bralorne Mines Limited

Company office, 555 Burrard Street, Vancouver; mine office, Bralorne. A. C. Taylor, president; M. M. O'Brien, vice-president and managing director; D. N. Matheson, general manager; C. M. Manning, mine superintendent; A. Almstrom, mill superintendent. Capital: 1,250,000 shares, no par value. Bralorne mine is on Cadwallader Creek, a tributary of Bridge River, and is 51 miles by road from Shalalth on the Pacific Great Eastern Railway.

Development work comprised 9,381 feet of drifts and crosscuts, 1,906 feet of raising, 403 feet of shaft sinking, and 3,340 feet of diamond drilling.

The drifting and crosscutting were completed on the 51 vein on 1900 level, the 53 vein on 1800 and 1900 levels, the 55 vein on 1200 level, and the 77 vein on 1400E, 1700, 2000E, and 2600E and W levels. After completion of the Crown shaft in May, a crosscut connection was driven on 2600 level from this shaft to the Empire shaft.

Mining operations were concentrated between 1400 and 2000 levels. Below 2000 level, work commenced driving transfer raises and cutting station pockets on the Crown shaft.

In August a new electric hoist motor and stronger shaft were installed in the Crown hoist.

Ore was mined chiefly by cut-and-fill methods, although some was obtained by square-set and shrinkage stoping. All ore was mined using detachable, tungsten-carbide tipped drill-steel bits, and both ore and waste fill were moved with the aid of scrapers. Broken reserves were estimated to be 35,238 tons on December 31st.

On the surface, seven new four- and five-room houses were completed at the Bradian townsite, thus completing a section of twenty new homes. In July the Department of Public Works surfaced the main road through the Bralorne camp with asphalt (black-top).

In January the miners' basic wage was established at $9 per day. In May this was increased to $10 per day.

The number of men employed averaged 346. The actual number employed at the beginning and end of the year was more than 400, but during the summer and autumn the total was less than 300. The average crew employed underground was 267 men.

In June one accident caused two fatalities.

Pioneer Gold Mines of B.C. Limited

Company office, 711 Yorkshire Building, Vancouver; mine office, Pioneer Mine. Victor Spencer, president; H. T. James, managing director; W. B. Montgomery, mine manager; H. A. Rose, general superintendent; T. Bevister, mill superintendent. Capital: 2,500,000 shares, $1 par value. Pioneer mine is on Cadwallader Creek, a tributary of the Bridge River, and is about 54 miles by road from Shalalth on the Pacific Great Eastern Railway. The property adjoins Bralorne Mines property on the east.

In 1951 a total of 2,468 feet of drifting and crosscutting was completed. This work was done in development drifting on the 29 vein, extending drifts on the 27 vein, in crosscuts contained in the No. 5 shaft development programme, and in crosscuts contained in the main ventilation-raise system.

A total of 1,860 feet of stope raises was driven in mining operations and 408 feet was driven on the main ventilation raise. Work commenced on diamond-drill ring-drilling and slashing the main ventilation raise in 50-foot sections. When completed,

* By J. E. Merrett.

the raise will be 11.5 feet in diameter. Diamond-drill ring-drilling totalled 13,264 feet during the year, and exploratory drilling totalled 4,610 feet.

On 2400 level the temporary hoistroom for the No. 5 shaft, the hoisting-rope crosscut, and the crosscut to the bottom of the ventilation raise were completed. In addition, the 2500 level crosscut to No. 5 shaft was completed.

All stopes on the 27 vein were converted to ore-filled rill or cut-and-fill stopes, slusher scrapers being used to move all ore and waste fill. The normal stull-and-lagging sills have been converted to boxhole and subdrift sills.

The underground drainage pumping system was converted from manual operation to automatic flooded control.

A total of 102 family housing units is now maintained on the surface.

The average number of men employed was 254, of whom 135 were employed underground.

Golden Ledge Syndicate

Company office, 503 Rogers Building, Vancouver. J. S. Harrison, president and manager. This private syndicate holds four Crown-granted mineral claims and twenty-one located claims astride the Hurley River, half a mile below its junction with Cadwallader Creek. The camp is halfway between Bralorne and B.R.X. mines on the Bridge River road. During 1951 a crew of four men completed a total of 570 feet of exploratory drifting on Nos. 3, 4, and 5 levels.

Wayside (L.A.P. Mining Company Limited)

Company office, 626 West Pender Street, Vancouver; mine office, Gold Bridge. L. A. Prosser, manager; W. H. Clarke, superintendent; J. Marshall, foreman. Capital: 3,000,000 shares, $1 par value. This private company owns seventeen claims and seven fractions astride the Bridge River road, midway between Gold Bridge and Minto. The property was formerly owned by Wayside Consolidated Gold Mines Limited. Mill machinery was installed for the flotation and cyanidation of concentrates.

Underground, caved stopes on No. 3 and No. 4 levels were retimbered, and ore was by-passed down to the main, or No. 5, level. On the surface a box chute 320 feet long was constructed from near the main adit to a surface ore dump below No. 3 level. Ore from both sources was used for mill test purposes. The hoistroom has been increased in size preparatory to the installation of larger hoisting equipment.

In August a fire destroyed the machine-shop, compressor-house, and compressor. The building was replaced in September, and a 500-cubic-feet-per-minute compressor was installed in October.

A new two-story office building measuring 22 feet by 12 feet was constructed. The average number of men employed was eighteen.

Antimony

Gray Rock (Gray Rock Mining Company Limited)

Company office, 207 West Hastings Street, Vancouver; mine office, Gold Bridge. G. H. Clark, president; L. Belliveau, vice-president and manager. Capital: 3,000,000 shares, $1 par value. This property comprises twenty claims which are near the headwaters of Truax Creek, a tributary of Bridge River. It is reached by 18 miles of truck-road from Gold Bridge. Diamond drilling was successful in locating the No. 1 vein, which had been the objective of the crosscut completed in 1950. The vein was drifted on in a westerly direction for a distance of 35 feet and was found to be shattered and slightly displaced by minor faulting. It was estimated to have an average width of 1.5 feet and that the stibnite constituted between 20 and 30 per cent of the vein material. Further diamond drilling from the drift established a minimum length of vein of 150 feet at a horizon 175 feet below the surface outcrop.

A new crosscut was driven 25 feet into the face of a bluff, at an elevation of 6,475 feet or 325 feet below the portal of the upper adit.

A crew of nine men was employed from May to October.

ANDERSON LAKE (50° 122° N.E.)*

Gold

Golden Contact Mines Limited

Company office, 850 West Hastings Street, Vancouver; mine office, McGillivray Falls. M. McGregor, president and managing director. Capital: 3,000,000 shares, 50 cents par value. This company owns seventeen claims and holds options on three others on the north slope of McGillivray Creek, 4 miles by pack-trail from McGillivray Falls on the Pacific Great Eastern Railway. It is reached also by 5 miles of tractor-road from Marne Station.

Between May 1st and July 31st a crew of twelve men completed 500 feet of drifting and crosscutting on the Pep level. A continuous quartz vein with an average width of 9 feet was exposed throughout the final 320 feet of drift. The vein exhibited light banding and scattered minor concentrations of sulphides.

THOMPSON RIVER (50° 121° N.E.)*

Gold-Copper

Baby's Own

This property, comprising four mineral claims owned by C. Ellingsen, of Spences Bridge, adjoins the Cariboo Highway 10 miles north of Spences Bridge and 1 mile north of 89-Mile Ranch, which is on Lot 500 in the Kamloops Land Recording District. The claims also adjoin the main line of the Canadian National Railway and are on the east slope of the range of hills between the Thompson River and Venables valley.

The predominant rock type is volcanic, of andesitic composition; two bodies of limestone have been disclosed by surface stripping.

Mineral occurrences are of two types: the principal one being fracture fillings in the andesite; the other and less common type being pocket concentrations of sulphides. The fracture fillings vary in width from 2 inches to paper-thin seams. The principal mineral is hematite accompanied by minor amounts of chalcopyrite which, on the surface, has weathered to malachite. Occasional isolated blebs of hematite as much as 1 inch in diameter were observed in the andesite. The blebs did not appear to be connected in any way with the fractures. Hematite was also observed in a finely disseminated form along a limestone-andesite contact which is exposed at the north end of the No. 1 or road cut. A sample taken from a fracture filling in the road cut assayed: Gold, 0.01 oz. per ton; silver, trace; copper, 0.6 per cent across a width of 0.2 feet.

No. 2 cut, approximately 100 feet northwest of No. 1, was filled with surface slide rock, but the dump material indicated an occurrence similar to that in No. 1 cut.

No. 3 cut, 300 feet northwest of No. 1, is in an outcrop of andesite with inclusions of hematite. A grab sample from No. 3 cut assayed: Gold, 0.02 oz. per ton; silver, trace.

Nos. 4 and 5 cuts, approximately 100 feet west of No. 2 cut, were both filled with slide material.

No. 6 cut is 400 feet southwest of and 250 feet above No. 1 cut. At this point approximately a 50-foot square of bedrock had been exposed by surface stripping, disclosing a short length of calcite vein 2 feet wide and several small pockets of pyrite with hematite and chalcopyrite. Most of the pyrite pockets have been mined out. It was reported that one pocket contained approximately 4 tons of sulphides which assayed: Copper, 3.8 per cent; silver and gold, $2 per ton.

* By J. E. Merrett.

At no point was sufficient mineral seen to warrant extensive development work on this property. It is suggested that only a minimum of work be done until the relocated Cariboo Highway is built through the property. This construction will undoubtedly disclose a considerable amount of fresh rock, which will provide additional information on the value of the property.

KAMLOOPS (50° 120° N.E.)*

Copper

Iron Mask (Kamloops Copper Company Ltd.) Company office, 210 Victoria Street, Kamloops. Eric Larsen, president; A. M. Affleck, vice-president; R. A. Krenke, mine foreman. This company was incorporated late in 1951 to take over the property of the Kamloops Copper Syndicate. The property includes most of the original holdings of the Iron Mask mine, and several recorded claims about 4 miles southwest of Kamloops. On the Lucky Strike Fraction, half a mile south of the Iron Mask mine, an old shaft 60 feet deep was retimbered and the workings were examined. On the Night Hawk Fraction, half a mile northwest of the Iron Mask, an old shaft 35 feet deep was reconditioned and deepened to 90 feet. Several tons of copper ore mined in deepening the shaft was stored on the surface. No shipments were made. Five men were employed.

BLACK POOL (51° 120° N.E.)†

Silver-Lead-Zinc

Queen Bess The Queen Bess property, also known as the Lone Prospector and Ironclad, is 1,000 feet above and immediately east of the Canadian National Railway tracks 3 miles south of Black Pool, a station on the east bank of the North Thompson River 70 miles north of Kamloops. The base of the hill below the workings can be reached by road from Black Pool, which in turn can be reached from the North Thompson highway by ferry. A trail extends from the old mill and camp buildings at the base of the hill to the mine workings above. Two days were spent at the workings in July, 1951.

This property is mentioned in several Annual Reports of the British Columbia Minister of Mines, and brief descriptions appear in the reports of 1918 and 1927. Uglow‡ described the workings in 1921, and Walker§ gave a detailed account of the property in 1930.

Two attempts have been made to put the property into production. In the period from 1917 to 1920 underground work was begun, a mill was constructed, and small shipments were made. A second effort that resulted in more underground development and a remodelling of the mill ended with permanent closure in 1927. Apparently nothing has been done on the property since the latter date because Walker's description fits the workings as they are to-day.

Two Crown-granted claims—the Lone Prospector and Ironclad—that appear to cover most, if not all, of the showings are owned by G. F. McGregor, of the Spar-Mac Ranch at Black Pool.

Narrow veins carrying galena and sphalerite occur in fissures in greenstone of the Fennell formation. The fissures strike northeastward and dip steeply to the northwest. Faults indicated by gouge zones from 1 inch to 6 feet or more wide are numerous throughout the workings. The fissures containing the veins are relatively continuous, but the sulphide mineralization tends to be erratic and occurs as spotty lenses. Although veins as much as 6 feet wide have been reported in the past, no mineralized widths greater than 1 foot were observed during this examination.

* By E. R. Hughes.
† By J. W. McCammon.
‡ *Geol. Surv., Canada*, Sum. Rept., 1921, Pt. A, pp. 102, 103.
§ *Geol. Surv., Canada*, Sum. Rept., 1930, Pt. A, pp. 140–143.

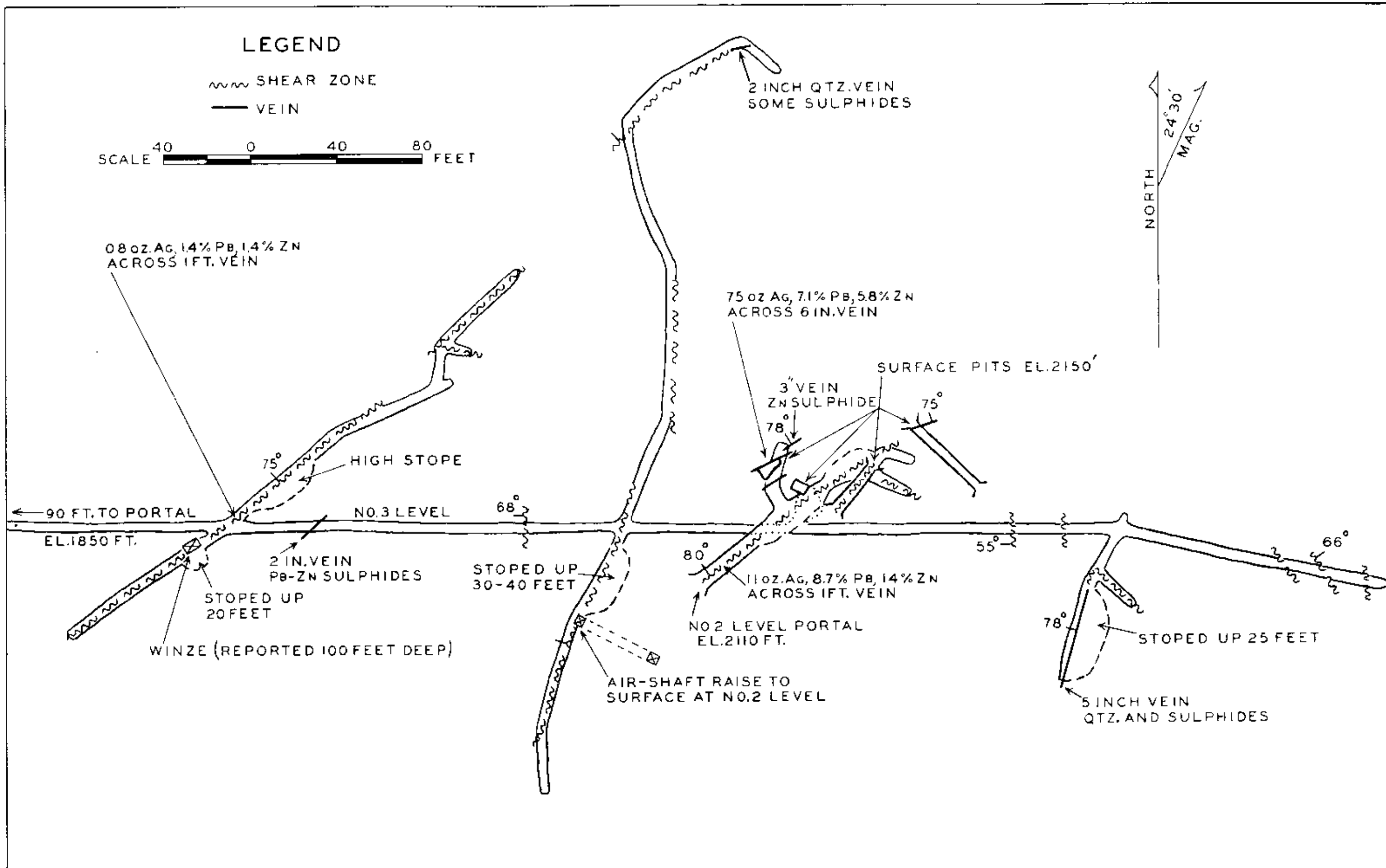


Fig. 8. Queen Bess workings, Black Pool—tape and compass survey.

The workings seen were No. 3 level adit, No. 2 level adit, and several pits and open-cuts on the surface above No. 2 level.

The portal of No. 3 level, the main underground development, is 720 feet above and about 400 feet due east of the remains of the old mill building which is at the same elevation as the railway tracks. This level consists of a crosscut adit that goes east for 595 feet and then bends slightly to the south to continue on for another 125 feet. Drifting has been done from the adit on three mineralized fissures: the Cameron vein, 185 feet from the portal; the Bigelow vein, 366 feet from the portal; and a small vein 595 feet from the portal.

The Cameron vein strikes north 50 to 55 degrees east and dips as much as 75 degrees to the northwest. A drift follows this vein 87 feet to the southwest. Sulphides are sparse along the fissure exposed by the drift, the only noticeable amounts being in a 6-inch wide lens visible in the back of a small stope 20 feet in from the main adit. A winze, reported to be 100 feet deep and now full of water, is below the stope.

An irregular drift follows the Cameron vein fissure for 186 feet northeastward. Ten feet from the start of the drift is a high stope 40 feet long. The only sulphide mineralization seen was in a zone 1 foot wide in the back of the drift between the stope and the main adit. Sample No. 1 was taken across a 1-foot width of this material 4 feet from the crosscut.

The Bigelow vein fissure has an average strike of north 20 degrees east and an almost vertical dip to the northwest. It has been drifted on both to the north and south. The south drift extends for 133 feet along the fissure. A raise to the surface near No. 2 level portal has been driven up from a point 48 feet from the start of this drift. The back of the drift has been stoped up for 30 to 40 feet between the raise and the main crosscut. Sulphide mineralization was seen only in a zone 1 foot wide in the back of the drift. This was inaccessible.

The northerly drift on the Bigelow fissure is 286 feet long. The only sulphides seen in it were in a 2-inch wide quartz veinlet at the bend 24 feet from the face of the drift.

A shear 595 feet from the adit portal has been drifted on for 85 feet to the southwest. The last 45 feet of this drift has been stoped up for about 25 feet on a 5-inch stringer of sulphide-bearing quartz. A subdrift 8 feet from the start of the main drift follows a barren 2-inch wide quartz veinlet for 24 feet.

No. 2 level portal is 260 feet above No. 3 level portal. The workings on No. 2 level consist of an adit 116 feet long with a crosscut 34 feet long to the north 50 feet from the portal and a 17-foot long drift to the south on a barren shear 87 feet from the portal. The adit follows a shear that strikes north 50 degrees east and dips 80 degrees northwest. The shear contains vein matter that pinches and swells from 1 inch to 1 foot in width. The back of the adit has been stoped up about 10 feet for a distance of 70 feet, starting 30 feet from the portal. Two veinlets 3 inches wide containing sphalerite were cut by the crosscut, one in the face and the other 14 feet from the crosscut. Sample No. 2 was taken across 1 foot of sulphide-bearing vein matter in the back of the main adit 18 feet from the portal.

Two small pits and two caved trenches were examined on the surface 40 feet above No. 2 level. The two pits contained small patches of galena and sphalerite up to 10 inches wide. Sample No. 3 was taken across 6 inches of vein material from the most westerly pit. One trench was dug northeasterly along a barren shear; the other was dug along a northwesterly line and in the west end exposes a vein 6 inches wide carrying sulphides.

The ground surface in the area adjacent to the surface pits is covered with overburden so the veins could not be seen elsewhere in the immediate vicinity.

Assay results on the three samples taken during the examination are as follows:—

Sample No.	Width	Silver	Lead	Zinc
	Inches	Oz. per Ton	Per Cent	Per Cent
1	12	0.8	1.4	1.4
2	12	11.0	8.7	14.0
3	6	7.5	7.1	5.8

According to Uglow* the first mill run of 720 tons of ore gave the following:—

(1) Twenty-seven tons of lead concentrate assaying 40 to 50 per cent lead, 12 per cent zinc, and 48 ounces of silver per ton.

(2) Seventy-eight tons of zinc concentrate assaying 48 per cent zinc, 7 to 8 per cent lead, and 14 ounces of silver per ton.

NICOLA (50° 120° S.W.)†

Copper

Copperado (Guichon Mine Limited)

Company office, 119, 744 West Hastings Street, Vancouver. J. D. Ferguson, mine manager. This company did some exploratory and development work at the Copperado mine, 5 miles by road northeast of Nicola. The shaft was deepened to 450 feet, and a station was cut on the 425-foot level. On the 100-foot level the north drift was extended to a point 101 feet northerly from the shaft, and 180 feet of drifting and cross-cutting was done on the 425-foot level. Following an examination of the property by the company's consulting engineers, mining operations were suspended, and pumps, pipe, and track were taken out of the mine. The mine was closed on November 23rd.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1949, pp. 115–120.]

Iron Mountain†

Silver-Lead-Zinc

Lucky Todd

The Granby Consolidated Mining Smelting and Power Company Limited took an option on this property on Iron Mountain, about 14 miles by road from Merritt. The property, formerly known as the Leadville, was located by Emmitt Todd in 1927, and a shaft was sunk about 100 feet. The mine was leased by George G. Hunter and partners in 1947, and 36 tons of ore was sent to the Trail smelter, but there was no other activity until the Granby Company dewatered the shaft in June, 1951. After the workings were examined, no further work was done.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1927, p. 212; 1928, p. 224; 1929, p. 245; 1930, p. 207; 1947, p. 136.]

TULAMEEN RIVER (49° 120° N.W.)†

Gold

El Alamein Mines (1950) Limited

Company office, 607 Rogers Building, Vancouver. R. C. Cragg, manager. This company did some development and exploratory work during the summer months at the El Alamein mine on the Tulameen River, 4½ miles upstream from Tulameen. The main face in the upper adit was not extended in 1951. Sixty feet from the portal of the lower adit a raise was driven 25 feet to connect the lower and upper adits, and a winze was sunk 12 feet from the foot of the raise. Thirty feet of raising and stoping was done from the upper adit, and 10 feet of slashing was taken from the side of the stope. A 3-ton compressed-air hoist and a mine-car turn-table were installed at the head of the raise

* *Geol. Surv., Canada,* Sum. Rept., 1921, Pt. A, p. 103

† By E. R. Hughes.

connecting the adits, and track was laid in the raise and winze. On the north side of the Tulameen River, between 225 feet and 375 feet east of the mill, a bulldozer was used to excavate overburden from the river bank in search of an extension of the mineralized zone. The crew averaged two to three men, and the work was done between June 1st and September 9th. There was no production in 1951.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1949, pp. 124–129.]

Silver-Lead-Zinc

Silver King and Jensen (Silver Hill Mines Ltd.) Company office, 1412 Royal Bank Building, Vancouver. E. L. Borup, president; E. H. Kinder, mine manager. A crew of three to fourteen men was employed to improve the road, erect mine buildings, and rehabilitate underground workings preparatory to reopening the old Silver King and Jensen properties at Tulameen Summit, 21 miles southwest of Tulameen by road. The old Silver King property is often referred to as the Dornberg mine.

Track was relaid in the Dornberg No. 3 level. This level is at an elevation of 4,330 feet and is the lowest crosscut adit. The distance from the portal to the vein intersection is 1,258 feet. When this level has been fully prepared, the management intends to drive a raise to the Dornberg No. 2 level, which is at an elevation of 4,733 feet. The only ore produced was that obtained in cleaning up and reconditioning the Jensen adit; it was shipped to the Trail smelter.

Production: Ore shipped, 20 tons. Gross content: Silver, 478 oz.; lead, 6,787 lb.; zinc, 5,898 lb.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1926, p. 223; 1927, p. 254; 1928, p. 265; 1929, p. 278; 1930, p. 214; 1931, p. 129; 1932, p. 139.]

COPPER MOUNTAIN (49° 120° S.E.)*

Copper

Copper Mountain (The Granby Consolidated Mining Smelting and Power Company Limited) Company office, 675 West Hastings Street, Vancouver. Julian B. Beaty, president, New York, N.Y.; L. T. Postle, vice-president and general manager, Copper Mountain; W. I. Nelson, assistant general manager, Allenby; J. A. C. Ross, mine superintendent; L. H. McKay, mill superintendent. 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 mine and to the concentrator at Allenby, 3½ miles south of Princeton. A branch line of the Kettle Valley Railway from Princeton serves the power plant, mine, and concentrator.

The main development of the mine is from No. 6 adit level, two vertical shafts, and an auxiliary raise. No. 1 shaft is a service shaft that extends from the surface at the mine camp to the No. 6 or main haulage level. No. 2 shaft is used to service No. 7 and No. 8 levels and is an internal shaft, with the hoist on No. 5 level. An auxiliary raise connects Nos. 2, 3, 4, 5, and 6 levels with the surface at a point 350 feet southwest of the collar of No. 1 shaft. The work of equipping the auxiliary raise with a manway and skipway, together with electric cables and compressed-air pipes, was completed in 1950. All ore is passed to No. 6 level and taken from 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 8 miles by rail to the concentrator at Allenby.

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.

* By E. R. Hughes.

Mining of undercuts with jack-leg machines instead of by diamond-drill blast holes was a successful new development in 1951. Twenty-three jack-leg machines and nineteen Holman Silver Bullet stoping-machines, all using tungsten-carbide tipped steel, were used in development and ore breaking. Drilling for pillar blasting is still done with diamond drills. Mining is extensively mechanized. Most of the ore is mined in diamond-drill shrinkage stopes and is transferred from slusher-drift draw-points to grizzlies by electric slusher-hoists. Because of the more friable nature of the ground now being mined, most of the slusher-drifts are reinforced with a concrete lining. Ventilation raises, equipped with auxiliary fans, provide each slusher unit with fresh air, so that the dust and smoke from scraping and blasting are carried away quickly. Diamond drilling done during the year comprised 95,287 feet of exploratory and 330,540 feet of blast-hole drilling.

The major underground development in 1951 was the starting of the new No. 3 inclined shaft from No. 6 level. The shaft is inclined at 45 degrees and is being raised to the surface a slope distance of approximately 1,000 feet. At the end of December it had been advanced about 400 feet. When completed, the new shaft will replace No. 1 shaft, which will be engulfed by subsidence when the 6-1/13 and 6-13 east ore blocks are mined. The search for new orebodies was intensified. An 8,000-foot long exploratory drift was started from the extreme south end of the mine on No. 6 level. At the end of 1951 this drift had been advanced 200 feet. Other long drives into virgin areas to the north and east of the mine workings were started on the Nos. 4, 5, and 7 levels.

The 250-horsepower electric motor on the No. 2 shaft hoist was replaced with a 400-horsepower motor, and the 100-cubic-foot capacity ore skips were enlarged to 123 cubic feet to increase ore-hoisting facilities from No. 8 level to No. 6 level. Two additional loading pockets and grizzlies were built on No. 8 level. No. 3 bunk-house was further enlarged to accommodate an additional twenty-four men.

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 camp. 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 9th.

A slide on the railway between Copper Mountain and Allenby caused a suspension of production from June 18th to June 22nd. Except for this brief interruption, mining and milling were continuous throughout the year. The crew at Copper Mountain averaged 587, with 464 employed underground. The total crew at the Copper Mountain, Allenby, and Princeton operations was 925 at the end of 1951.

JELLICOE (49° 120° N.E.)*

Gold-Silver-Copper-Lead-Zinc

Lucky Strike This group is a relocation of part of the Snowstorm group. It consists of the Lucky Strike, Diamond, Blue Grouse, Judy, and other claims and is owned by E. Mullin *et al.*, of Princeton. It is on Siwash Creek, north of the Crown-granted Fissure Maiden Fraction, and about 8 miles by road from Jellicoe on the Kettle Valley Railway. In 1928 the upper adit had been driven 110 feet in a southwesterly direction from the west side of the creek. In 1929

* By E. R. Hughes.

No. 2 adit, 60 feet downstream from No. 1, was driven 140 feet. These adits were cleaned out in 1951, and a crosscut was driven south 40 feet from the face of No. 1 level to connect with No. 2 level. From the intersection of the levels the face was advanced 45 feet on the vein.

A compressor was installed, and mining was done with a Copco jack-leg machine. No ore was shipped, but about 100 tons was mined and stored at the property.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1925, p. 210; 1927, p. 247; 1928, p. 264; 1929, p. 277. *Geol. Surv., Canada,* Mem. 243, pp. 108–109.]

HEDLEY (49° 120° S.E.)*

Gold

Nickel Plate and French (Kelowna Mines Hedley Limited)

Company office, Room 2630, 630 Fifth Avenue, New York 20, N.Y.; British Columbia office, 640 West Pender Street, Vancouver; mine office, Hedley. George L. Mill, manager; E. W. Johnson, mill superintendent; J. Biggs, mechanical superintendent. This is a private company operating the Nickel Plate mine and the French mine at Hedley. In February the name of the company was changed from Kelowna Exploration Company Limited.

Nickel Plate Mine.—C. T. Williams, mine superintendent; P. C. B. Emery, chief engineer. Full descriptions of the operation have appeared in previous Annual Reports. Major underground development in 1951 consisted of sinking the 4150 winze and driving the 4160 drift. The 4150 winze is an inclined shaft sunk at 46½ degrees from the 4150 level and has a slope length of 430 feet. The bottom of the winze is at an elevation of 3,820 feet on the Morning mineral claim near the boundary of the Nick of Time. The winze was completed in 1951 but had not been completely equipped for hoisting at the end of December. The 4160 drift was driven 1,000 feet for exploratory work in the Climax fault area.

Two new bunk-houses were built to provide additional accommodation for sixteen men. There were no other major additions to plant or equipment. Mining is done with Copco and Gardner-Denver drilling-machines using Copco steel, and Timken and Craig bits. The type of machine and bits used depends on the kind of work to be done and the hardness of the ground to be drilled. Total development consisted of 3,343 feet of drifting, raising, crosscutting, and winze sinking, of which 1,394 feet was done in the Nickel Plate and 1,949 feet in the Morning workings. Diamond drilling amounted to 15,158 feet, of which 12,156 feet was exploratory and the remainder was for stope preparation. At the end of the year 237 men were employed, of whom 125 worked underground.

The percentage production from the main parts of the mine was: Nickel Plate, 80.2 per cent; Morning, 10.8 per cent; Sunnyside, 9.0 per cent. Production: Ore milled, 115,488 tons.

French Mine.—F. Garbutt, mine superintendent. The mine is on the Oregon mineral claim which the company recently purchased from F. H. French and associates, of Hedley. The mine is about 8 miles by road from the company's mill at Hedley, and 1½ miles east of the Hedley–Nickel Plate road. As far as is known at present the ore occurs in a shallow deposit. The workings consist of an adit level at an elevation of 3,910 feet, with two open stopes, one on each side of the level. The broken ore is scraped from the underground workings along the adit level to a storage bin outside the portal. A small crushing and sampling plant is installed at the mine. A 500-cubic-foot Holman belt-driven air compressor powered by a 100-horsepower General Electric motor provides compressed air for the mine. Electrical power is obtained from the West Kootenay Power and Light Company Limited. Two new Canadian Ingersoll-Rand

* By E. R. Hughes.

slusher-hoists were added to the mine equipment. In December preparatory work was done towards driving a new adit 20 feet higher than the present portal. Ore mined at the rate of 32 tons per day was trucked to the company's mill at Hedley for treatment. Six men were employed. Operations were suspended on December 17th for the winter. Production: 7,247 tons.

Silver-Lead-Zinc-Gold

Iota (Hedley Yuniman Gold Fields Limited) Company office, 45 Kingsway, Vancouver. J. W. Gallagher, president. The Iota property is on Stemwinder Mountain, about 3 miles northwest of Hedley. In January and February K. G. Ewers and William Hegan deepened the shaft on the mineralized fracture zone to 40 feet and shipped 40 tons of ore to the Trail smelter. Later in the year Hedley Yuniman Gold Fields Limited acquired the property from the owner, J. W. Gallagher, and mining equipment at the Yuniman mine on Bradshaw Mountain was moved to the Iota. The shaft was retimbered and some surface stripping was done. An adit was started 100 feet lower than and 380 feet southerly from the shaft. In driving the adit the broken muck was scraped from the face to outside the portal with a Canadian Ingersoll-Rand double-drum slusher-hoist and 30-inch scraper; a Copco jack-leg machine was used for drilling. A 210-cubic-foot capacity Schramm portable compressor supplied compressed air. At the end of 1951 the adit had been advanced 154 feet. Two men were employed.

Production: Ore shipped, 40 tons. Gross content: Gold, 2 oz.; silver, 480 oz.; lead, 4,681 lb.; zinc, 1,031 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. No. 6 is the haulage level, and mining is done by shrinkage stoping. 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, with an average production of 1,500 tons per month.

BEAVERDELL (49° 119° S.E.)*

Silver-Lead-Zinc-Cadmium

Highland-Bell Limited Company office, 844 West Hastings Street, Vancouver; mine office, Beaverdell. K. J. Springer, president; D. F. Kidd, director and consulting geologist; O. S. Perry, mine manager; G. W. West, mine engineer; P. R. Clarke, mill superintendent. The Highland-Bell mine on Wallace Mountain is 4 miles by road east of the main camp at Beaverdell. No. 4 adit, at 3,976 feet elevation, is the main haulage level. Compressors, power plant, and steel-shop are at the portal of No. 4 level. The 34-degree main winze connects No. 4 level with No. 7 level and No. 8 level. A second winze connects No. 8 level with No. 10 level, a vertical distance of 100 feet. Most of the ore mined in 1951 came from No. 7 level workings.

The ore is trucked down the mountain to the mill, which is adjacent to a spur of the Canadian Pacific Railway at Beaverdell, elevation 2,685 feet, and the concentrates are shipped to the Trail smelter. The company dwellings, office, and mine buildings are on the valley bottom near the West Kettle River. During the past six years the company

* By E. R. Hughes.

has added ten modern homes at the camp and a new curling rink. The average number of men employed was fifty.

Silver-Lead-Zinc

Wellington (Silver Bounty Mines Limited) Company office, 208 Pacific Building, 744 West Hastings Street, Vancouver. G. S. Eldridge, president; John Broatch, manager; G. A. Day, mine superintendent. This company continued development at the Wellington mine on Wallace Mountain, near Beaverdell. No. 5 level is the main haulage adit, and a winze connects this level with Nos. 6, 7, and 8 levels. Most of the development in 1951 was on No. 8 level. A vein was reached by a crosscut driven 75 feet from the winze. Drifting was done 180 feet westerly and 60 feet easterly on the vein, and two raises were driven 30 feet and 37 feet from the level. No ore was shipped in 1951, but several tons was mined and stored at the property until a carload could be accumulated. Three men were employed in the early part of the year, but in the last four months the crew was increased to five.

LIGHTNING PEAK (49° 118° N.E.)*

Silver-Lead-Zinc

Waterloo, Dictator (Paycheck Mining and Development Company Limited) Company office, 804 Silica Street, Nelson. H. A. McKen, managing director. This private company controls sixty-four claims on the main mineral discoveries in the Lightning Peak area, including such old groups as the Waterloo, Dictator, Rampalo, and Pay Day. The Waterloo camp, used as the base of operations, is 18.5 miles by road from Inonoaklin Crossing on the Monashee Highway. Most of the claims lie between the headwaters of Rendell Creek and Granby River on a plateau terrain with an average elevation of 5,900 feet.

At the Waterloo mine a nearly vertical mineralized shear zone striking east-west has been investigated by four adits over a vertical range of 150 feet. The three upper adits total about 450 feet in length, but the lowest or No. 4 adit has been driven 1,780 feet to the east. During 1950 and 1951 the present company stripped the shear zone on the surface above No. 1 adit, where the shear was offset 30 feet to the north by a fault. A shaft was sunk to a depth of 30 feet on the faulted segment, the dip of which had flattened to 45 degrees to the north. Galena and sphalerite were sorted from the shaft, and sixty-eight sacks plus 10 tons of fines were obtained but were not shipped in 1951. Below No. 4 adit, bulldozer stripping was done in an effort to locate the shear zone, but bedrock was not reached.

Mill machinery was brought to the property during the summer, and a mill-site was chosen near the Waterloo workings. This machinery consisted of jaw crusher, ball mill of 90 tons capacity, classifier, rolls, two Denver jigs, flotation cells, and Vivian diesel unit. In addition, four compressors had a combined capacity of about 1,100 cubic feet per minute. A sawmill was erected and mill timbers were cut on site. Buildings included cook-house, bunk-house, tractor-shed, and warehouse. Closing of the Monashee Highway forced a shut-down by the end of November, but by then the mill building had been erected. Eight men were employed under the direction of H. A. McKen.

GREENWOOD (49° 118° S.W.)†

Gold-Silver-Lead-Zinc

Providence W. Madden, owner. This mine is 1½ miles north of Greenwood and has been worked intermittently for over fifty years. During 1951 work was done by lessees. Leo Madden and Mark Madden

* By J. W. Peck.
† By E. R. Hughes, except as noted.

did some exploratory and development work in the No. 2 shaft workings. A raise was driven 50 feet from the 600-foot level at a point 320 feet southerly from No. 2 shaft, but no ore was shipped.

E. Wanke, O. Johnson, and J. S. Kleman sank an inclined shaft from the surface at a point about 150 feet northerly from the old No. 1 shaft. At the end of the year the shaft had been sunk 80 feet at an angle ranging between 25 and 40 degrees. The shaft was sunk on a narrow vein. Two shipments of ore were made.

Production: Ore shipped, 14 tons. Gross content: Gold, 8 oz.; silver, 2,964 oz.; lead, 1,285 lb.; zinc, 1,112 lb.

Silver-Lead-Zinc

Dynamo

This property, at the south end of the City of Greenwood, is owned by a syndicate represented by J. McDonell and M. M. Butorac. An adit on the Mamont claim was driven 255 feet southeasterly by hand. The quartz vein is faulted at the face of the adit. An underhand stope 185 feet from the portal was sunk 20 feet on the vein which ranges in width from 6 inches to 2 feet. A shipment was made to the Trail smelter in November. The work was done by J. McDonell and one man.

Production: Ore shipped, 36 tons. Gross content: Silver, 188 oz.; lead, 10,804 lb.; zinc, 3,127 lb.

Copper

Attwood Copper Mines Limited*

Company office, 330 Bay Street, Toronto; British Columbia office, 844 West Hastings Street, Vancouver. D. F. Kidd, president. This company controls a large block of ground in the Greenwood district, including the old Granby holdings in Phoenix, which have been owned by W. E. McArthur, of Greenwood, for some years, and locations to the east towards the B.C. mine. Ground located by Mr. McArthur in the vicinity of the B.C. mine southeast of Eholt was included in the holdings late in the year.

A small crew under the direction of R. H. Seraphim was engaged in geological mapping, geophysical surveying, and geochemical prospecting. Diamond drilling was done late in the year.

Mr. McArthur and his son carried out geochemical prospecting on the ground in the vicinity of the B.C. mine. Twig samples were taken and analysed by the dithizone method. Samples were taken every 50 feet on lines 200 or 300 feet apart in an area of very few outcrops. Some anomalous areas were indicated but not investigated. One diamond-drill hole was put down 270 feet at a point 400 feet north of the B.C. open pit, but the last half of the hole was in granitic dyke rock, of which there was no surface indication.

ROSSLAND (49° 117° S.W.)†

Gold

Midnight and I.X.L. (Kootenay Central Mines Limited).—Head office, Room 2, 815 Victoria Street, Nelson. J. A. Cooper, manager. Capital: 500 shares, $100 par value. This company, which owns the Midnight and I.X.L. mines 1 mile south of Rossland, remained inactive during 1951. However, J. Gillis, H. Wuori, and L. McLellan, operating under a lease arrangement, removed remnants of ore from the main adit level of the Midnight mine about 200 feet from the portal. This ore was trucked to the Trail smelter.

Production for 1951 includes 26 tons mined in 1950.

* By M. S. Hedley.
† By J. W. Peck.

Gold-Silver-Lead-Zinc

Bluebird (Rossland Mines Limited) Company office, 675 West Hastings Street, Vancouver. Capital: 3,000,000 shares, no par value. This company owns a group of claims in the South Belt, adjacent to Rossland. The company was inactive during 1951, but the LBB mining partnership continued operations on the Bluebird claim. The shaft begun in 1950 was sunk a further 10 feet to a total depth of 50 feet. At the bottom the vein was 5 feet wide. Sinking was then stopped, and efforts were concentrated on extending an old adit 120 feet lower down the hillside. After the adit had been driven about 400 feet, it reached the downward projection of the vein in the shaft, and a mineralized zone considerably wider than that in the shaft was reported to have been encountered.

Ore shipments were made from the shaft early in the year. About 40 tons remaining in the ore-pocket were not shipped in 1951. Two men were employed throughout the year.

TRAIL (49° 117° S.W.)*

Gold

Casino Red Cap This claim, owned by T. P. Voiken and associates, of Trail, is on the slope of the Columbia River valley, 4.5 miles by road east of Trail. An open-cut 8 feet long and 6 feet deep was made on a quartz vein with an average width of 14 inches. The vein is in a volcanic formation and strikes north 23 degrees east and dips 78 degrees to the west. Samples taken from each end of the bottom of the cut assayed: Gold, 0.30 and 0.88 oz. per ton; silver, *nil*.

An adit was collared 40 feet below the outcrop, and a crosscut was driven towards the vein. Due to an injury to one of the partners, work ceased at 47 feet before the vein was intersected. A small shipment of ore sorted from the open-cut was made to Trail.

NELSON*

Eagle Creek (49° 117° S.E.)

Gold-Copper

Eureka (Copper Leaf Mines Limited) Company office, 675 West Hastings Street, Vancouver. F. C. Buckland, managing director; J. C. S. Moore, manager. Capital: 3,000,000 shares, $1 par value. This property, at the head of Eagle Creek, 2½ miles by road above the Kenville camp, was purchased from Kenville Gold Mines Limited. During 1950 F. C. Buckland started a raise 1,200 feet from the portal of the 450 level to connect with a winze reportedly sunk 110 feet from the 250 level. The winze was not encountered, and the raise was stopped after it had been driven 100 feet. In 1951 the present company reopened the 250 level for 600 feet to where the vein was encountered, but further reopening was considered impractical. An old shaft was then rehabilitated to provide access from surface to the workings behind the caved area. The old winze was located, and a survey is now proposed to establish its relation to the raise. Three men were employed for four months on this work.

Gold

Granite-Poorman (Kenville Gold Mines Limited) British Columbia office, Royal Bank Building, 675 West Hastings Street, Vancouver; mine office, Box 390, Nelson. G. H. Rainville, president. Capital: 3,500,000 shares, $1 par value. This property, 7 miles by road west of Nelson, remained inactive during 1951, although the mill was operated intermittently on custom ore. Selkirk Mining Co. Ltd. leased the mill until July to concentrate ore from the Jackson mine near Retallack. The mill was then enlarged by the installation of additional flotation cells. Ore was then treated from the Emerald mine of Emerald Glacier Mines

* By J. W. Peck.

Limited of Burns Lake and from the Goodenough mine at Ymir of Pacific Mining Services Limited. J. C. S. Moore was in charge of operations.

Production: Ore milled for Emerald Glacier, 1,658 tons. Ore milled for Goodenough, 50 tons. The Jackson concentrates were not shipped by Kenville Gold Mines Limited.

Hall Creek (49° 117° N.E.)

Gold

Sun

This property is owned by W. Rozan and J. Haines, of Nelson. It is on the summit between Fortynine and Hall Creeks and is reached by 15 miles of road from Nelson up Fortynine Creek. The showings are at an elevation of 6,400 feet. For the past three years Mr. Rozan, aided by a partner, has been developing intermittently a quartz vein in granite containing visible gold. There are two adits 50 feet apart; the upper is 45 feet long and the lower 230 feet long. The vein strikes north. In the upper adit the vein has been stoped; where seen on the floor, the vein is 1 foot wide and dips 30 degrees to the east. The lower adit was driven for the first 95 feet as a crosscut, and the vein, where intersected 87 feet from the portal, was a mere fracture. The vein was followed by a drift for 135 feet, and in the last 30 feet of this distance it widened to 1 foot; the dip is 50 degrees to the east. The quartz is honeycombed, and a hand-sorted shipment of it was sent to the Trail smelter. A portable compressor was used in the recent work. One building for living-quarters is on the site.

YMIR (49° 117° S.E.)*

Gold-Silver-Lead-Zinc

Goodenough (Protection)

This mine, on the north slope of Ymir Creek valley 5½ miles by road from Ymir, is controlled by J. Turk, of Ymir, F. Patula, and the estate of A. Fata. Most of the ore mined came from No. 2 level, but in the latter part of 1951 work was concentrated on a section of the vein in a raise between No. 3 and No. 2 levels, about 1,700 feet from the portal of No. 3 level. In this raise, about 40 feet above No. 3 level, the vein widened to 4 feet and was well mineralized with galena and sphalerite. J. Turk and a helper used hand-steel methods to mine 209 tons of ore, which was trucked to the smelter at Trail.

In November Pacific Mining Services Limited (company office, 640 West Pender Street, Vancouver) purchased the property together with the adjoining Ymir mine. A 365-cubic-feet-per-minute compressor was installed, and mining commenced on a larger scale on No. 3 level. Ore obtained was trucked to the Kenville mill at Nelson. A crew of twenty was employed, the men being transported daily from Ymir. E. C. Rudd was in charge of operations.

Dundee

This property is owned by A. Burgess and associates, of Ymir. Remnants of ore were mined until early summer, when work stopped. The ore obtained was trucked to the Trail smelter. In November, 1951, Pacific Mining Services Limited, of Vancouver, optioned the property but did no work on it.

Zinc

Jack Pot, Oxide, Last Chance (New Jersey Zinc Explorations Limited)

Company office, 714, 525 Seymour Street, Vancouver; mine office, Ymir. R. C. Macdonald, manager. This company controls a group of claims extending northerly from the summit between Hidden and Porcupine Creeks to the summit between Oscar and Ymir Creeks. The main showings are reached by roads leaving the Porcupine Creek road. On the Jack Pot group an adit-site was selected at an elevation of 4,378 feet on the south side of Porcupine Creek, 7 miles by road from Ymir. The adit was driven about 1,100 feet to investigate

* By J. W. Peck.

diamond-drill intersections obtained by surface drilling late in 1950 and also in 1951 on the "East" zone of mineralization. The adit was driven as a crosscut south 12 degrees west for 500 feet, when it was flooded with dolomite sand from a cavern measuring 35 by 25 by 15 feet encountered on a northeast-dipping fault. After the sand was removed, the adit was turned northwest for 55 feet to by-pass the cavern and then was driven south 10 degrees west for 120 feet. The dolomitic zone, which was the objective, was then encountered and was followed to the southwest for 400 feet. Some low-grade mineralization was seen, but the horizon is below that reached by the surface drilling. Stations were established at 100-foot intervals along the drift, and ring drilling was in progress at the end of 1951. Oxidized mineralization was encountered between 425 feet and 465 feet from the adit portal and another mineralized section at the end of the bend to the northwest, but these were not investigated in 1951.

On the surface a change-house was erected near the portal, but other than a tent camp for the diamond-drilling crew no camp was built. Surface diamond drilling amounted to 13,200 feet in thirty-three holes by November 15th, and the underground drilling was expected to total 3,000 feet. The number of men employed averaged eighteen.

On the Oxide group the Ox 4 adit, collared in 1950 on the Rio Tinto No. 4 claim, at an elevation of 4,085 feet, was advanced 114 feet in a northerly direction to a point 406 feet from the portal. The ground was badly broken and consisted of decomposed quartz-mica schists and black argillites. The adit had to be heavily timbered. Operations were suspended early in 1951, when running silt was encountered before the projected shear zone was reached. Two men were employed.

On the Last Chance group a diamond-drill hole was put down in October. Core recovery was poor, and the hole was stopped at 186 feet.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1950, pp. 121–123.]

Tungsten

Stewart (Arrow Tungsten Mines Limited)

Head office, Room 1008, 330 Bay Street, Toronto; British Columbia office, c/o W. A. Sutton, 900 West Pender Street, Vancouver. A. J. Ingraham, superintendent. Capital: 3,000,000 shares, $1 par value. This property is on Stewart Creek, 4.3 miles by newly constructed road from Porto Rico on the Nelson–Nelway Highway. The present company holds an option on fourteen claims from E. P. Haukedahl, O. P. Anderson, and E. Emilson. The claims are called the Scheelite and N.H. groups, but the property was at one time named the Stewart.

Considerable difficulty was encountered in constructing the last mile of road through cedar swamp that had to be corduroyed. At the showings an adit was driven at an approximate elevation of 4,600 feet, just below one of the old open-cuts. The adit followed a band of skarn exposed in the open-cut above. When the property was visited in September, the skarn had an average width of 2 feet; the drift was then 50 feet long. The drift has since been advanced an additional 200 feet but was reported to have been stopped when the skarn band became indistinguishable. Diamond drilling was in progress at the end of 1951.

At the portal of the adit a portable compressor was set up and a tent change-house erected. Living-quarters for the crew were provided in Ymir. Ten men were employed in September.

[Reference: *B.C. Dept. of Mines,* Bull. 10 (Revised), 1943, pp. 150–152.]

SALMO (49° 117° S.E.)*

Erie Creek

Gold-Silver-Lead-Zinc

Arlington

This property on Rest Creek, 7 miles by road from Salmo, reverted in 1950 to its former owners, A. Shrieves, of Nelson, and R. and K. Golac. A small mill was erected on the site of the old stamp-mill. The essential machinery included: Jenckes jaw crusher, Hardinge 6- by 2-foot ball mill (75-ton capacity), Dorr duplex 4- by 18-foot classifier, 6- by 5-foot conditioner, twelve flotation cells, G.M.C. diesel 180-horsepower unit, 75-kva. generator. The mill operated about six weeks, until a shortage of water forced a shut-down in November. About 400 tons obtained from the lower adit dump was milled. A bulk concentrate was made and was trucked to the Trail smelter.

In December a new company, New Arlington Mines Limited, with office at 609 Baker Street, Nelson, was reported to have been formed to develop this property.

Sheep Creek

Gold

Sheep Creek Gold Mines Limited

Company office, c/o Robertson, Douglas & Symes, Bank of Montreal Building, 640 West Pender Street, Vancouver; mine office, K.W.C. Block, Nelson. A. E. Jukes, president; H. E. Doelle, managing director. Capital: 2,000,000 shares, 50 cents par value. At the Queen mine, clean-up and salvage operations continued throughout the first half of 1951. The mine was then abandoned and allowed to flood. Most of the mill and mine equipment is still on site, but some has been shipped to other operations of the company. The mill has not operated since May, 1950.

Gold Belt

A. Burgess, of Salmo, and associates obtained a lease on this mine but worked for only a few months. Shipments of ore from the 3500 vein east on No. 14 level were made to the Trail smelter. Five men were employed in this work, and later in the year the same crew salvaged all pipe, rail, and equipment from the mine.

Silver-Lead-Zinc

Iron Cap (Salmo Prince Mines Limited)

Company office, 507 Metropolitan Building, Vancouver. A. R. Allen, consulting engineer. The Iron Cap claim is on the east side of Fawn Creek at an elevation of 4,500 feet. During 1951 three-quarters of a mile of new road was built to the property from the Reno road at a point 2.7 miles from its junction with the main Sheep Creek road. The workings are fully described in the British Columbia Minister of Mines Annual Report for 1924 (p. 193) and in Geological Survey of Canada Memoir 172 (p. 69). No work has been done since then. The main showing is a shallow shaft exposing 5 feet of lead-zinc replacement in limestone. Open-cuts north and south of the shaft show little mineralization, but exploratory diamond drilling was started late in 1951.

Victory (Boleen Mines Limited)

Company office, 573 Hornby Street, Vancouver. B. N. Murphy, president. Capital: 150,000 shares, $250 par value. This company was formed to develop the Victory group of claims lying west of Bennett Creek and south of Sheep Creek. The ground adjoins the Canadian Exploration holdings on the northeast and is owned by J. Sapples, of Salmo. The property was formerly known as the Little Keen group and has been explored for scheelite and molybdenite. No work was done by the present company in 1951.

* By J. W. Peck, except as noted.

Black Rock

The Black Rock group of claims lies astride Sheep Creek, adjoining Canadian Exploration ground on the north and H.B. ground on the west. An option is held on this group from L. R. Clubine, of Salmo, by D. I. Hayes, of Metaline Falls, Wash. During 1951 work was restricted to surface diamond drilling.

Aspen Creek

Silver-Lead-Zinc

H.B. (The Consolidated Mining and Smelting Company of Canada, Limited)

The H.B. mine is on the west side of Aspen Creek, a southerly flowing tributary of Sheep Creek, 8½ miles by road from Salmo. The main development level has been the No. 4 adit connected by raise to the No. 2 adit 300 feet above. An intermediate, No. 3, level is driven from this raise. Successful development in 1950 led to the decision to bring the property into production at a rate of 1,000 tons per day, and to this end a new programme of development was planned. The ore zone already partly explored on No. 4 level is a replacement in dolomitized limestone and rakes to the south at an angle of 20 to 25 degrees, parallel to the axis of a large dragfold. The plan included driving a new adit level (No. 8) approximately 700 feet below No. 4, from the Sheep Creek slope, at a convenient height above the valley bottom to provide room for a camp and mill-site. A system of raises and sublevels will develop the ore up the rake.

In 1951 No. 8 adit, at 2,820 feet elevation, was driven 2,700 feet to the north, about three-quarters of the contemplated distance. The adit is 8 by 9 feet in cross-section and will be used as the main haulage. A diesel locomotive is used, the first in a metal mine in British Columbia. At the portal a compressor building, warehouse, and change-house were erected. A start was made on five dwellings, and the mill-site was cleared.

On No. 4 level a drift was driven 1,300 feet to the south, 350 feet west of and parallel to the drift on the main orebody. A service shaft is planned to connect this drift with No. 8 level below. In the ore zone itself, raises and sublevels were developed for stope preparation.

Mining of the oxide zone ceased in May, bringing the total tonnage trucked to Trail in 1951 to 5,041 tons. The number employed had increased to eighty-eight by December. J. E. McMynn was superintendent in charge of operations.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1950, pp. 124–126.]

Bell (Sheep Creek Gold Mines Limited)

The Bell group of claims is north of the H.B. and south of the Salmo Malartic mine on Aspen Creek. In 1950 Sheep Creek Gold Mines Limited obtained an option on these claims from L. A. Bell, of Fruitvale, and commenced a programme of surface diamond drilling. This programme was continued into 1951, when the option was dropped. A total of 1,696 feet was drilled in eight holes, the longest hole being 420 feet. F. R. Thompson was in charge.

Aspen (Sheep Creek Gold Mines Limited)

The Aspen mine is on the east side of Aspen Creek, 2 miles by road north of the H.B. mine. In 1951 Sheep Creek Gold Mines Limited obtained an option from Salmo Malartic Mines Limited and drilled eleven holes, seven from underground and four from surface, totalling 3,019 feet. The underground drilling was mainly in the north drift of "B" adit and was all done in a north to northeast direction. The surface drilling was from stations southwest of "A" portal. The option was dropped at the end of this work. F. R. Thompson was in charge.

Iron Mountain

Lead-Zinc-Tungsten

Emerald, Jersey, Dodger (Canadian Exploration Limited)*

Head office, Royal Bank Building, Vancouver; mine office, Salmo. H. Lakes, manager; R. S. Douglas, acting manager; J. B. Magee, general mine superintendent; G. A. Gordon, mine superintendent, Jersey mine; W. Atkins, mine superintendent, Emerald mine; R. Mason, mine superintendent, Dodger and Feeney mines; Clive Ball, chief geologist; G. H. Grimwood, mill superintendent. The main or original mine camp, at an elevation of 4,070 feet, is on the summit between Sheep Creek and Lost Creek, 8 miles by road from Salmo.

The Emerald-Jersey property was bought from the Canadian Government in 1947 for $950,000 (fully paid by May 1st, 1951), and the Emerald section was mined for tungsten until January, 1949. In March, 1949, mining changed over to lead-zinc in the Jersey section. Early in 1951 the Canadian Government bought back from the company two blocks of ground, including the known Emerald tungsten orebodies and the partly developed Dodger tungsten showing, for $328,000. An agreement was made for the company to build at Government expense a 250-ton mill and to mine tungsten ore on a fee basis.

A new mill and a wholly independent camp were built near the portal of the 3800 Emerald level, and the mine was rehabilitated. In the meantime, however, diamond drilling along the length of the Jersey lead-zinc zone, which had from time to time indicated the presence of scheelite, encountered more than ordinary amounts of that mineral at the northern or Dodger end of the zone, beneath the general lead-zinc horizon. Intensified drilling demonstrated the existence of an important tungsten zone beneath the lead-zinc throughout the length of the Jersey zone. The tungsten zone is about 7,000 feet long, longer than the Jersey zone, and is named the Dodger, after the showings on the north end.

When the drilling had demonstrated the existence of a large tonnage of tungsten ore on its own ground, a tonnage greater than that known in the Government-owned Emerald and Dodger blocks, the company agreed to buy the new tungsten mill from the Government. At the same time the capacity of the mill was to be increased by about 300 tons daily capacity to treat company ore. Long-term Government contracts were obtained for sale of the company's concentrates.

Concurrently with the tungsten development, diamond drilling from the surface had continued to block out the Jersey lead-zinc orebodies through a zonal length of more than 6,000 feet. The company in September, 1951, placed the reserves of lead-zinc ore at 7½ million tons.

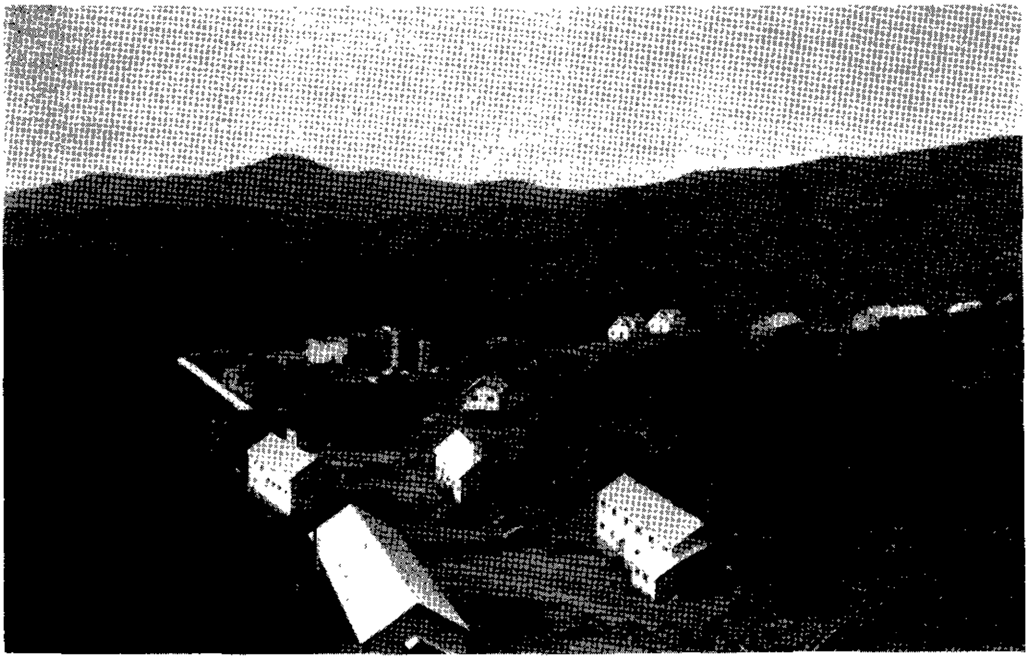
As a result of the rapid and impressive growth of ore reserves, mining was organized as three distinct operations, each with a superintendent, engineer, and geologist. These are the Jersey lead-zinc mine, the Emerald tungsten mine operating the Government-owned ground, and the Dodger tungsten mine (including the Feeney ore zone).

With the main camp as a point of reference at 4,070 feet elevation, the Jersey mine is 6,000 feet to the south with the main haulage adit at 4,010 feet elevation, the Emerald mine and mill are about 3,600 feet to the southwest at 3,860 feet elevation, and the Dodger mine is 2,500 feet northeast at 4,400 feet elevation. The Feeney tungsten mine is south of and adjacent to the main camp. The lead-zinc concentrator, formerly the tungsten mill, is on the Nelson–Nelway Highway 5 miles south of Salmo and is served by tram-line and by road from the mine.

The many changes in and rapid growth of the operation as a whole cannot be detailed, but the following notes outline the main activity.

* By M. S. Hedley and J. W. Peck.

Emerald.—A 250-ton mill was erected near the 3800 level adit, the ore being delivered direct from mine to coarse-ore bin. A complete and independent camp was built, including bunk-house, cook-house, change-house, warehouse and office, power-house, and eight duplex houses. A 6-mile 10-inch pipe-line was installed to bring water by gravity from Lost Creek. The Emerald workings were rehabilitated, as all pipe and rail had been removed; broken ore left by previous operations amounted to more than 10,000 tons. Milling began in December.



Camp, mill, and townsite at the Emerald tungsten mine, Salmo.

Jersey.—Operations were expanded to attain a production of 800 tons per day by the end of 1951. Mining is carried out up the low rake of the orebodies to the north, leaving pillars at 50-foot intervals. The ore is scraped to box holes and passed to the main haulage level. The ore is crushed near the portal and is hauled by truck direct to the mill or to the head of the tram-line. The tram-line was overhauled and the capacity increased. A new townsite was built below and west of the mine buildings and extending towards the Emerald camp.

Dodger.—Initial development started on the north end of the zone. A 14- by 14-foot adit was driven through part of the Government-owned block and will be driven down grade on the rake of the ore zone to the south. A second adit was started to cross-cut the zone 4,000 feet to the south at 4,200 feet elevation. These workings will ultimately be connected. Mining is to be carried out by diesel trucks and loaders.

The Feeney zone south of the main camp was discovered in 1947 and has been diamond drilled and partly stripped. It is west of the Dodger zone and is on the strike of the Emerald zone and about 700 feet north of it. An adit was started at 4,035 feet elevation and was driven several hundred feet by the end of 1951.

The lead-zinc concentrator has been steadily expanded since its conversion from a tungsten mill. A new crushing plant was built, and secondary crushing equipment installed. Additional flotation cells were installed.

More than 600 men were employed at all operations at the end of 1951.

LOST CREEK (49° 117° S.E.)*

Lead-Zinc

Kontiki Lead & Zinc Mines Limited Head office, 330 Bay Street, Toronto; British Columbia office, Canadian Bank of Commerce Block, 459 Baker Street, Nelson. Capital: 3,500,000 shares, $1 par value. J. Cormie, manager. This company controls more than 130 recorded claims in four groups. The first group lies south of Lost Creek and north of the south fork of Salmo River; it adjoins Canadian Exploration and Molly ground to the south. The second group is near Rosebud Lake, and the third is on the west side of the Salmo River south of Swift Creek. The fourth is west of the H.B. holdings. The only work done in 1951 was on the first group, on which a drill-site was selected and a camp was set up late in 1951 on Wilson Creek, 4 miles by road from the Nelson–Nelway Highway. Diamond drilling was being done " blind " in an effort to determine if favourable structure lies south of the Canadian Exploration mines.

NELWAY (49° 117° S.E.)†

Silver-Lead-Zinc

Reeves MacDonald Mines Limited‡ Company office, 413 Granville Street, Vancouver; mine office, Remac. L. P. Larsen, Spokane, Wash., president; W. L. Zeigler, Metaline Falls, Wash., general manager; F. R. Jones, superintendent. The company is capitalized for 3,000,000 shares at $1 par value, of which 2,338,000 are outstanding. Pend Oreille Mines and Metals Company owns 1,389,000 shares. This company operates the Reeves MacDonald mine on the Pend d'Oreille River on the Nelway–Waneta road, 4 miles west of Nelway. A zinc-lead-limestone replacement orebody has been developed by two connected adits 766 feet apart vertically. The lower adit is the 1900 level, and the upper is the 2650 level.

Production steadied during the year at 1,000 tons per day, with a slight increase towards the end of 1951. Ore came from all levels of the mine, from 1950 level to the glory-hole. In the upper section of the mine, above 2650 level, a bulldozer is replacing scrapers to move the ore to the main ore-pass. In the section about 2000 level, blast-hole methods are being used to break the ore, which is then drawn through box holes to the 1950 scram level. In the upper section of the mine below 2650 level the orebody is mined in slots the width of the orebody, and the ore is moved by slushers to wings out of the main ore-pass. At 100-foot intervals, pillars are being left from footwall to hanging-wall, and within these pillars service raises are to be driven. By the end of 1951 the 58 manway raise in the pillar west of the shaft was nearing completion to 2650 level. The shaft itself was retimbered, a hoist was installed on 2650 level, and handling of men commenced in November.

Development in the western end of the ore zone, which splits into two branches or tails, has added considerably to the known tonnage. Some of the sphalerite is so pale in colour that the grade of ore is very difficult to judge from inspection, and it has recently been found that some sections of diamond-drill core, logged but not assayed during the initial development of the property, contained sufficient zinc to constitute ore at current prices.

Exploration during the past two years has been limited to geochemical prospecting. Soil samples were analysed by the dithizone method. In 1951 diamond drilling was started to explore the downward continuation of the main or Reeves orebody. Investigations of rock alteration by L. Green, of the Geological Survey of Canada, demonstrated the existence of an envelope of dolomite surrounding the orebody, but no reason for localization of the dolomite zone within the limestone was found. If the structural factors

* By J. W. Peck.
† By J. W. Peck, except as noted.
‡ By M. S. Hedley and J. W. Peck.

which localized the ore were determined, exploration on this and other properties would be aided.

The company did some diamond drilling on the Rainbow group at the upper edge of the main limestone bluff on the Salmo River.

Camp improvements included the erection of a community hall and several dwellings. The number employed averaged 170.

Bar (The Consolidated Mining and Smelting Company of Canada, Limited).*— This group of about fifty located claims is south of Pend d'Oreille River on the International Boundary. Geochemical soil prospecting was done in 1950, and a geological examination was made in 1951. Late in the year a vertical diamond-drill hole on Church Creek was drilled to a depth of almost 1,300 feet to investigate an area of anomaly.

Alps (The Granby Consolidated Mining Smelting and Power Company Limited).—This company controls a group of about sixty claims located north of the International Boundary, east of the International and Reeves MacDonald properties. No work was done in 1951, but arrangements were made to commence diamond drilling in January, 1952. R. C. Wilmot is in charge.

International Lead and Iron Company

The International group is about 2 miles west of Nelway, adjacent to the Reeves MacDonald property. It is owned by Mrs. Shallenberger, of Nelson. During 1950 the Lomond section was mined for iron oxide for use in the Lehigh Cement Works at Metaline Falls, Wash. Little work was done in 1951, and the property was sold in December to E. G. Brown and associates.

SOUTH KOOTENAY LAKE (49° 116° S.W.)†

Summit Creek

Gold-Silver-Lead-Zinc

Bayonne.—This mine is on Bayonne Creek, 24 miles by road from Tye. During 1951 it was under lease to W. McLaren, J. Gibbs, L. Evert, and E. McLaren. Two carloads of ore were shipped during the summer months.

Spokane.—This mine is on Wall Mountain, 18 miles by rough road from Tye. It was worked briefly during the summer months by K. Laib, of Bayonne. One carload shipment was made from Tye to the Trail smelter.

NORTH KOOTENAY LAKE (49° 116° N.W.)‡

Riondel

Silver-Lead-Zinc

Bluebell (The Consolidated Mining and Smelting Company of Canada, Limited)§

D. S. Campbell, superintendent; W. R. Selby, assistant superintendent; D. York, mill superintendent. This property is at Riondel, 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. Development during the year was directed toward completing the No. 1 production shaft and preparing stopes in the Kootenay Chief ore zone for production. This development included 2,750 feet of drifting, 408 feet of crosscutting, 726 feet of raising, and 299 feet of main-shaft raising. In addition, 1,487 feet of workings were timbered, 16,960 cubic feet cut for shaft stations, and 71,858 cubic feet of slashing was done. Diamond drilling to delimit known oreshoots and to explore for new ones amounted to 1,670 feet drilled from the surface and 3,306 feet from underground.

* By M. S. Hedley.
† By J. W. Peck.
‡ By J. W. Peck, *except as noted.*
§ By H. C. Hughes.

The three-compartment No. 1 production shaft between the Bluebell and Kootenay Chief orebodies has over-all dimensions of 7 by 21 feet and is driven on a 35-degree slope. The shaft was raised from the 375 level to the surface, a distance of 900 feet. Pockets for ore were put in at the 75- and 225-foot levels and for waste at the 225-foot level. Pockets at the 375 level are still in course of construction. The steel head-frame with a 500-ton ore-bin and a 200-ton waste-bin housed in conjunction with the primary jaw crusher was about half completed, and the hoist was installed.

Stope preparation was carried on from the 0-, 75-, and 225-foot levels. Six stopes were fully prepared—one to be mined by diamond-drill blast holes, two by horizontal cut-and-fill, and three as open bench-type stopes. The stopes were laid out to suit local conditions, such as the width of ore and type of hangingwall.

On the surface the construction of a 500-ton-per-day concentrator, together with subsidiary buildings and services, was carried on. The building housing the secondary Symons cone crusher and conveyor-belt to the fine-ore bin was about half completed. In the mill building itself, the installation of the rod mill, ball mill, classifier, agitators, zinc and lead flotation cells, thickeners and filters was completed, with the exception of piping and wiring. A start was made on the tailings-disposal line to the lake.

Buildings for the accommodation of staff, crew, and essential services, completed and occupied during the year, included six staff residences, one 52-man bunk-house, six 7-man bunk-houses, a 150-man cafeteria, a 200-man change-house, an office building, warehouse, and machine-shop. The new compressor building was well under way, but no machinery was installed. The concentrate loading dock at Galena Bay was half completed.

The 6-mile transmission-line from the South Slocan–Kootenay power-line to the mine was completed, and a good start made on the substation at the mine.

Production is scheduled to start early in April, 1952.

The Consolidated Mining and Smelting Company has developed a safety programme for its outside properties, which is in practice at the Bluebell mine. This includes instruction in first aid and mine-rescue work, as well as on-the-job training for employees. Seven men were trained and qualified for the Department of Mines certificate of competency in mine-rescue work in 1951, and a team, captained by E. Halstrom, made a very creditable showing in the annual competition at Kaslo.

Ainsworth

Highlander-Hot Springs Area*

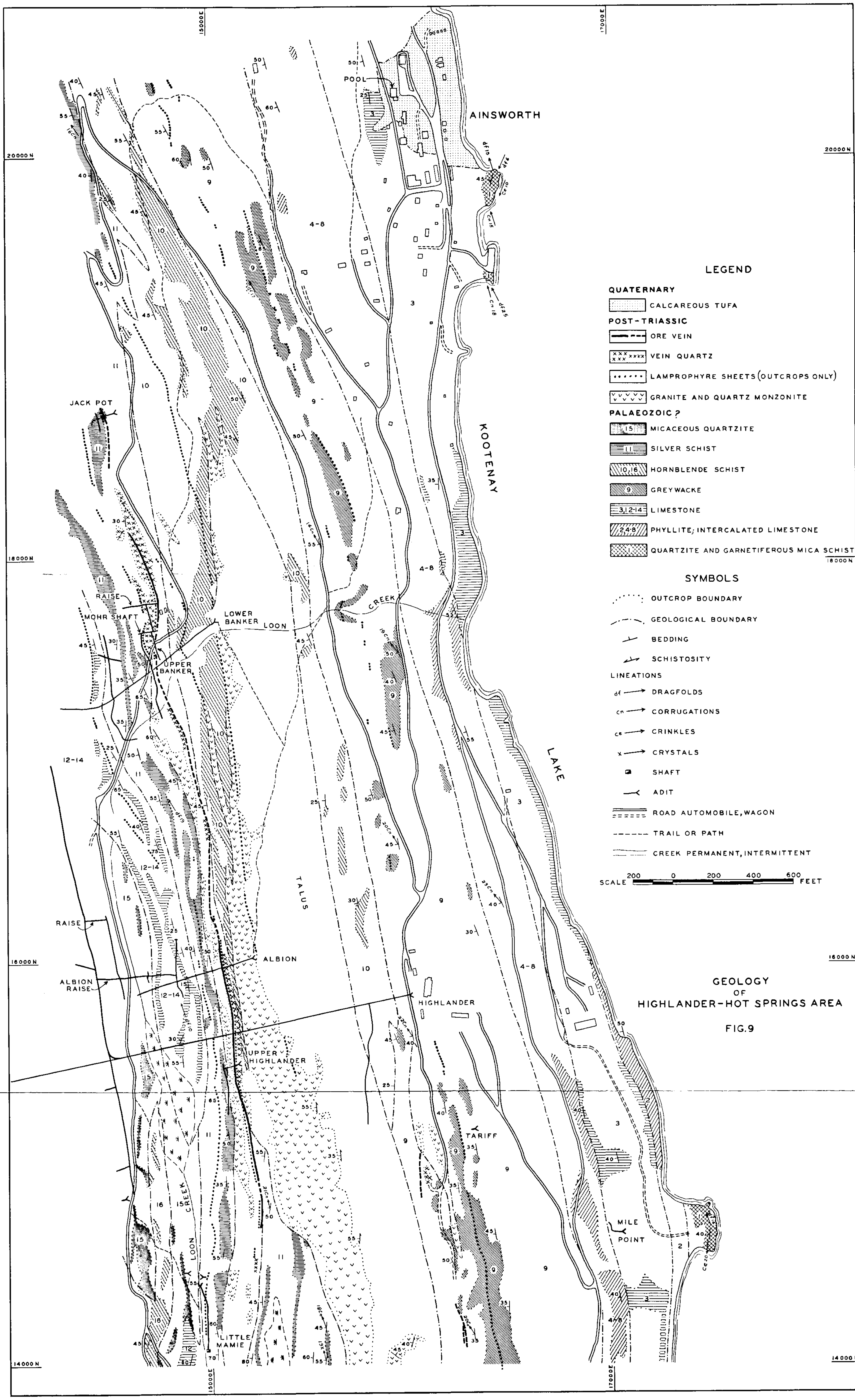
This area includes that part of the Ainsworth mining camp extending 1 mile south from the Ainsworth community and half a mile west from Kootenay Lake. It is entirely covered by mineral claims, except for the Ainsworth townsite in the northeast corner. Yale Lead and Zinc Mines Limited owns or controls most of the claims, but three or four Crown-granted claims are held by local residents. The area contains the Albion, Banker, Highlander, Jack Pot, Little Mamie, Mile Point, and Tariff mines.

The Nelson–Kaslo Highway passes through Ainsworth and a good mining road zigzags uphill through the area, providing ready access to the Highlander and Banker mines and to other mines farther west.

History.—The first quartz claims in the camp were located in 1883–84. Most of the properties produced intermittently, but the camp as a whole maintained a fairly steady production from 1889 to 1930, mostly by lessees from 1920 to 1930. Very few mines operated from 1930 to 1943. Increased metal prices after World War II have revived interest in the camp.

In the Highlander-Hot Springs area mining has proceeded in five stages—namely, 1895–99, 1905–09, 1917–30, 1935–37, and since 1950. The following table sum-

* By G. E. P. Eastwood.



GEOLOGY OF HIGHLANDER-HOT SPRINGS AREA

FIG. 9

marizes the production up to 1950. The figures for 1895–1909 include some ore mined from the Little Donald and Black Diamond, just west of the area, that was not reported separately from Highlander ore.

GROSS PRODUCTION FROM HIGHLANDER-HOT SPRINGS AREA, 1895–1937

Period	Tons Mined	Silver	Lead	Zinc
		Oz.	Lb.	Lb.
1895–1909	1,391	48,261	1,761,558	....
1917–30	871	14,224	725,480	53,102
1935–37	4,128	50,159	1,586,173	11,190
Totals	6,390	112,644	4,073,211	64,292

The Tariff mine was the principal producer during the first stage, and was almost mined out; lessees gleaned a small tonnage from it between 1918 and 1926. The Highlander vein was discovered in 1890, and a small amount of ore was mined from the Upper Highlander workings in 1895–96. The main Highlander adit and south drift were driven in 1899–1903. Mining was resumed in 1905–07 in stopes off the south drift. After a small amount of development in 1911 the workings remained closed until 1948.

The Albion and Banker mines were developed sporadically after 1905. A small amount of ore was mined from the Banker in 1909, and from the Albion in 1917 and 1924–25. The Banker produced steadily during 1927–30 and 1935–37, and was the only producer in the area during the latter period. The Mile Point property was mined only in 1895, and the Little Mamie only in 1921. There is no available record of mining on the present Jack Pot claim.

The present stage of development and production began in 1948. Yale Consolidated Lead and Zinc Mines Limited, reorganized in January, 1949, as Yale Lead and Zinc Mines Limited, acquired a large block of claims centred about the Highlander adit. Diamond drilling carried on from 1948 through 1951 totalled about seventy-five holes from surface and underground. Development began in 1950. A raise was driven in ore from the north Highlander drift to the Albion drift. The north drift was extended to a length of 1,700 feet by the end of 1951, and a raise was started to the Lower Banker drift. Scraper sublevels were established off the Albion raise at approximate elevations of 2,200, 2,300, and 2,450 feet.

A sink-float plant and mill were constructed between November, 1950, and April, 1951, and the latter operated continuously for the balance of the year.

General Statement.—The writer, with one assistant, spent five months of 1951 plane-tabling the Highlander-Hot Springs area on a scale of 200 feet to 1 inch. Accuracy of the mapping was increased by tying plane-table circuits to stations of company transit surveys. H. D. Forman and W. M. Sharp, manager and assistant manager of Yale Lead and Zinc Mines Limited, kindly supplied the co-ordinates of these stations and of diamond-drill holes, and engineering plans of underground workings.

Previous Work.—G. M. Dawson and R. G. McConnell visited the Ainsworth camp while preparing the West Kootenay sheet. W. A. Carlyle, Provincial Mineralogist, made a hurried examination of the properties in 1896. Philip Argall examined some of the properties for the Zinc Commission in 1906. S. J. Schofield mapped the camp on a scale of 2,000 feet to 1 inch in 1914, 1915, and 1918. H. M. A. Rice visited the camp in 1938 and plane-tabled parts of it at various scales in 1943.

Topography.—The area slopes moderately to steeply up from Kootenay Lake. In the southwestern part a talus slope and bluff are surmounted by a relatively level bench, incised by Loon Creek. In the remainder of the area, elongate patches of lesser slope alternate with north-south strips of moderately steep slope.

Loon Creek is the only stream of any consequence, and even it is normally intermittent, except for short stretches fed by adit discharges. It drains north from Loon

Lake, then turns at the Banker workings and cascades down to Kootenay Lake. Water emerging from the Lower Banker adit has been piped and ditched down to Ainsworth for domestic water-supply. Small springs are common, but only one, 400 feet north of the Highlander portal, flows all summer. Several hot springs occur in Ainsworth, and one has been utilized for a hot-water swimming-pool.

General Geology.—The bedrock comprises a heterogeneous group of west-dipping sedimentary and volcanic rocks, probably Palæozoic, and three types of intrusive rock, as shown in the following table. It is partly covered by a relatively thin veneer of glacial till, sands and gravels, talus, and, locally, calcareous tufa.

The layered part of the bedrock is readily divisible into three formations and sixteen units. These formations were named and described by Schofield. The lowest or Princess formation is exposed only on two small promontories at Ainsworth, and on Mile Point. It consists of thin-bedded quartzite interleaved with garnetiferous mica schist and is intensely dragfolded.

TABLE OF FORMATIONS

Age	Formation	Unit No.	Description	Thickness
				Feet
Quaternary			Till, talus, sand, gravel, calcareous tufa	
			Unconformity.	
Jurassic or Cretaceous	Nelson Granite	X	Quartz-carbonate veins	
		L	Lamprophyre sheets	
		V	Granite and quartz monzonite	
			Relations uncertain.	
?		H	Hornblendite	
			Intrusive contact.	
Palæozoic?	Josephine	16	Hornblende schist	250+
		15	Micaceous quartzite	90–400+
		14	Quartzose limestone	0– 75
		13	Carbonaceous limestone	0– 40
		12	Quartzose limestone	0– 65
		11	Silver schist	100–470
		10	Hornblende schist	0-800
		9	Greywacke	440–700+
			Disconformity?	
	Ainsworth	8	Phyllite	0– 10
		7	Quartzose limestone	20– 40
		6	Phyllite	120
		5	Quartzose limestone	30
		4	Phyllite	0- 75
		3	Quartzose limestone	200–350
		2	Platy mica schist	180±
			Contact not exposed.	
	Princess	1	Quartzite and garnetiferous mica schist	100+

The Ainsworth formation is well exposed in the southern two-thirds of the area but is largely covered in the northern third. It comprises three units of quartzose limestone alternating with four units of very thin-bedded, very fine-grained quartz-poor phyllite, containing common thin beds and lenses of limestone. The limestone is normally medium grained and buff-weathering, but coarse-grained white recrystallization lenses are very common. Beds are commonly 6 inches to 2 feet thick. The limestone has been invaded by numerous small blebs of vein quartz, without discernible alteration.

The Josephine formation is fairly well exposed across the western four-fifths of the area, except for talus and drift covering much of the lower part in the south. It is characterized by lensy units, steep, abrupt facies changes, and widely distributed hornblendic material. The greywacke and silver schist units contain the principal ore occurrences in the Highlander-Hot Springs area.

Uniform greywacke constitutes a thick basal unit of the formation. It is more or less granitized in the lower part and contains innumerable small granite sills and quartz veins in the upper part. Beds range in thickness from half an inch to 6 inches. Hornblende-rich beds are interspersed with mica-rich beds increasingly towards the top of the unit, and the contact with the overlying hornblende schist is gradational.

Alternating bands of hornblendic and micaceous material included in granite in the Highlander adit suggest that much of the hornblende schist unit passed southward to greywacke by intertonguing.

The hornblende schist, unit 10, appears to have been a gigantic lens, in part intertonguing with greywacke to the south, and tapering both south and north by gradation into the overlying silver schist. It is normally dark green and rather fine grained, with a silky aggregate lustre. Foliation is everywhere pronounced and parallel to bedding in adjoining units but is itself rarely recognizable as bedding. It is warped or crumpled in many places, but definite dragfolding was not observed in it. A 20-foot band of crystalline limestone is intercalated for a short distance. This fourth limestone is cut out by granite in the bluff and grades into silver schist along strike to the northwest, near the second hairpin bend of the road.

The silver schist, unit 11, is characterized by brilliant pearly to pearly-metallic lustre, very thin even lamination, and almost universal cross-crinkles. The characteristic sheen is produced by abundant chlorite and micas, and the colour of the fresh surface ranges from green to brown, depending on the relative proportions of these minerals. Hornblende is present in places and forms lenses, beds, and narrow bands in the upper part of the unit. Quartz predominates at the top. The cross-crinkles are about half an inch wide and range from roughly hemispherical bows in the lamination to definite small dragfolds, generally plunging almost down the dip.

The fifth limestone, units 12 to 14, consists of quartzose limestone, similar to the first three limestones, enclosing a carbonaceous unit (unit 13). The lower contact is exposed only in the Highlander adit, where there is some gradation through hornblendic and quartzose silver schist. Narrow bands or lenses of hornblende schist are scattered through unit 12 south to Loon Creek swamp. The fifth limestone grades to micaceous quartzite (unit 15) upward, and also southward across the swamp. South of the swamp the quartzite grades back to a highly quartzose, micaceous limestone.

The micaceous quartzite is usually strongly banded, fine grained, vitreous, and reddish grey to dark grey in colour. A thin section of a sample taken opposite the Little Mamie adit shows marked graded bedding. Mica increases to the northwest, and the rock grades to a quartz-mica schist.

Hornblende is scattered through parts of the micaceous quartzite, as isolated crystals, and in a few thin bands of hornblende schist. Three of the larger of these bands coalesce near the beginning of the road to Loon Lake, forming another large lens of hornblende schist (unit 16). Quartzite and hornblende schist alternate in the western part of the Highlander adit, and the last 400 feet is driven through predominantly hornblendic material.

Hornblendite.—Hornblendite occurs as a thin dyke in unit 1, a sill in unit 2, 200 feet southeast of the mill, and as a small sill in unit 9 south of the Highlander portal. It is massive and medium to coarse grained. Its age is unknown.

Granitic Rocks.—Sills of granite and less quartz monzonite, together with some bodies of completely granitized rock, are abundant in the Josephine. They are not common in the Princess and Ainsworth formations. In addition, considerable volumes of the greywacke, especially towards the base, have acquired a texture and composition resembling biotite granite, although bedding remains conspicuous. A small, highly irregular stock intrudes the third limestone in the northern part of the area. Only a very few of the sills exceed 10 feet in thickness. The narrower ones are also short and can rarely be traced from outcrop to outcrop. An exception is a lone sill in the Ainsworth formation, intrusive into unit 6, which maintains a thickness of 7 feet for at least 3,500 feet along the highway.

The principal granitic body of the area underlies most of the southern part of the talus slope and bluff, where it intrudes hornblende schist and the equivalent greywacke and silver schist to the south. Northward it tongues into hornblende schist east of the

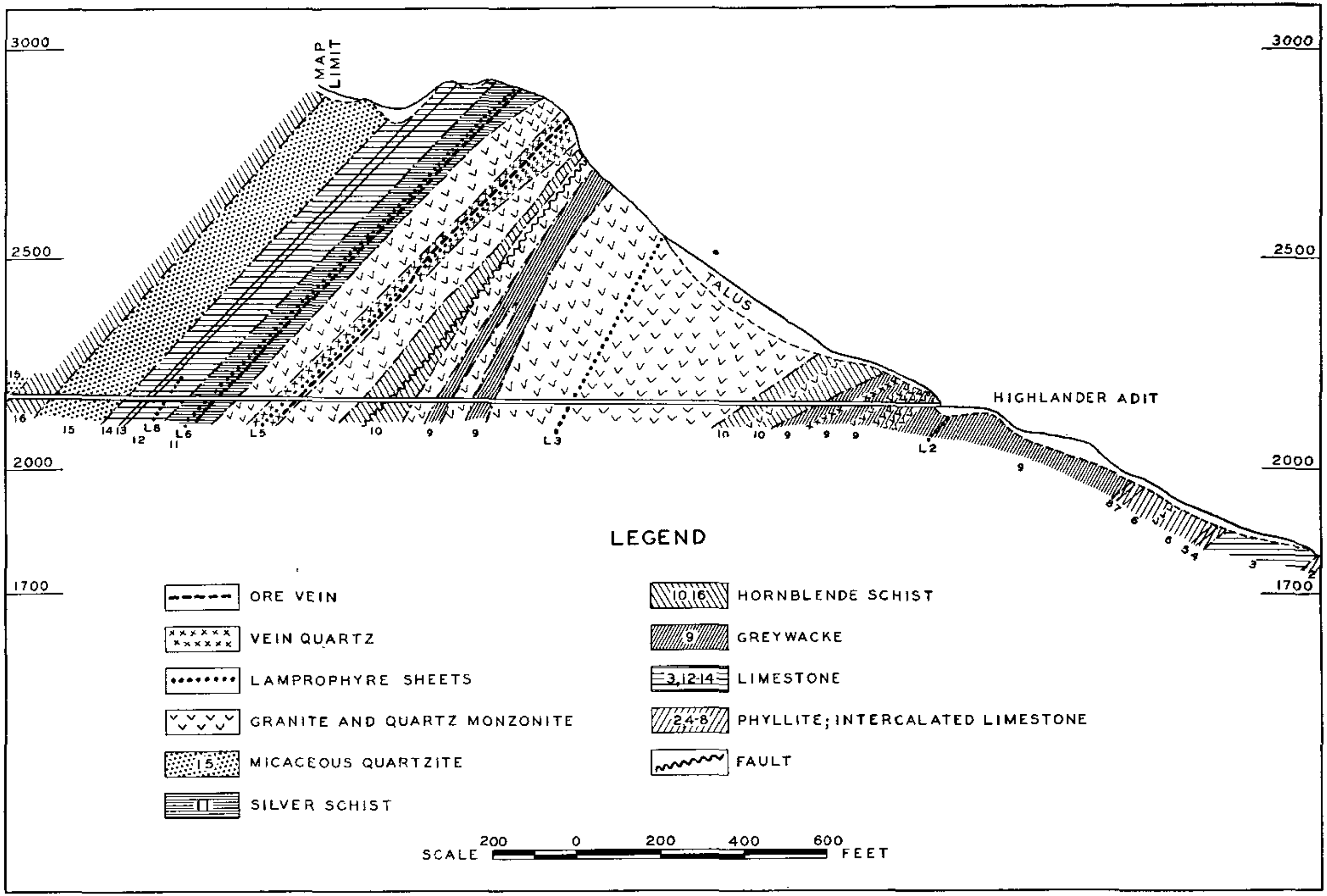


Fig. 10. Cross-section through Highlander adit.

Banker and Jack Pot workings. It is gneissic almost everywhere and seems to have been emplaced by a combination of forceful intrusion and granitization.

Silver schist has been granitized for a thickness of 50 feet or more next to the hangingwall of the main Highlander-Banker quartz vein, from the road to the south border. The contact with silver schist is gradational over a few feet, but well defined and fairly straight. The rock is characteristically massive, aplitic, and flesh coloured, although iron-oxide stain commonly extends 3 or 4 inches from the weathered surface. Near the south border it grades to a medium-grained granite. Northward it grades to normal silver schist and a narrow band of silicified rock.

The sills are predominantly medium to fine grained or aplitic, commonly sub-porphyritic. However, three small sills in the Princess formation are coarsely porphyritic, with somewhat augenized phenocrysts. An outcrop of quartz monzonite, on the west edge of the area, contains large phenocrysts of basic oligoclase, extensively replaced by microcline.

Lamprophyre Sheets.—Eight thin, massive, persistent sheets of mafic rock intrude the Josephine formation, and three of them also cut the main granitic sill. They are cut in turn by quartz veins. Four subsidiary sheets lying close to one or another of the main sheets may be traced for short distances only and are probably offshoots of the respective main sheets. The sheets range in thickness from 1 to 15 feet. Seven are mostly concordant, but the eighth cuts the beds diagonally. Deviations from concordance are normally right-handed jogs in plan and downward crosscutting by steepening of dip in section; left-handed jogs and dips flatter than those of the enclosing rocks are rare. Most sheets are readily recognized by their medium-grey to dark greenish-grey colour. Some are even grained and dioritic-looking, others are diabasic, and yet others are marked in places by nearly spherical aggregates of euhedral epidote crystals. They have been known as lamprophyres since the early days of the camp.

The first sheet intrudes greywacke north of the Highlander-Ainsworth road but does not outcrop south towards the border. It is distinguished from other lamprophyres by large phenocrysts of plagioclase feldspar, rarely of hornblende, and also inclusions of greywacke and granite at many places. Epidote aggregates, commonly with a plagioclase shell, are well developed. Thickness ranges from 6 to 13 feet. A 60-foot right-handed offset occurs at Loon Creek, but the relations are hidden by drift.

The second lamprophyre can be traced with some gaps across the entire length of the area, increasing in thickness from 1 to 12 feet from south to north. It is a little darker than the first sheet and is slightly greenish. It contains small plagioclase phenocrysts almost everywhere, but the groundmass is normally medium grained. The margins are normally chilled, and the narrow south end is entirely aphanitic, although still porphyritic. A subsidiary sheet, 2 feet thick, outcrops about 50 feet stratigraphically above No. 2 for a length of 50 feet near the south border.

A distinctive feature of this sheet is the rather regular occurrence of small, right-handed jogs of about 10 feet every 350 to 400 feet. The precise nature of the jog is obscured by drift in almost all cases, but one jog is fairly well exposed on an old trail at co-ordinates 20,100 north and 14,850 east. The south segment turns abruptly to the northeast, becomes aphanitic, and pinches within a few feet. The north segment is less well exposed but apparently pinches southwest towards the tip of the south segment. This jog is probably controlled by a small northeasterly fracture, pre-lamprophyre in age. Other jogs are probably similarly controlled, although the northeasterly fracture direction can be definitely inferred for only a few. This uniformity is broken by a left-handed jog of 110 feet at 19,100 north. It is possible there are two different lamprophyres here.

The third lamprophyre passes from silver schist to hornblende schist at the second hairpin bend in the road, continues south through the main granitic sill, and disappears in an inaccessible part of the bluff, 700 feet south of the Albion portal. It is uniformly concordant with the country rock foliation, except for one right-handed jog of 20 feet near the south end. The sheet is continuous through the jog as a short northeasterly dyke. The thickness is fairly uniform, ranging between 12 and 15 feet. A subsidiary stringer lies just below it in the Highlander adit. The main sheet is greenish-grey to medium grey in colour, medium grained, and resembles diorite.

The fourth lamprophyre intrudes the hornblende schist of unit 10. It disappears in an inaccessible part of the bluff 300 feet south of Loon Creek ravine, and can be traced north only to the deep draw south of the Jack Pot workings. It is too poorly exposed to show whether any jogs are present. It is about 40 inches thick, fine grained, and grey-black in colour. Quartz blebs occur here and there.

Lamprophyres Nos. 5 and 6 are important because they are associated with mineralized quartz veins and probably contributed to ore localization. No. 5 is in the hangingwall of the Banker orebody, wholly within vein quartz, and No. 6 is 40 feet stratigraphically above, mostly above the quartz vein, but associated with a minor ore lens. One or possibly two subsidiary sheets, 1 to 2 feet in thickness, rake south within the quartz vein 12 feet from the footwall of No. 5; another outcrops for 60 feet north from the road between Nos. 5 and 6.

The fifth and sixth lamprophyres cannot be traced with certainty, and the following description is partly inferred from indirect evidence. No. 5 is apparently continuous from the Banker mine to 500 feet short of the south border; it is interrupted north of the Banker but is present in the Jack Pot. No. 6 diverges westward from the main quartz vein north to the Jack Pot; it is missing for 1,000 feet south of the road then reappears about 100 feet stratigraphically above No. 5 and continues to the Little Mamie shaft, 70 feet from the south border. No. 6 has three small right-handed jogs. No. 5 is 4 feet or less in thickness on surface, but 5 to 8 feet underground; at the south end of the Highlander 2150 level it splits into two strands on opposite walls of the drift. No. 6 is 4 to 6 feet in thickness north of the road and 9 to 12 feet farther south.

The fifth lamprophyre is altered to some extent everywhere but most intensely where closest to the ore zone. It is least altered in the Lower Banker and some of the Highlander 2150 level openings and is a grey to greenish-black medium- to coarse-grained rock. Biotite is prominent everywhere, but feldspar phenocrysts are uncommon, and epidote aggregates are rare. In much of the sheet the groundmass is altered to a dark mat of fine-grained carbonate, serpentine, and chlorite, although biotite and plagioclase phenocrysts are still recognizable. The intensely altered parts of the lamprophyre, as in the Upper Banker and south end of the 2150 level drift, are light grey and clay-like, with characteristic green spots. The clay consists almost entirely of talc and kaolinite. The spots are yellow-green epidote dust on talc. Some greenish spots in less intensely altered material consist of epidote dust on either plagioclase or epidote crystals.

The sixth lamprophyre is for the most part dark grey and fairly fresh and contains plagioclase phenocrysts. Biotite is inconspicuous, although universally present as scattered small flakes. Small epidote aggregates occur in places but are uncommon.

Lamprophyre No. 7 is exposed only near the bend of the road 750 feet southwest of the Upper Banker at the base of unit 13. It is 10 feet thick north of the road, but varies erratically to the south, where it appears to have intruded along two northwesterly fractures for short distances.

The eighth lamprophyre is exposed only in three places underground, striking northwestward and dipping 65 degrees southwest to almost vertical. It is 3 feet thick, medium grained, and dark grey to black where it crosses the Highlander adit. At the south end of the main drift it is only 1 foot thick and is altered to green-spotted grey clay.

Structural Geology.—The major structural feature is a slightly deformed regional dip to the west. Regional schistosity is everywhere parallel to the bedding. In the northern two-thirds of the area the strike is rather uniformly north-northwesterly, ranging between north 10 and 30 degrees west. In the southern third, however, it bends to north, and in the southwestern corner to north 15 degrees east. The structure is further deformed by a series of shallow dragfolds near the Banker workings. The wave length of the dragfolds ranges from 100 to 250 feet, and the plunge is southwest at an average angle of 45 degrees.

Reliable cross-bedding or graded bedding was not observed in the field. West tops are suggested by indistinct cross-bedding in the first limestone and by the major sedimentary succession in the lower part of the Josephine formation: greywacke-silver schist-limestone corresponds to a normal sandstone-shale-limestone succession. In any case, major internal folding is precluded by the non-repetitive character of the section.

Minor dragfolds are common in the phyllite, silver schist, and carbonaceous limestone, and are so numerous in the Princess formation as to obscure the regional dip. The plunge is mostly to the northwest at 10 to 25 degrees, but southeast plunges occur here and there and seem to be more common in the Highlander adit. These dragfolds are mostly of reverse type, the upper beds having apparently moved down relative to the lower. Some normal dragfolds occur, but their relation to those of the reverse type is not known.

Corrugations are common in the greywacke and in silicified parts of the silver schist and are especially conspicuous in the walls of small granitic sills. The ribs are perfectly straight, with a rather uniform plunge of 14 to 22 degrees at north 30 degrees west. The wave length ranges from half an inch to 1 inch, and the amplitude is about one-tenth of an inch. Their significance is not known.

Crinkles occur in places in the greywacke, are common in the mica schist of the Princess formation and in the phyllite, and are an integral part of the silver schist. In the greywacke, mica schist, and parts of the phyllite they are irregular and resemble very small tight dragfolds, plunging south to southwest at 10 to 20 degrees. In the silver schist and in parts of the phyllite they are very regular and suggest closely spaced incipient shear planes striking northeasterly.

No major fault has been definitely identified, but one may be present in the pronounced draw south of the Jack Pot adit. A few faults of a few inches displacement were seen at widely separated places. They strike westward to northwestward and dip south to southwest at low to moderate angles. The movement is reverse near the lake-shore but normal farther west.

Three sets of fractures are inferred from the behaviour of the lamprophyre sheets. One set parallel to the bedding and schistosity of the country rock accounts for the generally concordant relations of the sheets. A second set, less well developed and striking northeastward, served as avenues for the lamprophyre sheets in crossing from one bedding fracture to the next. The third set, striking northwestward, is largely confined to the southwestern part of the area. It is indicated by the strike of the eighth lamprophyre and the southern part of the seventh. None of these fractures can be recognized on surface or underground. They were probably joints, but it is possible that minor faulting occurred along some of them. The northeasterly fractures were probably small. The north and northeast sets are post-granite, and all are pre-lamprophyre.

Shears and gouge seams, up to 3 feet thick, are prominent in the western part of the Highlander adit. Some are bedding shears, but a greater number are crosscutting. Displacement is rarely more than 2 feet. The majority strike between north 40 degrees west and north 10 degrees east and dip southwest to west at 40 to 60 degrees. Three cases of normal, one of reverse, and one of right-handed horizontal movement were determined. The distribution of attitudes indicates little control by bedding, regional schistosity, or pre-lamprophyre fractures. Some shears cut lamprophyres or quartz veins, and all may be post-vein. Some shears within the Highlander-Banker quartz vein are associated with ore and are discussed further under economic geology.

Open, water-bearing fractures are numerous in the western part of the Highlander adit. There appear to be three sets, striking respectively north 70 degrees west, north 20 degrees west to 5 degrees east, and north 30 degrees east. Dips are mostly high and to the southwest or west. The first set roughly parallels the strike of the most prominent jointing, but dips are steeper and in the opposite direction. One fracture in this set is strongly slickensided, indicating reverse and left-handed movement of unknown amount. Similar water-bearing fractures were observed cutting vein matter in the Highlander main drift, and many, if not all, are probably post-vein. A few additional fractures, some of them water-bearing, were observed in the Lower Banker, Albion, and east part of the Highlander adits. They strike northwestward and dip steeply southwest.

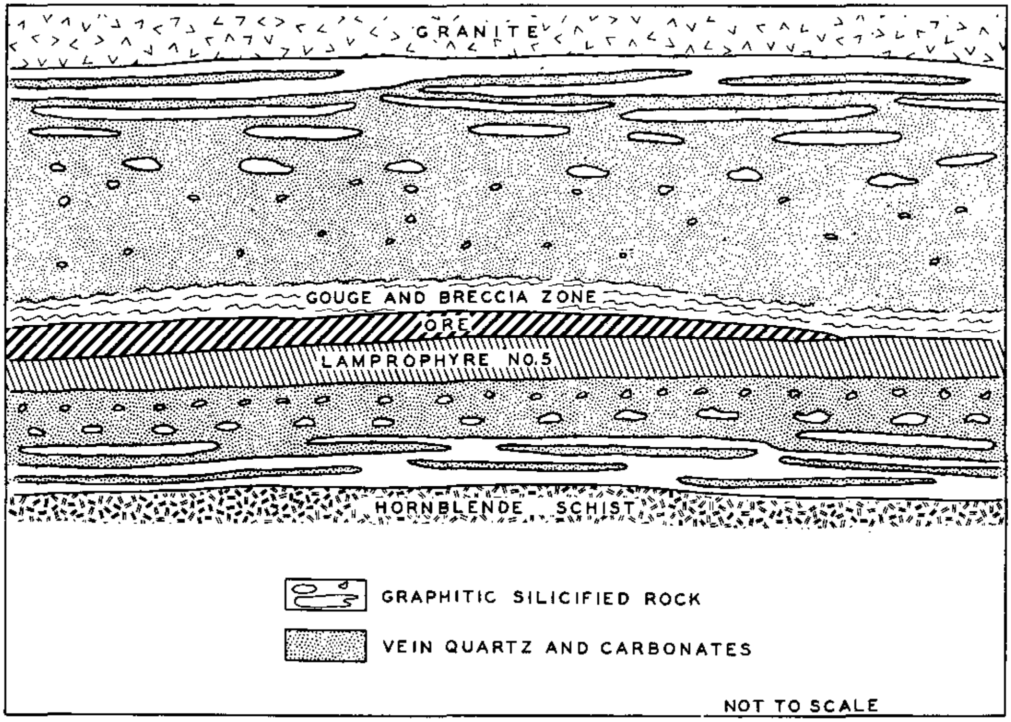


Fig. 11. Sketch of Highlander vein on surface above Albion adit.

Jointing is common in the less schistose rocks. The most prominent direction is westerly to northwesterly, with moderate north dips.

Economic Geology.—Ore in the area is confined to large bedded quartz-carbonate veins, with the exception of Mile Point ore, which appears to be a replacement deposit in limestone. Eight veins are known that are 3 feet or more thick and contain sphalerite and silver-bearing galena, but only three of these veins contain concentrations more than 6 inches thick. These are the Highlander-Banker and Little Mamie veins in silver schist, and the Tariff vein in greywacke.

Highlander-Banker Vein.—This quartz-carbonate vein has produced most of the ore mined in the area. It is 50 to 150 feet thick and has been traced from 400 feet north of the south border through the Highlander, Albion, Banker, and Jack Pot mines to the western edge of the area, a length of 5,000 feet. Ore is everywhere restricted to the vicinity of a shear and lamprophyre. Details of the vein are diagrammed in Figure 11.

The wallrocks vary from place to place as a result of facies changes and granite emplacement. They are silver schist north of the Banker, but the hangingwall rock is completely granitized silver schist south to the border, and the footwall rock is hornblende schist from the Lower Banker south to the Highlander adit, granite for a further 900 feet, and silicified silver schist at the south end. The vein has engulfed the fifth lamprophyre, probably by ingress along the same fracture.

The vein contains abundant inclusions of silicified rock, commonly highly graphitic. Near the centre of the vein they are small, angular, and more or less equant, suggesting breccia fragments. Towards the margins they increase greatly in size and number and give the vein a sheeted structure.

The vein tends to be somewhat cavernous in that some quartz druses are present, and pockets of coarsely crystalline, euhedral calcite are common. Pockets and irregular lenses of anhedral siderite suggest some replacement of quartz but are much less common.

The vein quartz has been fractured to greater or lesser extent and healed with calcite and less siderite. The degree of fracturing appears to be inversely proportional to the silicified rock content of the vein. In the Lower Banker adit, fracturing decreases steadily towards the hangingwall as silicified rock constitutes an increasing percentage of the vein, but no regular pattern was observed elsewhere.

One or possibly two major shears traverse the vein lengthwise. One is followed by the Highlander workings and has been exposed in places on the surface. The other constitutes the footwall of the Upper Banker orebody but dips more steeply than the vein, intersecting the Lower Banker adit near the vein footwall. Its downward projection very nearly coincides with the first shear in the Highlander north drift. A flat hangingwall split is seen in places along the Lower Banker drift and smaller splits are visible in other parts of the vein. Relations between this shearing and the general fracturing are not entirely clear, but it is believed that they resulted from the same stress. The shears vary somewhat in character and thickness. They are normally plastic gouge seams 6 inches to 3 feet thick but contain variable amounts of larger fragments and grade into breccia bands. The walls are commonly graphitic and slickensided. The Highlander main shear is a simple fracture along most of the north drift, but it widens near the north end to twin breccia bands separated by a 3- to 6-foot zone of imbrication.

Ore-bearing solutions are believed to have ascended the main shear. Ore deposition is believed to have been partly localized by the relatively impervious sheets of gouge and altered lamprophyre, but further localization by some unknown factor separated the ore zone into alternations of orebodies and barren stretches. These orebodies rake north and are tabular, with relatively blunt north and gently tapering south edges. Four are indicated within the area. Within the orebodies, ore normally occurs between the shear and lamprophyre where they are close together and tails out where they diverge. The tails follow either wall of either shear or lamprophyre and also follow some subsidiary shears between the sheets. Ore more than 3 inches thick rarely occurs in the shear wall away from the lamprophyre and nowhere in the lamprophyre wall away from the shear.

The southernmost orebody is less than 6 inches thick on surface but averages about 2 feet for a length of 300 feet in the middle of the Highlander south drift. It was mined for 60 and 50 feet, respectively, up and down the dip before 1908.

The second orebody is approximately defined by the extremes of the Upper Highlander and Albion drifts and attains a maximum thickness of 7 feet in the latter. It is the source of most ore now being mined from the Highlander. The Upper Highlander contains 8 to 12 inches of good-grade ore, some of which was shipped directly to the smelter, and 2 to 4 feet of concentrating ore. The vein outcrops on a cliff face for 250 feet northward, but trenches have exposed 2- to 4-foot widths estimated to exceed 25 per cent galena for a further 150 feet. Beyond 400 feet north of the Upper Highlander adit the orebody narrows rapidly.

A diamond-drill hole intersected 4 feet of ore at 2,650 feet elevation 100 feet southeast of the Albion drift in the hangingwall of a shear, 12 feet from the lamprophyre hangingwall. A 4-foot zone in the lamprophyre footwall carries scattered pockets of sphalerite. In the Albion main (2600 level) drift the orebody is 7 feet thick near the adit, containing an estimated 20 per cent of galena and sphalerite, but pinches near the north face. It is about 3 feet thick in a small drift directly above the adit, occupying the shear footwall 7 feet from the lamprophyre hangingwall. On the 2450 level the orebody is 4 to 6 feet of massive galena, with some sphalerite, but decreases to 3 feet on the 2300 level, to 2½ feet on the 2200 level, and thins rapidly to less than 6 inches of lean mineralization on the 2150 level (Highlander north drift).

The third orebody is not adequately defined, but appears to extend on surface for about 900 feet south from the north Banker winze, mostly in the lamprophyre footwall. Widths up to 8 feet are reported from the Upper Banker, and a near-by drill-hole intersected 4 feet. Other drill cores indicate widths of 3 to 5 feet up to 500 feet south of the Mohr shaft, but only a 1-inch seam at 750 feet south. In the Upper Banker the shoot is closely confined between the shear in the footwall and the lamprophyre in the hangingwall. As these sheets diverge downward, some ore follows the lamprophyre footwall, and some follows subsidiary shears between it and the main shear. Beneath the Lower Banker adit several seams of disseminated galena and sphalerite occur in the lamprophyre hangingwall. The orebody, therefore, can hardly be said to exist at the elevation of the Lower Banker, but may be present at lower levels, where it is probable that the lamprophyre and main shear are closer together.

A fourth shoot is indicated by ore in the Jack Pot workings but is as yet undefined. It consists of 2 to 3 feet of 50 per cent combined galena and sphalerite. A little chalcopyrite was observed in a hangingwall strand.

Lean mineralization extends from 1,150 to 1,500 feet north along the 2150 level drift in the footwall of the shear between the second and third orebodies. It is probably a minor pocket but might conceivably be the top of another orebody. Other orebodies may be expected in the vein north of the fourth orebody.

Within the oreshoots, sphalerite and galena occur as veinlets, pockets, and clusters in quartz and carbonates, and in lesser amounts as veinlets in the adjoining part of the gouge band or altered lamprophyre. Some of the pockets suggest replacement of fragments of silicified rock. Sphalerite predominates in pockets of siderite, but galena is the more common ore mineral elsewhere.

Little Mamie Vein.—A thin cavernous quartz vein persists along the footwall of No. 6 lamprophyre for 2,300 feet north from the south border. It is trenched at intervals but appears to have yielded ore only in the southern 450 feet. These openings are now caved and could not be examined. Farther north the vein contains abundant druses of quartz crystals with some pyrite. Ore mineralization is very lean at surface, but intersections of as much as 2 feet of 30 per cent combined galena and sphalerite were obtained in drill cores 200 feet lower.

In the Highlander 2150 adit there is no definite quartz vein, but instead a succession of gouge and breccia bands below the lamprophyre. Siderite and appreciable amounts of galena have been introduced between the first pair of gouge bands below the lamprophyre, and a small stope was driven from the adit. Some galena and sphalerite also occur as veinlets in the lamprophyre.

Vein quartz intersected by drilling west of the Mohr shaft, in the hangingwall of No. 6 lamprophyre, contained about 3 feet of 60 per cent galena and less sphalerite; the lamprophyre contacts are barren farther north. This ore is probably a direct offshoot of the Banker vein, rather than an extension of the Little Mamie vein.

Tariff Vein.—The Tariff workings are now caved, and the long drift on what is presumably the downward continuation of the vein in the Highlander adit is dammed at 60 feet. Poor surface exposures indicate that mineralized vein quartz extends 1,100 feet north from the south border.

The vein is in greywacke near many small granitic sills, and in the Highlander adit it follows a chloritic shear. The vein dips 25 degrees west in the adit but steepens to 50 degrees near the south border. The vein consists of quartz, calcite, and siderite, with a little galena and sphalerite.

Argall's report (Ingalls 1906, pp. 156–158) indicates that ore was confined to a northwest-plunging shoot in a not very persistent vein, and was even then completely stoped out.

The lean ore observed on surface near the south border presumably belongs to another shoot. There is no evidence of the vein to the north of the Highlander adit.

Miscellaneous Veins.—Vein quartz occurs in micaceous quartzite near the road in the southwestern corner of the area. Although no mineralization was seen, this may be the barren southward continuation of the Maestro-Little Phil-Black Diamond-Little Donald vein, lying a short distance west of the area.

Scattered indications of lean mineralization occur along the edge of the outcrop west of Loon Creek, between the south border and the swamp. This zone has been prospected by a short adit, now caved, 500 feet north of the border. North of the swamp a few caved pits along the footwall of the carbonaceous limestone indicate some mineralization that may possibly be the continuation of the zone west of Loon Creek. This zone has been identified as the " big soft vein " of early miners; it may be in part a replacement deposit.

A quartz vein is poorly exposed in hornblende schist and silver schist for 750 feet south from the second hairpin bend in the road. It is barren for most of its length but contains a little galena in the road cut. Its northward continuation merits examination.

A thin, poorly defined quartz vein is in greywacke in the footwall of the second lamprophyre, 700 feet north of the Highlander portal. It is on the Good Luck claim owned by W. E. Lane, of Ainsworth. A short winze and 50-foot adit have disclosed less than 6 inches of galena. This vein could not be traced in either direction.

Eight to 10 feet of cavernous vein quartz in greywacke is exposed in two places near the trail at the north border. It is believed that two short veins are represented. The more northerly vein exposure contains traces of galena.

Traces of galena occur rarely in quartz veins less than 3 feet thick in the greywacke, but none of the veins can be traced more than a few tens of feet. In general, the greywacke appears much less promising than the silver schist for the discovery of new orebodies.

Mile Point Replacement Deposit.—The only probable replacement deposit in the area is in the first limestone just west of Mile Point. No sign of mineralization can now be seen on surface. A short adit and drift were reopened in 1950, but most of the walls are closely lagged and little can be seen. A small dump in front of the portal contains some ore so badly oxidized that few characteristics can be determined.

The ore appears to have consisted of galena and some sphalerite, associated with quartz, secondary carbonates, and much pyrite. The body seems to be somewhat irregular but is generally northerly striking and west-dipping.

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Silver-Lead-Zinc

Highlander, etc. (Yale Lead & Zinc Mines Limited)*

Company office, 525 Seymour Street, Vancouver; mine office, Ainsworth. H. W. Knight, president; H. D. Forman, manager. Capital: 3,000,000 shares, $1 par value. This company controls most of the claims lying between Coffee and Cedar Creeks in the Ainsworth Camp. The mine plant and sink-float plant are above, and the mill is below, the Nelson–Kaslo Highway, about three-quarters of a mile south of Ainsworth. The bunk-houses, staff dwellings, and mine office are in Ainsworth.

In the Highlander mine, stoping proceeded from the 2150 (adit), 2200, 2300, and 2450 levels, near the Albion raise, and on a restricted scale from the south 2150 level. Stopes were open, with the hangingwall supported by posts. Muck from the 2450 and 2300 level stopes was slushed into the ore-pass compartment of the Albion raise. Muck from the 2200 and 2150 level stopes was drawn from chutes established at 100-foot intervals in the north 2150 level drift. The 2150 level drift and adit crosscut were used as haulageways. The north 2150 drift was extended to 1,700 feet from the crosscut, and a raise started towards the Banker mine.

The coarse-ore bin and primary crusher are at the edge of the Highlander dump, and a cone-type sink-float plant is immediately below it. The oversize from a vibratory screen goes to the sink-float plant, and the sink product, after recrushing, joins the screen undersize in a 600-foot flume to the mill. The sink-float plant operated only a few weeks, mainly on ore that was trucked continuously through the summer and autumn from dumps of the Tariff, Banker, Little Phil, Krao, and Black Diamond mines. The mill started operating in April, and capacity was increased to 200 tons per day by December, following installation of a secondary cone crusher.

It is estimated that 75 per cent of the mill feed came from the Highlander mine, and the remainder from dumps, ore mined by contractors from the Black Diamond, and from the Vigilant mine on Woodbury Creek. Of the latter, 551 tons was purchased, and the remaining 425 tons was custom-milled.

Electrical power is obtained from the City of Nelson. The number of men employed averaged eighty.

Kootenay Florence (Western Mines Limited)†

Company office, 1768 East Hastings Street, Vancouver; mine office, Ainsworth. H. M. Wright, president; H. L. Hill, consulting engineer; W. J. Bull, mine manager. This company in October, 1951, bought the Kootenay Florence property from Ainsmore Consolidated Mines Limited. The property is about 2 miles north of Ainsworth, and the camp and main haulage level (No. 9) are just above the highway. A mill of 120-tons-per-day capacity is operated.

The original Florence group was explored in the 1890's, but serious development commenced in 1916. In that year Florence Silver Mining Company Limited commenced building a 150-ton mill, tram-line, and power plant and did 2,000 feet of tunnelling. The mill was in operation in 1917, and the rate of mining in 1918 and 1919 was the highest in the history of the mine. Production in 1920 was about 1,200 tons, and in 1921 some 500 tons of selected ore was shipped to the smelter. At that time it was reported that " large bodies " of milling ore were developed, but that the grade was too low at current prices. During the succeeding two years, ore was milled as mined, partly on a leasing basis.

Late in 1926 Kootenay Florence Mining Company Limited, a Stobie Forlong-sponsored company, acquired the property and by the end of 1927 had driven No. 9 adit a distance of 2,000 feet. No. 9 level was driven a total distance of nearly 8,000 feet by the end of 1929, when all operations ceased. During this stage of development the Lakeshore and Nicolet-Snelling groups were added to the Florence group. Drifting

* By J. W. Peck and G. E. P. Eastwood.
† By M. S. Hedley.

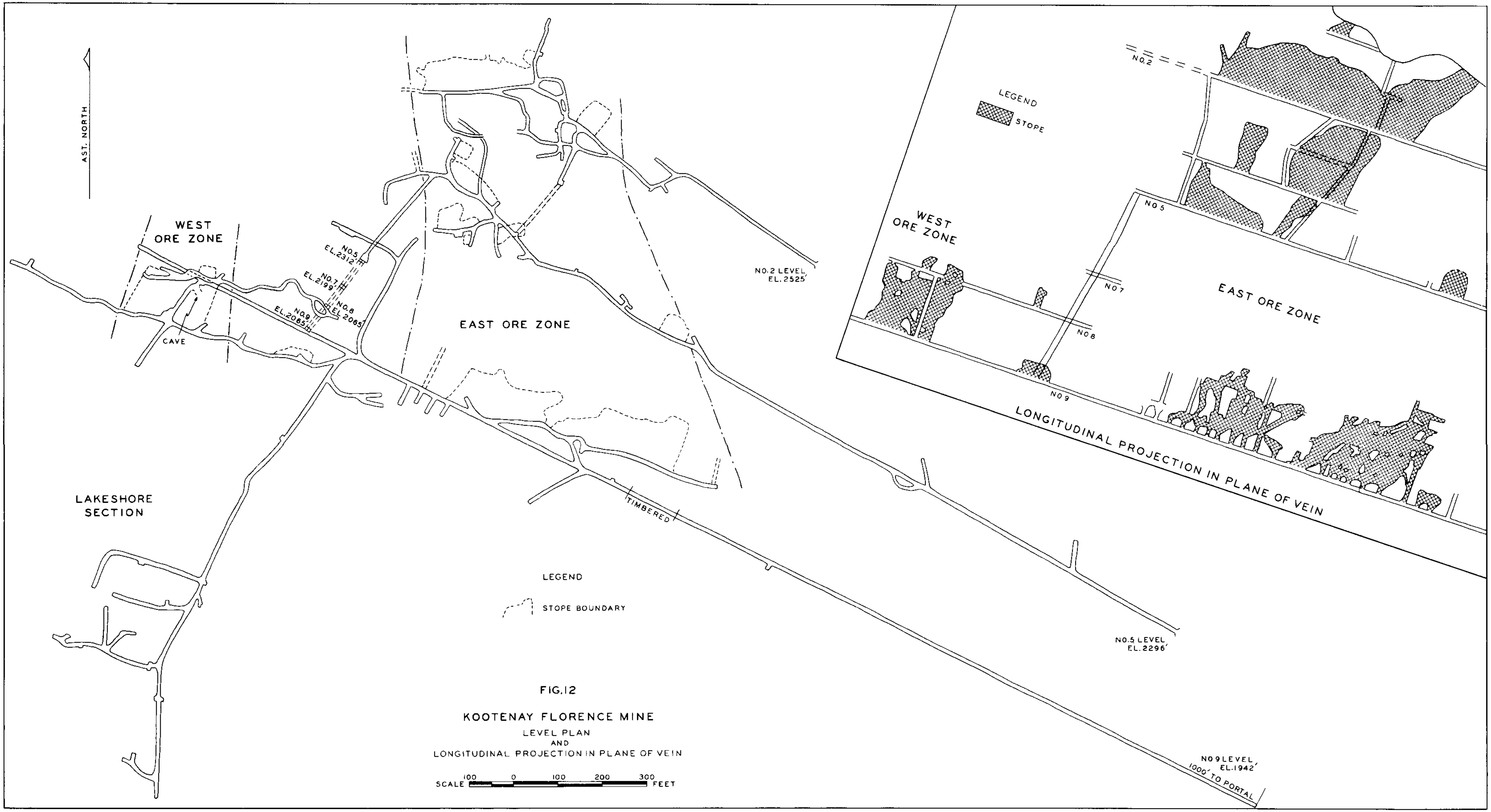


FIG. 12

KOOTENAY FLORENCE MINE

LEVEL PLAN AND LONGITUDINAL PROJECTION IN PLANE OF VEIN was done on the Florence vein on No. 9 and No. 8 levels, and exploration was done on what was believed to be the downward extension of the Lakeshore vein south of the Florence. No ore was mined, except 41 tons of uncertain derivation. Late in 1942 Wartime Metals Corporation came into control of the mine and started immediately to bring it into production. The mill was completely remodelled and was in operation June 30th, 1943, on jig tailings dredged from the lake. A raise was driven from No. 9 to No. 5 level, and No. 5 level was rehabilitated from the portal to a point from which a crosscut was driven to the top of the raise. Work stopped May 16th, 1944.

In 1945 Ainsmore Consolidated Mines Limited bought the mill and optioned the Kootenay Florence property. Some 1,500 tons of ore left broken in the stopes was milled on a contract basis for the owner, George Webster, of Toronto, and some development work was done. The property was bought at the end of 1946 and merged with the Spokane group and other claims to form an extensive holding. Under the management of Carl Mohr the mill was operated for the most part on a one- or two-shifts-per-day basis. A little work was first done on Nos. 7 and 8 levels in addition to No. 9, and later production came from a winze with two sublevels 50 and 105 feet on the slope below No. 9 level. The winze is reported to have caved in 1947.

W. J. Bull assumed charge following Mr. Mohr's death in the autumn of 1947 and drove a raise on a vein fissure east of the main raise; this section provided most of the ore mined in succeeding years. When the present company bought the property in the summer of 1951, Mr. Bull was retained as manager.

The ore occurs in a vein zone striking about north 70 degrees west and dipping on the average 45 degrees to the south. The vein crosses schists and some bands of limestone dipping to the west at angles between 20 and 40 degrees as a rule. The details of stratigraphy and bedding structure have not been worked out. Old reports referring to the upper workings, above No. 5 level, mention the occurrence of ore replacing limestone, but current workings below No. 5 level show that almost all the ore occurs as a fissure filling and is not restricted to limestone. A newly opened stope section on No. 9 level shows galena and sphalerite in green, silicified, and chloritic rock beyond the limits of the vein fissure in a replacement-alteration zone that is not known to be restricted to limestone.

The mine is opened by No. 9 adit level, elevation 1,942 feet, driven 3,800 feet along the general strike of the vein; the vein is not seen in the outer 2,400 feet. No. 5 adit, 350 feet above No. 9, encounters the vein about 1,200 feet from the portal. No. 2 adit, elevation 2,525 feet, apparently contained most of the stoping ground of the old mine. Figure 12 shows the levels and a longitudinal projection. The ore zone on No. 2 level is inaccessible, and the inner part of No. 5 is open only to a crosscut to the top of the raise from No. 9 level. Information regarding stopes above No. 5 level is taken from old maps and may or may not be complete. Nos. 3 and 4 levels are omitted for clarity. No. 8 level was driven from a vertical raise 3,680 feet from the portal of No. 9, and No. 7 level, omitted for clarity, was driven from a raise extending from No. 9 to No. 5. Workings 600 to 1,000 feet southwest of the main course of No. 9 level are believed to be on the downward continuation of the Lakeshore vein, exposed at the surface. A winze 100 feet below No. 9 in the west ore zone is not shown.

Two ore zones are indicated by the present extent of the workings—an eastern zone 450 to 700 feet long and a western zone 200 to 250 feet long. The boundaries of these zones are poorly defined, and future work may prove the concept of two zones to be wrong; the vein is known to be mineralized between the zones but so far has not produced ore.

Mining is made difficult by bad air and bad ground. The air in unventilated workings is deficient in oxygen, a result apparently of strong oxidation. In 1951 none of the workings west of the east ore zone could be entered and the raise to No. 5 level had caved, completely cutting off natural ventilation. The bad ground is a result of slaking and swelling of some limestone and limy schist, a condition exaggerated by dampness. The final product is a sort of plastic mud in which it is very difficult to maintain openings. The ground is particularly bad in the general vicinity of a natural cave in the footwall of the vein on No. 9 level and extends up the general course of the vein to the east, caves having been encountered on No. 7 level and possibly in the older workings on No. 5 level. The cave zone is a locus of higher temperatures. When encountered, the cave was full of hot water, and many exceptionally fine crystals of green fluorspar were recovered from it.

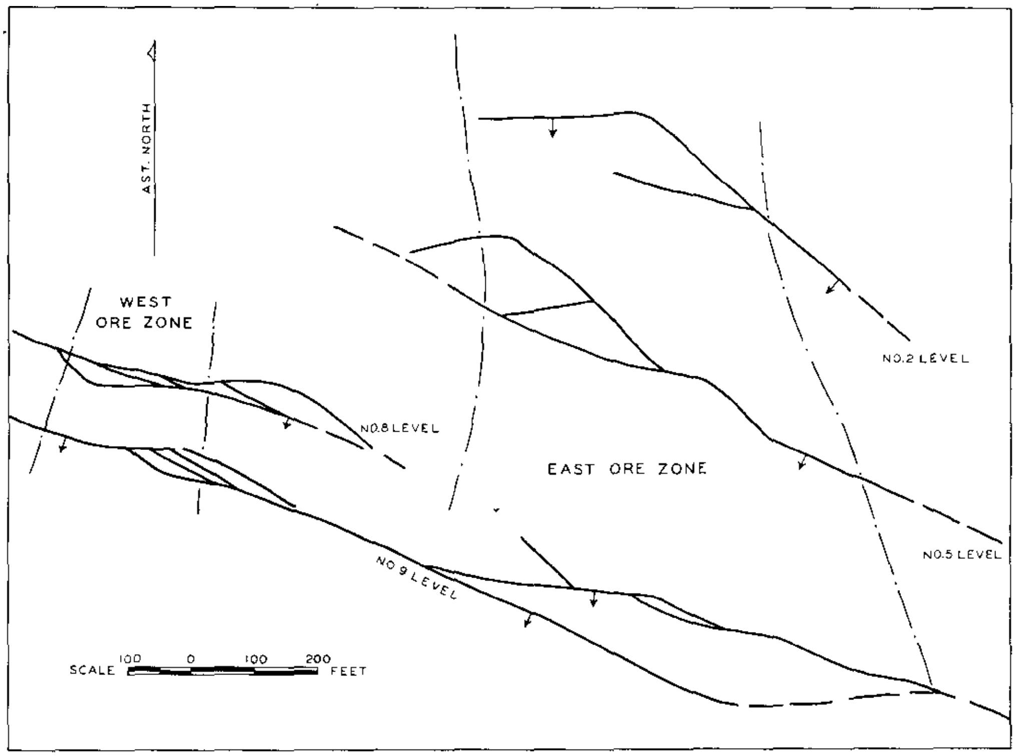


Fig. 13. Kootenay Florence—vein pattern in mine workings.

The pattern of workings in Nos. 2 and 5 levels, together with the report of replacement ore, suggests that ore formed along the bedding in a northerly direction, presumably in bands of limestone. On the same levels, ore was stoped on vein branches striking northwest and east-west.

The west ore zone is on an east-west section of vein, and the eastern ore zone on No. 9 level, although continuous, shows northwest and east-west stretches of vein. The east orebody is on a footwall part of the lode—the hangingwall branch may cross the main part of the adit in a heavily timbered section to join the footwall branch east of the east orebody.

It appears that, in the region of the present mine workings, the vein does not occupy a single fissure but rather a fissure zone. Figure 13 illustrates what is known and inferred of the main elements of this fissure zone. It is obvious on the lower levels and inferred on the upper levels that the two known ore zones are localized on two "eyed" sections of the vein fissure, involving a jog to the left in each case. It follows that if the displacement on the vein fissure was of hangingwall to the east then the east-west branches are tensional in origin and would theoretically favour ore deposition. The displacement on the fissure is not known, and although the offset of limestone bands represents hangingwall to the east, the amount or nature of dip-slip is not known. It is not known whether the "eyes" in the vein fissure are localized by bedding structure. Variations from the northwesterly dip are to be seen in the inner part of No. 5 level, and although the full structure cannot be seen, there is some folding. The nature and extent of the folding and its possible influence on the course of the vein are matters of some interest for future investigation. In the meantime it is an obvious fact that the ore zones rake down the dip of the vein across the bedding, whereas if character of rock were a dominant factor, the ore zones would follow the bedding with a low rake to the west.

The ore occurs in widths up to 15 feet. The gangue includes rock, calcite, quartz, pyrite, pyrrhotite, chalcopyrite, and fluorspar. Galena and sphalerite occur in pods and lenses, or more or less evenly distributed through the vein. The walls of the east ore zone are locally sheeted and locally soft and swelling, so that care must be taken not to overlook ore in the walls and also to provide adequate support. Mining has been by open stoping.

At the end of 1951 a raise was put through to No. 5 near the east edge of the east orebody. At this time, preparations were made to drive two sublevels between No. 9 and No. 5 and to mine by shrinkage stoping.

Ore was purchased and milled as follows: Daisy mine of Woodbury Mines Limited, 40 tons; Nameless Fraction lease, 1,230 tons; August Fraction, 46 tons; and Star mine, 187 tons. The new owners built a new warehouse and remodelled the change-house and the office building. The crew was increased from twenty-five to forty.

Mine production: Ore milled, 17,984 tons. Gross content of concentrates: Gold, 5 oz.; silver, 23,473 oz.; lead, 1,311,010 lb.; zinc, 645,401 lb.; cadmium, 2,784 lb.

Danira, Keystone Fraction, Hector (Ainsworth Syndicate).—These claims are located northwest of Ainsworth and adjoin the Yale Lead & Zinc holdings to the north. Surface diamond drilling, amounting to eight holes, each about 150 feet deep, was done on the Danira claim under the direction of H. D. Forman.

Noah

This Crown-granted claim is just north of the Kootenay Florence mine and is crossed by the Nelson–Kaslo Highway. It is owned by Western Mines Limited, but a lease was obtained in the autumn of 1951 by M. Perdue and R. Watson, both of Ainsworth. A site was chosen about 20 feet below the highway, and about 30 feet of adit was driven by the end of 1951 in an effort to intersect a fissure vein exposed above the highway. A portable Le Roi 105-cubic-feet-per-minute compressor was used in this work.

Early Bird

This Crown-granted claim is crossed by the Nelson–Kaslo Highway just south of the Kootenay Florence mill, 1½ miles north of Ainsworth. It is owned by M. Perdue and R. Watson, both of Ainsworth, and F. W. Robinson. During 1949 and 1950 intermittent drifting and underhand stoping were done on a narrow fissure vein in an adit at road level. In 1951 an adit was collared 60 feet lower in slide rock below the highway. When the adit had been driven 20 feet, old workings were broken into, and it was found that a further 75 feet of stoping had been done almost to road level. A drift on the vein extended an additional 75 feet with no further stoping. A few tons of sorted ore obtained in this work was trucked to the Trail smelter. Work ceased in the fall of 1951.

Ayesha (Ayesha Lead-Zinc Mines Ltd.)

Company office, Seattle, Wash. R. R. Armstrong, president; W. S. Hamilton, vice-president and consultant. This company took over the option on the Logan McPhee group of claims on Cedar Creek after Northern Exploration Limited ceased work. A lease was given to T. Lane and G. Talbot, both of Ainsworth, who commenced a raise 60 feet from the portal of the Ayesha adit, where slight mineralization was observed to follow the bedding. The replacement mineralization widened to

5 feet in the first 20 feet of raise. The lease was then cancelled but no further work was done, and by the end of 1951 the property had reverted to its former owner. One truck-load of ore obtained from the raise was sent to the Trail smelter.

Libby and Highland

These claims are on Cedar Creek, 2 miles by road from Ainsworth. Two hand-miners, B. Sterno and E. Meyer, have a lease from The Consolidated Mining and Smelting Company of Canada, Limited. Most of the ore shipped to Trail was obtained from the vein on No. 2 level about 180 feet from the portal. Here the vein was at first only 1 inch wide, but it widened in an underhand stope 30 feet long and 15 feet deep. About 60 tons was obtained from this work, and the partners intend to raise up to this stope from No. 3 level. During the summer of 1951 work was concentrated on the surface above No. 1 adit, where the vein was stoped through to surface. Some sorted ore was shipped from this section.

Hercules (Pataha) (Nubar Mines Limited)

Company office, Toronto. R. E. Legg, consulting engineer. Three cancelled Crown-granted claims, Pataha, Ellen, and Bugaboo, were relocated by T. Hawes, of Ainsworth, under the respective names of Hercules, Noranda, and Sullivan. Nubar Mines Limited holds an option on these as well as on the adjoining Crown-granted claims, Silver Bell, Glen Ellen, Harrison, Free Silver, and Silver Glance. The workings on the Hercules consist of two adits—one 60 feet long and the other caved—one shaft 15 feet deep, and some trenching. During 1951 a tent camp was erected about 1 mile by trail from the Highland mine and diamond drilling was started. This work, under the direction of S. Walsh, ceased in the fall of 1951.

Silver Boy

This is a located claim southeast of the Krao mine and is reached by a road three-quarters of a mile long from the No. 1 mine road. It is owned by J. Delprato, of Ainsworth, who mined ore from an open-cut and an old shaft dump. The property was then sold to Yale Lead & Zinc Mines Limited, but the ore, amounting to a few tons, was not shipped.

Carey Fraction

This claim is part of the Western Mines holdings in the Ainsworth Camp. It was leased by T. Lane, of Ainsworth, and J. E. Matthews who trucked 6 and 5 tons respectively to the Trail smelter. Matthews obtained his ore from an old dump, and Lane from a surface cut. Production: Ore shipped, 11 tons. Gross content: Silver, 47 oz.; lead, 4,003 lb.; zinc, 1,903 lb.

Nicolet

This claim is part of the Western Mines holdings in the Ainsworth Camp. It was leased by A. Dosenberger, who mined ore from a surface cut. One truckload was sent to the Trail smelter. Production: Ore shipped, 6 tons. Gross content: Silver, 17 oz.; lead, 2,121 lb.; zinc, 1,403 lb.

Star, Sunlight (Privateer Base Metals Limited)

Company office, 207 Ford Building, 193 East Hastings Street, Vancouver. H. L. Hill, consultant. Capital: 3,000,000 shares, $1 par value. This company, a subsidiary of Privateer Mine Limited, purchased the Star and Sunlight claims from D. H. Norcross, of Nelson. The mine is reached from Ainsworth by about 6 miles of road. During the first half of 1951 ore was shipped to the Trail smelter and to the Kootenay Florence mill. The present company then carried out a surface diamond-drilling programme until weather conditions closed operations in November. J. McIvor was in charge of drilling. Production: Ore milled, 187 tons. Gross content: Silver, 486 oz.; lead, 17,204 lb.; zinc, 19,822 lb. Ore shipped to the Trail smelter, 279 tons. Gross content: Gold, 13 oz.; silver, 2,807 oz.; lead, 65,723 lb.; zinc, 56,908 lb.

New Jerusalem (Ainslo Mining Company Limited) Company office, K.W.C. Block, Nelson. G. W. Cameron, president; P. Lincoln, secretary-treasurer. Capital: 500 shares, $100 par value. This private company owns the New Jerusalem, Yankee Girl No. 2, and Sara Kay claims on the south bank of Cedar Creek, 2 miles by road from Ainsworth. The Sara Kay is a relocation of the cancelled Crown-granted Sweden claim. The key claim, New Jerusalem, has been idle since 1938. Workings consist of 130 feet of surface underhand stoping on a vein that is also developed by an adit 100 feet below. The adit is a crosscut for 200 feet, with 100 feet of drifting on the vein which is intersected 150 feet from the portal. A raise on this vein extends to surface. Work in 1951 consisted of 38 feet of drifting in a westerly direction until a fault was reached. The vein averaged about 6 inches in width and was well mineralized with galena and sphalerite. The work was done by two men with the aid of a portable compressor.

Woodbury Creek

Daisy Bell (Woodbury Mines Limited) Company office, 850 West Hastings Street, Vancouver; mine office, Ainsworth. H. L. Hill, consultant; D. Davidson, superintendent. Capital: 3,000,000 shares, 50 cents par value. This company controls a group of ten claims south of Lendrum Creek, accessible by approximately 2 miles of road from the Kootenay Florence camp. Five Crown-granted claims are in the group—Florence M, Daisy, Wakefield, Normandy, and Laura F.

The main workings are on the Florence M and Daisy claims. In 1951 diamond drilling was done and a 120-foot adit on a fissure vein was extended 80 feet to the property boundary. Ore obtained from this work was trucked to the Kootenay Florence mill. Work was then concentrated on the Bell Fraction claim, which lies approximately 2,000 feet northeast of the Daisy workings. Ten holes of an aggregate length of about 3,000 feet were drilled fanwise from the portal of an old 160-foot adit on the south bank of Lendrum Creek. This gave information on a fissure vein exposed in the adit at 130 feet from the portal. The total diamond drilling done on the property was about 5,000 feet.

Production: Ore shipped to Kootenay Florence mill, 40 tons. Gross content: Silver, 76 oz.; lead, 4,320 lb.; zinc, 2,640 lb. Ore shipped to Trail smelter, 37 tons. Gross content: Silver, 315 oz.; lead, 13,074 lb.; zinc, 5,099 lb.

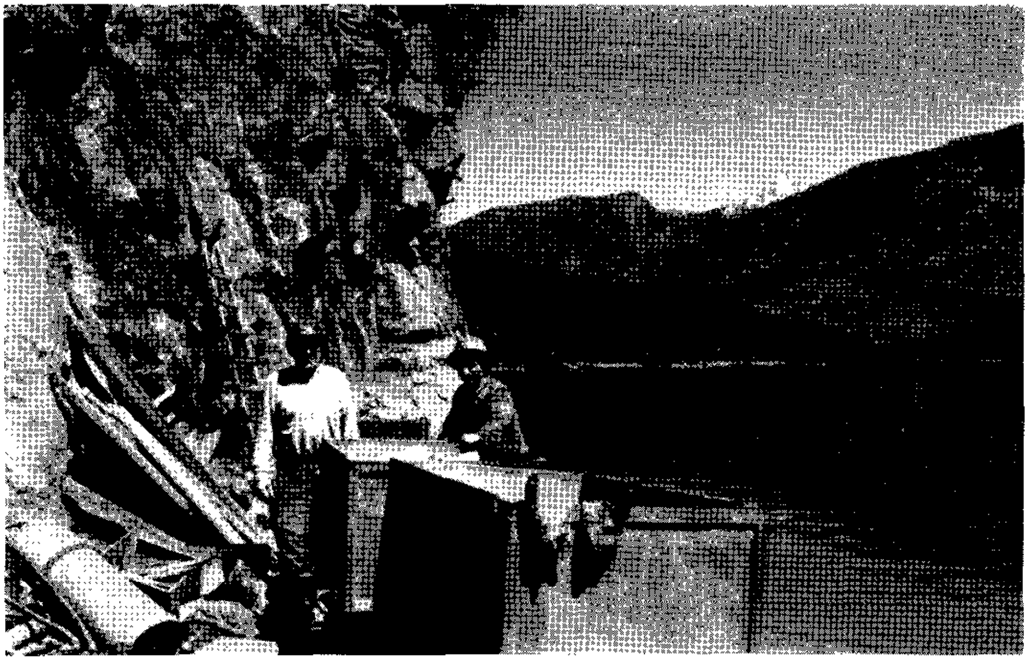
Woodbury Dr. L. D. Besecker, of Ainsworth, owns the Woodbury group of claims at the mouth of Woodbury Creek. The Nelson–Kaslo Highway crosses the property; the Vigilant and Dixie Fraction claims are west of the road and the Nameless and August Fractions east of it.

J. A. Cooper, of Ainsworth, continued to operate the Vigilant mine under a lease-purchase arrangement. A fissure vein is developed by two adits 100 feet apart vertically. The upper adit is on a short access road, and the lower adit is serviced by a surface incline. During 1951 ore was obtained from both levels; sorted ore was trucked to the Trail smelter, and ore of milling grade was taken to the Yale Lead & Zinc mill. Five men were employed.

On the Dixie Fraction claim, which adjoins the Vigilant to the south, A. McDougall and F. Moulton stripped a vein which is also exposed on the adjoining Budwiser No. 2 claim, owned by Kaslo Base Metals Ltd. Two tons of ore obtained was sent to the Trail smelter under the name of Woodbury group.

The Nameless Fraction, on the shore of Kootenay Lake, continued to be operated under lease by C. A. McLeish and W. McCulloch, both of Kaslo. Two fissure veins known as "B" and "C" are developed by short adits, the work in 1951 being concentrated in "B" adit, which was extended to a length of about 200 feet from the portal.

The vein ranges in width from 1 to 18 inches, but replacement of the walls, principally on the footwall side, makes an ore zone locally 8 to 10 feet wide. The best section begins 20 feet from the portal, and stoping was done on it above and below the adit. By the end of 1951 stoping had reached a depth of 35 feet below the adit, the ore being removed on an inclined track. A raise near the face of the adit was driven 50 feet in low-grade replacement ore. Rock bluffs were blasted, and a surface track 750 feet long was built to a loading-ramp for truck-haulage; 1,230 tons was sent to the Kootenay Florence mill and 19 tons to the Trail smelter.



The Nameless Fraction mine at the mouth of Woodbury Creek, Kootenay Lake.

On the August Fraction Dr. Besecker continued to work on "A" vein, 375 feet south of " B " vein on the Nameless Fraction. The adit on the "A" vein is on the same track that extends to the " B " adit. The adit was driven about 110 feet to a total length of 200 feet from the portal. An underhand stope was later filled with waste.

Production: *Vigilant,* 774 tons to Yale mill and 446 tons to Trail smelter. Gross content: Silver, 3,699 oz.; lead, 229,289 lb.; zinc, 109,249 lb. *August Fraction,* 46 tons to Kootenay Florence mill. Gross content: Silver, 46 oz.; lead, 3,910 lb.; zinc, 2,714 lb. *Nameless Fraction,* 1,230 tons to Kootenay Florence mill and 19 tons to Trail smelter. Gross content: Silver, 1,975 oz.; lead, 141,247 lb.; zinc, 105,401 lb.

Budwiser No. 2 (Kaslo Base Metals Ltd.)

Company office, 902, 470 Granville Street, Vancouver. J. E. Hanlon, manager. Capital: 3,000,000 shares, 50 cents par value. This company owns the Budwiser No. 2, Amazon, Superior, and Superior Fraction claims at the mouth of Woodbury Creek. On the Budwiser No. 2 claim a deep trench was made on a fissure vein that within 100 feet crosses into the adjoining Dixie Fraction claim of the Woodbury group. The vein dips at about 55 degrees into the Budwiser No. 2 claim. A few tons of ore obtained from this work was trucked to the Trail smelter. A short access road was built from the Vigilant road, and some exploratory work was done on the Amazon. All work ceased in late summer. About five men were employed.

Talmor Mines This is a partnership of J. W. Moore, M. Richards, and E. W. Nix, all of Richland, Wash.; G. Talbot, of Ainsworth; O. C. Albrittin and I. Scott that was formed to develop a group of eighteen located claims on Cottonwood Creek, a southerly flowing tributary of Woodbury Creek. A rough road was built half a mile to the showings from a point on the Woodbury Creek road about 6 miles from the Nelson–Kaslo Highway. The main showing is a 2-foot quartz vein which was stripped for 50 feet. The quartz contains principally chalcopyrite and pyrite and minor amounts of sphalerite and galena. All work ceased in the fall of 1951.

Gold-Silver-Lead-Zinc

Scranton Consolidated Mining Company Company office, 444 Pacific Building, Portland 4, Ore.; British Columbia office, Ainsworth. R. B. Mahan, manager. Capital: 650,000 shares, $1 par value. This company owns the Scranton mine, which is in Kokanee Glacier Park on Pontiac Creek, a northerly flowing tributary of Woodbury Creek. The property, 11 miles by private road from the Nelson–Kaslo Highway, was operated continuously throughout 1951. Ore was mined from the Sunset and Pontiac workings.

The Sunset workings explore a quartz vein in granite, mineralized with galena and sphalerite. The adit, driven in 1949, is across Pontiac Creek from the camp. The vein was followed for 415 feet in a southerly direction until it ended against a fault. The fault was followed for 150 feet to the southeast and then a fracture in the granite was followed for a further 115 feet in a southerly direction, but no vein was located. The best section of the vein is near the portal, where a 50-foot length 3 feet wide was partially stoped to surface in 1950. A crosscut was driven 50 feet into the hangingwall at a point 150 feet from the portal, and a 6- by 8-foot winze was sunk to the southeast at 75 degrees. As the vein dips 50 degrees to the southeast, it is intended to establish a sublevel at the vein intersection about 50 feet down the winze.

The new Pontiac adit, driven in 1949 from the camp-site, was further advanced. The adit is a drift on a quartz vein that dips at about 20 degrees and is 18 inches in average width for 200 feet from the portal. A few inches of lead-zinc mineralization occurs on each side of the quartz. No work was done in the main Pontiac adit, which is 22 feet vertically above on the same vein; a survey of the workings revealed a total of 1,795 feet of drifting and crosscutting in this adit, mainly in a northeasterly direction.

On the surface a new compressor-house was erected and a Gardner-Denver 380-cubic-feet-per-minute compressor installed. Ore from the Sunset and Pontiac workings was hand-sorted and trucked to the Trail smelter. The number of men employed averaged ten.

KEEN CREEK (49° 117° N.E.)*

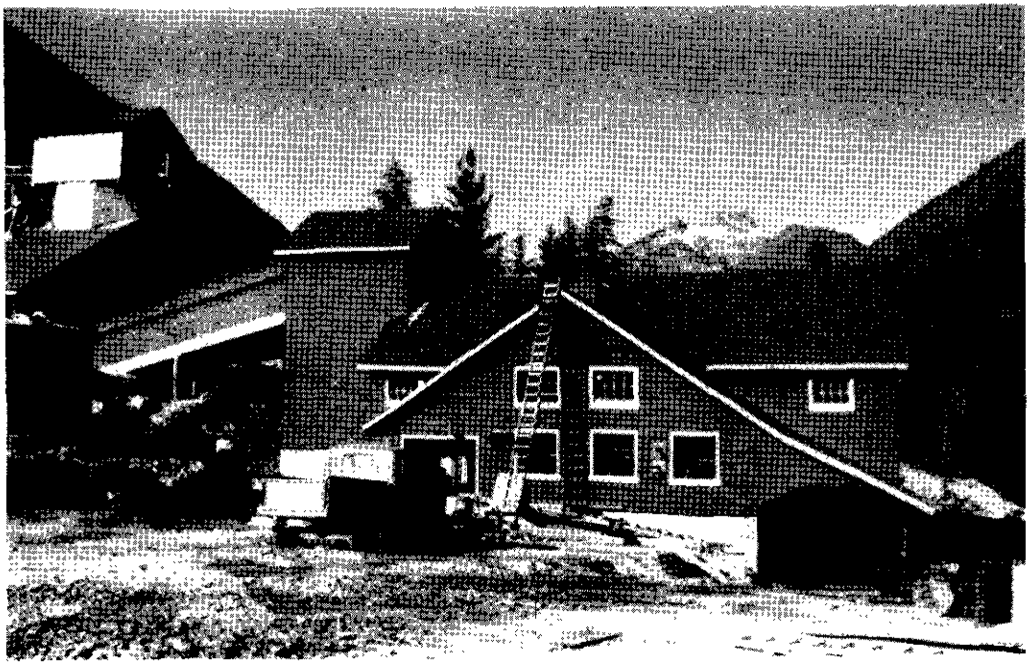
Silver-Lead-Zinc

B.N.A. Mines Limited Liability Company office, 614–615 Central Building, 620 View Street, Victoria. Capital: 1,000,000 shares, $1 par value. This company owns the B.N.A. group of five Crown-granted mineral claims on the east side of Keen Creek north of Kyawats Creek. A narrow tractor-road, built in 1951, leaves the Keen Creek road 3.7 miles southwest of the Cork Province mine and climbs 1,000 feet to the camp in a distance of 2 miles. Work in 1950 and 1951 was in the No. 6, or lowest, adit, which is an exploratory drift on a 15-foot wide shear zone containing lenses of galena, sphalerite, and native silver. During 1951 two hand-steel miners were employed from July to October. A raise was driven about 200 feet from the portal, and an estimated 50 tons of ore obtained from this work was stored on the dump. A few tons of ore was rawhided down to the Keen Creek road for shipment to the Trail smelter. The work was under the direction of W. E. Newton.

* By J. W. Peck, except as noted.

Cork Province (Base Metals Mining Corporation Limited)*

Head office, 62 Richmond Street West, Toronto. A. P. Earle, president; Chamberlain Management Corporation, manager; C. Rutherford, consulting engineer; Donald McLean, mine manager. The property is on Keen Creek, about 10 miles by road from Kaslo. A 100-ton mill was completed in April, 1951, powered by two 90-kw. and one 60-kw. Murphy diesel engines. From the 200-ton coarse-ore bin a 24-inch by 6-foot 6-inch coarse-ore feeder delivers to a Dillon double-deck screen and a 10- by 21-inch Telsmith jaw crusher, and the crushed ore is transported by an 18-inch by 63-foot 6-inch conveyor to a 200-ton fine-ore bin. An



The Cork Province mill, Keen Creek.

18-inch by 14-foot fine-ore feeder delivers the crushed ore to a 6- by 4-foot ball mill and a 36-inch by 16-foot 8-inch modified Akins classifier, the overflow from which goes to six Denver flotation cells in the lead circuit. The feed is then conditioned in a 5- by 6-foot Denver conditioner and goes to eight Denver flotation cells in the zinc circuit. The concentrates are dewatered in a 6-foot 3-disk American filter before going to two 100-ton concentrate-bins.

The old camp was renovated, and several new buildings were erected. Rail was replaced on No. 3 level from the portal to the winze, and the level was generally rehabilitated. Smallness of the sump at the bottom of the winze made semi-continuous pumping a necessity, but an automatic electric pump was installed.

The ore picture was not fully outlined because drift faces had stopped in ore during the period of mill construction. The general extent of the ore had, however, been outlined by diamond drilling.

The main zone of fissuring on which the winze is sunk strikes northeast and dips southeast. It is about 600 feet long and crosses the bedding of schists and limestone at a small angle. Parts of it constitute ore. At each end of the section 600 feet long are two ore sections which trend easterly and are more or less bedded. These sections, 120 to 130 feet long and as much as 20 feet wide, are under development on Nos. 5 and

* By M. S. Hedley.

6 levels. The southwesternmost of these bodies, discovered in 1949, extends from No. 6 to some distance above No. 4 level but is not seen on No. 3 level, which passes directly above it. Further exploration is warranted and a full geological examination is advisable because details of fissuring and of rock distribution remain obscure in spite of the considerable amount of diamond drilling already done. The ore is of replacement type with a siderite gangue, but is dominantly controlled by fissuring and does not occur wholly in limestone.

A road was built to the old Dublin workings, which are 1,900 feet south of and 900 feet above No. 3 level. Some exploratory work is intended at the Dublin and also on Nos. 1 and 2 levels where sections of the Cork Province vein relatively rich in zinc were left by former operators. The number of men employed averaged fifty.

Black Fox (Ainsworth Base Metals, Limited)*

Company office, 902, 470 Granville Street, Vancouver. W. A. Rutledge, president; H. F. Kenward, managing director. Capital: 3,000,000 shares, 50 cents par value. This company controls a group of sixteen claims on Keen Creek, adjoining the Cork Province mine to the southwest. The Black Fox group consists of four Crown-granted claims—the Black Fox, Daisy, California, and Patrick—and twelve located claims—the Ainsworth Nos. 1 to 12. The main workings are on the Daisy claim and have been inactive for over forty-five years.

An adit just above the road half a mile southwest of the Cork Province mine is driven as a crosscut 325 feet to the southeast. Veins are encountered at 100 feet, 275 feet, and 305 feet. An old shaft 200 feet northeast of the crosscut and 135 feet above may be on the apex of one of the inner veins or possibly a junction of the two. Both are quartzose zones swelling locally to a maximum of 4 feet of quartz but in some places consisting of a few inches of poorly mineralized quartz; the mineralization is not consistent. The vein 100 feet from the portal is a quartzose sideritic zone as much as 5 feet wide containing abundant pyrite and locally a considerable amount of sphalerite; it is bedded in staurolite schist.

In 1951 the adit was reopened, and work was done on the first vein at 100 feet and on the main vein 275 feet from the portal. On the first vein 65 feet of drifting was done from the crosscut, and a stope was carried up 20 feet. On the main vein the eastern drift was extended towards the downward projection of the old shaft. Diamond drilling was done to explore the first vein at depth and also to search for parallel veins.

On the surface a compressor-house was built, and air for drilling supplied by a portable Ingersoll-Rand 315-cubic-feet-per-minute compressor; a Le Roi 105-cubic-feet-per-minute compressor was used as a stand-by. An ore-bin was constructed, and a bunk-house was built below the Keen Creek road. Ore obtained from the first vein was trucked to the Whitewater mill at Retallack. The number of men employed averaged five.

[Reference: *Geol. Surv., Canada,* Mem. 184, pp. 196–197.]

Silver Bear

This Crown-granted claim is on the east side of the Keen Creek road, 4.1 miles southwest of the Cork Province mine. A lease was obtained by S. Hallgren from Mrs. Helm, of Kaslo, and a sub-lease given to K. Firth, A. Bovair, and J. McQuillan. Commencing in November the main work in 1951 was the rehabilitation of the lowest adit at the side of the road. Some ore was obtained 40 feet up a raise 500 feet from the portal. Native silver is the most valuable mineral in the ore.

Index (Kaslo Base Metals Limited)

This property is on Keen Creek, 14½ miles by road from Kaslo. It has been inactive for about thirty years, except for some surface stripping done by Kaslo Silver-Lead Co. Inc. in 1949. There are two main adits, the lower or No. 1 being collared just below the Keen Creek road 215 feet vertically below No. 2 adit. No. 1 adit extends in a south-

* By M. S. Hedley and J. W. Peck.

easterly direction for 807 feet without encountering the mineralized zone that is exposed in the upper workings. A 45-foot branch to the south, 650 feet from the portal of No. 1 adit, was extended 57 feet in 1951 by Kaslo Base Metals, but no mineralization was encountered. J. E. Hanlon was in charge of this work, which took only a few weeks. About five men were employed. (*See* Budwiser No. 2, p. 162.)

Bismark (B.C. Metal Mines Ltd.) Company office, 821 Hall Building, 789 West Pender Street, Vancouver. C. C. Labrie, president; H. L. Hill, consultant. Capital: 3,000,000 shares, $1 par value. This company was formed late in 1951 to develop the Bismark group east of Briggs Creek, a tributary of Keen Creek. The property is at an approximate elevation of 6,400 feet and is reached by a newly constructed tractor-road which leaves the Keen Creek road half a mile southwest of the Cork Province mine. Because of the lateness of the season, little work could be done in 1951, but arrangements were made for diamond drilling to be carried out by Columbia Diamond Drilling Company.

[Reference: *Geol. Surv., Canada,* Mem. 184, p. 194.]

RETALLACK-THREE FORKS (50° 117° S.E.)*

Silver-Lead-Zinc

Whitewater (Kootenay Belle Gold Mines Limited) Company office, 475 Howe Street, Vancouver; mine office, Retallack. J. L. Trumbull, president; V. McDowall, manager; S. Bruce, mine superintendent. 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. The company carried out a varied operation. In the name of Retallack Mines Limited ore was recovered from the Whitewater dumps and from Nos. 11, 12, 13, and 14 levels of the Whitewater mine, and some jig tailings were recovered from Kaslo Creek. On a lease or royalty basis, dumps were mined in various parts of the Slocan. Several old properties near Sandon were acquired on a cash instalment or cash option basis, including the Altoona, Elkhorn, Monitor, Payne, Richmond-Eureka, and Ruth-Hope. Ore was obtained from all but the Payne in 1951. A sink-float plant was installed on the Richmond-Eureka, and consequently ore recovered from that property was in excess of that listed as milled in the following table. Ore from the Cork Province early in 1951 was milled on a fee basis. Ore was purchased from five sources.

The total ore milled at Retallack from all sources, including ore on stockpile at the end of 1950, is tabulated as follows:—

Sources of Ore Milled in 1951	Tons	Total
Retallack Mines Limited—		
Whitewater dumps	14,725	
Whitewater mine	13,424	
Jig tailings (Kaslo Creek)	2,003	
		30,152
Kootenay Belle leases—		
Rambler tailings (Seaton Creek)	27,038	
Monitor dump	6,972	
Utica dump	95	
Richmond-Eureka dump	1,428	
		35,533
Carried forward		65,685

* By J. W. Peck.

Sources of Ore Milled in 1951	Tons	Total
Brought forward		65,685
Kootenay Belle Sandon properties—		
Richmond-Eureka dump	8,759	
Richmond-Eureka mine	1,265	
Elkhorn dump	3,033	
Altoona mine	4,228	
Ruth-Hope dump	7,206	
Monitor mine	2,836	
		27,327
Custom ore—		
Cork Province	1,301	
		1,301
Ore purchased—		
Slocan Charleston Mining Company Limited	642	
Montezuma lessees	36	
Silver Ridge Mining Company Limited	327	
Ainsworth Base Metals, Limited	192	
Jackson (Selkirk Mining Co. Ltd.)	728	
		1,927
		96,240
On stockpile, December 31st, 1951—		
Whitewater mine and dumps	2,549	
Kootenay Belle Sandon properties	2,026	
Custom ore	376	
		4,951

The mill was closed for two months early in 1951 to permit alterations and the installation of new flotation cells. Difficulty was encountered in the milling of ore from some of the company's Sandon properties because a relatively high content of soluble silica in the zinc concentrates made them unacceptable at the Trail smelter. This restricted the milling of Sandon ores during the latter part of the year. The crew at Retallack was increased steadily, with eighty men employed at the end of the year, thirty-five of whom were underground.

Doherty, Caledonia (Pioneer Gold Mines of B.C. Limited)

The Doherty claim and the Caledonia group extend along the Kaslo–New Denver Highway from Rossiter to Lyle Creek. The Caledonia group is owned by G. E. McCready, of Retallack, who also owns a half interest in the Doherty with L. N. Garland, of Retallack. Late in 1951 Pioneer Gold Mines of B.C. Limited and Alaska Gold Dredging Corporation optioned this ground and began diamond drilling on the Doherty. A series of vertical holes was drilled along a line just above the highway, extending from Lyle Creek to the east. Twenty holes, from 40 to 70 feet deep, were drilled under the direction of Pioneer management.

Jackson Basin Mining Co. Ltd.

Company office, 800 Hall Building, 789 West Pender Street, Vancouver. B. I. Nesbitt, managing director; S. J. Pedley, resident manager. Capital: 3,000,000 shares, no par value. This company was formed in 1951 to acquire the Jackson mine from Selkirk Mining Company Limited. The mine is on Stenson (Jackson) Creek, 5.7 miles by road from Retallack.

The former company operated on a small scale during the spring and summer. Ore was obtained from a stope on No. 3 level in the same area mined in 1950. During the first half of 1951 the Kenville mill at Nelson was rented, and the ore was trucked 80 miles to it. Later, however, ore was concentrated at the Whitewater mill at Retallack. When the present company took over in the fall, no further ore was mined, but efforts were concentrated on enlarging the camp facilities and rehabilitating No. 5 level, the lowest adit. Preparations were made to explore the lode near the portal by diamond drilling. On the surface two prefabricated buildings were erected, and a new G.M. diesel 525-cubic-feet-per-minute compressor was installed. Five men were employed in December.

Winona-Boon

This group of eight Crown-granted claims is in Jackson Basin on the east flank of Reco Mountain. It is owned by L. N. Garland, of Retallack, who mined and shipped ore from the Winona claim, on which a narrow fissure vein has been developed by open-cuts and by two adits 60 feet and 80 feet long. The vein in both adits ends against a fault. The levels, 16 feet apart vertically, are connected by a raise near the end of the workings, and ore was mined in 1951 from a bench off this raise. The vein is 10 inches wide. The ore was taken down the trail to the Jackson mine road by means of a narrow-gauge "scooter" and was then trucked to the Trail smelter.

Lucky Jim (Zincton Unit, Sheep Creek Gold Mines Limited)

Company office, Room 209, 413 Granville Street, Vancouver; mine office, Zincton. J. S. McIntosh, general superintendent; G. Avison, mill superintendent. This company owns and operates the Lucky Jim mine at Zincton. The mine is serviced by two main adits; No. 9 is the lowest and main haulage to the mill, and No. 3 is the uppermost. No. 3 is reached by an outside road and tramline and is also connected underground by a series of raises with No. 9 level. A labour shortage caused a drop in production during the spring months, but for the remainder of 1951 full mill capacity was maintained. Most of the ore continued to come from below No. 9 level, which is serviced by two inclined winzes—one to No. 10 level and one to No. 11 level. The No. 11 or lowest level now contains about 600 feet of development, mostly done during 1951. Much of the work on No. 11 level has been done below the limestone, and full development was halted pending the solving of structural problems which, at least on No. 9 level, involved some close folding. Some promising ore was found in the southwest part of No. 9 level and was being explored and developed towards the end of the year. The upper workings, above No. 3 level, produced between 10,000 and 12,000 tons.

On the surface 4,075 tons was obtained from an old dump on which mining started in 1950 and finished in 1951. One new bunk-house was erected, and another 275-horse-power diesel electric unit was installed in the power-house. The number of men employed averaged ninety.

Development: Drifting, 850 feet; raising, 859 feet; diamond drilling, 12,983 feet.

Rambler

Tailings from the old Rambler mill lie in the bed of Seaton Creek, about halfway between Zincton and Three Forks. They are owned by Sheep Creek Gold Mines Limited but have been under lease since 1950 by Kootenay Belle Gold Mines Limited. About 27,000 tons was dug up and trucked to the Whitewater mill at Retallack.

Monitor

This property is at Three Forks, on the south side of Carpenter Creek. The mine is developed by five adits, No. 4 being above and No. 5 below the New Denver–Sandon Highway. Kootenay Belle Gold Mines Limited, which leased and mined the two lowest dumps during 1950, optioned the mine and reopened No. 5 level. The lode was developed past a stoped-out section, and a shrinkage stope was started. The lode was narrow and averaged about 1 foot in width.

On the surface a change-house and a warehouse were erected at the No. 5 portal. A portable compressor supplied air for mining. An ore-bin was built, and all ore was trucked to the Whitewater mill at Retallack. The number of men employed averaged twelve, most of whom lived in New Denver.

SANDON (49° 117° N.E.)*

Silver-Lead-Zinc

Ruth Hope

This old producer at Sandon was optioned by Kootenay Belle Gold Mines Limited. A road was built to the base of No. 5 dump, and shipments were made from this and No. 4 dump to the Whitewater mill at Retallack. No. 5 adit was reopened, and the workings were examined. Three men were employed. All work ceased in the fall when it was learned that excessive soluble silica in the ore made the zinc concentrates unacceptable at the Trail smelter.

Silversmith (Carnegie Mines Limited)

Head office, 276 St. James Street, Montreal; mine office, Sandon. Archibald Sinclair, president; T. R. Buckham, mine manager. Capital: 3,000,000 shares, no par value. This company controls the old Silversmith mine south of Sandon. Operations were on a small scale throughout 1951. During the first part of the year a small crew was employed stoping and raising in a sublevel above No. 10 level in the Rabbit Paw section. During the latter part of the year No. 5 level was reopened and an attempt was made to reopen the blocked raise system down to No. 10 level.

On the surface a power-line was built up Sandon Creek to the mine from the hydro plant at Sandon. A start was made to extend the power-line to the old mill building on the western outskirts of Sandon. During December, 1950, and January, 1951, ore obtained from No. 10 level was trucked to the Western Exploration mill at Silverton, but ore obtained later was shipped to the Trail smelter. The number of men employed averaged eight.

Production: Ore milled, 160 tons. Gross content: Silver, 442 oz.; lead, 2,940 lb.; zinc, 21,612 lb. Ore shipped to Trail, 105 tons. Gross content: Silver, 635 oz.; lead, 4,213 lb.; zinc, 19,906 lb.

Richmond-Eureka (Kootenay Belle Gold Mines Limited)†

This old property, formerly owned by The Consolidated Mining and Smelting Company, is under option by Kootenay Belle Gold Mines Limited from R. Crowe-Swords, of Vancouver. A road was built in 1950 from the Silversmith road, and 8,000 tons of dump ore was shipped to the Whitewater mill at Retallack. In 1951 work commenced in April to erect a sink-float plant at the base of the lowest, or No. 6, dump. The plant was in operation in July, and the sink product was hauled to Retallack for further concentration. A double-drum hoist scraped the dump rock on to a grizzly above an ore-bin. The ore was crushed and conveyed to a small bin and thence to a diesel-powered cone-type sink-float plant using ferrosilicon as a medium. It was planned to use a separate scraper to deliver rock from the higher dumps to within range of the scraper on No. 6 dump. The situation is on a steep slope subject to snowslides, so that winter operation is impossible.

No. 5 and No. 6 adit levels were reclaimed, necessitating work chiefly in the outermost parts of the levels. No. 6 level contained in its inner part zinc-bearing ore that appeared to warrant further examination, particularly as the distribution of ore relative to the main part of the lode was in doubt.

Difficulties experienced chiefly with the generator retarded operation of the plant, and when snow conditions forced a shut-down in November the greater part of the dumps had not been treated as anticipated. Ore was obtained on No. 6 level by slashing the side of the drift about 1,000 feet from the portal. The ore was dumped outside and then loaded on to trucks by a mobile loader and hauled to the Whitewater mill. The road was improved by building a cut-off from the Silver Ridge mine road across Ruth-Hope property, thus eliminating the excessive grade up Sandon Creek. In December a crew of twenty-three was employed under W. Maybank. Office and living accommodation was provided in Sandon.

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* By J. W. Peck, except as noted.
† By M. S. Hedley and J. W. Peck.

Noble Five and Deadman (Cody Reco Mines Limited)

Head office, 721 Eastern Avenue, Toronto. James A. Taylor, president; D. M. Kline, consultant. Capital: 3,000,000 shares, $1 par value. This company owns twenty-two claims and fractions, including the Noble Five, Slocan Sovereign, Last Chance, Deadman, and other old mines north of Cody. A mill building was erected at Cody, and machinery for a 100-tons-per-day operation was being installed at the end of 1951. The Noble Five tram-line was rebuilt. Little underground work was done in 1951, other than some rehabilitation of the Slocan Sovereign adits. The road was improved to the Noble Five camp and was extended to the Deadman mine. Eight men were employed at the mine camp and forty at the mill-site.

Bluebird (Bluebird Slocan Mines Limited)

Company office, 507 Stock Exchange Building, 475 Howe Street, Vancouver. C. Rutherford, consultant. Capital: 2,500,000 shares, 50 cents par value. The Bluebird property is northeast of Cody and crosses the divide between Carpenter and Stenson (Jackson) Creeks at an elevation of about 7,000 feet. During 1951 the 2-mile trail from the Noble Five camp was widened to permit "jeep" transportation. The old camp on the Carpenter Creek slope, consisting of bunk-house, blacksmith-shop, and compressor, was used; these are in a precarious position. In the Idaho No. 2 adit close to the camp, diamond drilling done to the west intersected a parallel lode, and crosscuts were driven to explore it. Air for drilling was supplied by a Le Roi 105-cubic-feet-per-minute compressor. About four men were employed under P. Augustine.

Vulture

This Crown-granted claim is on the north side of Carpenter Creek, about 1½ miles east of Cody. Underground work started in the early fall but was abandoned within a few weeks when the compressor was destroyed by fire. About three men were employed.

Chambers

The Chambers group, owned by J. M. Harris, of Sandon, is half a mile east of Cody, on the north side of Carpenter Creek. During August J. A. Hanna employed a small crew reopening the workings for a Vancouver syndicate.

Noonday (Leadsmith)

The Noonday mine, also known as the Leadsmith, is on Cody Creek, 1½ miles by road south of Cody. This road was built during 1948, and the last half a mile through swampy ground is impassable. The mine is owned by the Alpine Mining Company, of Spokane, but an option was granted in 1951 to a group of Toronto and Vancouver business men. It has been inactive for about twenty years.

The mine is developed by four adits, the lowest, or No. 4, adit being at 5,000 feet elevation, 300 feet below No. 3. No. 4 adit was reopened during 1951, and because the air was low in oxygen an examination of the 3,000 feet of workings had to be made with self-contained breathing apparatus. No. 4 adit has been described in the Annual Report of the British Columbia Minister of Mines for 1929, and the main work since then has been the driving of a raise on a narrow lode at the end of the workings. A sublevel had been established 50 feet up this raise, and about 40 feet of drifting done. The lode had been stoped on this sublevel to a height of 20 feet over a length of 20 feet, and no ore was visible in the back of the stope. The reopening of No. 4 level was done by Harrison Drilling & Exploration Co. Ltd. under the direction of N. F. Brookes, consulting engineer. No further work was done during 1951.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1929, p. 306.]

Altoona (Kootenay Belle Gold Mines Limited)*

This property, owned by Kootenay Belle Gold Mines Limited, is about 1 mile northwest of Sandon. No. 2 level is on the old K. and S. railway grade which now serves as a road. The property was worked years ago, but there was no production. It was acquired in 1949 by E. Doney, who sold it to the present company. There are five adits, of which only the upper two have encountered mineralization. They are

* By M. S. Hedley.

driven in argillites and quartzite, which include one 25-foot band of limestone, and which are intruded by several dykes and sills in the vicinity of a large stock. Mining was first done on replacement ore in limestone 200 feet from the portal of No. 2 level. The ore extended for a maximum distance of 20 feet in the hangingwall of the lode. A steep stope was carried up for 60 feet above No. 2 level, and a raise was continued an additional 20 feet to No. 1 level, above the orebody. Replacement ore is seen in an old open-cut on the surface, east of No. 1 adit portal, but no further work has been done on it.

The upper two levels explore two directions of fissuring striking southeast and east, and dipping to the southwest and south respectively. Both are mineralized, but ore has been found only in an east-west fissure. The two fissures offset one another or roll into one another with a changing relationship between levels that suggests that they were formed contemporaneously. Stopes on an east-west oreshoot, 75 feet long on No. 1 level and 100 feet long on No. 2, were mined in 1951. The ore was hauled by truck to the mill at Retallack.

Production: Ore shipped, 4,228 tons, including about 400 tons mined but not milled in 1950. Gross content of concentrates: Silver, 5,027 oz.; lead, 66,377 lb.; zinc, 319,077 lb.

Carnation (Kelowna Mines Hedley Limited)* Company office, 75 West Street, New York; mine office, Hedley. R. McLean Stewart, president; Paul Billingsley, consulting engineer; G. L. Mill, manager. The company name was changed early in 1951 from Kelowna Exploration Company Limited. The former Carnation group is part of the company's extensive holdings south of Sandon. Exploration on the Carnation lode, started in 1949, was continued until June, 1951, when all work was stopped. In that interval the company had done the following work: Driven two crosscuts in the old 6300 adit to explore the lode which had not been followed through the length of that adit; driven a new 6100 adit along the general westerly course of the lode for 545 feet from the portal; driven a main 5480 adit a total distance of more than 4,000 feet; driven an eastern 5480 adit a distance of 410 feet. Altogether, more than a mile of tunnelling was done without satisfactory results.

Two lodes, about 400 feet apart, were encountered in the 5480 adit, both dipping to the south and southeast. The lodes apparently converge to the west in the general vicinity of the upper levels, where only one lode has been recognized. The footwall or northern lode probably continues through the old Minniehaha property to the northeast.

The footwall or Minniehaha lode was explored for 340 feet in the 5480 main adit and for 320 feet in the 5480 east adit, the two drifts being about 250 feet apart on the course of the lode. The lode dips to the east under a porphyry hangingwall near the portal. The lode is mineralized in a few places, the best showing being a pod of galena and sphalerite a few feet long and a maximum of 18 inches wide where first encountered in the main crosscut. The hangingwall or Carnation lode was followed by a drift for about 1,800 feet on the 5480 main adit, to a point down dip from the upper levels. Two crosscuts were each driven about 300 feet south into the hangingwall. The lode is a well-defined zone of fissuring and shearing dipping about 60 degrees to the south. It locally contains sparse sphalerite.

The 6100 level, elevation 6,060 feet, explores the Carnation lode for a length of 545 feet from the surface. The adit was not examined, but the lode is reported to be essentially unmineralized and to dip at angles between 30 and 45 degrees to the south.

At the conclusion of work all equipment, pipe, and rail were removed. Oxygen deficiency in 5480 main adit now precludes entry for more than a few hundred feet. The work was under the direction of J. C. Black and John Lamb. An average of eighteen men was employed during the first half of 1951.

E. H. Petersen, of Sandon, sorted from the 5480 main dump 2 tons of ore, which was shipped to the Trail smelter.

* By M. S. Hedley.

Wonderful (Silver Ridge Mining Company Limited)*

Company office, 373 Baker Street, Nelson; mine office, Sandon. John R. Kenney, managing director. This company owns a large group of claims west of Sandon, including the old Wonderful. Work was confined to the Pearson adit on the west bank of Tributary Creek below the main Silver Ridge road. This adit was started in 1948 to explore the Wonderful lode, which was exposed by stripping southeast of the old Wonderful workings.

The adit is a crosscut for 100 feet and follows the lode for about 600 feet to the west, in which distance the lode dips at a moderate or low angle to the south in relatively flat sediments. At the eastern end the lode dips about 45 degrees, and at the western end of the workings it is nearly flat; it is mineralized where first encountered. Work early in 1951 explored the hangingwall in search of possible additional breaks, and then a diamond-drill hole, drilled into the footwall in the central part of the adit, encountered mineralization about 30 feet distant. A footwall drift was driven on this material, which proved to be a nearly vertical lode converging slowly with the Wonderful lode towards the east. In the first 100 feet of drift this lode, apparently a steep footwall branch of the Wonderful, was seen to be mineralized sporadically, the best section, a few feet long, being zinc ore about 3 feet wide and of moderate grade. The mineralization was more abundant in the lower half of the drift. Some of the ore was roughly selected, and 327 tons was shipped to the Whitewater mill at Retallack. Eight tons was shipped to the Trail smelter. The work was under the direction of Sam Marzoli.

Production: Ore shipped, 335 tons. Gross content: Silver, 708 oz.; lead, 10,995 lb.; zinc, 6,056 lb.

Sylverite (Slocan Base Metals Limited)

Company office, 904 Hall Building, 789 West Pender Street, Vancouver. L. N. Smith, manager; W. S. Ellis, consultant. Capital: 3,000,000 shares, no par value. This company owns the Silver Ridge, Silver Ridge Fraction, Speculator, Consolidated Virginia, Elk, and G. Fraction claims, 2½ miles northwest of Sandon. An agreement of purchase is held on the Black Colt claim. This group is adjacent to Queen Bess, Palmita, and Violamac ground.

The Black Colt workings, idle during 1950, were reopened in June, 1951. The No. 3 adit portal is on the Silver Ridge Fraction, but the No. 2 level is reached from No. 3 by a raise on the Black Colt claim. Exploration on No. 2 level, started in 1949, was continued for a few months in 1951 back into the Silver Ridge Fraction claim. Bulldozer stripping was done on the Silver Ridge and Silver Ridge Fraction claims in an effort to expose the extension of the Queen Bess lode. As a result of this work, a new portal was collared at an elevation of 4,100 feet above the Victor mine road a short distance south of Violamac ground. By the end of December a closely timbered adit had been driven 150 feet in a westerly direction. A building containing compressor-room, blacksmith-shop, and change-room was erected at the portal. Air for drilling was supplied by a Canadian Ingersoll-Rand 210-cubic-feet-per-minute compressor. Three men were employed.

Palmita.—This claim is adjacent to Violamac and Sylverite ground. It was leased by Cecil Higgins, of Sandon, who made one small shipment to the Trail smelter.

Elkhorn

The workings on this Crown-granted claim are on the Victor mine road, 1 mile northwest of Sandon. The claim is held under option by Kootenay Belle Gold Mines Limited. Two men were employed for a short period reopening No. 3 portal a few feet below the road, and 50 feet of adit was retimbered before the work was abandoned. From the No. 2 dump about 3,000 tons was loaded by means of a scraper and bin set-up and trucked to the Whitewater mill at Retallack. All work ceased in September, when it was found that excessive soluble silica made the zinc concentrates unacceptable at the Trail smelter.

* By M. S. Hedley.

Victor (Violamac Mines (B.C.) Limited)*

Head office, 67 Yonge Street, Toronto; mine office, New Denver. Mrs. Viola R. MacMillan, president; George A. MacMillan, vice-president; J. W. Ambrose, consulting engineer; J. C. Black, mine manager. The property is southwest of Carpenter Creek, 2½ miles northwest of Sandon. Ore was encountered on No. 7 level in mid-May, 1,000 feet from the portal. The vein was first cut by diamond drilling, and the No. 7 crosscut, driven parallel to the vein, was deflected to the southeast a short distance and then continued as a drift. The vein exposed by the first 100 feet of drift does not differ appreciably from that exposed in a similar length of drift in the general ore zone on higher levels. Very wet, soft ground makes close timbering necessary. A raise was started to connect with No. 5 level, 217 feet above, but was abandoned in 15 feet because of a large flow of water. A 75-degree winze was then sunk from No. 5 level and was 90 feet deep by the end of 1951.

A good deal of the known ore block above No. 5 level was mined by the end of 1951, although development remained to be done. This oreshoot contained an average of 1 foot of galena in a length of 260 feet. When the property was visited in September, ore was coming from a shallow winze below No. 5 level, in which was seen a face of ore 6 feet wide that was estimated to contain 50 per cent lead.

The new mill had not proved satisfactory and was remodelled. In the new flow-sheet, lead was recovered in a 1-cell jig, and after grinding in a 4- by 4-foot ball mill, final recovery was made in three lead and six zinc flotation cells. Closely sorted galena ore was shipped direct to the smelter.

A new No. 4 adit was started on the Lone Batchelor, at an elevation of 4,200 feet. It was planned to crosscut between 700 and 800 feet to the vein by following a favourable part of the formation rather than to drive a longer distance in the same general direction as the vein in order to get beneath the old workings. The work was stopped at 135 feet.

Additional power was supplied by the installation of a new D-13000 Caterpillar diesel-electric set. Additional air was supplied by a new Sullivan 700-cubic-feet-per-minute compressor driven by a D-13000 Caterpillar diesel. The number of men employed averaged forty.

Production: Ore shipped, 892 tons. *Gross content*: Gold, 44 oz.; silver, 77,856 oz.; lead, 1,096,626 lb.; zinc, 242,686 lb. Ore milled, 5,197 tons. Gross content of concentrates: Gold, 54 oz.; silver, 48,015 oz.; lead, 609,532 lb.; zinc, 562,726 lb.

Queen Bess (Bess Mines Limited)†

Head office, 555 Burrard Street, Vancouver. A. C. Taylor, president. Bess Mines Limited was formed jointly by Bralorne Mines Limited and Kelowna Mines Hedley Limited to explore the ground of the former Queen Bess, Idaho, and Alamo groups. The property comprises thirty-four Crown-granted claims on Howson Creek. Work continued with hand-steel in the B adit, which was advanced to a distance of 400 feet from the portal in a southeasterly direction. The face is 100 feet southeast of and 110 feet below the portal of No. 5 adit. The adit follows for 90 feet from the portal a lode striking northeastward but which swings to a southeast strike and southwest dip. This is the main Queen Bess lode, deflected from its course along a near-bedded fissure, a branch of a prominent zone of strike faulting which is exposed in No. 10 level, and probably lies a short distance ahead of the face of B adit. The lode is sporadically mineralized, not in sufficient quantity to encourage further exploration on this level, particularly as further drifting would lead into the old mine zone.

An old adit on the road west of Howson Creek, consisting of a 175-foot crosscut and a short drift, was driven to the east to provide a total drift length of 230 feet on the continuation of the Queen Bess lode. The strong lode fissure zone contains a small amount of sulphide mineralization which is least abundant in the presence of porphyry

* By M. S. Hedley and J. W. Peck.

† By M. S. Hedley.

gouge. A porphyry sill or dyke about 100 feet wide is apparently offset 200 feet to the left by the lode fissure.

The work was done by Kelowna Mines Hedley Limited under the direction of John Lamb. All work stopped in midsummer.

Payne This old producer north of Sandon was optioned by Kootenay Belle Gold Mines Limited. The lowest, or No. 15, adit was reopened. The No. 8 adit was also reopened, and sampling was done on this level as well as on No. 9 and No. 10. A road was built over the ridge summit to the St. Keverne claim on the McGuigan Creek slope. A new portal was collared at 6,800 feet elevation below an old showing, but the drift was stopped after being driven 70 feet. Seven men were employed when work ceased in the fall.

Discovery Fraction.—This is a located claim near the summit of Mount Payne, north of Sandon. It is owned by E. H. Petersen, of Sandon, who made a small shipment to the Trail smelter.

SLOCAN LAKE (49° 117° N.E.)*

Silver-Lead-Zinc

Bosun (New Santiago Mines Limited) Company office, Suite 4, 423 Hamilton Street, Vancouver; mine office, New Denver. W. Postlethwaite, superintendent. Capital: 1,500,000 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. The main haulage level, No. 6 adit, is driven beneath the highway from a site 40 feet above Slocan Lake.

Except for some maintenance and leasing operations, this mine was inactive from March until November. During January and February Santiago Mines Limited mined ore from No. 5 level in the same area as at the end of 1950. This ore was crushed in the small crushing plant at the portal and sold to the Western Exploration mill at Silverton. In November New Santiago Mines Limited began operations with a crew of five men. The main winze remained flooded approximately 20 feet above No. 7 level, but a sublevel below No. 6, 800 feet west of the main winze, was drifted on for about 50 feet. Other work was in the central part of the mine, where a crosscut was started on No. 6 level to investigate the results of previous diamond drilling.

Leasing was done in the western part of the mine about 1,000 feet from the portal, where N. Scribchuck, S. Cluff, and O. Johnson mined ore by underhand stoping.

Western Exploration Company Limited† Company office, 38 South Dearborn Street, Chicago, Ill.; mine office, Silverton. M. P. McCulloch, Chicago, president; A. M. Ham, Silverton, managing director; R. A. Avison, superintendent; C. C. Starr, consulting engineer. This company owns and operates the Standard, Mammoth, and Enterprise mines and the Standard mill.

Mammoth.—This property on Avison Creek is reached by a steep one-way road from the Standard, and ore is brought to the mill at Silverton by a 16,000-foot aerial tram. Mining was carried on throughout the year in the square-set stope above No. 8 level. The raise between Nos. 9 and 8 levels was timbered, and development of ore on No. 9 was undertaken.

The development on No. 8 level has brought to light a condition not encountered on the levels above—namely, the intersection of the northerly trending Buffalo lode with the easterly trending Mammoth lode. It appears that on higher levels the displacement marked by the Buffalo lode occurred as interbed slippage with no well-defined zone of fissuring. In the ore zone the Buffalo cuts, or rather terminates, the Mammoth hanging-wall and is itself terminated by the Mammoth footwall. East of the point of intersection

* By J. W. Peck, except as noted.

† By M. S. Hedley.

and east of the main pipe-like orebody the Mammoth footwall zone is mineralized across a width as great as 8 feet for about 100 feet east of the main orebody. The stope area above No. 8 level is about 2,000 square feet, and the eastern extension will provide an as yet unknown amount of stoping ground in addition, a condition not encountered on the levels above.

Mineralization was encountered in diamond-drill holes in the footwall of the ore zone on No. 8 level, indicating perhaps footwall splits in the lode. The change in pattern and the increase in amount of mineralization below No. 7 level so far encountered indicates interesting possibilities for development on No. 9 level, in progress at the end of 1951.

J. Kelly and R. Welch leased in the upper workings, removing a sill pillar below No. 2 level. Work ceased in April after four shipments were made to the Trail smelter.

Production: Ore shipped, 33 tons. Gross content: Silver, 3,903 oz.; lead, 33,153 lb.; zinc, 7,962 lb.

Standard.—Ore was recovered from Nos. 4 and 5 dumps and trucked to Silverton to the sink-float plant. The abundance of fines encountered somewhat lessened the concentration effected by this plant. About 1,600 tons was treated. Mining of stopes above No. 6 level continued, and stoping was started in 705 stope, 1,000 feet from the portal of No. 7 level, in a section partly mined by lessees in past years. The camp remained closed, the crew being transported from Silverton.

Enterprise.—The Enterprise mine is on Enterprise Creek, 12½ miles from Silverton. Ore is hauled to Silverton by truck. The vein, dipping steeply to the southeast in Nelson granite, is developed by eight main levels between elevations of 4,450 and 5,350 feet. The ore in many stopes is 1 to 1½ feet wide, in a sheeted zone 3 to 4 feet wide. Current mining has been on Nos. 8 and 6 levels.

An old 4- by 6-foot shaft on the Iron Horse claim is reported to be 316 feet deep on the dip of the lode. No. 8 adit level reaches the vein in a crosscut 240 feet long and intersects the shaft 25 feet farther at a point about 60 feet below the shaft collar. The shaft was pumped out to an old level 60 feet long 155 feet below the collar, and this level, No. 9, was extended to the southwest to get beneath stopes on No. 8 level.

Standard Mill.—The mill at Silverton treated ore from the three mines—about 30 tons per day from the Enterprise, 10 to 15 tons per day from the Standard, and in the latter part of 1951, 50 tons per day from the Mammoth. Early in 1951 a drum-type sink-float plant using ferrosilicon as a medium was installed in the mill building. The chief purpose of this plant was to treat dump ore from the Standard, but it was hoped that it might enable lower-grade ore to be mined across greater widths at the Mammoth and Standard than was previously possible.

Some old mill tailings were reclaimed from Slocan Lake. Custom ore was purchased from the Bosun, Silversmith, and Galena Farm mines.

On the average thirty-three men were employed at the Mammoth and twenty at the Enterprise. Twelve men were employed at the Standard at the end of 1951. In December ninety-five men were employed at all the company's operations.

Hilda (Johnson)

The Hilda and Silverton Boy claims were located in 1947 on Bartlett Creek, to the west of the Standard group, by P. Johnson, of Silverton. In 1951 Violamac Mines (B.C.) Limited obtained an option, and four more claims known as the Viking, Norseman Fraction, Able, and Baker were located. A road 1,500 feet long was built to Bartlett Creek from the Standard mine road. On the right bank of the creek an old adit had been collared at an approximate elevation of 1,900 feet. About 150 feet of work had been done in the past to investigate a broad zone of shearing and brecciation. During 1951 two men with the aid of a portable compressor extended a drift on the apparent footwall of the shear zone 45 feet, but no worth-while lead and zinc mineralization was encountered, and the work was stopped.

The zone is in locally bleached black argillite and argillaceous quartzite and is mineralized erratically with sphalerite and galena. The full width of fracturing in the zone is not apparent.

Van Roi, Hewitt (Van Roi Consolidated Mines Ltd.) Company office, 1519 Marine Building, 355 Burrard Street, Vancouver; mine office, Silverton. W. B. Milner, president; D. R. Wilson, manager. Capital: 3,000,000 shares, no par value. This company, controlled by Transcontinental Resources Limited, owns the Van Roi and Hewitt mines at Silverton. Options on the adjoining Galena Farm and Metallic properties were dropped during 1951. The Van Roi camp is 6½ miles by road from Silverton.

The Van Roi mine is developed by several adits, but recent work has been on No. 3 and No. 5 adit levels. There have been recognized two principal veins or lodes known as the " north vein " and the " south vein " whose strike is roughly east and west, but geological examination of the mine and its surroundings, now in progress, alters somewhat the basic concept of two bedded lodes offset by a major fault. Rather, the indication is that there exists a broad zone of dislocation in which ore may occur in favourable situations along two or more members of a complex lode system. In common with many Slocan properties, the occurrence of ore favours some but not all parts of the bedding structure and, in particular, crosscutting rather than bedded parts of the lode are more apt to be mineralized.

During 1951 No. 5 level, which is a drift on the north vein, was reconditioned as a main haulage, and an ore-pass and manway were established to No. 3 level in an old raise 1,300 feet from the portal. At 2,200 feet from the portal the 544 crosscut was driven 300 feet to the south to intersect the south vein, which had not been explored in the west end of the mine on this level. On No. 3 level a stope was prepared in the central block on the south vein, and also a drift was driven to the southwest oreshoot. On the surface a large power-house was built below No. 5 portal. Machinery installed consisted of a D-17000 Caterpillar diesel driving an Ingersoll-Rand 670-cubic-feet-per-minute compressor, a D-13000 Caterpillar diesel driving a Gardner-Denver 365-cubic-feet-per-minute compressor, and a G.M.C. diesel driving an Ingersoll-Rand 365-cubic-feet-per-minute compressor. A Ruston 20-horsepower diesel locomotive was purchased for operating on No. 5 level.

At the Hewitt, mining continued in the 1046 stope on No. 10 level. This stope was mined up 90 feet over a length of 80 feet. The width of the ore increased to 15 feet, necessitating the adoption of square-set stoping. A raise was also put through to No. 9 level 200 feet above. At the portal, on Twigg Creek, a compressor-shed houses a Schramm 315-cubic-feet-per-minute compressor. Horses were used on No. 10 level to haul broken rock. The crew lives at the Van Roi camp, one-quarter of a mile to the east.

A modern camp was erected during the year close to the old Van Roi camp between Twigg and Maurier Creeks. Six 8-man bunk-houses, change-house, cook-house, and central heating plant were completed by December. A 100-tons-per-day flotation mill, in conjunction with a 25-tons-per-hour sink-float plant, was constructed on Slocan Lake, at Hasty Creek, about 1 mile south of Silverton on the Nelson–Nakusp Highway.

At the mill, ore from a 200-ton coarse-ore bin is conveyed to a 3- by 6-foot Ty-roc screen and a 10- by 20-inch Pacific jaw crusher. The crushed ore is conveyed to a 3- by 10-foot Ty-roc washing screen and a 25-tons-per-hour drum-type sink-float plant, from which the sink product goes to a 200-ton fine-ore bin. The ore is then conveyed to a 6- by 3-foot ball mill in closed circuit with an Akins-type classifier. Lead is removed in six flotation cells; the pulp is conditioned and zinc is removed in eight flotation cells. The concentrates are dried in a 6-leaf Eimco filter and stored in bins of 200-ton capacity. The mill is powered by two D-17000 and one D-13000 Caterpillar diesel engines.

The mill was in operation at the end of September, and the sink-float plant started in December. Most of the ore milled in 1951 came from a stockpile of 7,000 tons accumulated over the past year from stoping operations at the Hewitt and development work at the Van Roi. To improve truck-haulage, the road was partly relocated and a connection made with the mill-site. The total crew employed had increased to ninety-five by the end of 1951.

Galena Farm This property was under option until December to Van Roi Consolidated Mines Ltd. This company carried out a geophysical survey followed up by bulldozer stripping, but no lode was discovered. Frank S. Mills, of Silverton, operated his lease during January and February and again in November and December. Ore obtained was sold to the Western Exploration Company at Silverton.

Production: Ore milled, 418 tons. Gross content: Silver, 625 oz.; lead, 15,039 lb.; zinc, 36,254 lb.

White Hope This property lies astride the Nelson–Nakusp Highway about 5 miles north of Slocan City. It is owned by Spokane Slocan Company. As in 1950, leasing operations were carried out by J. J. McDonell, of Slocan City.

Silver

SPRINGER CREEK (49° 117° N.E.)*

Ottawa (Harrison Drilling & Exploration Company Ltd.) Company office, P.O. Box 230, Noranda, Que.; British Columbia office, 1408, 675 West Hastings Street, Vancouver; mine office, Slocan City. Capital: 800 shares, $50 par value. This company has operating control of the Ottawa mine under an agreement with Violamac Mines (B.C.) Limited, which optioned the property from the Ottawa Silver Mining & Milling Company. The mine is north of Springer Creek, about 5 miles by road from Slocan City. Work was concentrated in the No. 6, or lowest, adit, in which leasing operations had been carried out previously. Compressed air was installed, and stoping commenced on a vein intersected by the adit crosscut 1,600 feet from the portal. This vein has a dip of 25 degrees and, where mined, is 5 feet wide. The vein matter is principally quartz with a few inches of high-grade silver-bearing minerals on the hangingwall. Cut-and-fill mining methods were employed, and careful sorting was required. To improve ventilation and provide a second exit, a raise was started on the vein to No. 5 level. Ore obtained was trucked to Slocan City for transhipment by rail to the Trail smelter. The mine was idle during the summer and fall, but mining and development work commenced again in December on No. 6 level. In the early part of the year fifteen men were employed under W. E. Leonard.

Little Tim (L.T.) This property is at the head of Little Tim Creek, a southerly flowing tributary of Springer Creek. It is owned by D. B. O'Neail, of Slocan, but was optioned in 1951 to Harrison Drilling & Exploration Co. Ltd. In the fall a 2-mile road was constructed to the property from the Ottawa mine. Four men were working underground by the end of 1951.

Republic No. 2 This property, 3 miles by road north of Slocan City, is owned by C. B. Tipping, of Slocan City. In 1951 an option was granted to Harrison Drilling & Exploration Co. Ltd. A diamond-drilling programme was commenced late in the year.

Speculator This claim, owned by W. E. Parker, of New Westminster, was optioned in 1951 by Ottawa Silver Mining & Milling Company. It is north of the Arlington mine, about 7 miles by road from Slocan City. One small shipment was made from a dump near the road.

* By J. W. Peck.

Arlington.—This property is on the north slope of Springer Creek, about 6½ miles by road from Slocan City. During 1951 Ottawa Silver Mining & Milling Company made a small shipment from the lowest mine dump.

Silver Leaf.—This claim is on Springer Creek below the Arlington mine. Two small shipments were made to the Trail smelter by E. Kline and R. Stedile, both of Nelson.

NORTH LARDEAU (50° 117° N.W.)*

Silver-Lead-Zinc

Lakeshore and Sampson, Young Canuck (Samson Mines, Limited)

Company office, 120A McKenzie Avenue, Revelstoke. H. Stewart, president. Capital: 200,000 shares, $1 par value. This is a private company formed to develop a group of claims about a mile north of Whisky Point on the northeast arm of Upper Arrow Lake. The group consists of thirteen located claims and the Crown-granted Young Canuck claim. The ground formerly covered by the cancelled Crown-granted Cracker Jack claim is in the group. Exploratory work was done during 1951 under A. E. Peterson, of Revelstoke.

Spider (Sunshine Lardeau Mines Limited)

Company office, 525 West Pender Street, Vancouver; mine office, Beaton. H. E. Holcombe, president; W. J. Scorgie, vice-president; B. W. W. McDougall, consultant; P. L. Clark, manager. Capital: 3,000,000 shares, no par value. This company owns the Spider mine on Pool Creek, 2 miles by steep tractor-road from the base camp and mill at Camborne. Mine development continued throughout the year. A crosscut 115 feet from the portal in No. 5 adit, started in December, 1950, was driven westerly to investigate the results of diamond drilling done in 1950. The crosscut was driven 110 feet, with the last 25 feet exposing lead and zinc mineralization. This mineralization appears to follow numerous joint planes and is of high grade in the last 6 feet of crosscut. Blocks of waste occur in the ore zone, and an estimate of grade would be difficult without extensive bulk sampling. As a result of this new discovery, No. 6 adit was collared 185 feet north of and 90 feet lower than No. 5 portal. This adit was driven south 25 degrees west for 140 feet, encountering mineralization at 75 feet. At 140 feet the adit was swung slightly to the south to follow the hangingwall of an ore zone that presumably is the one exposed in No. 5 adit. Short crosscuts were driven through the ore zone at 100 feet, 150 feet, 190 feet, and 240 feet from the portal. These crosscuts expose a zone of lead-zinc mineralization as much as 14 feet wide, with a hangingwall dipping about 75 degrees to the east. Drifting and crosscutting were still in progress on No. 6 level at the end of 1951.

On No. 5 level some work was also done in the southeast section, which is directly under the old workings on No. 4 level. A dog-leg raise was driven from No. 5 to break through on No. 4 level 120 feet from the portal.

During 1951 the Dentonia mill was purchased, and a jaw crusher, 50-ton ball mill, classifier, thickener, six flotation cells, and filters were installed in the old Meridian mill building. The power plant is a 90-horsepower Vivian diesel engine. An adit was driven above the mill into the hill for 105 feet, and then a raise connection was made to the road above, about 1½ miles from the mine. This will provide coarse-ore storage and eliminate the steep grade of the first part of the mine road. The number of men employed averaged twenty.

Silver Dollar (Monterey Mining Company Limited)

Company office, 321 Pemberton Building, Fort Street, Victoria. J. Dalziel, president; C. G. Beeching, managing director. Capital: 3,000,000 shares, no par value. This company owns the Silver Dollar mine near the head of the east fork of Mohawk Creek, a northerly flowing tributary of Pool Creek. A 4-mile trail connects with the Spider mine road at the No. 4 level of the Spider mine. During 1951

* By J. W. Peck.

a crew of three was employed to widen the trail to 5 feet so that a 4-wheel-drive tractor can be used to haul supplies. The old log building at the mine was rehabilitated, but no work was done underground. The crew was withdrawn in October because of snow.

Nettie L, G.Y.P. Fraction, and Ajax (Trout Lake Mining Company Limited) Company office, 120A McKenzie Avenue, Revelstoke. R. M. Patriquin, president; D. Burns, superintendent. Capital: 200,000 shares, $1 par value. This company controls a group of claims on Nettie L. Mountain, overlooking the townsite of Ferguson. During 1951 the levels of the Nettie L were rehabilitated; the timber in general was found in good condition. About 2,000 feet of diamond drilling was done to test the Main and Cross veins in unstoped areas. Some raising was also done on the Cross vein on No. 3 level. Along the outcrop of the Main vein a silicified zone 10 feet wide, mineralized with sphalerite and galena, was uncovered and was traced a short distance. An adit was driven on this zone, but the mineralization disappeared 15 feet from the portal, and 80 feet of additional drifting was done without results.

On the surface a bunk-house, office, explosives magazine, compressor-shed, and two dwellings were built. In November W. S. Hamilton took charge. The average number of men employed was twelve.

[Reference: *Geol. Surv., Canada,* Mem. 161, p. 68.]

Silver Cup The Silver Cup mine on Silver Cup Mountain is the largest and one of the oldest mining properties in the Lardeau. It is owned by The Ferguson Mines Limited, the English stockholders being represented in British Columbia by E. C. Wragge, of Nelson. Very little mining has been done for thirty-five years. In 1951 Toronto interests obtained an agreement, and a sampling programme was undertaken by W. S. Hamilton, of Nelson.

Mollie Mac This property is on the north side of Gainer Creek, about 3 miles from Tenmile on the Lardeau Creek road. During 1951 a road was built up Gainer Creek to the property. The old trenches were cleaned out, some new ones dug, and all showings were thoroughly sampled. A small crew was directed by C. S. Parsons.

Wagner (Sheep Creek Gold Mines Limited) The Wagner group lies at the headwaters of Hall and Healy Creeks. It was examined by St. Joseph Lead Company in 1949. During 1951 Sheep Creek Gold Mines Limited optioned the property and commenced building a road up Healy Creek from the Lardeau–Gerrard road. About 10 miles of road was completed before winter conditions forced a shut-down.

SOUTH LARDEAU (50° 116° S.W.)*

Silver-Lead-Zinc

St. Patrick (Hamil Silver-Lead Mines, Limited) Company office, 902 Rogers Building, 470 Granville Street, Vancouver. H. F. Kenward, managing director; R. E. Renshaw, manager. Capital: 3,000,000 shares, 50 cents par value. The St. Patrick mine is 3 miles by steep road from a point on the Argenta–Howser road 6 miles from Argenta. The workings consist of a 75-foot inclined shaft at 4,045 feet elevation and an adit 500 feet to the southeast at 3,880 feet elevation. The adit has been driven in a northwesterly direction, with the northwestern end below the shaft workings. The adit contains more than 1,000 feet of drifts and crosscuts, one short raise and sublevel, and one winze. At 320 feet from the portal a crosscut to the west exposes 30 feet of lead-zinc replacement mineralization in limestone. This was investigated early in 1951 by diamond drilling, and a crosscut 230 feet from the portal was started to investigate one of the drill intersections, but was stopped after being driven 10 feet. On the west side of the replacement showing a fault

* By J. W. Peck.

had been followed northerly for 80 feet by a drift which was extended an additional 60 feet. Lenses of galena and sphalerite were exposed in this mineralized fault on the hangingwall side.

In the latter part of 1951 the shaft was rehabilitated and a raise connection made from the adit below. Two old log buildings at the adit portal were repaired for living-quarters. A small bunk-house and a tractor-shed were also erected. Air for drilling was supplied by a portable compressor. Water for drilling and domestic use was scarce and had to be collected underground. The average number of men employed was eight.

Surprise

This property is on the west side of Glacier Creek, 3 miles by road from the Argenta–Howser road. It is owned by W. Clark, of Howser, and is optioned by J. Gallo, of Howser, and his partner, F. Pellizari. The mine is 1,300 feet vertically above the camp on Glacier Creek and is served by a road to a point 500 feet below the upper adit. As in 1950, most of the ore came from a quartz-tetrahedrite vein in a stope at the end of the upper adit. The stope was carried to about 100 feet above the level on an average dip of 35 degrees. In some sections the vein was 6 feet wide, but the tetrahedrite lenses were narrow and sorting was required. The ore was lowered from the portal to the road by a 2-ton skip on skids. Twenty-two carloads of ore were trucked 20 miles to a loading-ramp at Lardeau for shipment to the Trail smelter. Three men were employed.

J.G. (Lardeau Lead & Zinc Mines Ltd.)

Company office, 900 West Pender Street, Vancouver. B. W. W. McDougall, consultant. Capital: 3,000,000 shares, $1 par value. The J.G. group of claims is northwest of Glacier Creek and extends across the ridge to the lower arm of Duncan Lake. The ground was known in the late 1920's as the Amato-Ruby and Glacier groups. A band of limestone striking northwest and dipping steeply northeast extends across the claims. Certain beds have been replaced along the strike by pyrite, galena, and sphalerite. These have been explored in the past by numerous open-cuts and by seven diamond-drill holes put down in 1928 by The Consolidated Mining and Smelting Company. Late in 1951 the present company drilled seven holes from the Glacier Creek side of the ridge and three from the Duncan Lake side, of an aggregate length of about 1,500 feet. In December a short access road was made from the Glacier Creek road and an adit-site was cleared.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1926, p. 267. *Geol. Surv., Canada*, Mem. 161, p. 95.]

Moonstone, Right Bower

These two old claims, Crown-granted in 1897, are three-quarters of a mile south of Lardeau, about 500 feet above Kootenay Lake. They are owned by Mrs. R. M. Robinson, of Nelson. Fourteen claims and fractions were located early in 1951 to form a group. On the Moonstone there is an adit 172 feet long, 80 feet above which is an inclined shaft with water 22 feet below the collar. In November J. Robinson made an open-cut, 2 feet wide and 16 feet long, midway between the workings. From this cut, 1,400 pounds of lead ore was sacked and shipped to the Trail smelter, using the new road which extends south from Lardeau about 400 feet below the showings.

CRESTON (49° 116° S.W.)*

Silver-Lead

Alice.—The Alice mine, owned by K. C. Constable and R. B. Staples, is on the west slope of Arrow Mountain, 2 miles north of Creston. It was leased by R. Welloff and J. S. Maines, who shipped ore to the Trail smelter.

Delaware

This property is at 4,500 feet elevation on Rolf Mountain, north of Creston. It is reached by 7 miles of road from the highway 5 miles east of Creston. It is owned by J. W. Hill, of Tucson,

* By M. S. Hedley.

Ariz., and is leased by R. W. and F. E. Crawford, of Creston. A quartz vein is explored by two adits 50 feet apart vertically; the upper adit is 125 feet long and the lower is 500 feet long. A third lower adit 100 feet long is not on the vein.

A sublease was granted L. Freed and Tom Welsh, who worked from July to October. Twelve tons was shipped to Trail and 21 tons to Kellogg, Idaho.

MOYIE (49° 115° S.W.)*

Society Girl

The Society Girl mine is at an elevation of 5,200 feet, on the east side of lower Moyie Lake, 4½ miles by fair road south of Moyie. The property is bounded on the north, west, and south by claims held by St. Eugene Mining Corporation.

The Society Girl claim (Lot 4405) covers the principal mine workings. It was purchased at a tax sale by M. Nicholson in 1948, in which year he shipped seven cars (333 tons), mainly from the old surface dumps. Average grade of the ore was: Silver, 2 ounces per ton; lead, 9.7 per cent; zinc, 0.5 per cent. In 1951 Society Girl Mining Syndicate, of Vancouver, obtained a lease and option on the property and, with a crew of twelve men under William Nielson, shipped twelve cars of ore during the early summer. The returns did not meet expenses, and in August, 1951, the Syndicate subleased the property to J. Sullivan and four partners.

The country rock is Aldridge quartzite. The vein is narrow in thin-bedded argillaceous quartzite and widens in thick quartzite beds, with an average width of about 2 feet. The ore contains chiefly lead carbonates with some galena in a quartz gangue. The vein strikes eastward and dips 70 degrees to the north.

Considerable work has been done since the Society Girl was discovered and first developed in 1899. On the surface the outcrop has been stripped, and a 35-foot shaft is reported to have yielded some very high-grade ore. Seventy feet below the outcrop an adit level (elevation 5,200 feet) was driven and the ore stoped to the surface. Three hundred and eighty feet below the upper level a crosscut has been driven for about 1,200 feet, and a considerable amount of drifting and stoping has been done. Another vein was intersected north of the main vein, and an exploratory raise driven on it, but no ore was found. On the main vein, west of the crosscut, a stope has been carried up about 75 feet with a length of 150 feet, and a raise driven from the middle of the stope to the upper level.

In September, 1951, the sublessees were doing underhand stoping from the upper level beside the raise and had uncovered a small pocket of high-grade lead carbonate ore.

ST. MARY RIVER (49° 116° N.E.)†

Boy Scout (Thomas Consolidated Mines Incorporated)

Head office, 640 Peyton Building, Spokane, Wash.; mine office, Marysville. David E. Watson, secretary-treasurer. This property, consisting of the Warhorse, two other Crown-granted claims, and twenty-four located claims, is on Hellroaring Creek, 5 miles by new road from St. Mary Lake. The showing is a broad shear zone striking north 50 degrees west and dipping on the average between 60 and 65 degrees southwest. It is mineralized with pyrrhotite, pyrite, sphalerite, galena, arsenopyrite, and a little chalcopyrite. The zone is in Aldridge quartzites, and there is extensive pegmatite in the footwall.

No. 1 adit, at about 5,400 feet elevation, is more than 100 feet long. The face is in the footwall of the lode. The full width of the lode was not explored. No. 2 adit, 100 feet lower, is about 200 feet long and was not everywhere on the lode. No. 3 adit is a crosscut for 340 feet and a drift for more than 500 feet. The air is deficient in

* By F. J. Hemsworth.
† By M. S. Hedley.

oxygen in the inner part. These three adits partly explore a zone that is of uncertain width and is not uniformly mineralized. The present company decided that rather than clear out the old adits and fully explore the lode at these elevations, they would drive a new low adit at an elevation of 4,550 feet, about 360 feet above the creek and 475 feet below No. 3. The lode was projected downhill and exposed by bulldozing, and the 4600 adit was collared at the end of the new road.

At the 4600 adit the zone of fissuring and shearing is 55 feet wide, a width not apparent at higher levels but not disproved by the existing workings. The adit was 400 feet long on August 6th and disclosed some mineralization near the footwall, although the full width of the zone was exposed only near the portal. It was the intention to explore the lode for a considerable distance in an effort to demonstrate the existence of orebodies at this horizon.

By the end of 1951, 800 feet of drifting had been done on the zone, and mineralization consisting of veins and lenses individually as wide as 3 feet had been encountered in the inner 200 feet of drift. There hundred feet of crosscutting had been done to explore the full width of the zone.

A temporary change-house, office, garage, and compressor-house were built near the portal. A crew of eight men was employed at the end of the year under the direction of W. N. Campbell.

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. A new phase of mining started with production from the open-pit operation. About 2,000,000 tons of ore was stripped of waste rock as much as 150 feet thick and surface gravel as much as 30 feet thick. Stripping operations were started by Northern Construction on October 16th, 1950, and finished a year later. The first ore was blasted on November 22nd, 1951. The difficulties created in 1950 by the generation of sulphur dioxide in the mine backfill were overcome by suitable controls. The following report, prepared by the management, is a synopsis of the 1951 operations:—

" SAFETY.—A keen interest in accident-prevention was maintained throughout the year by all employees. The results obtained show up in the new safety records established during the year. Frequency of accidents at 0.17 per 1,000 shifts worked was the best on record.

" The highlight of the year was the commendable record of 230 accident-free days established by the West Section. The 230 accident-free days represent 34,943 man-shifts of exposure. The previous section record of 227 accident-free days was established by the Surface Section during 1950.

" The Underground School of Instruction again played an important part in accident-prevention work. All new underground employees attended the school whether they have had previous underground experience or not. Any underground employee who had a lost-time accident since the previous class also attended the school. The school is of four days' duration, and all matters pertaining to accident-prevention are thoroughly explained. The Instruction School is under the direction of a member of the Safety Department, and he is assisted by a different supervisor from the operating department for each class. A total of 106 employees attended the school during 1951, and eight supervisors acted as assistant instructors. Since the school started in 1946, a total of 1,708 employees have received training.

" St. John Ambulance Association first-aid classes were held for all employees during the year, and 217 senior awards were granted by the association.

" The East Kootenay mine-rescue and first-aid competitions were held in Fernie during 1951, and the mine first-aid teams won the Department of Mines Cup and Rotary Shield.

" Mine-rescue training was actively carried out during the year. Twenty-four employees successfully completed the Department of Mines mine-rescue course. Two teams from the mine entered the East Kootenay mine-rescue competition and one placed third.

" For the first time a local mine-rescue competition was held, with teams from each of the four Underground Sections taking part. The Chemox apparatus only was used in this local competition.

" Mine-rescue personnel were on duty in fume-control areas during the year.

" 1952 mine-rescue plans call for the training of all underground supervisors who can qualify.

" VENTILATION.—*(a) General.*—No major changes were made in the main ventilation circuits during the year. The main exhaust fans operated all year at a capacity slightly exceeding 400,000 cubic feet of air per minute.

"A detailed study of long-term ventilation requirements was completed during the year. This will entail the installation of six new fan units on the surface and will require 10,000 feet of added development for new airways underground. The programme will require two years to complete and will increase air passing through the mine from 400,000 to over 700,000 c.f.m.

"*(b) Fume Control for Float-filled Stopes.*—Rigid control was maintained by sealing of float-filled stopes together with anti-corrosive equipment operating on a closed circuit and connecting all stopes to the contamination outlet. The greater part of sulphur dioxide handled originated from two stopes, and gas temperatures in filled stopes varied from 78° F. to 383° F.

"An observation test was made in November to determine the effect of a complete power failure on mine ventilation and fume control. The conclusion was that a time interval of one hour could be used for the safe direction of mine personnel.

" The draught on the fume-control circuit is operated by a Buffalo Vaneaxial 36-B fan, 25 horse-power at 3.4″ s.p. for 24,000 c.f.m., with variations in the flow from the stopes by controls on return air from 3902 conveyor ventilation. Two fans of the above type are completely rubberized for protection. The discharge of fumes is directed out of the mine via a 7- by 5-foot subdrift in the 3900 sill pillar, sealed 10- by 9-foot drift, and thence to 10- by 11-foot raise to surface.

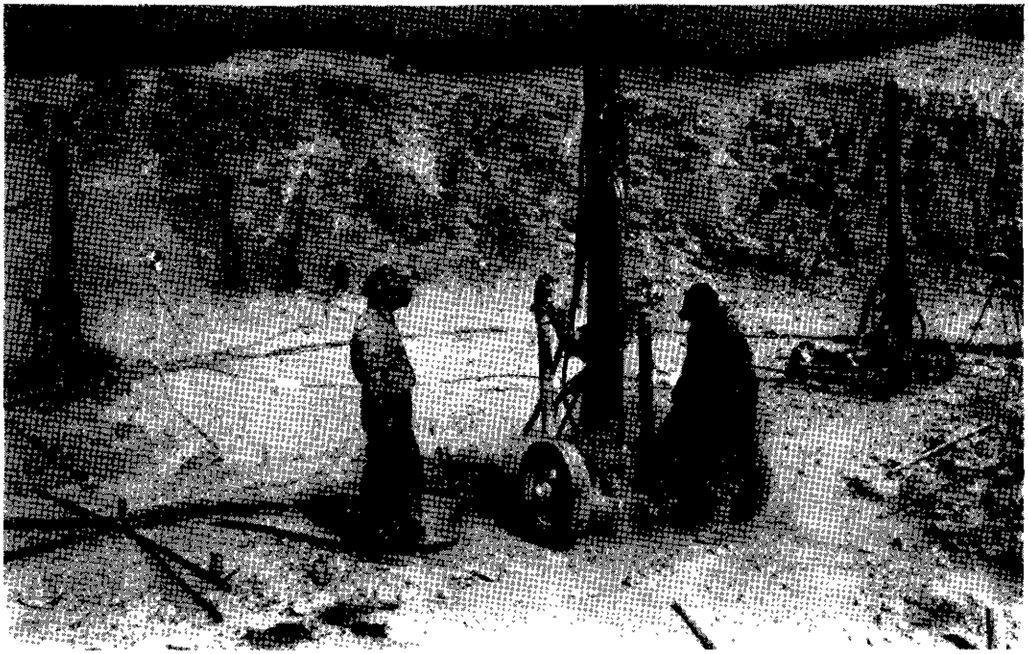
"*(c) Underground Dust Samples.*—The indicated average dust contents in the mine air for the following operations by the Konimeter method are tabled below:—

	Dust Count in Particles per C.C. of Air
Stopes	277
Ventilation air	235
Development	502
Slushers	462
Miscellaneous	343
Above 3900 division	360
Below 3900 division	322
General mine average	347

"An exhaust-duct system on the coarse-ore dumps at 501 bin was installed to alleviate the dust condition. This operates on 10,000 c.f.m. a 4.5″ s.p. by a Sirocco 400 E fan, 25-horsepower drive, and discharges direct to the contamination outlet via connecting raise.

"A dust-collecting system was installed in the new 2850 crushing chamber at the end of the year. A branch exhaust-line also takes care of the feeder to the conveyor. The exhaust from the system enters the north-end exhaust airway to the surface and does not re-enter any active operating mine areas.

" Dust counts are currently averaging below 400 particles per c.c. in this new plant. The average counts in the 3800 crushing plant were under 400 for the year.



Wagon drills in stripping operation at the Sullivan mine.

" Open-pit Operations.—Northern Construction completed their contract for removal of the gravel and waste rock above the ore in the open pit in October. Operation of the pit was then taken over by the Sullivan mine. Approximately 200,000 cubic yards of gravel and 1,100,000 cubic yards of waste rock were removed by Northern Construction.

" Percussion drilling of ore benches at the upper end of the open pit commenced in September by Cominco while Northern Construction was completing the removal of waste rock. Holes are drilled to a maximum depth of 30 feet with five wagon drills, using tungsten-carbide bits.

" The first blast of ore was made on November 22nd, and production commenced immediately thereafter. Production is expected to be approximately 3,000 tons per operating day. A day shift only is being used in this operation at present.

"An electric shovel of 6½-cubic-yard capacity is used to load four end-dumping 12-yard Euclid trucks which transport the ore to a transfer raise in the lower end of the pit. This transfer raise delivers the ore directly to the 3900 level, where it is trammed to the 3800 crushing chamber. The crew consists of approximately twenty-five men.

" Foreman's office, garage, steel-shop, oil-storage building, and warehouse are maintained adjacent to the open pit.

" Underground Highlights.—During the year each of the 2850, 3050, and 3200 level drifts was extended to the north. The 2850 level drift was also extended to a point approximately 1,000 feet east of No. 1 shaft. An exploration crosscut on the 2850 level was driven 1,400 feet into the hangingwall, and diamond drilling for the vein extension was carried on.

" Installation of equipment in the 2850 level crushing unit, the 3902 conveyor extension, and the 2850 level pumping station was completed during the year, and all are in operation.

"At No. 2 shaft all installations were completed, and the shaft is now servicing the 3800, 3650, 3500, and 3350 levels in place of 3901 shaft.

" Considerable development was completed on the 3050 and 3200 levels in order to prepare stoping blocks there for mining.

" During the year 504,421 cubic yards of float-sulphide fill were placed in five stopes below the 3900 level.

" Production from pillars was approximately 47 per cent of the total mine production."

Production: 2,533,212 tons.

FORT STEELE

Silver-Lead-Zinc

Victor*

(49° 115° N.E.) The Victor group consists of twelve claims, recorded in 1951 and owned by Ralph Sostad and Gordon Blaney, of Vancouver. The claims are on the headwaters of Maus Creek, which flows into the Kootenay River south of Fort Steele. There is a good road from Fort Steele for 5 miles to the foot of the mountain. The old road up the mountain, for about 6 miles to the mine, is only passable by jeep in dry weather. The old mine camp is at an elevation of 6,700 feet.

The Victor mine was developed by R. Abernethy and his son, Elmer R. Abernethy, of Spokane, who formed the Victor-Silver Leaf Mining Company in the early twenties, and erected a 50-ton concentrator on the property. In 1921, 7 tons of mixed ore and concentrate was shipped.

The property has been opened by three adits. The upper adit (No. 1), about 400 feet long, is driven into the cliff face about 1,000 feet below the summit. No. 2 level, 125 feet lower, is 412 feet long, 52 feet as a crosscut and 360 feet as a drift on the vein. No. 3 level was started in slide rock at the base of the bluff, 100 feet below No. 2. There are no raises connecting the levels.

The country rock is argillaceous quartzite of the Creston formation. The beds strike north and on the average dip about 70 degrees to the west.

Looking up the ridge from the No. 3 portal, a vein can be seen cutting the quartzite at an acute angle. The vein has a strike of north 15 degrees east, and the average dip is nearly vertical.

The vein is a quartz-filled fissure, irregularly mineralized with galena, sphalerite, and pyrite. In the two upper levels the average width of the vein is about 2 feet. In No. 3 level a narrow vein, about an inch wide, has been drifted on. This may be the same vein, but there is a possibility that due to the variable dip the main vein may lie to the east and the lower drift may be on a parallel fracture.

Five samples were taken—four from No. 2 drift and one from No. 1. The second sample was of quartz containing little sulphide; the other four were taken where the vein contained abundant sulphide mineralization.

Sample No.	Location	Description	Width	Gold	Silver	Lead	Zinc
			Feet	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent
1	Face, No. 2 level	Hangingwall side	0.5	0.48	10.8	3.9	23.6
2	Face, No. 2 level	Footwall side	2.5	*Nil*	*Nil*	Trace	0.7
3	140 feet north of No. 2 face		2.4	0.02	4.1	9.5	11.1
4	280 feet north of No. 2 face		2.3	0.01	1.9	3.1	14.9
5	No. 1 level, 50 feet from portal		1.0	0.02	2.0	1.7	14.3

* By F. J. Hemsworth.

Kootenay King (Kootenay Base Metals Limited)*

(49° 115° N.W.) Company office, 525 Seymour Street, Vancouver. W. B. Milner, president. Capital: 3,000,000 shares, 50 cents par value. The property is on the north side of Wild Horse River, 10 miles from Fort Steele. The mill-site is 4 miles from Fort Steele, near the end of the old road up the creek. A road constructed in 1951 leads from mill-site to mine camp, a distance of 7 miles, and to the mine half a mile beyond. The workings, consisting of three adits, are on a steep slope about 1,000 feet below the ridge crest. No. 3 adit is at an elevation 7,100 feet and the camp is at 6,700 feet.

The property was located many years ago, and initial work was done by the owner, W. Myers. The property was acquired in 1925 by W. B. Dornberg and associates and in 1928 by Kootenay King Mining Company Limited who did some development work and 4,000 feet of diamond drilling in the same year before optioning the property to Britannia Mining and Smelting Company Limited. The latter company continued development and did 3,400 feet of diamond drilling before the option was dropped in 1929. The Mining Corporation of Canada Limited optioned the property in 1942 and did 1,000 feet of diamond drilling.

The ore is a replacement of dolomitic argillite contained in a quartzite band in the transition zone between the Aldridge and Fort Steele formations and is localized within a minor dragfold in the steeply dipping strata. The argillite is a soft, dense grey rock with a total width across two bands of about 60 feet. It is crumpled in the dragfold and is cleaved axially to the fold. The dragfold plunges at a very low angle to the north. The ore is fine grained and consists of light-coloured sphalerite, galena, and pyrite.

No. 1 adit is a northwest crosscut 65 feet long across the main ore band. The ore, encountered about 40 feet from the portal, is 7 to 8 feet wide in the lower band of argillite 30 to 40 feet below the surface showings. No. 2 adit is driven 355 feet northwest as a crosscut, and a drift 165 feet from the portal is 185 feet long at north 10 degrees east; the structure is not clear and the extent and true width of ore are not apparent. No. 3 adit is 750 feet long and discloses no ore. Structural details are complex, and the picture is further complicated by faulting.

No work had been done since the diamond drilling by Mining Corporation, which had indicated a shoot of ore along the axis of the fold as far as could practically be reached by surface holes. Late in 1951 a raise was driven from No. 3 to No. 2 level, and exploration and development of the ore zone were in progress. All ore is to be drawn through No. 3 adit, the portal of which is in an exposed position on the steep slope.

During 1951 the road was built from the mill-site to the mine, and some new road was built between Fort Steele and the mill-site. A 50-ton mill building was completed, and machinery was being installed at the end of the year; a mill camp was built. At the mine camp a cook-house and six prefabricated huts were erected; three cabins were repaired for use as bunk-houses. A compressor-house was built at the mine. A service raise was driven from No. 3 level, 117.5 feet to No. 2 level, and 600 feet of No. 3 level was slashed to provide adequate width for haulage. An average of forty men was employed under the direction of L. G. White.

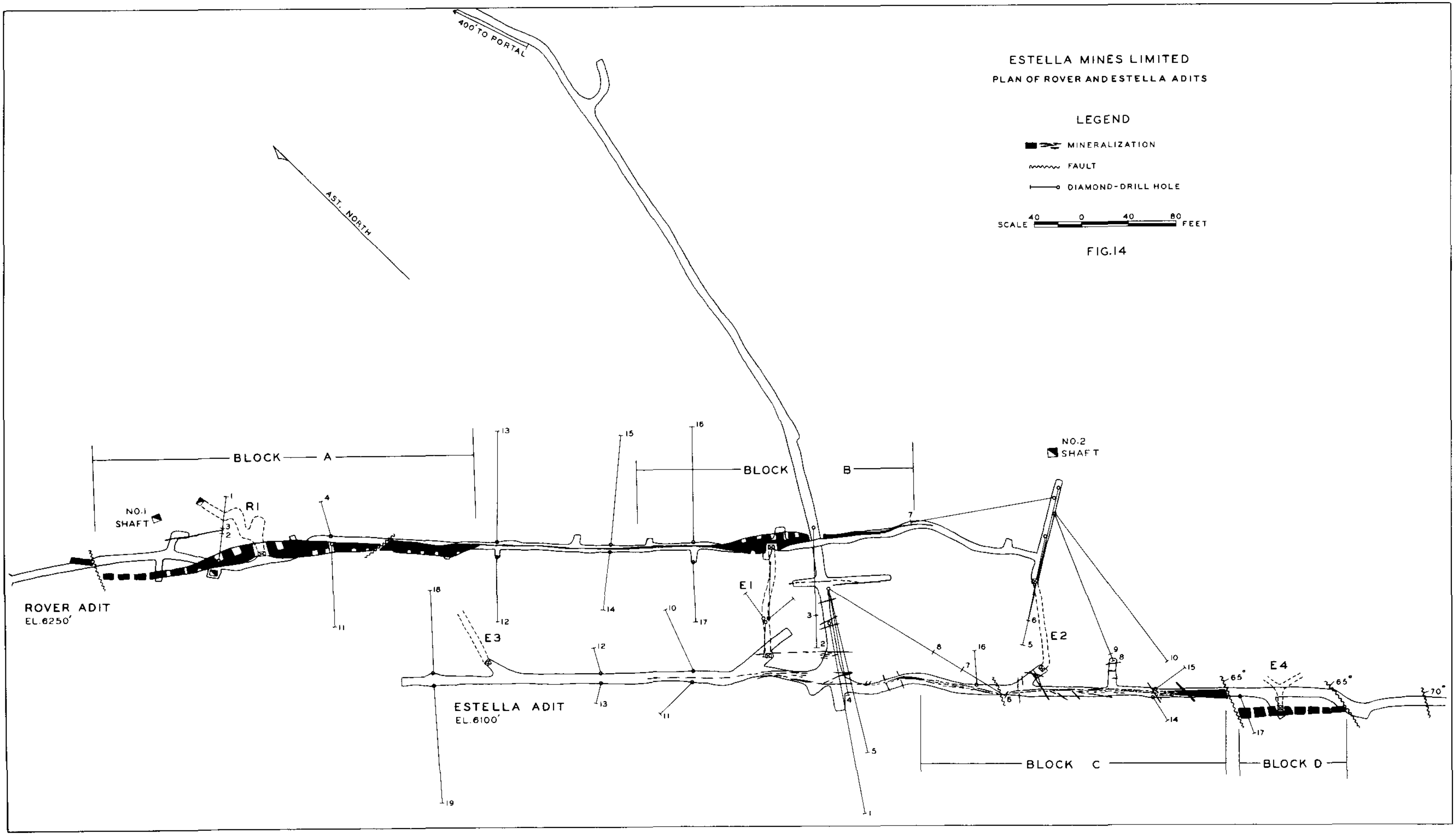
WASA (49° 115° N.W.)*

Silver-Lead-Zinc

Estella (Estella Mines Limited)

Company office, 736 Granville Street, Vancouver; mine office, Wasa. E. J. Chapman, president; Mathew Sutton, vice-president; N. L. Harvey, secretary-treasurer; W. A. Sutton, F. D. Farrell, G. H. Kirkpatrick, J. E. R. Wood, C. C. Mahon, directors; R. B. Lamb, managing director; A. F. Kent, mine manager. The mill-site is at Wasa, 11

* By M. S. Hedley.



ESTELLA MINES LIMITED
PLAN OF ROVER AND ESTELLA ADITS
LEGEND
MINERALIZATION
FAULT
DIAMOND-DRILL HOLE
SCALE 40 0 40 80 FEET
400' TO PORTAL
AST. NORTH
BLOCK A
BLOCK B
BLOCK C
BLOCK D
NO.1 SHAFT
NO.2 SHAFT
R1
E1
E2
E3
E4
ROVER ADIT
EL.6250'
ESTELLA ADIT
EL.6100'
65°
65°
70°

FIG.14

miles north of Fort Steele, and the mine is about 5 miles to the east, in a basin at the head of Tracy Creek in the Rocky Mountains.

The mill is on the edge of the Kootenay River flat and is connected to the railway by a spur about half a mile long. A good road leads to the mine at an elevation of 6,000 feet in 16½ miles, all but the first 5 miles having been built in 1950. Ore is hauled from mine to mill by truck.

The property is an old one, having been located in the 1890's. During the course of years some surface work was done, and an adit, the Rover, was driven on the vein zone. A lower adit, the Estella, was driven as a crosscut that stopped short of the vein zone. The property was optioned in 1927 by The Consolidated Mining and Smelting Company of Canada, Limited, and diamond drilling was done, but the option was dropped. The property was reoptioned in 1944 and a geological examination was made of the mine area, but no further action was taken.

Estella Mines Limited was formed in May, 1950, and immediate plans were made to bring the property into production, with Alfred R. Allen as mine manager. The old mine camp was re-established, and a new road to Wasa was built to replace the former steep road up Tracy Creek. Some diamond drilling was done, and the face of the Estella crosscut was advanced to the vein zone at the end of 1950. Simultaneously a camp was built at the mill-site at Wasa, and construction of a mill started in the spring of 1951. Stope preparation was started in June, and milling commenced on November 1st, 1951.

The rocks at the mine are in the transitional zone between the Aldridge and Fort Steele formations. They are argillites and quartzites striking northwestward and dipping to the southwest. Intrusive into these is a diorite body, sill-like in over-all form but locally crosscutting the formation. A body of syenite occurs at the portal of the Estella adit. The lode is a zone of fracturing and light shearing, semi-bedded in the sedimentary rocks and penetrating diorite in the mine workings. The over-all structure appears to be simple, but the details are not known, and minor flexures and crumples seen on the surface may or may not influence the location of orebodies. The ore is a replacement by sphalerite, galena, and pyrite, accompanied by more or less silica. Vein quartz is not abundant, except in diagonal veins which in general contain little if any sulphides.

The sphalerite is pale coloured and is locally abundant. Galena is present in varying quantity. The silver content is rarely more than a few ounces per ton and appears to be associated predominantly with the galena. The ore contains cobalt, and for that reason the zinc concentrates are not acceptable at the electrolytic refinery at Trail. All of 109 mine samples taken by the Department of Mines were assayed for cobalt, and soluble cobalt was found in each ranging from 0.0007 to 0.06 per cent. The arithmetical average of the 109 samples was 0.0153 per cent soluble cobalt.

The workings consist of two adits, two shallow shafts, and several small surface workings (*see* Fig. 14). The lode has been traced at intervals for 750 feet on the surface, across a knoll which rises to an elevation of 6,700 feet. Some of the surface showings contain interesting mineralization but not in widths comparable to the main orebodies. Continuity of mineralization throughout the explored length is not indicated at the surface, although the vein has not been completely traced.

The Rover adit, elevation 6,250 feet, is 870 feet long on the course of the lode and follows the lode structure for 730 feet. The Estella adit, elevation 6,100 feet, is 890 feet long and follows the lode structure for 590 feet (*see* Fig. 14). The lode has an average dip of about 65 degrees to the southwest and ranges in width from a single fracture to a zone about 15 or 20 feet wide, apparently fading out to the southeast on the Rover level and to the northwest on the Estella; it is terminated by a fault in the southeast end of the Estella level.

Rover Level.—The Rover adit follows the lode from a point about 50 feet from the portal. The adit is in diorite at the portal, and diamond-drill hole No. 1 is in diorite, but from a point 240 feet from the portal the lode footwall is all in quartzites and argillites. On the hangingwall side, drill-holes Nos. 11, 12, and 14 are in diorite, but the remainder of the level, including drill-hole No. 17, is all in quartzites and argillites. The lode appears to be bedded in general and is definitely bedded at its southeastern termination.

The lode is faulted where first encountered. Beyond the fault a length of 320 feet (Block A) is imperfectly exposed by the old workings but contains the best grade and width in the mine. It is as much as 14 feet wide and narrows rapidly at the southeast end. Beyond Block A the lode ranges in width from a few inches to 2 or 3 feet, except for a swelling about 100 feet long in Block B, beyond which the lode narrows and passes into the bedding. The enlargement in Block B is partly at least due to a flattening of the lode, and the width is exaggerated by the flat dip. The lode narrows rapidly below the level in E-1 raise and is not explored above the level.

In the inner part of the level no lode structure is seen. Drill-holes Nos. 8 and 10, drilled at 25 and 32 degrees downward respectively, encountered material of ore grade 40 to 80 feet below the level. Hole No. 5, down at 30 degrees, encountered a 5-foot intersection of fair grade, but hole No. 9, flat, and hole No. 6, up at 32 degrees, did not encounter anything. This mineralization probably represents the upper fringe of the Estella orebody (Block C).

Estella Level.—The level reaches the main part of the lode 1,000 feet from the portal. This is the hangingwall of a stringer zone about 100 feet in horizontal width, consisting of poorly mineralized quartz stringers. The drift and all drill-holes northwest of the crosscut are in diorite, and the workings to the southeast are in quartzites and argillites. The diorite contact in the crosscut is about 60 feet north of the main drift. The stringers are most abundant in the contact zone between diorite and sediments.

Southeast of the crosscut the lode zone is increasingly well defined, and 65 feet from the crosscut it constitutes ore of low grade. From this point southeast to a displacive fault, sampling indicates a minable grade for a length of 255 feet (Block C), in spite of local low-grade sections. In the inner 40 feet of this distance the lode is well defined and well mineralized. A feature of this block is the number of steep cross-stringers of quartz that diverge from or cross the vein. A few mineralized subparallel stringers occur in the footwall, and one of these is followed in the first 40 feet of raise E-2.

Block D, 90 feet long between two faults, is exposed in drill-hole No. 17, a crosscut, and at a second fault. Raise E-4 follows this ore for about 75 feet up the dip, but the ore feathers out between 50 and 60 feet up, in black argillaceous rock. Block D is relatively rich in lead.

Northwest of the crosscut, raise E-1 in the footwall of the lode, encounters ore of narrow width in the uppermost 30 feet, in sediments, the bulge on the Rover adit narrowing abruptly 10 feet below that level. In August a raise E-5 (not shown on Fig. 14) was driven from the extreme northwest end of the drift, and a sublevel was being driven 95 feet on the dip below the Rover level, supposedly close to the bottom of Block A. The sublevel was being driven in the hangingwall of the ore, so opportunity for study was limited.

The mine was sampled by the Department of Mines in June, at the time the map was prepared. At that time the ore was not fully outlined on the levels, particularly in Blocks A and D. Since that time the Rover level has been slashed to improve the track, and drawpoints have been established in the footwall of the ore on both levels. Raise E-5 was driven, raises E-3 and E-4 were extended, and a sublevel was driven from E-5. The results of the sampling on June 20th, 1951, follow.

Block A was assumed to extend 50 feet above and 50 feet below the level on the basis of surface showings and raise R-1. Block B was assumed to extend 25 feet above and 25 feet below the level, a generous assumption in view of the apparent local nature of the bulge at the top of raise E-1. Block C was assumed to extend 50 feet above and 50 feet below the level, the indication of ore in drill-holes higher than this figure being probably offset by the ragged nature of the northwestern end of the block; the extent below the level was completely unknown. Block D was assumed to extend 50 feet above and 50 feet below the level, the upper limit being roughly substantiated by raise E-4.

Samples were taken at 5-foot intervals in Block C, where opportunity offered in Blocks A and D, and at 25-foot intervals in Block B. Raises R-1, E-1, and E-4 were sampled. Continuity of mineralization was assumed to extend to the indicated structural limits of the lode in places where the lode was not fully exposed; in such instances the grade was estimated from the results of near-by sampling. The ore was calculated as follows, no allowance being made for dilution:—

Block	Tons	Length	Width	Silver	Lead	Zinc
Rover Level		Feet	Feet	Oz. per Ton	Per Cent	Per Cent
A	26,200	320	7.1	2.0	6.6	24.4
B	3,500	235	2.9	2.2	5.8	19.1
Estella Level						
C	12,700	255	4.1	0.5	1.8	11.0
D	5,400	90	5.2	4.2	11.6	12.0
Total	47,800					
Average grade			5.8	1.9	5.8	19.0

The above figures represent tonnage that is not fully blocked out but is nevertheless reasonably well assured. Development by August 12th, 1951, did not alter this picture.

The Estella mine camp, Tracy Creek.

The reasons for localization of ore within the lode are not understood. Ore is seen to occur in diorite, in soft grey argillite, and in quartzite, but in some parts the intensity of silicification and of mineralization makes it difficult to determine the character of rock being replaced. On the average the lode is bedded, but locally it crosses the bedding at a small angle as in raise E-4, where the lode passes into apparently less favourable rocks.

Relatively flat sections of the lode occur and have some bearing on ore localization—in Block B a flat roll in the lode produces a prominent bulge and in the top of raise E-4 the lode feathers out into flat stringers. The known orebodies may all have a flat rake, but the matter is not yet proved. Block A may be related to the diorite contact which plunges at a low angle to the southeast.

Diamond-drill hole intersections of promising grade are reported to have been obtained from surface holes southeast of the mine workings. With the present lack of knowledge concerning localization of ore and particularly the rake of oreshoots, it is impossible to calculate additional tonnage on the basis of these intersections.

The flow-sheet of the 150-ton mill is as follows: 300-ton coarse-ore bin; 24- by 18-inch Allis Chalmers jaw crusher; conveyor to Dillon screen and 3-foot Symons cone crusher; conveyor to 270-ton fine-ore bin; 7- by 8-foot Allis Chalmers ball mill and 54-inch Akins classifier; six Denver flotation cells in lead circuit; 6- by 6-foot Denver conditioner; ten Denver flotation cells in zinc circuit; 20- by 10-foot and 26- by 10-foot Denver thickeners delivering lead and zinc concentrates to a 6-foot 8-disk Oliver filter. Concentrates are loaded from bins direct to gondola cars on railway spur.

At the end of 1951 the mill was treating 150 tons per day, seven days a week. Lead concentrate was shipped to the Trail smelter. Zinc concentrate was bought by British Metals Corporation and smelted at Bartlerville, Okla.

A crew of 130 was employed, including fifty men underground and nine mill operators.

WINDERMERE (50° 116° S.E.)*

Silver-Lead-Zinc

Paradise (Sheep Creek Gold Mines Limited)

The Paradise mine is at the head of Spring Creek, at an elevation of about 7,800 feet. The mill-site is at Jackpine Flat on Toby Creek, 12 miles from Lake Windermere Station. The ore is hauled from the mine 7½ miles to the mill by truck. Square-set stoping continued, and by midsummer of 1951 most of the main orebody above 7800 level had been mined. Unmined blocks of ore existed southeast of the main orebody on 7900 and 7930 levels. The largest block of ore, about one-third of the known resources, lay below 7800 level in the vicinity of the old winze. A drift 80 feet down the 45-degree winze below 7800 level was driven 85 feet to the southeast, to the bottom of a new winze which was nearly completed by the end of the year. A few feet of work was done on the 7700 level, which in 1950 had reached the outer ore zone but had not encountered ore.

Development: Development drifting, 75 feet; crosscutting for stope fill, 328 feet; sinking in winze, 106 feet; rope raise, 75 feet.

A crew of forty men was employed under the direction of F. R. Thompson, twenty-four at the mine and sixteen at the mill.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1949, pp. 196–199; 1950, pp. 156, 157.]

Mineral King (Sheep Creek Gold Mines Limited)

This property, on the north side of Toby Creek and west of Jumbo Creek, 26 miles from Invermere, is controlled by Sheep Creek Gold Mines Limited. Work was restricted to repairing and extending the road from Jackpine Flat. Five bridges were rebuilt, one was redecked, and 2¾ miles of new road was built. The showings had very nearly been reached by the end of 1951. F. R. Thompson was in charge.

Delphine.—This property is on Delphine Creek, 22 miles from Invermere. Six diamond-drill holes were put down under the direction of W. H. Patmore, of Vancouver.

* By M. S. Hedley.

SPILLIMACHEEN (50° 116° N.E.)*

Lead-Zinc

Silver Giant (Giant Mascot Mines Limited) Company office, 908 Royal Bank Building, Vancouver; mine office, Spillimacheen. B. H. Gunning, managing director; P. W. MacMillan, mine manager. This company is a merger, effected May, 1951, of Hedley Mascot Gold Mines Limited and Silver Giant Mines Limited. Authorized capital: 3,000,000 shares, $1 par value. Giant Mascot issued one-year 3-per-cent production notes to provide working capital of $165,000. The Silver Giant is an old property in the Spillimacheen valley 8 miles by road from Spillimacheen.

A 200-ton mill was completed in February and production started on February 26th, 1951. Camp buildings and facilities were increased during the year. The mill is powered by a diesel plant. The mill flow-sheet is as follows: From a 100-ton coarse-ore bin the ore is conveyed by a 24- by 10-inch Jeffrey pan conveyor to a 20- by 24-inch Traylor type A jaw crusher and thence by a 24-inch by 112-foot conveyor to a 3- by 6-foot Niagara screen and a 3-foot Traylor TZ gyratory crusher. The fine ore from the 175-ton fine-ore bin is fed to a 7- by 5-foot Traylor ball mill in closed circuit with a No. 500 Denver unit cell and a 4- by 23-foot Dorr converted multizone classifier. The classifier overflow goes to six Denver flotation cells, from which the concentrates go to a 20- by 8-foot Denver thickener and an Oliver filter. A bulk lead-zinc concentrate is made; no attempt has been made to make a zinc concentrate from the approximately 1-per-cent zinc content of the ore. The ore is fine grained in a barite and silica gangue.

All ore is drawn through the lowest or No. 6 adit level. Ore transfer and service raises have been driven up to No. 3 level, the service raise being beneath the ore zone at an angle of 47 degrees. The ore zone is not sharply defined but was well explored by diamond drilling by Siscoe Gold Mines Limited in 1948–49. Shrinkage stopes were laid out in the light of this drilling above Nos. 5 and 6 levels, and chutes were provided at numerous drawpoints. The work was well organized by midsummer.

Development work included 913 feet of raising and 326 feet of drifting and crosscutting. In addition, 477 feet of exploratory driving was done on No. 6 level. At the end of December, 1951, the mill was treating about 170 tons per day.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1949, pp. 200–204.]

FIELD (51° 116° S.E.)†

Silver-Lead-Zinc

Monarch and Kicking Horse (Base Metals Mining Corporation Limited) Head office, Room 413, 62 Richmond Street West, Toronto. E. J. Gleason, manager; C. S. Ney, geologist and mine superintendent; V. C. Segur, mill 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 plant, the mill, and the camp are on the Monarch or railway side of the valley and the Kicking Horse is on the opposite side. Ore from the Monarch is delivered to the mill by aerial tram and that from the Kicking Horse is hauled by truck.

The mill operated intermittently all year. Mining of the east Monarch orebody continued, some of the ore being less continuous than it had been in the past. Late in 1951 work was resumed in the west Monarch orebody for the first time in several years, with a view to mining zincy remnants on the margins of the body and to investigating the possibility of extensions.

* By M. S. Hedley.
† By J. W. Peck and M. S. Hedley.

At the Kicking Horse mine the gravity aerial tram continued to operate from a portal at 4,730 feet elevation to the bin at 4,100 feet. A surface incline 1,139 feet long, with two 2-ton skips in counterbalance, was built to a new low level at 4,610 feet elevation. Operated under power, this tram will transport men and obviate the climb by trail to the workings. The new level is beneath the east orebody and will facilitate exploration and development.

Development at Monarch: Drifting and crosscutting, 1,141 feet; raising, 616 feet; diamond drilling, 3,729 feet.

Development at Kicking Horse: Drifting and crosscutting, 1,841 feet; raising, 381 feet; diamond drilling, 3,196 feet.

Sixty men were on the payroll at the end of 1951.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1949, p. 205.]

KINBASKET LAKE (51° 118° N.E.)*

Silver-Lead-Zinc

Mogul and Timbasket (The Consolidated Mining and Smelting Company of Canada, Limited)

This group of two Crown-granted and twenty-six located claims and fractions is on the west shore of Kinbasket Lake. It is under option from Kootenay Exploration Limited and was mapped and diamond drilled in 1951 under the direction of R. G. McEachern. The claims are on the very steep timbered mountainside above the lake and are reached by boat. A tent camp was erected on the shore. Galena ore was discovered and development work was done in the 1890's, but the Crown-granted claims lay idle for many years until attention was again turned to them in 1948. The original showing consisted of galena in quartz, but the recent work has been on replacement of limestone by sphalerite and galena. The rocks are strongly metamorphosed quartz-mica and garnetiferous schists and limestone, complexly folded. The average dip is about 50 degrees into the mountainside. The showings are 300 to 400 feet above lake level.

The original discovery is in quartzite and quartz-mica schist in the apex of a sharp fold surrounded by crystalline limestone estimated to be 100 feet or more thick. Quartz masses roughly follow the bedding but also break across it in the fractured apex of the fold in quartzite. An adit is driven 25 feet to the southwest across the main concentrations of quartz, and a branch 16 feet to the northwest reaches a shaft about 25 feet below the collar. A length of about 40 feet of quartz lenses in quartzite is exposed on the northwesterly limb of the fold, in masses up to 6 feet wide and making up about half the material encountered by the adit. Coarsely cubic galena occurs in masses as much as 2 feet across. Stripping for 100 feet to the northwest shows the same quartz zone about 3 feet wide and containing some galena.

Limestone in the northwesterly limb of the same fold is acutely dragfolded and appears to terminate in a series of sharp fingers about 1,000 feet northwest of the main fold. Continuity farther to the northwest had not been established, but it is probable that the limestone is greatly thinned by squeezing, and the continuation of it is not readily seen. Replacement by sphalerite and galena occurs over much of this distance, in thin bands up to 3 or 4 inches wide, and in local aggregates of such bands across widths of several feet. Mineralization is apparently concentrated in the dragfold "fingers." Diamond drilling in progress in August had not yet demonstrated continuity in detail of these sulphide bands, nor aggregates wider or of better grade than those exposed by surface stripping. The option was dropped in December, 1951.

* By M. S. Hedley.

REVELSTOKE*

Silver-Lead-Zinc

Regal Silver, Snowflake (Columbia Lead and Zinc Mines Limited) (51° 117° S.W.) Company office, 850 West Hastings Street, Vancouver; mine office, Albert Canyon. C. A. Campbell, president; W. B. Blair, manager. Capital: 2,500,000 shares, 50 cents par value. This company was formed to acquire from Stannite Mines Limited the Regal Silver and Snowflake properties on Clabon Creek, 7½ miles by road from Silver Creek Siding on the Canadian Pacific Railway 19 miles east of Revelstoke. As in 1950, work was restricted to the Regal Silver, which is below the Snowflake on the same vein system. In the Regal Silver mine, quartz sulphide veins in slate are developed by six adits, Nos. 5 to 10. No. 7 level, which was driven in 1950 as a sublevel from a raise above No. 8 level, was driven through to surface during 1951. About 350 feet of drifting was also done on this level in the opposite direction on the Upper Five vein. On No. 6 level about 250 feet of drifting was accomplished, and a break-through was made to the main raise from No. 8 level. On No. 9 level a crosscut was started towards Six vein but was stopped after being driven 40 feet of an estimated 240 feet. The best lead-zinc mineralization is exposed in the Upper Five vein on No. 5 level, from which ore was shipped during 1950. About 2,500 feet of diamond drilling was done on Nos. 5, 6, and 7 levels, mainly to explore and block out tonnage on this vein. A new adit, No. 4, was collared on the vein 145 feet above, but no drifting was done during 1951. From the stope on the Upper Five vein on No. 5 level, some ore was sacked for shipping to the Trail smelter. On the lowest, or No. 10, level, diamond drilling was done to test the parallel Six vein.

The camp at the portal of No. 10 adit was improved by building two new bunkhouses and a change-house. The cook-house was also enlarged. New machinery consisted of a 10-kw. Ruston lighting plant and a G.M.C. diesel driving a 350-cubic-feet-per-minute compressor. The present camp-site is, however, in an impractical position due to snowslide topography on each side. A new camp-site was cleared 1½ miles south, at the confluence of Clabon and Woolsey Creeks, at a location called Bell Point. Three dwellings had been erected by November. About twenty-five men were employed at the end of 1951.

Waverley-Tangier (Albert Canyon Syndicate) (51° 117° S.W.) An effort was made to reopen this old property at the head of Tangier Creek and of the north fork of Downie Creek. The property is reached from Albert Canyon on the Canadian Pacific Railway by a road 28 miles long. About 6 miles of road was rehabilitated before forest fires on Tangier Creek shut down operations.

Mastodon Zinc Mines Limited† (51° 118° S.E.) Head office, 844 West Hastings Street, Vancouver; mine office, Revelstoke. H. W. Knight, president; D. F. Kidd, vice-president and managing director; S. A. Perry, Andrew Robertson, Karl J. Springer, directors; J. A. Pike, mine manager. This extra-provincial company is a subsidiary of Golden Manitou Mines Limited; head office, 330 Bay Street, Toronto. Capital: 3,000,000 shares, $1 par value. Golden Manitou owns 50 per cent interest.

The property is about 25 miles north of Revelstoke on the divide between La Forme Creek and Carnes Creek. A road leaves the Big Bend Highway at Mile 17 and follows La Forme Creek 4½ miles to the mill-site. A trail climbs steeply out of the valley and continues about 2 miles north to the mine.

No. 3 level drift, 180 feet long at the end of 1950, was extended to a total length of 530 feet from the end of the 820-foot crosscut. A subparallel drift, 90 feet in the hangingwall of the first, was driven for 120 feet by early summer of 1951. A raise for

* By J. W. Peck, except as noted.
† By M. S. Hedley.

service and ventilation was driven to connect with the winze on No. 2 level, and a raise on ore was started. Work was concentrated on road, mill, power plant, and camp construction. Development at the mine was slow because of the inadequacy of the power plant, which could not readily be augmented until better access was provided to the mine. The former method of hauling supplies to the top of the steep rise was by dragging a light steel skip directly up the hillside with a gasoline hoist.

Development on No. 3 level to date has disclosed a band of ore between 175 and 200 feet long and as much as 16 feet wide, only locally exposed for the full width. A weaker, discontinuous zone is 90 feet in the hangingwall. The ore consists dominantly of sphalerite replacing dolomite or dolomitic limestone and is related in part to oblique fissuring. There is evidence in the mine workings of extreme deformation, including acute dragfolding, and strong shearing and attenuation of some rock members. Much of the limestone is dolomitic, and locally the dolomitization has obliterated all trace of the original structure. The amount of the dragfolding is not known, nor to what extent the ore may be related to it, so that continuity of ore has still to be proved. Some of the ore is very high grade, relatively massive sphalerite occurring across widths of several feet locally. Galena is restricted and is readily seen only in certain parts of the mine.

Work was started on construction of a surface railway 9,000 feet long from the mine to the edge of the steep slope and on construction of a surface incline rising 1,400 feet at 37 degrees from the 150-ton mill. The mill camp, of which two bunk-houses, staff house, and cook-house were completed by the end of 1951, was designed to accommodate the entire crew, the men to be transported between camp and mine daily. The building of a 1,000-horsepower hydro plant in La Forme Creek canyon was in progress at the end of 1951. From a dam farther up the creek, 10,000 feet of 2-foot diameter pipe was laid to provide a 600-foot head at the power-site. By November the crew had been increased to 130, with only three employed underground.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1950, pp. 159–166.]

SKAGIT RIVER (49° 121° S.E.)*

Copper

A.M. (Canam Copper Company Limited) Company office, 571 Howe Street, Vancouver. J. W. Heffernan, president. This group of eight Crown-granted claims is about 7 miles by truck-road south of Mile 30 on the Hope–Princeton Highway. On No. 6, the lowest, level, at about 5,000 feet elevation, six short drill-holes were drilled in a westerly direction at intervals along the south drift in order to sample the mineralized breccia zones in that area. Six men were employed.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1929, pp. 241, 242; 1938, pp. F 19, F 20.]

CHEAM RANGE (49° 121° S.W.)*

Copper

Lucky Four (Rico Copper Mines Limited) Company office, 210, 1155 West Pender Street, Vancouver; mine office, Laidlaw. William J. Asselstine, president; D. C. MacKechnie, manager. During 1951 surface and underground diamond drilling and underground development were carried on. An adit at an elevation of 5,970 feet near the northwest corner of the Lucky Four No. 4 claim and nearly 300 feet below the main showing was advanced in 1951. Forty feet of crosscutting and 440 feet of diamond drilling were done in the adit. Surface diamond drilling totalled 2,096 feet.

* By R. B. King.

LYNN CREEK (49° 123° S.E.)*

Zinc

Lynn Creek Zinc Mines Limited

This property has been optioned by Graham-Bousquet Gold Mines Limited, 85 Richmond Street West, Toronto. B. I. Nesbitt, manager. The property is on Hanes Creek, a tributary of Lynn Creek, and is about 8 miles from the mouth of Lynn Creek. During 1951 the work done on the property consisted of cutting out existing trails, cleaning out open-cuts and pits, and rehabilitating adits. Sampling and geological mapping were carried on in conjunction with this work.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1913, pp. 307–309; 1917, p. 208.]

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. Sharp, president; E. C. Roper, manager; T. M. Waterland, mine superintendent. This company owns and operates Britannia mine and mill at Britannia Beach. The following data, supplied by the management, give details of the operation in 1951. The development work totalled 12,236 feet for all sections of the mine and was made up as follows:—

	Jane Mine	No. 8 Mine	Bluff Mine	Fairview Mine	No. 5 Mine	Victoria Mine	Total
	Feet	Feet	Feet	Feet	Feet	Feet	Feet
Drifts	949	1,135	467	1,059	886	....	4,496
Crosscuts	1,301	211	120	520	255	....	2,407
Raises	412	878	1,524	1,357	1,038	61	5,270
Winzes	......	6	15	....	....	....	21
Powder-blast workings				42	....	....	42
Totals	2,662	2,230	2,126	2,978	2,179	61	12,236

Diamond drilling for core and for blast-hole mining totalled 63,284 feet and was made up as follows:—

	Jane Mine	No. 8 Mine	Bluff Mine	Fairview Mine	No. 5 Mine	Victoria Mine	Daisy Mine	Total
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
Core-drilling	1,611	10,233	3,100	2,010	356	1,408	2,730	21,448
Blast-hole drilling	..	.	28,120	11,749	....	1,967	....	41,836
Totals	1,611	10,233	31,220	13,759	356	3,375	2,730	63,284

Ore was broken in the various sections of the mine by different mining methods, as follows:—

	Shrinkage	Cut and Fill	Powder-blast and Cave	Blast-hole by Diamond Drill and Tungsten-carbide Bits	Open Square Set	Square Set and Fill	Total
	Tons	Tons	Tons	Tons	Tons	Tons	Tons
No. 8 mine	39,015	....	....	....	7,829	100,779	147,623
Bluff mine	....	....	210,638	128,664	....	....	339,302
Fairview mine	11,831	....	98,246	128,427	....	....	238,504
No. 5 mine	8,570	. .	....	....	....	9,778	18,348
Victoria mine	19,693	8,974	....	4,252	14,489	....	47,408
Totals	79,109	8,974	308,884	261,343	22,318	110,557	791,185
Development	. ..	....	....		....	....	11,926
Total	....	. .	....	....	....	....	803,111

* By R. B. King.

Explosives and blasting accessories used were as follows: Powder, 17,701 cases; No. 8 electric blasting-caps, 5,184; No. 6 blasting-caps, 300,666; safety fuse, 2,400,480 feet; primacord, 66,700 feet.

An active underground ventilation programme has been under way all year. A new ventilation set-up for the No. 8 mine is nearing completion.

The safety department working with the Management-Labour Accident-prevention Committee conducted an extensive accident-prevention campaign throughout the year. Groups of employees meet regularly underground for safety instruction. The use of sound movie films was introduced.

First-aid training programmes were continued and sound slide equipment was tried out for future use in these programmes. The annual competition for the Department of Mines First-aid Cup was held during the early spring. The winning team was sent to Victoria to the Victoria Annual Field Day competition. The Britannia mine-rescue team won the British Columbia Department of Mines Shield at Lillooet.

A supervisor's safety bonus plan was started this year to encourage each supervisor to strive for a 100-per-cent safety record. The Britannia 1951 safety record shows an improvement in both the severity and frequency rates. Compensable injuries occurred at the rate of 0.587 per 1,000 shifts worked in 1951, as compared to 0.859 per 1,000 shifts in 1950. The severity rate was 34.4 per 1,000 shifts in 1951, as compared to 39.7 per 1,000 shifts in 1950. Two fatalities occurred in the mine in 1951.

The total number of men on the mine payroll at the year-end was 584. The total number of shifts worked in the mining department during 1951 was 149,930, as compared to 144,225 in 1950.

The total production of all mines during 1951 was 796,566 dry tons, as compared to 858,698 dry tons in 1950.

TEXADA ISLAND (49° 124° N.W.)*

Gold-Copper

Little Billie (Vananda Mines (1948) Limited)

Company office, 640 West Pender Street, Vancouver; mine office, Vananda. A. E. Jukes, president. The Little Billie mine is almost half a mile southeast of Vananda on the east shore of Texada Island. The workings consist of a shaft 620 feet deep serving six levels spaced at irregular intervals. The levels are driven southerly to explore an irregular limestone-diorite contact. Orebodies are mined by shrinkage stoping. In May, 1951, mining of ore was stopped, and, until September, broken ore was removed from the mine and shipped to the Tacoma smelter.

In October a contract was let for a drive to intersect the lowest level of the Copper Queen workings. At the end of the year the drive was within 400 feet of its objective.

Development on No. 6 level: Crosscutting, 631 feet; raising, 40 feet; diamond drilling, 1,949 feet.

Stoping: No. 20 orebody, 5,125 tons; No. 30 orebody, 4,215 tons; No. 50 orebody, 14,055 tons; total, 23,395 tons.

Average grade of ore shipped: Gold, 0.178 oz. per ton; copper, 1.41 per cent.

Iron

Texada Mines Limited

Gillies Bay (49° 124° N.E.). Mine office, Vananda. Bruce Alexander, mine manager. In June, 1951, this company started to explore by diamond drilling the magnetite deposits on the Prescott, Paxton, and Lake properties at Gillies Bay, Texada Island. Seventeen holes were drilled, and a sufficient tonnage of magnetite was outlined to warrant further work. At the end of the year, roads were being built, foundations for a magnetic separator were laid out, and docking facilities were being prepared.

[References: *Geol. Surv., Canada,* Iron ores of Canada, Vol. 1, British Columbia and Yukon, pp. 86–100. *Minister of Mines, B.C.,* Ann Rept., 1916, pp. 298–300.]

* By R. B. King.

VANCOUVER ISLAND*

ELK RIVER (50° 127° S.E.)

Iron

Quatsino Copper-Gold Mines Limited

Company office, 572 Howe Street, Vancouver 1. This property of fifty-one Crown-granted and seven located claims is on Elk River in the northern part of Vancouver Island. In 1949 a large magnetite body was discovered on the Merry Widow No. 5 claim (Lot 1533), and in 1950, 1,070 feet of diamond drilling was done on this outcrop. In 1951 a crew of eight men was employed to drill twenty-eight vertical holes spaced at 50-foot centres on a grid pattern. Total drilling amounted to 4,228 feet, with each hole averaging 150 feet in depth. A preliminary survey was conducted to determine a route for a haulage road to Quatsino Sound.

ZEBALLOS (50° 126° N.W.)

Gold

Privateer Mine Limited

William Bowen and O. Torgerson, leasing the Privateer property, cleaned out ore-passes and mined small pillars in the underground workings. A small mill with a capacity of about 5 tons per day produces jig concentrates, table concentrates, blanket concentrates, and amalgam. The concentrates are amalgamated and then shipped to the smelter at Tacoma. The amalgam is retorted, and the gold recovered is shipped to the Royal Mint.

Iron

Anyox Metals Limited

Company office, 626 West Pender Street, Vancouver. Alexander Smith, field manager. This company, a subsidiary of Ventures Limited, controls a group of claims on the northwest side of the Zeballos River at the headwaters of Blacksand Creek. Five Crown-granted and two recorded claims are leased from the Ford Iron Syndicate, and agreements transferring all rights in iron ore are held on five adjoining Crown-granted claims owned by A. Morod and R. V. Murphy. The company also holds one recorded claim.

During the year 4,308 feet of diamond drilling was done on two bodies of magnetite. On the larger body seven flat holes were drilled in a southwesterly direction and three down holes were drilled from the hangingwall at angles ranging from 50 to 70 degrees in a northeasterly direction. Five flat holes were drilled in the second body of magnetite.

Churchill

This group of claims is at the headwaters of Lime and Fault Creeks, about 3½ miles from Zeballos. The magnetite showings are at an elevation of 3,500 feet. The Argonaut Co. Ltd. optioned the group from Charles N. Pretty, of Vancouver, and in September and October drilled twelve diamond-drill holes totalling 817 feet.

[Reference: *B.C. Dept. of Mines,* Bull. 27, 1950, pp. 131–134.]

MUCHALAT ARM (49° 126° N.E.)

Zinc

Danzig (Spud Valley Gold Mines Ltd.)

Company office, 525 Seymour Street, Vancouver. W. B. Milner, president; D. Wilmot, mine manager. The property is on the south side of King Passage in Muchalat Arm, about 15 miles by boat from Nootka. In July, 1951, a portable plant was installed to do some development work in the Silverado adit on U.P. Fraction (Lot 1589). At the end of the year the north drift had been advanced nearly 210 feet and the south drift nearly 50 feet. Additional exploration included drilling eleven holes from the adit totalling 679 feet and twelve holes from the surface totalling 2,098 feet.

* By R. B. King, except as noted.

HEAD BAY (49° 126° N.W.)

Iron

Glengarry and Stormont

C. B. Aitchison, Jr., of Tokyo, Japan, has optioned this group of claims from Canadian Collieries (Dunsmuir) Limited and has retained Wood and McClay Limited to supervise development work. The claims are nearly 1 mile by foot-trail north of Head Bay on Tlupana Arm. Surface exploration and diamond drilling were done during the summer of 1951. Sixty-eight vertical holes totalling 4,170 feet were drilled.

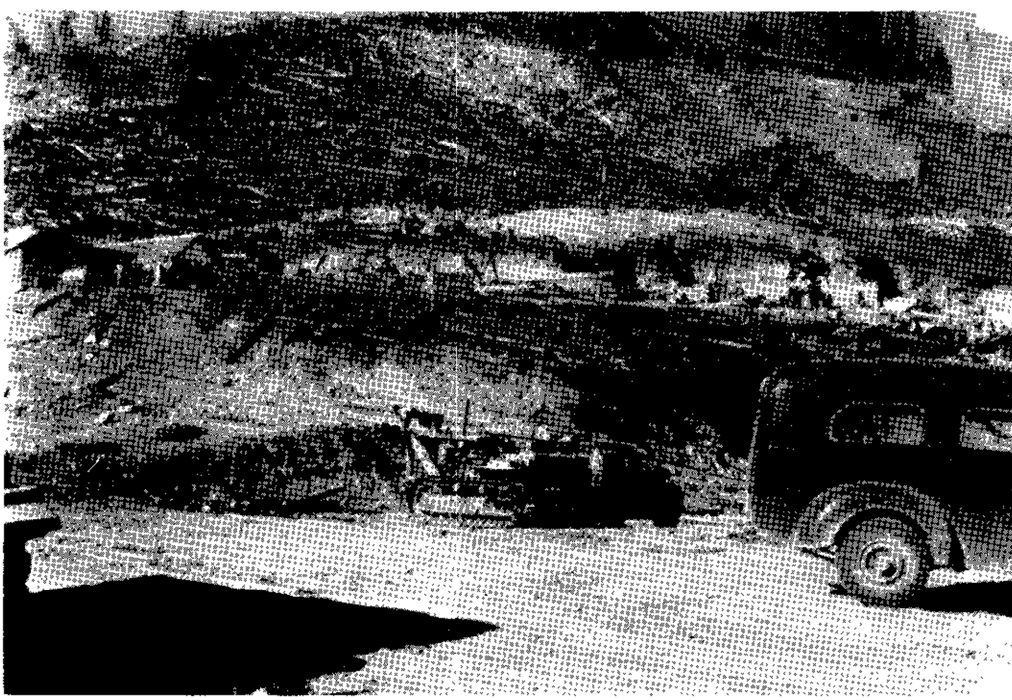
[References: *Minister of Mines, B.C.,* Ann. Rept., 1916, p. 293. *Geol. Surv., Canada,* Iron ores of Canada, Vol. 1, British Columbia and Yukon, pp. 231–235.]

QUINSAM LAKE (49° 125° N.W.)*

Iron

Iron Hill (The Argonaut Co. Ltd.)

Company office, 736 Granville Street, Vancouver; mine office, Campbell River. M. E. Broan, manager. The Iron Hill property is on Iron Hill, near Upper Quinsam Lake, and is nearly 24 miles by road from Campbell River. In January, 1951, preliminary surveys and diamond drilling were carried out on this property. In March construction started on a 23-mile long road, with minimum width of 30 feet, from the present dock-site to the property. Loading facilities and dock were built at tide-water just north of Campbell River. Construction of a magnetic concentrator was also started. The first shipment of 9,435 long tons of iron ore was made by September 1st, 1951. Mill construction was nearly completed by the end of the year.



Start of quarrying operations at Iron Hill, Upper Quinsam Lake.

Ten open-pit levels, spaced at 30-foot intervals from 1,550 to 1,820 feet elevation, are used to strip limestone and mine iron ore. Rock is drilled by wagon drills, blasted, and loaded by two 2½-cubic-yard diesel-driven shovels into fifteen 1-cubic-yard end-

* By R. B. King.

dump trucks. Waste or stripping material is trucked to waste dumps and ore is trucked to the mill-bin.

Ore is reduced to –8 inches in size in the primary crusher and is delivered to a crushed-ore bin. The ore is then fed to a vibrating grizzly and a double-deck Mesabi screen, making in all four sized products which are fed to nine belts equipped with magnetic pulleys. Concentrates from the magnetic separators go to the shipping-bin, tailings go to waste, and a middling product is sized and is recrushed in two secondary crushers before it is returned to the crushed-ore bin. Ore is trucked by 60-ton truck trailer units to the loading dock.

The following figures were supplied by the company: Diamond drilling, 8,572 feet; stripping, 234,430 cubic yards; ore mined, 189,225 long tons; concentrates hauled to dock, 102,526 long tons; tons stripped but not mined, 101,371 long tons.

Iron River

This property in Block 242, Comox Land District, is about 1½ miles from the mouth of Iron River, which empties into Quinsam River. The Argonaut Co. Ltd. drilled eight holes totalling 1,591 feet to investigate magnetite deposits on the property.

[Reference: *Geol. Surv., Canada,* Iron ores of Canada, Vol. 1, British Columbia and Yukon, pp. 71–73.]

Duncan (48° 123° N.W.)

Twin J (Vancouver Island Base Metals Limited)

Company office, Credit Foncier Building, Vancouver. C. Rutherford, mine manager; C. H. Hewat, mine superintendent. The Twin J mine on Mount Sicker, near Duncan, was operated throughout 1951. All development and mining were confined to the levels above the 300-foot level. The mill was started in June, and 9,146 dry tons of ore was milled to the end of the year. Copper, zinc, and lead concentrates were recovered. The total development work as reported by the company was: Drifting and crosscutting, 726 feet; raising, 618.5 feet; diamond drilling, 477 feet. The average number of men employed was forty-five.

East Sooke (48° 123° S.W.)*

During the spring of 1951 about fifty mineral claims on Sooke Peninsula were relocated by A. and H. Stretton and W. M. Cooke, of Victoria; Frank Cooke, of Burnaby; and Wilfred A. Gray, of Port Arthur, Ont. Between May 10th and November 22nd magnetic and electromagnetic surveying, geological mapping, and diamond drilling of selected areas were done under the immediate direction of P. A. Chubb, of Whitby, Ont. Shear zones which cut the East Sooke gabbroic intrusive were delimited by the geophysical surveys, and areas in the shear zones which appeared favourable for copper mineralization were diamond drilled.

The copper deposits explored during the summer are within the western half of Sooke Peninsula, about 15 miles west of Victoria. Descriptions of several of the mineralized zones appear in the British Columbia Minister of Mines' Annual Report for 1948 (pp. 162–170), and only recent developments will be described here.

Merryth Zone.—The Merryth zone, at the south end of Iron Mine Hill, was explored geophysically and by diamond drilling. Sulphide-bearing hornblendite of the mineralized zone is exposed on the south shore of the peninsula in the form of a narrow, southward-trending promontory bounded on the east and west by chasms eroded by waves along shear zones. Five holes were drilled to intersect the zone beneath the sea south of the mineralized exposures on the promontory. No. 1 hole, drilled westward, inclined downward at 55 degrees, intersected a sulphide-bearing zone an estimated 50 to 150 feet below sea-level beneath the south end of the promontory. No. 2 hole, drilled southwestward, inclined downward at about 45 degrees, cut a similar zone at

* By J. T. Fyles.

about the same depth 150 feet south of No. 1. No. 3 hole, drilled westward, inclined downward at 55 degrees, cut a sulphide zone at a depth of 150 to 200 feet below sea-level 300 feet south of No. 1. Two other drill-holes (Nos. 11 and 12) cut altered shear zones about 600 and 800 feet south of No. 1 hole. The altered shear zones in these two holes, however, contained very little sulphide. In No. 1 hole about 100 feet of sulphide-bearing core was obtained, in No. 2 about 50 feet, and in No. 3 about 100 feet. In the sulphide-bearing zones the cores are mainly pyrrhotite, pyrite, chalcopyrite, magnetite, and altered gabbro. Pyrrhotite commonly makes up more than 50 per cent of the core over lengths of several inches, and both pyrrhotite and altered gabbro are cut by fine veinlets of chalcopyrite and pyrite. Magnetite is disseminated throughout most of the gabbro but is more abundant near the sulphide zones. The grade of the copper mineralization encountered in the three drill-holes appears to be about the same as that on the promontory.

Main Valley Zone.—The prominent northward-trending valley east of Iron Mine Hill, separating the hill from the rest of Sooke Peninsula, appears to be the surface expression of a drift-covered shear zone. It has been termed the Main Valley zone. Small amounts of sheared and altered gabbro are exposed at the north and south ends of the valley. Magnetometer and electromagnetic surveys of most of the valley were made, and on the evidence obtained from them, one hole was drilled near the south end of the valley about 700 feet from the sea. The hole intersected about 30 feet of altered gabbro but showed no copper mineralization.

Hill Zone.—Copper mineralization was explored many years ago by a short adit and an open pit on the northwest side of Iron Mine Hill about 500 feet north and 200 feet east of the end of the East Sooke public road. Electromagnetic, magnetometer, and geological surveys, in the summer of 1951, disclosed that the mineralization lies in a northward-trending shear zone, known as the Hill zone, which extends about 1,000 feet north from the workings to the sea and probably about 200 feet south of the workings. Three drill-holes—No. 1, 40 feet north of the adit, No. 2, 450 feet north of the adit, and No. 3, 800 feet north of the adit—were drilled eastward into the hill, inclined downward at about 45 degrees. All three intersected sulphide-bearing altered gabbro—No. 1 from footages 27 to 129, No. 2 from 138 to 158, and No. 3 from 121 to 160. Most of the sulphide-bearing core appears to contain less chalcopyrite than core from the Merryth zone. Mineralization of the altered gabbro is similar to that of the other zones, pyrrhotite being cut by fine veinlets of pyrite and chalcopyrite. In places fine flakes of native copper are present, and magnetite is locally abundant.

Cooke Zone.—Old workings on the Willow Grouse and Blue Bird mineral claims, northwest of Mount McGuire, exposed copper mineralization in shear zones adjacent to a narrow, southwesterly trending valley. The valley is thought to be the surface expression of a major shear zone, known as the Cooke zone. During the summer of 1951 magnetometer, electromagnetic, and geological surveys were made from the shaft on the Willow Grouse claim for 4,500 feet southwest along the valley to within 350 feet of the Main Valley zone.

Two holes were drilled near the shaft to test the main shear zone beneath the drift-covered valley bottom. No. 1, about 100 feet south of the old shaft, was drilled north 25 degrees west, inclined downward at about 55 degrees, to a length of 195 feet. It intersected a little altered gabbro but no sulphide. No. 2 hole, about 170 feet south of the old shaft, was drilled south 25 degrees east, inclined downward at about 45 degrees. Throughout its length of 100 feet the core was relatively unaltered gabbro containing no sulphides.

Placer-mining

CONTENTS

INTRODUCTION

The summer of 1951 was extremely dry, and placer-mining in all areas was hampered because of insufficient water for sluicing.

ATLIN*

Spruce Creek (59° 133° N.W.)

Noland Mines Limited

J. D. McNeil, manager. This underground placer mine was worked throughout the year. Development work continued to the east, but production came from pillars in a previously developed area which extends about 3,000 feet east of the shaft. It is planned to mine the remainder of these pillars and then to sink a shaft about 4,000 feet east of the present one. The new workings will be larger than many of the old drifts in the present working area and will be laid out so that the mine may be more mechanized. It is hoped thereby to increase the yardage mined daily.

In 1951 about 90 cubic yards of gravel was mined per day of two working shifts. Drifting and crosscutting totalled 9,745 feet. The gravel mined amounted to 22,299

* By J. H. Bennett.

cubic yards in place, from which 11,938 fine ounces of gold and 1,978 fine ounces of silver were recovered. The number of men employed averaged about fifty-five.

Enterprise Placers John M. Acheson, Clyde B. Day, and Floyd M. Wilson leased ground on Spruce Creek from Spruce Creek Placers Limited. A diesel shovel was used to feed gravel into the sluice-boxes, and a dragline was used to remove tailings. A drain was dug before sluicing was started about July 10th. About 42,500 cubic yards of material was moved in digging the drain. Slightly more than 70,000 cubic yards of gravel was washed, and from this 2,367 ounces of gold was recovered.

Duncan K. Falconer did some drifting on his lease.

Albert and Otto Miller shovelled in old tailings on their lease.

Gens Olson, working on a lay from John W. Noland, shovelled in old tailings on the Clydesdale lease.

Boulder Creek (59° 133° N.E.)

Boulder Creek Hydraulic Partnership.—Norman Fisher and partners worked on ground on Boulder Creek leased from The Consolidated Mining and Smelting Company of Canada, Limited. Hydraulicking was started about May 15th and continued for six weeks. Six men were employed.

Birch Creek (59° 133° N.E.)

Ture and Allan Mattson moved about 3,000 cubic yards of gravel on their lease on Birch Creek, partly with a monitor and partly by ground-sluicing. Lack of water stopped work early in the summer, and a final clean-up could not be made.

McKee Creek (59° 133° S.W.)

Joe and Luigi Piccolo did a little drifting on their lease. About 200 cubic yards of gravel was moved.

Swanson and Watt continued hydraulicking on their lease, although handicapped by a shortage of water.

Bruce Morton worked alone on his lease, above Swanson and Watt.

OMINECA*

Germansen River (55° 124° N.W.)

Loper and Son.—This hydraulic placer mine is on the north side of Plug Hat Creek, about 1 mile south of Germansen Landing and close to the Manson Creek–Germansen Landing road. No hydraulicking was done; G. H. Loper and one man cleaned bedrock in the large pit by hand.

Kwanika Creek (55° 125° N.E.)

Some test work was done by Mrs. Winnifred Tait on gravel along Kwanika Creek. In August a drill was taken in for further testing.

CARIBOO†

Hixon Creek (53° 122° S.W.)

Hixon Placers Inc. Company office, 1905 Second Avenue, Seattle 1, Wash. H. W. Hargood, president; C. J. Norris, superintendent. This property, 3 miles east by road from the Cariboo Highway at Hixon, is held under option from B. Briscoe, of Vancouver. Stripping of the clay and gravel over-

* By J. H. Bennett.

† By J. E. Merrett, except as noted.

burden covering the old channel of Hixon Creek continued, and during 1951, 50,000 cubic yards of this material was removed. In addition, the crew of five men constructed, with the aid of a bulldozer, more than 2 miles of ditch, 12 feet wide.

Willow River (53° 121° S.W.)

Lowhee Gulch.—O. K. Nason and four partners hydraulicked 60,000 cubic yards of gravel in the Lowhee pit.

Ketch Placers.—R. E. MacDougall and a crew of three men hydraulicked 20,000 cubic yards of gravel at the north end of the Devil's Canyon channel, which cuts across Burns Creek pit.

Devil's Canyon.—Eric Rask hydraulicked 1,000 cubic yards of gravel on Placer-mining Lease No. 4432, at the head of Devil's Canyon.

Devil's Lake Creek.—Leo Bedford and E. Smith hydraulicked 5,600 cubic yards of gravel on a bench on the west side of Devil's Lake Creek.

Coulter Creek.—I. Andracki and J. Chouse completed 120 feet of exploratory drifting on the latter's lease on Coulter Creek.

Nelson Creek.—W. M. Hong and two partners hydraulicked 25,000 cubic yards of gravel from the Slough Creek benches near Nelson Creek.

Slough Creek.—A. Haryuk, of Langley Prairie, drilled three Keystone drill test holes, each to a depth of 100 feet, on the Slough Creek benches opposite Nelson Creek.

Red Gulch Exploration Company*

(53° 121° S.W.) During 1951 a small private company was formed and financed by R. N. Van Bibber and associates to explore the dredging possibilities of Willow River near the mouth of Mosquito Creek. The placer leases at the mouth of Mosquito Creek as well as the entire placer holdings of the Lowhee Mining Company were subject to an option agreement between J. J. Gunn and W. F. McGowan, and the Lowhee company.

Van Bibber bought the big Bucyrus-Erie drill which had been used at Wingdam, and with Alf Brown, of Stanley, as driller, began drilling early in July.

A line of seven holes was drilled across the valley of Willow River about 600 feet downstream from the old placer shaft at the mouth of Mosquito Creek. This shaft† has a depth below water-level of 110 feet, and rich bedrock gravel had been mined from it. The first hole on the east side of Willow River hit bedrock at a depth of 61 feet. Three other holes at 100-foot intervals to the east hit bedrock at 63 feet, 68 feet, and 62 feet respectively. On the west side of Willow River, two holes uphill at 100-foot intervals and a third 400 feet from the river encountered bedrock at depths of 60 feet, 58 feet, and 60 feet respectively. No pay gravel was encountered in any of these holes. An eighth hole, drilled 250 feet south of the Mosquito Creek shaft, hit bedrock at a depth of 85 feet but encountered no pay gravel. The last and ninth hole, about 150 feet southeast of hole No. 4, hit bedrock at a depth of 45 feet.

Drilling was abandoned when neither bedrock gold nor the presence of a deep channel of Willow River was found.

Kong Fu Creek.—Fifteen hundred feet of ditch 10 feet wide was constructed with a bulldozer on Kong Fu Creek in the Beaver Pass area, on ground held by W. E. North, of Wells, and W. K. Nichols, of Vancouver. In addition, 600 feet of hydraulic pipe, 20 inches at the intake and 9 inches at the monitor, was laid from the ditch to the placer pit.

Hyde Creek.—P. McColm hydraulicked 350 cubic yards of gravel near Hyde Creek on the bench lease owned by Dr. O. R. Hougen, of Vancouver.

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* By Stuart S. Holland.

† *Minister of Mines, B.C.*, Ann. Rept., 1902, p. 100.

Beaver Channels Limited.—Three men, under the supervision of K. K. Langford, hydraulicked 135,000 cubic yards of gravel from the Phantom and upper Aura Fina pits. Work in the Phantom pit was suspended when it was found that bedrock dipped steeply below sluice grade. Work was then commenced in a new pit above the canyon on Aura Fina Creek. Evidence of an ancient stream channel was disclosed by hydraulicking on the west bank of the present creek. No work was done in the main Aura Fina pit.

Cooper Creek.—A. W. Frankish hydraulicked 200 cubic yards of gravel on Cooper Creek. Access to this property has improved with the repair of the Sugar Creek road to within 2½ miles of Cooper Creek.

Eight Mile Lake.—M. A. Anderson hydraulicked 1,100 cubic yards of gravel near Eight Mile Lake.

Antler Creek (53° 121° S.E.)

Upper Antler Creek.—A. Holm and T. Peterson sluiced 2,000 cubic yards of gravel on Upper Antler Creek.

Wolfe Creek.—E. S. Dowsett hydraulicked 100 cubic yards of gravel on Wolfe Creek.

Canadian Creek.—John Holland and D. S. Ross hydraulicked 5,000 cubic yards of gravel on Canadian Creek.

Antler Mountain Gold Limited.—The water-supply was inadequate for hydraulic operations, and most of the season was spent on repair work to ditches.

Shepherd Creek.—R. D. Rees hydraulicked 1,000 cubic yards of gravel on Shepherd Creek, a tributary of Summit Creek.

Antler Creek.—G. Milbourne hydraulicked 1,500 cubic yards of gravel at the junction of Empire and Antler Creeks.

Lightning Creek (53° 121° S.W.)

Houseman Creek.—Mr. and Mrs. L. Biggs sluiced 3,500 cubic yards of gravel on Houseman Creek.

Grub Gulch.—F. W. Freeman and J. Hind hydraulicked 5,000 cubic yards of gravel at the Ennerdale placer pit on Grub Gulch.

Perkins Creek.—C. A. Ritchie and W. Sebolt hydraulicked 2,500 cubic yards of gravel on Perkins Creek. After this operation was completed, work commenced on the construction, with the aid of a bulldozer, of a water-supply ditch which will, when completed, draw water from upper Amador Creek.

Bedrock Placers Inc. Office, 816 Northern Life Tower, Seattle, Wash. Two small earth-filled dams, approximately 2½ miles of ditch 8 feet wide, 800 feet of inverted siphon 30 inches in diameter, sluices and hydraulic washing equipment were prepared for hydraulic mining of this property on Dry Gulch, near Stanley. The property was optioned from J. Williams, of Stanley. D. H. Wells, of Seattle, supervised a crew of six men and hydraulicked 10,000 cubic yards of gravel.

Last Chance Creek.—A. F. Brown completed an additional 77 feet of drifting and removed 120 cubic yards of gravel from the 75-foot level of his underground placer mine near the junction of Last Chance and Lightning Creeks.

Anderson Creek.—E. M. Falck drifted and sluiced 350 cubic yards of gravel.

Hat Mountain Creek.—J. H. Freyer sluiced 350 cubic yards of gravel.

Wormwold Creek.—J. H. Freyer sluiced 350 cubic yards of gravel.

Angus Creek.—Steven Radencic hydraulicked 3,000 cubic yards of gravel.

Slade Placers.—Steve Surinak hydraulicked 4,000 cubic yards of gravel at the old Slade Placer operation at the junction of Mostique (Mosquito) and Lightning Creeks.

Cottonwood River (53° 122° S.E.)

Cottonwood River.—Ellis McMillan sluiced 800 cubic yards of gravel at and below the junction of John Boyd Creek and the Cottonwood River.

Nienaber-Busch Dredging Company.—R. A. Nienaber and a crew of five men treated 20,000 yards of gravel with the dragline and washing plant installed by the A.P. and S. Company in 1950, on the Cottonwood River below Umity Creek.

Stoney Creek Placers Limited.—Mine office, Quesnel. This company holds placer leases on the Cottonwood River between the Cariboo Highway bridge and the settlement of Cinema. H. R. Hatch and a crew of three men constructed two large wooden barges, on which it is proposed to install machinery for a suction dredge.

Quesnel River Area

Lawless Creek Mining Company (52° 121° N.W.) Company office, 6930 Beverley Boulevard, Everett, M 26, Wash.; mine office, Likely. Clifford V. Landon, manager. In the early part of the season 3,120 cubic yards of gravel was hydraulicked on Lawless (Half Mile) Creek, near Quesnel Forks. Construction then began on a log-cribbed earth-filled dam at the outlet of Rosette Lake, 2 miles southeast of Lawless Creek. The dam is 345 feet long, 100 feet thick at the base, 33 feet high, 15 feet thick at the top, and will raise the lake level 23 feet. It is anticipated that the lake will hold sufficient water to sustain a continuous hydraulic operation. In addition, 2 miles of ditch was widened to a minimum of 3 feet on the bottom. A crew of three men was employed.

Cariboo Metals Limited (52° 121° N.E.) Company office, 379 Coleman Building, Seattle, Wash.; mine office, Likely. This private company managed by A. von Alvensleben, employed a crew of six men on a group of eight leases south of Cedar Creek. A small crew was employed to the beginning of September, surface stripping and ditching over the main placer deposit. When this was completed, the crew was increased during washing operations. Gravel was removed by a 1½-cubic-yard Marion dragline and was trucked half a mile to the sluice erected in 1950, overlooking Cedar Creek. An inclined adjustable grizzly screen to remove large boulders was installed at the head of the sluice.

Quesnel Forks Placers Incorporated (52° 121° N.W.) Mine office, Likely. J. R. Foster, manager. Early in the season a crew of five men completed a small amount of hydraulicking on Kangaroo Creek, a tributary of Cariboo River. Work was suspended because of a shortage of water. The concrete dam completed in 1950 was found to be undermined by a placer prospect drift and could not be used for water storage.

Keithley Creek (52° 121° N.E.)

Weaver Creek.—H. Asserlind and V. E. Johnson abandoned work on their underground winze when no satisfactory means could be found to maintain drainage. They began mining pay gravel on the south side of the drift, opposite the winze.

Snowshoe Creek.—G. A. McGregor, G. Goldsmith, and L. Fournier installed hydraulic equipment to mine a bench channel at the junction of Snowshoe and Keithley Creeks.

LILLOOET*

Bridge River

Yalakom Placers Limited.—(50° 121° N.W.) G. Haycock, of Lillooet, did assessment work on twenty leases held by Yalakom Placers Limited and associates on

* By J. E. Merrett.

Bridge River between the B.C. Electric Company's diversion dam and the Horseshoe Bend.

Tyaughton Creek.—(50° 122° N.W.) William Gerullo hydraulicked 300 cubic yards of gravel on Tyaughton Creek, 1 mile below its junction with Liza Creek.

Hurley River.—(50° 122° N.W.) W. Haylmore completed 23 feet of timbered drift on a lease on the Hurley River near Gold Bridge.

BARNES CREEK (50° 118° S.E.)*

Barnes Creek Mining Association Limited

This syndicate holds four placer-mining leases, Nos. 30 to 34, on Holden Creek, a southeasterly flowing tributary of Eureka Creek, which flows easterly into Barnes Creek. The upper lease, which was worked in 1951, is reached by 6 miles of rough road from a point 5.3 miles west of Inonoaklin Crossing on the Monashee Highway. Sluice-boxes were installed in the creek bed above the old workings, and the overburden was pushed aside with a bulldozer. The channel is 40 feet wide, the overburden 4 feet deep, and the paystreak a few inches above bedrock. The pay gravel was washed into the boxes by means of a hose and pump. About 50 feet of the creek bed was worked in this way. W. H. Simons was in charge, with two men employed.

[Reference: B.C. Dept. of Mines, Bull. No. 1, 1931, pp. 100–101.]

COLUMBIA RIVER (49° 117° S.W.)*

Placer-mining Lease No. 190

This lease, owned by L. L. Carter, of Nelson, lies between the International Boundary and the confluence of the Pend d'Oreille and Columbia Rivers. It covers a gravel ridge that lies west of a trench used by the Great Northern Railway. The ridge is 1,000 feet long, 75 feet to 100 feet high, 40 feet wide on top, and 250 feet wide at the base.

During 1950 the gravel was checked for possible uranium content in the black sands. Nine samples were taken from various places on the hill. Pan concentrates showed some radioactivity but not enough to be of present economic value. It was observed that the black sand is more abundant at the southern end of the ridge and the gold is coarser at the northern end.

In 1951 F. L. Packard optioned the ground and installed a pump-hydraulic at the northern end of the ridge. A clean-up of 880 pounds was shipped to Hoffman Metallurgical Works at New Westminster.

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* By J. W. Peck.

Structural Materials and Industrial Minerals

CONTENTS

INTRODUCTION

Progress notes and reports on structural materials and industrial mineral deposits are contained in this section.

Production statistics for industrial minerals and structural materials will be found under those sub-headings in Table I, page 17; Table III, page 18; Table VIIA, page 24; Table VIID, page 27; and Table VIIE, page 28.

No new properties came into production in 1951. The British Columbia Cement Company began construction of a new kiln that will almost double present capacity once it is put into use. Cassiar Asbestos Corporation carried out development on its asbestos deposit at McDame and hopes to get into production during 1952. The Victoria Tile and Brick Supply Company took over the former Abbotsford Fire & Pressed Brick property at Abbotsford and is operating it under the name "Fraser Valley Brick Company Limited."

As in former years, the production figures for this section are accounted for almost completely by the companies producing aggregate, clay products, gypsum, and limestone.

ASBESTOS

Heli and Copter*

Atlin (59° 133° N.W.). In the summer of 1950 twelve claims—the Heli Nos. 1 to 6 and the Copter Nos. 1 to 6—were located on an asbestos discovery near Atlin. Helicopter Exploration Co. Ltd. made a geological survey of the claims and then dropped the Heli Nos. 5 and 6 and Copter Nos. 5 and 6 claims. At the time of writing the Heli Nos. 1 to 4 claims are registered in the name of D. M. Cannon, of Vancouver, and the Copter Nos. 1 to 4 claims are registered in the name of Nels Hals, also of Vancouver.

Two days were spent examining the claims in July, 1951. No one was on the property at the time.

The claims are about 2,500 feet above Atlin Lake and form a rectangular block three claims wide by four claims long oriented northwesterly across the rather flat, open top of the prominent mountain 3 miles southeast of Atlin town. A rough 3-mile long trail up the west side of Little Spruce Creek from a point 4 miles east of Atlin on the

* By J. W. McCammon.

Spruce Creek road extends to the base of the mountain upon which the claims lie. Any route can be taken from the end of the trail up the mountain to the claims.

Serpentinized ultrabasic rocks outcrop abundantly in the area covered by the claims. Asbestos occurs in scattered veinlets in the serpentine, but during the examination only a relatively small amount of fibre was observed. The asbestos that was seen consisted of rather harsh chrysotile cross-fibre material in veinlets one-sixteenth to one-eighth of an inch wide. The best exposure containing fibre that was noted was a short irregular 10-foot wide zone striking northwesterly across the line between the Heli Nos. 3 and 4 claims. This zone consisted of numerous parallel fractures, each in a narrow band weathered to a light colour. Some of the fractures contained cross-fibre asbestos in veinlets one-sixteenth to one-eighth of an inch wide, but many of the fractures were barren. Scattered veinlets of similar-length fibres were seen in patches at other widely separated points.

Chrysotile and Olivine*

McDame (59° 129° S.W.). This group of claims is about 6 miles northeast of the Cassiar Asbestos Corporation property near Mount McDame (*see* p. 210). The Chrysotile Nos. 1 to 4 claims were originally located by William Mossop and the Olivine Nos. 1 to 4 claims by George Edzerza in the summer of 1950. In 1951 the original claims lapsed, and approximately the same ground was relocated as the Asbestos Nos. 1 to 8 group by J. C. Simpson. Numerous other claims were located in the surrounding area during 1950 and 1951.

At the end of July, 1951, four days were spent examining the property. No development of any type had been done on the claims then.

There is no trail to this area, but it can easily be reached by a 12-mile trip on foot or on horseback from the end of the Cassiar Asbestos Corporation road by following the valley to the north and then turning east along the first valley in that direction. Alternatively, one can leave the road at Quartzrock Creek, travel north up the east fork of Quartzrock Creek, cross the divide, and follow the tributary of Blue River to the claims. This latter route is also about 12 miles long and is suitable for horse travel.

The claims lie between 5,500 and 6,500 feet altitude, astride the crest and down the nose at the north end of a long northerly trending ridge. The west slope of the ridge is steep and precipitous, while the north and east slopes are more gentle and largely covered with talus. Except for the west face, outcrops are scarce below the crest of the ridge, and the slopes are almost completely covered by grass and heather below the 5,000-foot level. Timber ends at the 4,500-foot level.

Cross-fibre chrysotile asbestos occurs on the property in veinlets in a large mass of serpentine. The serpentine body is arc-shaped, concave to the east, and was observed over a length of 2½ miles, with a maximum exposed width of about three-quarters of a mile. It is reported to extend for a greater distance to the southeast of the claim area. The mass is composed of dark-green to black, usually slickensided, serpentine with a few remnants of incompletely serpentinized gabbroic rock, particularly along the western edge. The serpentine is bordered along the west by a series of metamorphosed sedimentary rocks, predominantly black slates and cherty argillites; to the south, it is cut off by a hornblende-syenite intrusive that appears to form the main mass of the ridge farther south, while to the north and east the limits are obscured by talus.

Asbestos can be found to some extent almost anywhere in the serpentine, but with a few exceptions it is in veinlets of widths of less than one-eighth of an inch and usually less than one-sixteenth of an inch. The veinlets are normally scattered widely and run in all directions but favour slightly a northwesterly strike. Areas that appeared to have a more than ordinary concentration of veinlets are indicated in Figure 15. Single veins, usually traceable for a length of only a few feet, with fibres half an inch long, were noticed in the walls of a narrow gully that crossed the ridge 300 feet north-

* By J. W. McCammon.

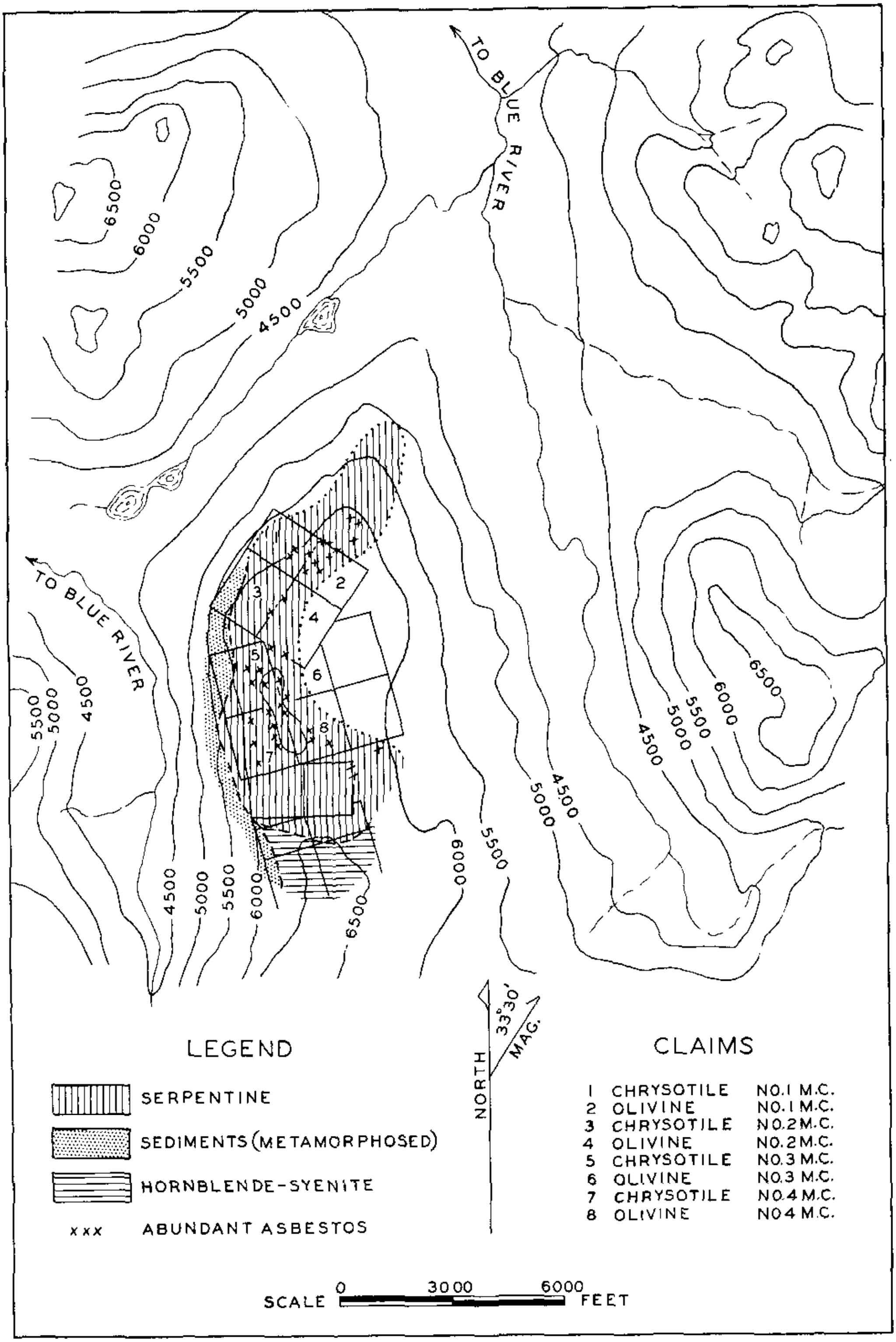


Fig. 15. Chrysotile-Olivine group, McDame Creek area.

east of the No. 1 post of the Chrysotile No. 1 and Olivine No. 1 claims, at three or four places on the Olivine No. 1 claim, on the Chrysotile No. 1 claim, near the northeast corner of the Chrysotile No. 3 claim, and south of the southeast corner of the Olivine No. 4 claim. The best showings seen were on the Chrysotile No. 1 and Olivine No. 1 claims. Near the centre of the Chrysotile No. 1 claim a group of six veinlets gave a combined width of 1⅛ inches of fibre over a total width of 20 inches. Down the slope from this a vein seven-eighths of an inch wide, but with a central parting, was visible for 100 feet along the strike. Another vein near by was 1 inch wide, but it, too, had a central parting. Near the centre of the Olivine No. 1 location-line, one outcrop exposed eight veinlets giving a cumulative fibre width of 1¼ inches across a total width of 1 foot. Fibre half an inch long was rare in the deposit, and the longest fibre seen was three-quarters of an inch long from the inch-wide vein noted above on the Chrysotile No. 1 claim.

Cassiar Asbestos Corporation Limited*

McDame (59° 129° S.W.). Head office, Suite 1001, Federal Building, 85 Richmond Street West, Toronto; British Columbia office, Royal Bank Building, Vancouver. F. M. Connell, president. Capital: 2,500,000 shares, no par value. This company was organized in July, 1951, to investigate the Rugged group and surrounding claims on an asbestos deposit north of Mount McDame in northern British Columbia. A description based on a preliminary examination of the deposit made in July, 1950, has been given by O'Grady.† The present report is based on an examination lasting two weeks made in early August, 1951.

The property straddles a spur of the main ridge 2.2 miles northwest of Mount McDame.‡

At the time the property was visited, cars could take the McDame Creek road south from the Alaska Highway at Mile-post 648 and drive 85 miles to Quartzrock Creek. During the late autumn of 1950 Conwest Company built an 8-mile long road from Quartzrock Creek along Troutline Creek and up the north fork of Troutline to a temporary camp. The route chosen proved unusable in the summer, and the road was being relocated and reconstructed in 1951. A 3-mile long tractor-road extended from the temporary camp to the asbestos showing.

Chrysotile asbestos occurs on this property in an elongate lens-shaped body of serpentine bounded by metamorphosed sedimentary rocks on the west and by interlayered metamorphosed sedimentary rocks and volcanic flows on the east. The series strikes northward and dips steeply to the east. It forms part of the west limb of a large syncline.

The rocks to the west of the serpentine are chiefly black, splintery, slaty argillites with minor amounts of cherty quartzite, one prominent band of white-weathering siliceous dolomitic limestone about 400 feet thick, and minor black limestone beds. The strike of these rocks averages north 15 to 30 degrees west, and the dip averages 60 to 65 degrees east. Minor folding was not common in the exposures seen. Joints running in many directions are common in the argillites.

The rocks bordering the serpentine on the east are interlayered slates and volcanic flows. Immediately adjacent to the serpentine, the slates and minor quartzites predominate, but flows become more abundant eastward along East ridge and to the north along Goat ridge. The series strikes about north 15 degrees west and dips around 65 degrees east.

Actual exposures of serpentine in place are few and small. The exposures that are visible indicate that the main serpentine body is lens shaped and is for the most part conformable to the bedding of the slates but in some spots is slightly transgressive.

* By J. W. McCammon.

† *Minister of Mines, B.C.*, Ann. Rept., 1950, pp. 207-214.

‡ Dept. of National Defence, National Topographic Series, Canada, Sheet 104P, McDame, British Columbia, First Edition.

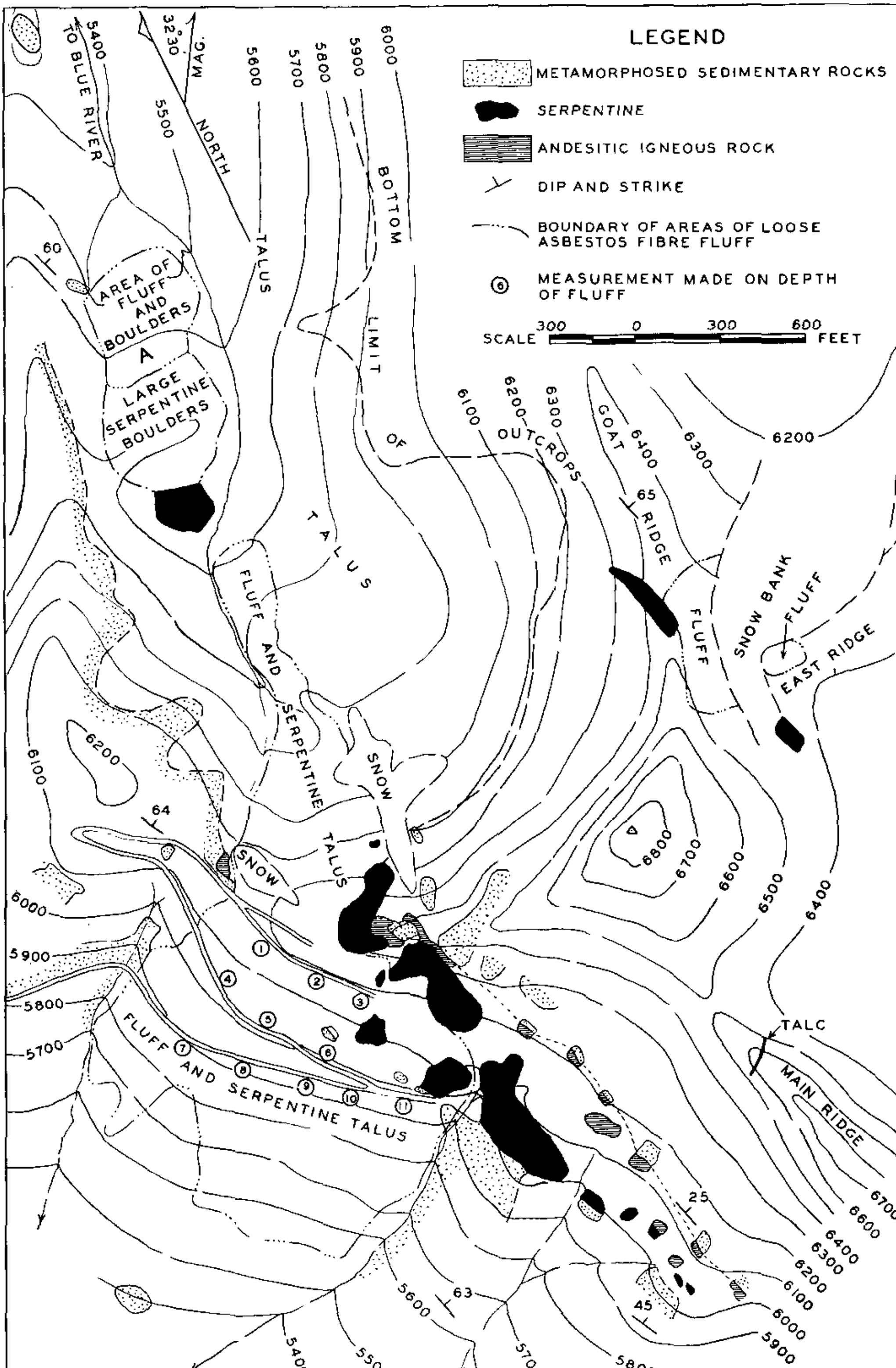


Fig. 16. Cassiar Asbestos Corporation property, McDame Creek area.

Serpentine outcrops along a length of 2,000 feet, with a width varying from 50 feet at the most southerly exposure to 450 feet at the north end.

A second serpentine showing is in the floor of a cirque about 1,200 feet north of the northern limit of the main showing (*see A* in Fig. 16). Very little serpentine bedrock is exposed in this showing, but there is a large accumulation of big asbestos-bearing boulders. This serpentine is separated from the main body by a steep talus-covered area, but the two bodies are on strike and appear to be parts of a single mass. Northward the second showing plunges under the valley debris and apparently fails to reappear on the mountainside beyond.

The serpentine appears to be an altered basic sill. Along the east or upper contact there are narrow remnants of slightly serpentinized andesitic rock. Thin sections show this rock to be composed largely of about equal parts of andesine, in various stages of alteration, and of augite, partly or almost completely altered to actinolite. Along the west contact, except for one small outcrop near the north end, the serpentine rests directly on top of slaty argillite. Near this contact the serpentine is very dark and platy and gives the impression of having absorbed some slaty material. The argillite underlying the serpentine is not much disturbed and shows little or no effect of contact metamorphism, whereas the overlying beds do show some signs of disturbance and slight metamorphic effects.

Cross-fibre chrysotile asbestos forms veinlets that criss-cross in all directions most of the serpentine exposures. The main central mass of fibre-bearing serpentine is dark green and weathers to light olive-green. Measurements made on seven outcrops indicated a fibre content ranging from 3½ to 12½ per cent. Because of the limited number of exposures, this cannot be considered representative of the serpentine body as a whole, but it does give an indication of what may be expected. The asbestos veinlets range in width from one thirty-second of an inch to 1⅞ inches, with a fair proportion greater than half an inch. Most of the wider veinlets have one or more central partings. The longest single fibre length seen was 1⅝ inches. A zone of dark bluish-black weathering serpentine extends diagonally across the southwest end of the main showing. Some of this dark material near the west contact contains no fibre, and the rest has veinlets only one-sixteenth to one-eighth of an inch wide.

A spectacular feature of the McDame asbestos deposit is the immense accumulation of loose asbestos fibre " fluff " that mantles the hillside. As indicated in Figure 16, the serpentine extends along the hillside and then crosses over the top through a small saddle. Weathering *in situ* has left a large expanse covered with serpentine fragments surrounded by and embedded in loose fibre fluff. Much of this material has remained in its original location, but considerable quantities have been washed down the slopes on both sides of the saddle. The approximate areal extent of the loose fibre is indicated in Figure 16. The thickness of the fibre mantle varies along the slopes and down them. At the time of examination no work had been done to establish depths of fluff, but some indications were obtained from exposures in the road cuts. Depth measurements of loose fluff made perpendicular to the ground surface at the points indicated by ringed numbers along the road in Figure 16 are as follows:—

Location	Depth	Remarks	Location	Depth	Remarks
	Inches			Inches	
1	40	Not to bedrock.	7	42	Loose slate bottom.
2	58	Not to bedrock.	8	45	Limestone bottom.
3	36	Serpentine bedrock.	9	62	Not to bedrock.
4	46	Not to bedrock.	10	66	Not to bedrock.
5	50	Not to bedrock.	11	74	Not to bedrock.
6	50	Not to bedrock.			

No pits of any type are present to indicate depths of loose asbestos down the north-east slope into the cirque nor in the cirque bottom.

The percentage of fibre in this loose mantle varies but would probably average 20 to 30 per cent by volume at least, with small patches running as high as 70 per cent. Bulk sampling on a large scale would be necessary to get any sort of reasonable estimate.

The loose fibre is weathered grey on the surface and yellow-brown down to a depth of 1 foot in places. Below this it is greenish to grey, just as it is in bedrock. Fibre lengths found in the fluff vary from 1½ inches down, with a fair percentage greater than half an inch. Preliminary trials have indicated that a satisfactory recovery of spinning fibre can be made from this material.

The origin of the accumulation of asbestos-bearing boulders and loose fibre at *A* in Figure 16 is not definitely known. The rim of serpentine around the south end of the boulders appears to be in place. It is dark and weathers brown, but carries no fibre. The boulders are pale olive-green weathering serpentine carrying veinlets of asbestos. These boulders are rudely rounded but are rough surfaced and are as much as 20 feet or more in diameter. The boulders may be talus from the serpentine out-crops in the saddle above and south of the cirque, or they may be residual boulders resulting from weathering *in situ;* the general appearance suggests the latter as the better explanation.

Reconnaissance traverses through the outlying area covered by the Rugged group revealed only one other serpentine exposure. This consists of a 50-foot wide zone that crosses the junction of Goat and East ridges as shown in Figure 16. This zone runs parallel to the bedding of the enclosing slates and is exposed in two short sections as shown. The serpentine here is dark and badly shattered and slickensided. Although no asbestos was seen in any of the serpentine, two small areas below the serpentine outcrops are covered by a thin film of loose fibre. A 10-foot wide band of whitish talc is formed along both sides of the serpentine.

A noticeable feature of all the rocks in the area is the abundance of white bull quartz veins and stringers varying in width from half an inch to 3 or 4 feet. These veins are common in the dolomite, thin veins are frequent in the slates, and all sizes of veins are abundant in the flows. None was seen in serpentine.

A late, wet spring combined with transportation difficulties held up exploratory work in 1951. During August a diamond-drilling programme was begun, but because of unsatisfactory core recovery it was stopped.

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 andesite building-stone. The stone is drilled to size and broken by blasting with black powder. Seven men were employed during the operating year.

Granite

Vancouver Granite Co. Limited* Nelson Island (49° 124° N.E.). Company office, 744 West Hastings Street, Vancouver; quarry, Nelson Island. Dimension stone for building purposes and monuments, and poor-quality stone for jetty-rock and rubble are mined at this quarry. The rock is drilled to size and then wedged or blasted for removal. Three 20-ton capacity wooden derricks are used to move stone from the quarry face to scows. The blocks are shipped

* By R. B. King.

to Vancouver for cutting and finishing. Approximately 1,800 tons of stone was produced from March to September, 1951. The average number of men employed was eight.

Coast Quarries Limited*

Granite Falls (49° 122° S.W.). Company office, 1840 West Georgia Street, Vancouver; quarry office, Granite Falls. W. A. Bickell, manager; D. R. Ross, superintendent. Jetty-rock, riprap, and rubble are produced. Rock, blasted from a high quarry face, is loaded by a 1-cubic-yard diesel-driven shovel into semi-cylindrical skips of 10-ton capacity. These skips are transported by a steam-driven derrick and loaded directly on scows. Approximately 50,000 tons of rock was produced at Granite Falls. Two smaller quarries which produced rock for breakwaters were also operated. At Nootka (49° 126° N.E.) 10,000 tons of rock was mined, and at Westview (49° 124° N.W.) 30,000 tons was mined.

Gilpin-Nash Limited*

Indian Arm (49° 122° S.W.). Company office, 2265 West Forty-first Avenue, Vancouver. C. W. Nash, general manager; R. H. Hankey, superintendent. Jetty-rock and rubble are produced from this quarry. Granite, after being blasted, is loaded by a ¾-cubic-yard diesel-driven shovel into trucks and transported to flat skips. These skips are transported by a steam-driven derrick and loaded on to scows. Approximately thirty men were employed during the operating year.

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. Granite for jetties and dykes is produced by this quarry. Rock is broken mainly by a " coyote hole " method of mining, although in some cases " snake holes " are still used. Broken rock is loaded by a 2-cubic-yard capacity diesel-driven shovel into 12-cubic-yard capacity trucks. The rock is dumped either directly on to scows or into the crushing plant. The crushing plant consists of a 42- by 60-inch jaw crusher and a 6-inch grizzly with a conveyor-belt for loading scows. Undersize material, –6 inches, is stockpiled. The average number of men employed during 1951 was thirty-five.

Valley Granite Products Limited*

Cheam View (49° 121° S.W.). Company office, 114 First Avenue, Chilliwack; plant, Bridal Falls. The quarry and crushing plant are several miles east of Rosedale (49° 121° S.W.). The granite is drilled, blasted, and hand-loaded into a 1-ton capacity car and transported to the crushing plant. The crushing plant produces turkey, chicken, and bird grit, stucco dash, sand-blasting material, and sanding material for automotive vehicles. Approximately 2,000 tons of rock was quarried during the year. The average number of men employed was ten.

CLAY AND SHALE

Bear Creek Brick Company*

Surrey (49° 122° S.W.). Head office, Victoria Tile and Brick Supply Co. Ltd., Vancouver; plant, Archibald Road, Surrey District. W. J. T. Ayling, plant manager. Surface clay is mined in a pit adjacent to the plant. Cars are hand-loaded and hauled to the 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. About 2,500 tons of clay was mined in 1951. The average number of men employed was seven.

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. This company operates a large plant producing primarily structural tile and drain-tile. Facebrick and common brick have also been produced. Plastic clay is mined from open pits adjacent to the

* By R. B. King.

plant. A ½-cubic-yard gasoline-driven shovel digs clay from benches 10 feet high and loads it on trucks for transportation to the plant. The clay is dried in a rotary wood-fired kiln and then conveyed to a dry pan for grinding. Bricks and tile are formed by the stiff-mud extrusion process and dried in a controlled-temperature drying-room. The formed products are burned in down-draught beehive kilns.

In 1951, 13,792 tons of clay products was shipped from the plant. The average number of men employed during the year was fifty.

Mainland Clay Products Limited*

Barnet (49° 122° S.W.). Head office, 8699 Angus Drive, Vancouver; plant, Barnet. D. Pitkethly, general manager. Surface clay is mined from an adjacent pit by shovel and bulldozer and transported to the plant for drying. Fireclay is trucked from Kilgard. Dry-pressed common brick and firebrick are burned in rectangular kilns. In 1951, 1,460 tons of clay was used in manufacturing bricks.

Clayburn Company Limited*

Kilgard (49° 122° S.E.). Head office, Credit Foncier Building, Vancouver; plant, Kilgard. R. M. Hungerford, managing director; R. Ball, superintendent. This company operates two plants—one plant, in which sewer-pipe and flue-lining are manufactured, is at Kilgard; the other, in which facebrick, firebrick, and special refractory shapes are made, is at Abbotsford.

In the Kilgard plant, sewer-pipe and flue-linings are extruded through dies, pre-dried, and burned in oil-fired down-draught beehive kilns. In the Abbotsford plant, bricks are dry-pressed, hand-piled on flat cars, and passed through a drier. From the drier, the bricks pass into an oil-fired continuous tunnel kiln that is 300 feet long.

Clay for these plants is mined from shale members of the Huntingdon formation of Sumas Mountain. Underground mining is done by room-and-pillar methods.

Clay mined during 1951 totalled 39,318 tons. Of this tonnage, 25,916 tons was used for the manufacture of firebrick and facebrick and 13,402 tons was used for the manufacture of sewer-pipe and flue-lining.

Richmix Clays Limited*

Kilgard (49° 122° S.E.). Office and plant, 2890 East Twelfth Avenue, Vancouver; mine, Kilgard. G. W. Richmond, manager. Strip-mining of clay pillars left by underground mining is being carried on by this company. The clay is drilled and blasted and loaded by a diesel-driven shovel on to trucks and transported to the plant. Four men were employed during the operating year.

Fraser Valley Brick Company Limited*

Abbotsford (49° 122° S.E.). Company office, Victoria Tile and Brick Supply Co. Ltd., Vancouver; plant, Abbotsford; John A. Wickson, general manager; A. T. Ayling, plant manager. In 1951 this plant was purchased from Abbotsford Fire & Pressed Brick Co. Ltd. Surface clay is mined by hand from a shallow clay pit and is trucked about 1 mile to the plant. Dry-pressed bricks are formed and burned in wood-fired scove kilns.

Baker Brick and Tile Company Limited.*—Victoria (48° 123° S.E.) Office and works, Victoria. J. V. Johnson and D. E. Smith, joint managers. Surtace clay is mined by gas shovel and transported by truck to storage bins. The clay pit is operated from March until November, and the plant all year. Total clay mined in 1951 amounted to 5,500 tons.

Canadian Canamin Ltd.

Kisameet Bay (51° 127° N.W.). Company office, 414 Standard Building, 510 West Hastings Street, Vancouver; plant, 2025 Beresford Street, South Burnaby; quarry, Kisameet Bay, King Island. This private company, formerly known as Ray-Vite Laboratories, has a lease on an area upon which is found a deposit of very fine-grained clay. The ground covered by the lease is Lot 1552, Range 2, Coast District, on the

* By R. B. King.

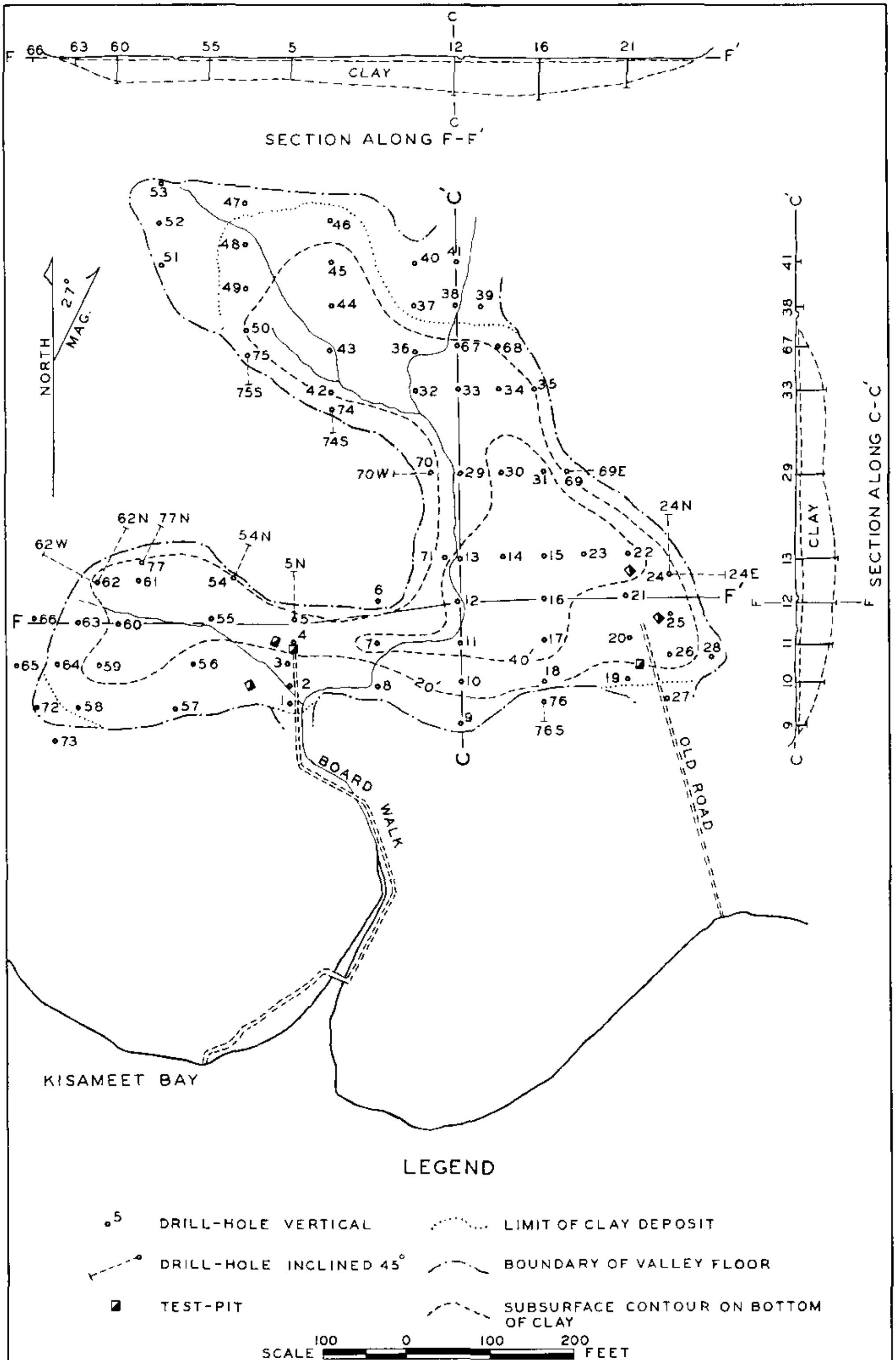


Fig. 17. Canadian Canamin clay deposit, south end of King Island.

north shore of Kisameet Bay, a small bay on the west side of King Island at the southern tip. The lot is about 28 miles southwest of Ocean Falls, 7½ miles north of Namu, or roughly 280 miles northwest of Vancouver.

This clay has been known to Indians for many years and was used by them for medicinal purposes. The present owners became interested in the clay because of the therapeutic properties, and they are attempting to exploit it for medical uses. The clay is sold in a water suspension under the trade-name "Absorvite," to be taken internally for stomach ailments. It is also sold in jars as a mud under the trade-name "Dermavite," for use on burns, sprains, and in beauty packs. Some experimental use has been made of the material by Vancouver medical and veterinary men.

The clay is in the bottom of a small depression about 400 feet inland from and less than 50 feet vertically above the shoreline of Kisameet Bay. The ground surface of the depression is flat, swampy, and bushy, and is traversed by a small stream and its tributaries, as shown in Figure 17. Except for three narrow openings where the main stream enters, where it exits, and in the southeast corner where the old road is indicated in the diagram, the depression is enclosed by well-timbered slopes that rise abruptly at its edges. The clay is overlain by 1 to 6 feet of overburden, largely organic matter, and is exposed only where pits have been dug or where large trees have been blown over. The bed of the stream is filled with sand and gravel and does not expose clay.

Bedrock exposed in the bluffs surrounding the clay depression, and in the creek bed above and below the clay deposit, is metamorphosed grey to black rock that varies between schist and gneiss. The mineral constitutents of this rock are chiefly quartz, plagioclase, biotite, and hornblende. Areal geological mapping* indicates the presence of acid plutonic rocks to the north on King Island.

The clay deposit was closely drilled in 1946, and the drill plan and drill logs were kindly made available to the writer by the company. Figure 17 is reproduced from the company plan. As indicated by drill logs, the clay underlies an area of approximately 5.2 acres and ranges in thickness from 1 to 42 feet. As previously mentioned, the clay is overlain by from 1 to 6 feet of overburden and is underlain usually by sand and gravel but in some spots by bedrock. The clay is of very fine grain size and is remarkably uniform in texture from top to bottom. No stratification nor varves were visible in the pit under operation. Occasional pebbles and boulders up to 8 inches in diameter are found scattered erratically through the clay. These pebbles are generally rounded, some are faceted and scratched, and they are of plutonic and volcanic origin. The clay is dark bluish-grey when moist and light grey when dry. It feels smooth and is very sticky when taken from the ground.

A sample of the clay was taken from the pit being worked at the time of examination. A size separation made by simple sedimentation and decantation showed the grain size of the sample to be as follows: (1) 6.2 per cent with grain diameter greater than 0.07 mm., (2) 8.5 per cent with grain diameter 0.003 mm. to 0.07 mm., (3) 54.6 per cent with grain diameter 0.0017 mm. to 0.003 mm., (4) 30.7 per cent with grain diameter less than 0.0017 mm. The coarsest product, except for stray rock fragments, consisted of angular to subangular, clear, fresh-looking mineral fragments. Minerals identified were, in order of abundance, quartz, feldspar, hornblende, biotite, magnetite, honey-yellow titanite, and zircon. In the second product the minerals identified were similar to those in the coarsest product. In the third and fourth products the grains were too small to identify. The grains of the third product appeared to be of three shapes—long thin rods or splinters, flat plates, and equidimensional grains. Vegetable matter in the form of grass-like and reedy fragments is scattered through the clay, but no animal fossils were recognized. The finest fraction of the products recovered was distinctly darker than the others and had a decided brownish cast. No carbonates were recognized

* *Geol. Surv., Canada*, Sum. Rept., 1921, Pt. A, pp. 22–49.

microscopically, and the clay and sized fractions did not react to dilute or concentrated hydrochloric acid.

The mineral suite in the coarse product is typical of acid igneous rocks, and it is interesting to note that Dolmage* describes "typical light grey quartz-diorite rocks" of this vicinity, some of which contain "a conspicuous amount of honey-yellow sphene."

A portion of the raw clay was well dispersed in pure water and left to settle. In thirty days all material had settled to leave the water clear.

The Physical and Crystal Chemistry Section of the Department of Mines and Technical Surveys at Ottawa kindly did differential thermal analysis and X-ray tests on samples of the No. 3 and No. 4 products but obtained inconclusive results that could not be interpreted.

Partial analyses of the raw clay as obtained from the deposit and of the various sized fractions separated from it are as follows:—

Sample	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Raw clay	51.8	18.2	1.0	2.6	5.8	5.2	4.1	2.9	3.2
No. 1 product (diam. > .07 mm.)	66.1	16.3	0.5	1.1	1.9	1.8	4.8	4.3	1.6
No. 2 product	57.8	18.0	0.8	1.9	3.4	3.1	5.1	3.5	2.4
No. 3 product	53.0	18.8	1.0	2.7	5.4	5.1	4.3	3.0	3.2
No. 4 product	46.2	19.0	1.1	4.8	6.4	6.5	3.3	1.8[1]	3.4

[1] Possibly slightly low.

A size separation experiment similar to that described on the raw clay was carried out on four jars of Dermavite as sold commercially. This experiment yielded four products, as follows: (1) 3.1 per cent of the sample with grain diameters greater than 0.07 mm., (2) 11.6 per cent of sample with grain diameters from 0.003 to 0.07 mm., (3) 43.2 per cent of sample with grain diameters from 0.0017 to 0.003 mm., (4) 42 per cent of sample with grain diameters less than 0.0017 mm. This fraction would pass through a No. 40 filter paper.

GYPSUM

Gypsum, Lime and Alabastine, Canada, Limited†

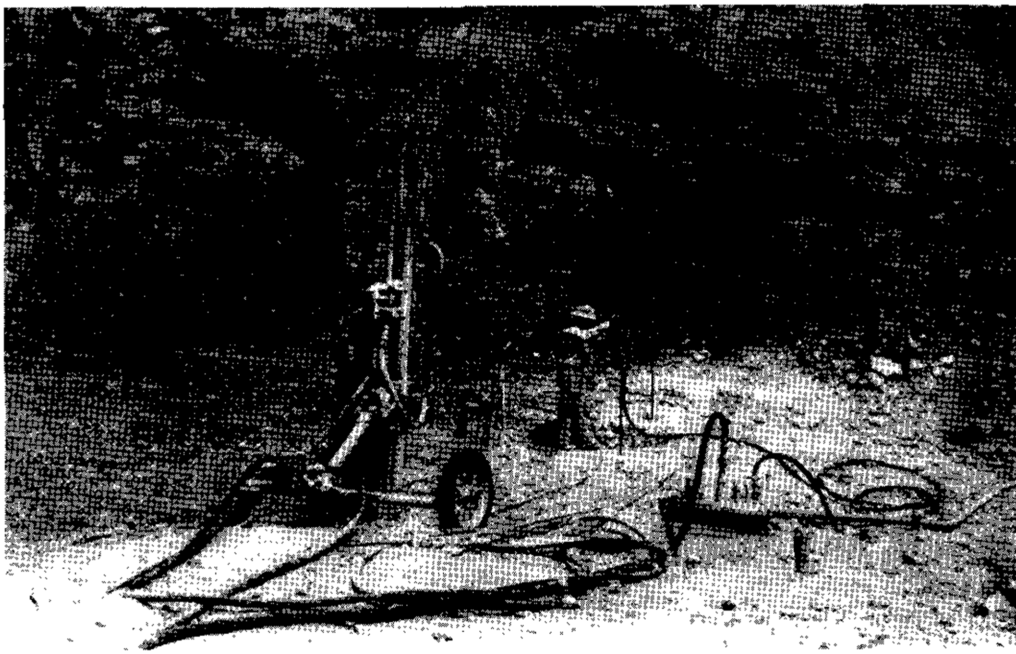
Falkland (50° 119° S.W.). Head office, Paris, Ont.; British Columbia office, 509 Richards Street, Vancouver. Norman Jessiman, British Columbia manager; Cecil J. Miller, quarry manager. This company mines gypsum at Falkland, 40 miles from Kamloops on the Vernon–Kamloops Highway and on the Vernon branch of the Canadian National Railway. Gypsum is mined from open quarries 500 to 800 feet above the railway on the steep hillside north of the village. Compressed-air jackhammers are used for drilling; 40 per cent Forcite explosive 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. Gypsum was obtained from No. 2 and No. 10 quarries throughout the year. Production was at the rate of 300 to 400 tons per day. Thirty men were employed.

Columbia Gypsum Products Inc.‡

Windermere (50° 115° S.W.). Head office, 425 Symon's Building, Spokane, Wash.; quarry office, Athalmer. J. M. Cummings, resident manager. This company owns a gypsum deposit on Windermere Creek. *Production and haulage of gypsum was con-*tracted to Carbon & Ludberg, of Spokane. Equipment at the quarry consisted of a

* *Geol. Surv., Canada,* Sum. Rept., 1921, Pt. A, p. 25.
† By E. R. Hughes.
‡ By J. W. McCammon.

365-cubic-feet-per-minute Caterpillar compressor, a 1¼-cubic-yard shovel, a D-8 Caterpillar tractor, and a complete portable crushing and screening plant with a maximum capacity of 500 tons per 8-hour day. Ten men were employed.



Drilling in the Columbia Gypsum quarry, Windermere.

Production was 37,700 tons of rock gypsum. This was shipped to the Canada Cement plant at Exshaw, Alta.; the B.C. Cement plant at Bamberton; the Spokane Portland Cement Company at Spokane, Wash.; the Western Gypsum Products plant at Calgary, Alta.; and the Columbia Gypsum plant at Spokane, Wash.

LIMESTONE AND CEMENT

Smith Island*

Prince Rupert (54° 130° S.E.). Columbia Cellulose Company Limited operated its quarry on Smith Island until December, when production was stopped so that a new wharf could be built. The company had difficulty in getting pure enough limestone from the deposit and had to obtain limestone from other quarries. This quarry will be abandoned if another more suitable limestone deposit can be found. Production was at the rate of about 1,000 tons per month until December. Eleven men were employed under the direction of J. R. Cross.

Beale Quarries Limited†

Vananda (49° 124° N.W.). Head office, 744 West Hastings Street, Vancouver; quarry office, Vananda. W. D. Webster, superintendent. Limestone is quarried to produce pulp rock for paper-mills, pulverized rock for agricultural and industrial uses, and for rock-dusting in coal mines. This quarry is worked in two elevations, each face being nearly 40 feet high. Quarried rock is loaded on trucks by two ¾-cubic-yard diesel-driven shovels and transported to the plant. Pulp rock is separated from spalls by means of a grizzly. The spalls are conveyed to a stockpile and from there to the crushing and pulverizing plant. Approximately 80,000 tons of rock was mined during 1951. The average number of men employed during the year was twenty-four.

* By J. H. Bennett.
† By R. B. King.

W. S. Beale Limited*

Vananda (49° 124° N.W.). Office and quarry, Vananda. Stanley Beale, manager. The Marble Bay quarry is now being operated under the name W. S. Beale Limited. Limestone is quarried to produce rock for paper-mills. Limestone, blasted from a quarry face which is nearly 70 feet high, is loaded by a ½-cubic-yard diesel-driven shovel into trucks of 5- and 10-ton capacity. These trucks transport the rock to a ramp, where it is dumped on a heavy-duty vibrating screen which separates pulp rock from finer material or spalls. The pulp rock is loaded on to scows by gravity; the spalls are stockpiled. Approximately 40,000 tons of limestone was shipped during 1951. Seven men were employed.

Pacific Lime Company Limited*

Blubber Bay (49° 124° N.W.). Head office, 744 West Hastings Street, Vancouver; Quarry and plant, Blubber Bay. F. W. Harvie, general manager; A. M. Stewart, assistant general manager; E. O. Magnussen, plant superintendent. Limestone is quarried nearly 2 miles from the plant, along the Blubber Bay–Vananda road. Limestone is broken from quarry faces by drilling and blasting horizontal and vertical holes. Broken rock is loaded by diesel-driven shovel on to 18-cubic-yard capacity trucks and hauled to the plant. The quarried limestone is used in pulp-mills, cement manufacture, and smelter flux, or is burned for lime products. The average number of men employed during 1951 was 105.

British Columbia Cement Company Limited*

Head office, corner of Fort and Wharf Streets, Victoria. N. A. Tomlin, managing director; R. E. Haskins, works 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 the Blubber Bay quarry, broken rock is loaded by 1¾-cubic-yard diesel-powered shovels into Koehring dumptors. These dumptors transport rock a short distance and transfer it to 6-cubic-yard capacity railroad dump cars that are hauled over a 36-inch gauge railroad by gas locomotives to the crushing plant. A 36- by 48-inch Dominion jaw crusher discharges a 5-inch product which is conveyed by an overhead conveyor to a stockpile. An underground conveyor beneath this stockpile conveys material to scows for shipment to the Bamberton plant.

At the Bamberton quarry, blast-hole drilling using a Bucyrus-Erie 27T churn drill has been carried on. Vertical holes spaced at 20-foot centres are drilled 150 feet long and have a burden of 25 feet. In one blasting operation in which a total of 23,000 pounds of 60 per cent Polar Forcite and 60 per cent Dynamex was used, more than 60,000 tons of rock was broken.

Broken rock is loaded by an electric shovel and transported by dumptors to the crushing plant. The crushing plant has been redesigned and rebuilt and now consists of a 42- by 48-inch Buchanan jaw crusher which is fed by a 60-inch Stephens-Adamson feeder. The discharge from the jaw crusher goes to a 5½-foot Symons cone crusher.

The number of men employed during the year in the quarry was nineteen. During the company's fiscal year, December 1st, 1950, to November 30th, 1951, 201,000 tons of rock was quarried at Bamberton and 177,000 tons was quarried at Blubber Bay.

Agassiz Lime Quarry*

Agassiz (49° 121° S.W.). Hiram Cutler, owner. This quarry, nearly 2 miles southwest of Agassiz, produces agricultural limestone. Broken rock is hauled by a loader of ¼-cubic-yard capacity to the crushing plant. The daily capacity of this plant is 40 tons. The average number of men employed during the operating year was seven.

* By R. B. King.

Fraser Valley Lime Supplies*

Popkum (49° 121° S.W.). J. G. Henderson, superintendent. This quarry and plant produce crushed and pulverized limestone for industrial and agricultural purposes. Limestone is blasted from the quarry face, hand-loaded into trucks, and transported to a crushing plant. In 1951, 2,693 tons of limestone was produced. Five men were employed.

The Consolidated Mining and Smelting Company of Canada, Limited†

Fife (49° 118° S.E.). Head office, Trail; quarry, Fife. G. E. Clayton, engineer; Oscar Tedesco, quarry foreman. Quarrying of limestone continued throughout the year. Compressed-air jackhammers are used for drilling, and the limestone is blasted from benches; 40 per cent Forcite and 55 per cent Stopeite explosives are used for blasting. The quarry is alongside the Kettle Valley branch of the Canadian Pacific Railway, half a mile north of Fife. A ⅝-cubic-yard Northwest diesel shovel is used to load the broken rock, which is hauled by truck to a loading-bin on the railway. It is then shipped to Trail, to be used as a flux in the smelter. During 1951 the output averaged 3,000 tons per month. Eight 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. Wet marl only is produced. A drainage ditch is being dug to lower the elevation of Cheam Lake so that deposits on the lake edge may be mined. Four men were employed during the operating year.

Popkum Marl Products Limited*

Popkum (49° 121° S.W.). W. A. Munro, manager. This company mines marl from a deposit on the east shore of Cheam Lake. A ½-cubic-yard dragline shovel digs marl and loads it on trucks for transportation to the drying plant. In the plant a sawdust-fired rotary kiln dries the marl. The plant has a capacity of 10 tons per day. Wet marl, dry marl, and dried humus are produced. Seven men were employed during the operating year.

PYROPHYLLITE

Riverside (Mountain Minerals Limited)‡

Semlin (50° 121° N.E.). Company office, Morris Building, P.O. Box 273, Lethbridge, Alta. R. A. Thrall, managing director. This group consists of the Juniper, Sonny, Shiela Fraction, and Margaret claims. It is on a pyrophyllite deposit immediately south of the tracks at Semlin Siding, on the Canadian Pacific Railway main line 10 miles east of Ashcroft. The showings are in the gully of a small creek in the open, terraced, " dry belt " bench land on the south bank of the Thompson River. The quarry is about 1,500 feet due south of the tracks and can be readily reached from them on foot either by walking up the creek bed or directly overland. A rough road has been bulldozed from the siding to the quarry. There is no usable road connection to any highway, although a washed-out ranch road extends for 7 miles from the road to Walhachin to a cabin near the No. 1 post of the Sonny claim.

The claims were located in 1947 and 1948 and surveyed in the autumn of 1951. Two days were spent examining and mapping the main showings in July, 1951. L. Stairnes, the original discoverer of the pyrophyllite, acted as guide.

On the claims the only rock exposures are found in the gullies, the remainder of the area being covered with overburden a few inches to 15 feet or more deep. The only rock type noted was rhyolite. Two small conglomerate patches consisting of mixed pebbles bonded by a lime-silica cement were seen in the creek bed, but these appear to be recent deposits now in process of formation.

* By R. B. King.
† By E. R. Hughes.
‡ By J. W. McCammon.

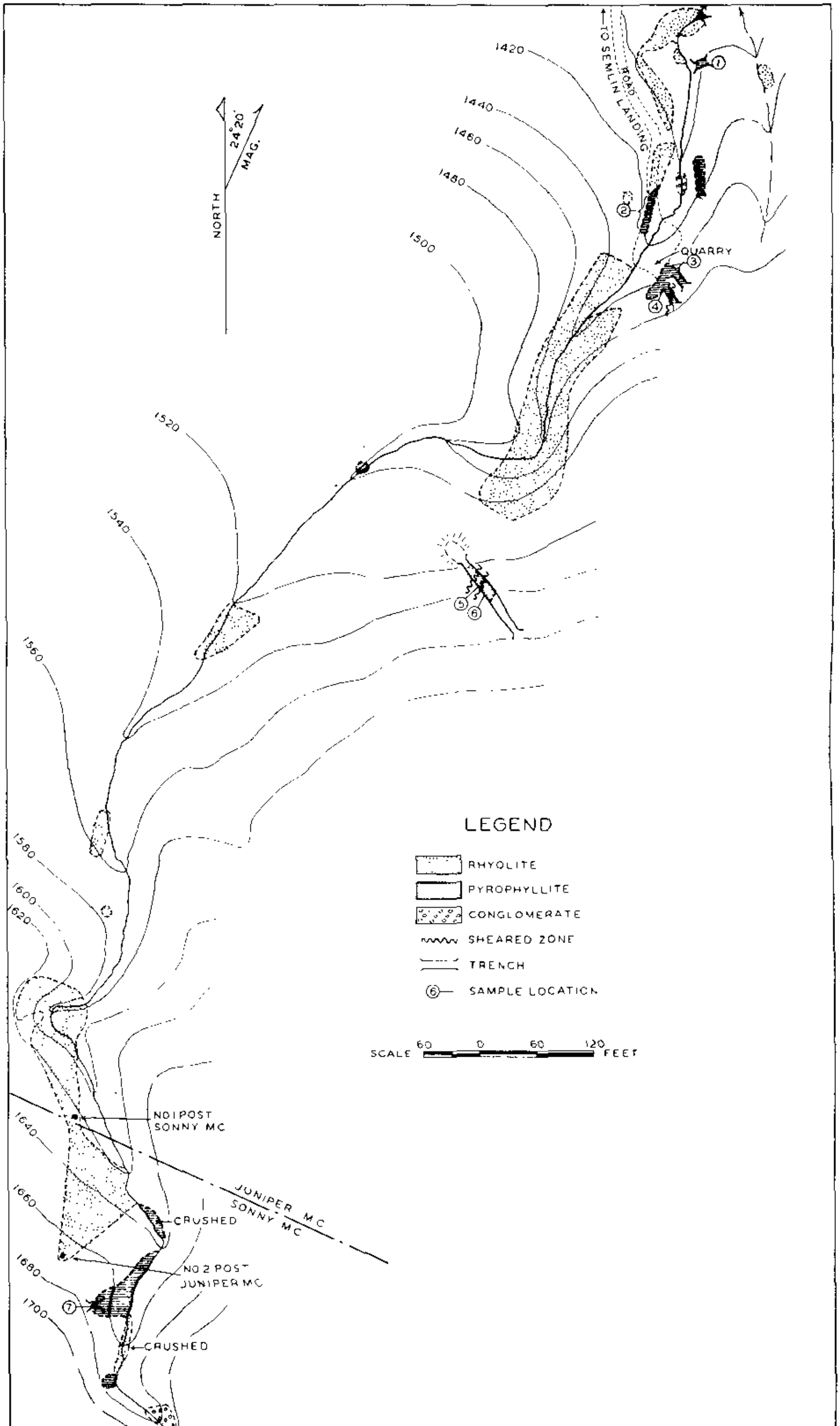


Fig. 18. Semlin pyrophyllite deposit.

Development seen on the property consisted of a small quarry joining two deep open-cuts, a 90-foot long trench south of the quarry, and two smaller cuts, all on the Juniper claim. One small trench and a few pits are on the Sonny claim. Nothing was seen on the Shiela Fraction and Margaret claims. These latter adjoin the Juniper claim in tandem to the east.

The pyrophyllite occurs in wallrock alteration along a shear zone in Upper Triassic* rhyolite porphyry. Away from the zone of shearing the porphyry is a slightly schistose, greenish-grey, porphyritic rock composed mainly of phenocrysts of quartz, orthoclase, and minor albite in a fine-grained groundmass. Near the shear zone the porphyry is sheeted or platy and the colour is light blue-grey. In the shear zone the rock consists mainly of quartz and pyrophyllite with minor pyrite and calcite. Just southwest of the most northerly open-cut the porphyry is noticeably brecciated.

The development of pyrophyllite in the shear zone has been erratic. In some places the rock exposed is predominantly pyrophyllite and in other places there is a very minor development of this mineral along shear planes. The pyrophyllite zone is conspicuous because of its light yellow-stained coloration. The natural exposures are very yellow and sparkle with small selenite crystals. In the quarry and large open-cut the pyrophyllite is a light-grey to white colour but is noticeably iron stained; whether or not this staining will persist with depth is not known.

A bulk sample of the pyrophyllite was sent to the Bureau of Mines, Ottawa, in 1948 for grinding tests. The conclusions reached as a result of these tests are as follows:† " The material as received contained a large percentage of discoloured material which, if not removed prior to grinding, would result in an off-colour product. Tests made on the portion of the sample remaining after the removal of as much as possible of the discoloured material indicated that a product suitable for ceramics or filler use can be obtained."

Partial analyses of seven samples taken during the examination are as follows:—

Sample No.[1]	Width	SiO_2	Al_2O_3	Fe (Total)	H_2O+	H_2O-	SO_3
	Feet	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
1	4	70.58	19.12	0.24	5.24	0.60	1.09
2	20	60.44	25.20	0.86	3.78	0.74	0.90
3	10	73.90	19.50	0.48	4.12	0.08	0.66
4	20	74.52	19.58	0.34	4.62	0.06	0.42
5	10	73.06	18.60	0.28	3.16	0.20	0.21
6	15	72.66	18.50	1.14	4.90	0.46	1.21
7	5	72.66	16.70	0.72	2.70	0.24	0.84

[1] Numbers correspond to sample locations on Figure 18.

In 1950 a 90-ton shipment of the pyrophyllite was made for commercial testing. In 1951 a further small shipment was made to the company grinding plant in Lethbridge, Alta.

SAND AND GRAVEL

Border Sand and Gravel Company‡ White Rock (49° 122° S.W.). Office and plant, Boundary Road, R.R. 4, White Rock. H. LaPierre, manager. This gravel pit and washing plant started operations in 1951. The washing plant has a capacity of 60 cubic yards of washed and sized gravel and gravel products a day. Gravel is pushed by a bulldozer to a bin, from where it is elevated by a bucket-conveyor and emptied into the washing plant. During 1951, 9,432 cubic yards of material was produced. Approximately five men were employed.

* *Geol. Surv., Canada, Map 1010A, Ashcroft, British Columbia, Geological Series, Sheet 92 I (west half), 1951.*

† Mineral Dressing and Metallurgical Laboratory Report No. 2435—Grinding tests on a sample of pyrophyllite from Semlin, British Columbia, Bureau of Mines, Ottawa, June 10th, 1948.

‡ By R. B. King.

Deeks-McBride Limited*

Company office, 1051 Main Street, Vancouver. J. W. Sharpe, general manager. Two gravel pits, with crushing, screening, and washing plants, were operated 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 is crushed and screened per day. Gravel is dug by a 1-cubic-yard capacity dragline and transported on a narrow-gauge railroad to the plant. Ten men were employed.

At the Seymour Creek pit, gravel is mined by digging into gravel banks with ¾-cubic-yard capacity shovels. About mid-year, recovery of gravel was started in an area adjacent to and under Burrard Inlet, a ¾-cubic-yard capacity dragline being used. Trucks are used to transport gravel to the plant. This plant produces 1,200 cubic yards of sized gravel products in a 16-hour day. Twenty-five men were employed.

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. Sand and gravel for making fill, concrete, and plaster are produced by this company. A ½-cubic-yard capacity diesel-driven shovel loads gravel on trucks. In 1951, 12,848 cubic yards of gravel was produced from the pit. Two men were employed.

E. R. Taylor Construction Company Limited*

Burnaby (49° 122° S.W.). Office, Seventy-first Avenue and Hudson Street, Vancouver; plant, Stride Avenue, Burnaby. A. G. Teed, superintendent. This company operates the Stride Avenue pit for Burnaby Municipality. Gravel is mined from high faces by a ¾-cubic-yard diesel-operated shovel and transported to a portable crusher. In 1951, 210,870 tons of gravel and 33,882 cubic yards of fill material were mined. Of the gravel mined, 67,350 tons was sold as run-of-the-bank gravel, 104,770 tons was crushed to 1⅛-inch size, and 38,750 tons was crushed to 2½-inch size.

Corporation of the Township of Langley*

Murrayville (49° 122° S.W.). W. Merrell, superintendent of works. This municipality operates two gravel pits for the purpose of road maintenance and construction. These pits are on Hunter Road and near the south edge of Fort Langley town. The Hunter Road gravel pit (N.W. ¼ Sec. 22, Tp. 7) is worked with a 15-foot face. A ⅜-cubic-yard diesel-driven shovel loads gravel into a hopper, from which it is conveyed to a portable crusher.

The Fort Langley gravel pit is worked with the same equipment as the Hunter Road pit. A gravel face nearly 40 feet high is maintained.

In 1951, 40,789 cubic yards of crushed gravel and 29,819 cubic yards of pit-run gravel were produced.

Corporation of the District of Surrey*

Cloverdale (49° 122° S.W.). J. A. Furiak, superintendent of public works. Several gravel pits are operated within the district. In all places gravel is blasted down by the use of 20 per cent blasting-powder. The gravel is loaded by a ½-cubic-yard shovel and either used as pit run or crushed in a portable crusher. In 1951, 60,000 cubic yards of crushed gravel was stockpiled, and 50,000 cubic yards of pit-run gravel was used.

Torgerson Construction Co. Ltd.*—Port Mann (49° 122° S.W.). Mr. Torgerson, manager. Gravel is mined by shovel from a 50-foot face and transported to a portable washing plant. This plant has a capacity of 40 cubic yards per hour. More than half the gravel produced is used in an adjoining asphalt plant.

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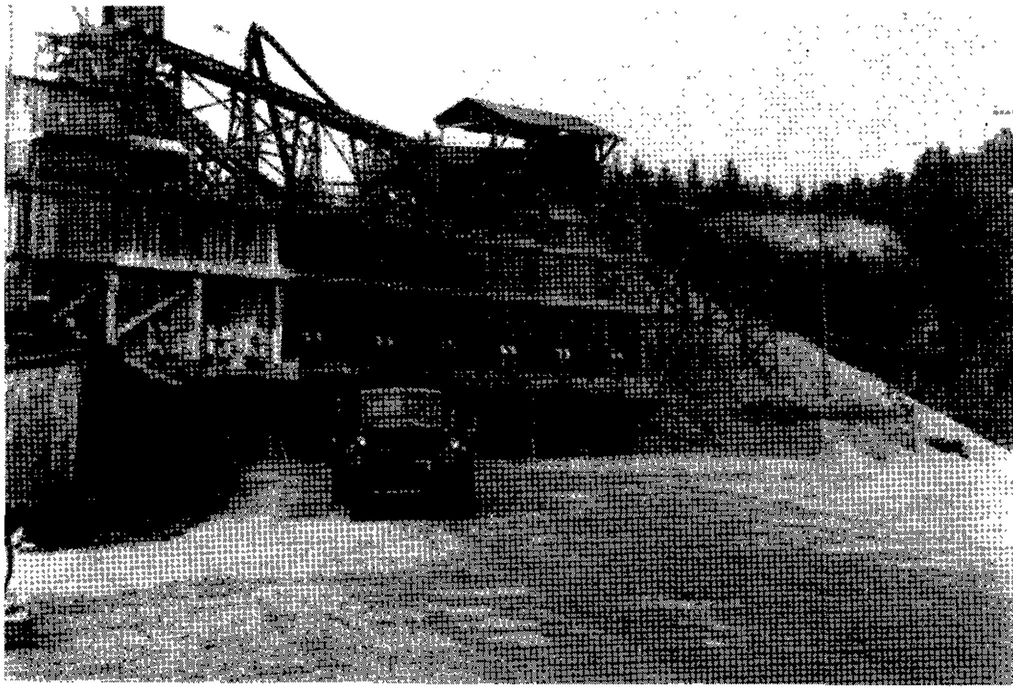
* By R. B. King.

Fresh Water Sand & Gravel Company Limited*†

Coquitlam (49° 122° S.W.). Company office, 902 Columbia Street, New Westminster. J. H. Gilley, general manager; Francis J. MacDonald, superintendent. This company produces sand and gravel from a pit on the Fraser River near Coquitlam. Gravel is washed from gravel banks and retained in enclosures. An electric



Part of the plant of the Fresh Water Sand & Gravel Company Limited, Coquitlam.

shovel of 1-cubic-yard capacity loads gravel from these enclosures on conveyor-belts that transfer it to the washing plants. The two plants for washing, crushing, and screening the gravel have a capacity of 200 cubic yards per hour. The average number of men employed during 1951 was thirty-five.

D. F. Gosling Gravel Pit*

Abbotsford (49° 122° S.E.). D. F. Gosling, owner and operator. This gravel pit is 7 miles west and 6 miles south of Abbotsford. Gravel is mined by shovel and crescent-type scraper and elevated by a bucket-conveyor to a washing, sizing, and screening plant. All grades of material are stockpiled.

During 1951, 42,000 cubic yards was produced. Of this amount, 32,000 cubic yards was sold as pit-run gravel, 4,000 cubic yards as washed and sized rock of five-eighths to 2 inches in diameter, and 6,000 cubic yards as washed sand.

Highland Sand and Gravel Company Limited*

Lynnmour (49° 123° S.E.). Company office and plant, Lynnmour. W. J. Barrett-Leonard, manager; W. Hills, superintendent. Sand, gravel, and crushed products are produced by this company. Sand and gravel are blasted from a 40-foot face and loaded on trucks by ¾-cubic-yard diesel-driven shovels. Two well drill-holes were drilled in 1951 to test for gravel below the present pit floor.

A crushing, screening, and washing plant is operated, producing 300 cubic yards of sized products per day, including concrete bricks and tile. In 1951, 150,499 cubic yards of material was sold. The average number of men employed was twenty-three.

* By R. B. King.
† Previously referred to as Maryhill Sand and Gravel Company Limited.

The Corporation of Delta*

Ladner (49° 123° S.E.). J. C. Johnstone, municipal engineer. Sand and gravel are produced for road surfacing and asphalt mixes, to be used on municipal roads. Gravel is dug by a ⅜-cubic-yard shovel and transported to a portable crusher. During 1951, 35,873 cubic yards of gravel was produced.

Road Materials Limited.*—Lynnmour (49° 123° S.E.). This company operates a sand and gravel pit and a processing plant for road materials. Gravel is loaded by a ½-cubic-yard capacity shovel on trucks and transported to the processing plant or stockpile on the Deep Cove Highway.

McIntyre and Harding Gravel Company Limited*

Saanich (48° 123° N.E.). Company office and plant, Royal Oak P.O., Saanich. J. Harding, manager. Sand, gravel, and sized gravel products are produced by this company. Gravel is either washed down from gravel faces and dug, or dug directly from these faces by two ½-cubic-yard diesel-driven shovels and transported to the washing plant by trucks and a conveyor-belt. The washing and screening plant has a capacity of 30 tons per hour. Approximately 75,000 tons of gravel and gravel products were produced in 1951. The average number of men employed was twelve.

Producers Sand & Gravel Company (1929) Limited*

Albert Head (48° 123° S.E.). Company office, 900 Wharf Street, Victoria; plant, Royal Bay. A. Parker, manager. Crushed and sized gravel and products are produced by this company at its plant, which is nearly a mile north of Albert Head. A scraper operated on a slack-line cableway is used to loosen packed gravel from a steep, high face. The gravel is loaded by a 1-cubic-yard shovel into a hopper, from where it is conveyed by a series of conveyor-belts to the plant. In 1951 a new plant, which has a capacity of 200 cubic yards per hour, was put into operation. Pit-run gravel is screened, and the oversize material is conveyed to a jaw crusher. The oversize from the jaw crusher is conveyed to a cone crusher, and the undersize from the jaw crusher and all material from the cone crusher are stockpiled. The undersize from the first screen is washed and screened. Various sized products are removed. The final product is a plaster sand which is recovered by two Telesmith classifiers. In 1951, 189,233 cubic yards of material was excavated.

TALC

Sonny, Barbara-Ann, and Bluff (Mountain Minerals Limited)†

Armstrong (50° 119° S.E.). Company office, Morris Building, P.O. Box 273, Lethbridge, Alta. R. A. Thrall, managing director. The Sonny, Barbara-Ann, and Bluff mineral claims are located on a talc deposit straddling Kendry Creek, 3¼ miles in a straight line northeast of Armstrong. The claims are 1,000 feet above and 1 mile due east of the Armstrong–Enderby Highway at the bend 2.4 miles north of Armstrong. A tractor-road has been built for 1 mile up the north side of Kendry Creek to the talc showing from a farm on the side-road east of the highway.

One week was spent examining the showing in June, 1951. At that time development on the property consisted of a small quarry and some stripping at the end of the tractor-road, several small pits and trenches scattered over the hillside above the quarry, and an open-cut with stripping at an exposure near the creek bottom 400 feet west of and 160 feet below the quarry.

The Barbara-Ann and Sonny claims were recorded in 1946 and surveyed in June, 1951. While the survey was in progress, talc was discovered south of Kendry Creek, so the Bluff claim was located southwest of and adjoining the two original claims.

* By R. B. King.
† By J. W. McCammon.

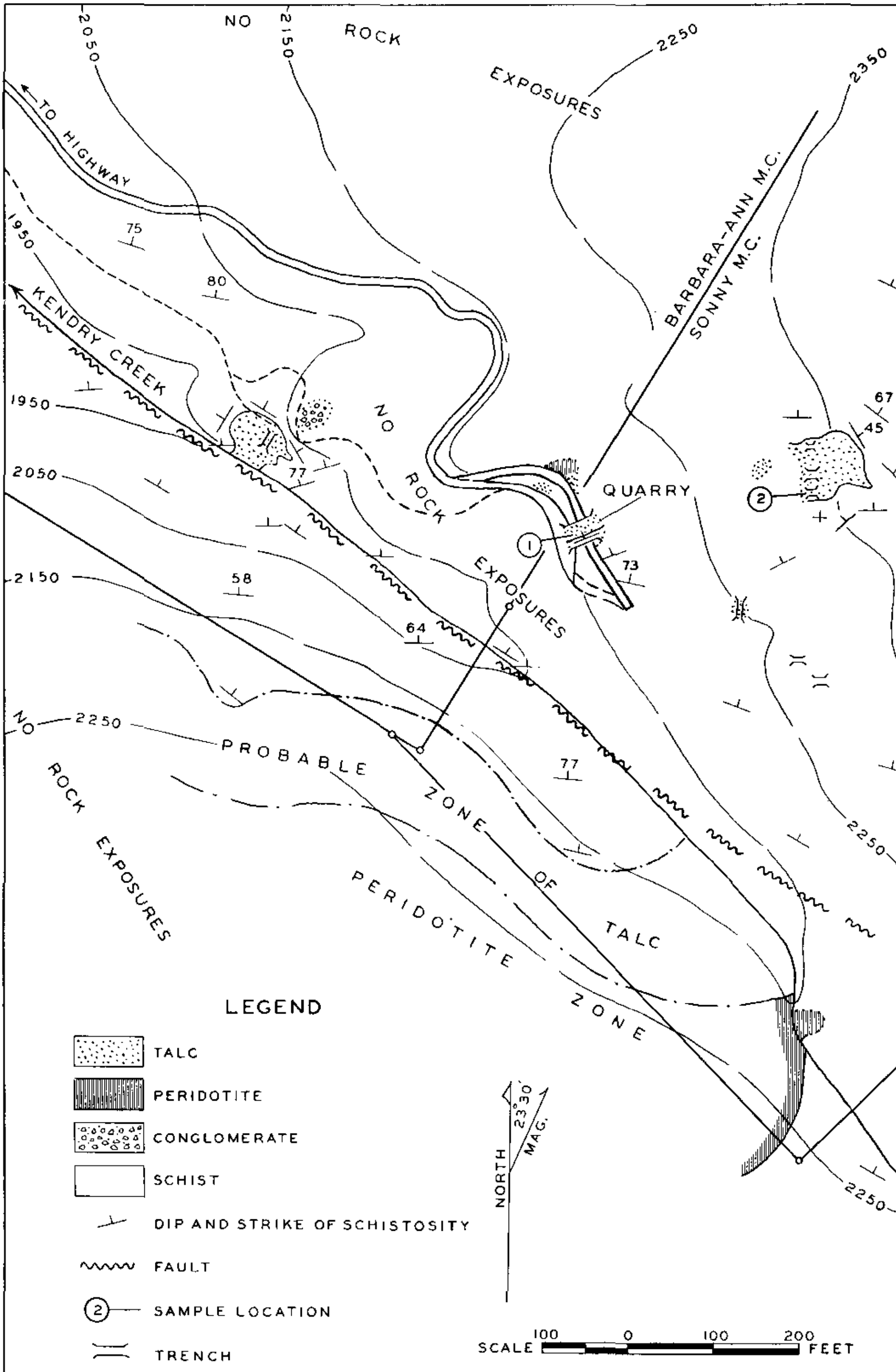


Fig. 19. Talc deposit near Armstrong.

The talc is found as discontinuous lenses and as part of an altered peridotite sill in quartz-mica schist mapped by Jones* as part of the Precambrian or Palæozoic Salmon Arm formation.

The country rock is a dark bluish-grey, medium- to coarse-grained quartz-mica schist. In places hornblende is present, sometimes in abundance. The schistosity in many places grades into well-developed gneissosity. The lineation has an average strike of north 75 degrees west with an average northerly dip of 64 degrees. Local abrupt changes in attitude due to small folds are not uncommon.

Interbedded in the schist on the hillside, above and 1,000 feet north of the quarry, is a bed of light-grey limestone about 150 feet thick. Down Kendry Creek, 1,800 feet to the west of the talc, is a small abandoned quarry in limestone interbedded in schist. This limestone is probably another exposure of the same bed noted higher up the hill. A small limestone lens 2 feet wide is exposed for 10 feet between layers of schist in the creek bank at the downstream edge of the talc exposure in the creek outcrop on the Barbara-Ann claim.

A small circular patch of conglomerate forms a knoll beside the trail just north of the creek outcrop of talc on the Barbara-Ann claim. This conglomerate consists chiefly of schist pebbles with a few quartz pebbles and is bonded with a calcareous cement. The conglomerate rests unconformably upon schist.

Talc is exposed on both sides of Kendry Creek. On the north side, three small areas, roughly in line from west to east, have been stripped and trenched. The most westerly outcrop forms a bluff in the creek bank just above water-level. Schist encloses the talc on three sides. The lineation in the schist bends around the west side of the talc and crosses the top of the outcrop to meet and run together with lineation in the schist on the east side and by so doing pinches off the talc in a northeasterly direction. The bottom of the exposure is covered by talus. No bedrock is exposed in the creek bottom at this point, and the nearest outcrop to the south is of schist, 100 feet from the creek. The talc in this exposure underlies an area about 50 by 70 feet. One shallow open-cut 20 feet long has been dug down the face of the exposure. The talc is heavily iron stained, contains a large amount of carbonate, and is badly sheared and fractured. Tremolite-actinolite crystals are erratically developed, and in a few places bladed aggregates of white talc crystals as much as 2 inches long have developed.

The next talc area, 400 feet east of and 160 feet higher than the one just described, is the site of a small quarry that marks the end of the tractor-road. The quarry opening is roughly 30 feet wide by 40 feet long. It exposes schist along the south wall and talc in the rest of the face. The talc is highly sheared and near the centre of the exposure contains an 8-inch wide lens of mica that lies parallel to the schist in the footwall. Several minor northwesterly striking slips are visible towards the southeast corner of the quarry. The presence of talc in two small strippings on the road 50 feet northwest of the quarry indicates a total width of about 80 feet for the talc area. The north edge of the talc is indicated in the upper of these two strippings, where the talc grades into dark-green altered peridotite spotted sparingly with talc flakes. The talc in the quarry is, in general, badly crushed and sheared, is rusty coloured, and contains variable amounts of calcite, magnesite, tremolite-actinolite, and magnetite. Chemical analysis of a sample taken across the base of the quarry indicated a composition of 71 per cent talc, 14½ per cent magnesite, 2½ per cent calcite, and 6¼ per cent magnetite. In a few small slips minor amounts of pure translucent green flaky talc can be found.

Two small pits and three small trenches, in line southeasterly from the quarry, indicate the presence of a 10-foot wide zone of talc in that direction. In all exposures the talc is rusty brown, badly sheared, and contains a high proportion of carbonate. The mineralization appears to be in a shear zone parallel to the cleavage of the surrounding schist. No talc has yet been found beyond the most easterly trench.

* *Geol. Surv., Canada,* Paper 48-4, Salmon Arm Map Area, British Columbia, p. 2 (1948).

Three small open-cuts have been dug in a bluff of talc above and 200 feet to the east of the quarry. As in the creek showing, the talc is surrounded by schist on three sides and lenses out to the east. On the fourth side, to the west, the talc is covered by overburden. Between the quarry and the open-cuts under discussion there are only two small outcrops—a small showing of talc 30 feet below the open-cuts and a small knob of peridotite 80 feet above the quarry. The talc rock in the three cuts is badly sheared, highly iron stained, and contains a high percentage of carbonate. The chemical analysis of a sample taken from the most southerly cut indicates a composition of about 52½ per cent talc, 34½ per cent magnesite, 1½ per cent calcite, and 5¾ per cent magnetite. Some slips in the rock contain large flakes and fibrous blades of white talc with carbonate crystals as large as 1 inch by 1½ inches, but these are rare. Needle-shaped crystals of tremolite-actinolite now partly altered to talc are conspicuous in this outcrop. In the exposure, talc is visible over an area roughly 70 by 70 feet, limited by schist on three sides and open on the fourth side.

The talc rock on the south side of Kendry Creek is part of an altered peridotite sill that strikes slightly north of west and dips steeply to the north conformable with the enclosing schist. The sill is approximately 200 feet thick. The southern contact of the sill with schist is well exposed near the southeast corner post of the Sonny claim. The northern contact between the sill and the schist was not seen, its position, shown in Figure 19, being estimated from the nearest outcrops of each type of rock. To the south and west, rock outcrops are scarce, and the extent of the sill in these directions is unknown. Except for the small extension indicated in Figure 19, no peridotite was found north of the creek. The main mass of the sill is dark-green fine-grained serpentinous rock containing scattered but conspicuous silvery talc flakes. A thin section of the rock contained olivine remnants, talc, magnetite, serpentine, and tremolite needles in various stages of alteration. Towards the north edge, presumably the top of the sill, the peridotite grades into talc-carbonate rock. This latter is a tan to greenish rock that has a rough, reddish-brown weathered surface. A thin section of it consisted of about equal parts of talc and carbonate with accessory magnetite and a few tremolite relics. The extent and continuity of the talc zone of the sill is not definitely known, since outcrops are spotty and no development has been done on it. However, scattered showings of talc were seen over a variable width for 700 feet along the strike west from the outcrop in the creek.

It is thought that the talc bodies on the north side of Kendry Creek represent the eastern extremity of the sill south of the creek. Although no conclusive evidence of a fault down the creek was seen, the straightness of the valley, the extreme narrowness of the bottom, the steep banks, and the fact that both the sill on the south and the talc outcrops on the north side of the creek terminate abruptly at the creek, all suggest the existence of a fault down the valley. Such a fault with an apparent relative movement of north side west would offset the talc on the north downstream from the talc-peridotite on the south. The lensed nature of the three talc outcrops on the north is apparently due to movement on and squeezing of the thin eastern extremity of the sill.

Analyses of two samples of the talc-carbonate rock are as follows:—

Sample No.	CaO	MgO	CO_2	SiO_2	Fe (Total)	Al_2O_3	H_2O-	H_2O+
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
1	1.34	29.23	10.44	45.22	4.50	1.32	0.21	4.52
2	0.88	33.14	21.42	33.52	4.23	0.32	0.10	3.22

Sample No. 1—across 13 feet at the base of the quarry.

Sample No. 2—across 10 feet in south cut above quarry.

Both samples were buff coloured when powdered.

In 1950 a trial shipment of 43 tons of talc was made from this deposit. The talc was used in experiments.

Inspection of Lode Mines, Placer Mines, and Quarries

By H. C. Hughes, Chief Inspector of Mines

CONTENTS

PRODUCTION

The output of metal mines for 1951 was 6,977,761 tons. This tonnage was produced from 119 mines, of which 64 produced 100 tons or more.

FATAL ACCIDENTS

During 1951 there were eleven fatal accidents connected with actual mining operations in metal mines and quarries. This was five more than in 1950. In addition, there were two fatal accidents on the surface not directly connected with mining operations. A description of these is included.

There were 7,480 persons employed below and above ground in metal mines and 1,307 persons employed in concentrators in 1951.

The ratio of fatal accidents per 1,000 persons employed was 1.47, as compared with 0.85 in 1950.

The tonnage mined per fatal accident during 1951 was 634,342 tons, as compared with 1,130,485 tons in 1950.

The tonnage mined per fatal accident during the last ten-year period was 524,884 tons.

The following table shows the mines at which fatal accidents occurred during 1951, with comparative figures for 1950.

Mining Division	Mine	No. of Fatal Accidents	
		1950	1951
Fort Steele	Sullivan	—	1
Golden	Paradise	—	1
Slocan	Van Roi	1	1
Nelson	Jersey	—	1
Greenwood	Waterloo	2	—
Osoyoos	Nickel Plate	—	1
Similkameen	Copper Mountain	1	—
Lillooet	Bralorne	2	2
Nanaimo	Iron Hill	—	1
Vancouver	Britannia	—	2
Victoria	Twin J	—	1
Totals		6	11

A blasting fatality at an abandoned mine and a fatality in connection with road construction for a mining property have been omitted from this table.

The following table classifies all fatal accidents as to cause and location:—

Cause	Number	Location
Falls of ground	5	Underground.
Hung-up chute	3	Underground.
Loading from chute	1	Underground.
Blasting-caps	1	Surface.
Adjusting bulldozer	1	Road construction.
Falling	1	Underground.
Blasting	1	Quarry.
Total	13	

A brief description of all fatal accidents follows.

On February 5th, 1951, Emile James Loran, Canadian, aged 28, single, employed as a motorman at Britannia mine was instantly killed by a fall of ground in the 3500 level fan station on the 3500 level of the Bluff mine. Loran was operating a motor when a slab of rock weighing about 2 tons fell from the back, striking him on the head. The ground in the area was known to be bad and was constantly checked. Just prior to the accident the rock that killed Loran had been tested with a bar but could not be moved.

On February 12th, 1951, Clarence Melville Olson, Canadian, aged 21, single, employed as a mucker at the Nickel Plate mine of Kelowna Mines Hedley Limited, was instantly killed by a fall of ground in the C-5-1 stope. The ground in this stope was blocky and loose. The miner and his helper, Olson, were engaged in barring down to make the place safe. One large slab could not be barred, and the men were instructed to drill and blast it. Drilling had just commenced when the slab broke away and a piece of about one-half ton struck Olson on the head. After the slab fell, a hidden slip, feathering off in the hangingwall farther down the stope, was revealed.

On June 21st, 1951, David Duerksen, Canadian, aged 26, single, employed as a motorman, and Gregory Kostek, Polish, aged 40, single, employed as a stope cleaner in the Bralorne mine, were killed in 1275 No. 4 stope when the caving of a hung-up chute released a large hangingwall slab which crushed them against the footwall of the stope. The 1275 No. 4 stope is a shrinkage stope, and the men were engaged in cleaning it down as it was being drawn. The hung-up chute had drawn from one side, and therefore the danger area was displaced from its normally expected position. Both men were experienced in this type of work, and both were aware of the hang-up because forty cars of muck had been drawn from the chute without changing the level of the muck in the stope. From the tools found near by, it was evident that the men were preparing to timber up the slab when the cave-in occurred.

On July 20th, 1951, Donald Edward McLenaghen, Canadian, aged 30, married, employed as a skip-tender at the Sullivan mine, was killed at the 3200 level loading-pocket in the No. 1 shaft. He was pulling a plank on to the loading-platform, when he accidentally struck the control valve, causing the chute gate to drop. He lost his balance, fell into the skipway, and the muck came down on top of him. He was an experienced workman and had been employed as a skip-tender for eighteen months immediately prior to the accident.

On September 13th, 1951, Kenneth A. Flanagan, Canadian, aged 22 years, single, diamond-drill helper employed by Boyles Bros. Drilling Company Ltd. at the Bluff mine, Britannia, was fatally injured when he fell into the No. 68 ore-pass from the 1200 level of the Bluff mine. The diamond driller and Flanagan were moving diamond-drill equipment past No. 12-68 dump on the 1200 level to a new set-up. They had removed the dump guard, dumped two loaded Granby cars and continued to a switch opposite the shaft station. There they hooked a hand-truck loaded with diamond-drill equipment to the end of a Granby car with a 9-foot drawbar. The diamond driller, who was running the motor, instructed Flanagan to go ahead towards 12-68 dump and make sure the path was clear. On receiving a go-ahead signal from Flanagan, he proceeded towards the dump. As he neared it, he saw a light flash down the ore-pass so he stopped the motor. Flanagan could not be found, so it was presumed that he had fallen down the ore-pass. After considerable difficulty the body was recovered in the control chute on the 1800 level 600 feet below where the accident occurred. From evidence submitted and measurements taken, it seemed that Flanagan was riding with his right foot on the hand-truck and left foot on the drawbar, possibly holding on to the diamond-drill equipment. As the truck moved by the dump and the first Granby car hit the dump bridge, the jerk was sufficient to cause Flanagan to lose his balance and fall into the dump.

On September 28th, 1951, George Dickson, Canadian, aged 26 years, married, employed as a miner by Canadian Exploration Limited in the Jersey mine, was asphyxiated in No. 4044 A 4 stope when he was buried under muck which suddenly settled after being hung up. Dickson and his partner had been detailed to drill holes for the purpose of slashing the top of the raise preparatory to installing a grizzly at the proper level. As the muck was too high to allow drilling in the correct place, the shiftboss arranged to draw a train load (ten 2-ton cars) from the chute below, after which he was to return to the top of the raise to detail the work. Six cars had been pulled when a spill occurred, and a short time later the ore was heard to settle in the ore-pass. Dickson's partner called down the manway that Dickson was buried. When his body was recovered about thirty minutes later, there was no sign of life, the deceased having died from asphyxia and shock. Evidence submitted brought out the fact that Dickson and his partner noticed the muck settle in the raise and then stop. They suspected a spill had occurred but did not know how many cars had been pulled nor did they expect a hang-up. They knew, however, that the muck had not gone down the equivalent of ten cars. Being on contract, they were anxious to start work. They started to collar holes about 4 feet apart when the muck subsided, burying Dickson.

On October 8th, 1951, Dave Soric, naturalized Canadian, aged 46 years, single, and employed as timberman at the Paradise mine of Sheep Creek Gold Mines Limited, was killed by a fall of ground in No. 7930 square-set stope. Soric and his partner were erecting a set from the third to the fourth floor. While they were lifting the cap into position, a rock weighing about 200 pounds fell from the back, striking Soric on the left hip and causing severe internal injuries and hæmorrhage. To make room for the set, Soric had previously drilled and blasted two shallow holes to remove a hump of rock. The back was then scaled and seemed to be safe. After the accident it was apparent that a hidden slip existed from which the rock fell.

On October 26th, 1951, Alexander Shukin, Canadian, aged 26 years, married, employed as a powderman by the Argonaut Co. Ltd. at their Iron Hill quarry near Campbell River, was fatally injured by a blast. The Iron Hill mine is open-cut and is worked by a system of benches 30 feet apart vertically. Shukin and his helper were doing secondary blasting on the 1610 level. Ninety-two holes had been drilled in oversized pieces of ore from a previous electrical blast and had been loaded, using caps and 4-foot fuse. One of the shots from the electrical blast had misfired and Shukin had reprimed it with cap and fuse, making ninety-three shots in all. Two groups of twenty each had been fired successfully by the two men. The third group, consisting of nineteen secondary holes and the misfire from the electrical blast, was being lit when the misfire exploded, apparently prematurely. The helper was knocked down and Shukin was pinned by a large piece of ore. The helper immediately tried to free Shukin but could not, and also tried to pull the fuses out but was unsuccessful. He was forced to retreat before the rest of the shots exploded, and when he returned Shukin was dead. Pieces of fuse were tested from the same roll as that from which the fuses used in the blast had been cut. All were found to have normal burning speed.

On December 4th, 1951, David Colin Campbell, Canadian, aged 34 years, single, employed as a miner in the Van Roi mine, near Silverton, was killed by a fall of ground in No. 350 stope. The No. 350 stope was being prepared for stoping. An inclined raise had been driven from No. 3 level to connect with the main raise leading to the level above. Campbell and his brother, F. N. Campbell, had been detailed to slash the back of the inclined raise connection in order to start a sublevel at that point. The necessary staging had been put up, the working-place barred down, and drilling was well under way when the men paused for a rest on the bulkhead over the manway of the main raise. F. N. Campbell heard his brother shout " Look out " and saw him run towards the drill. He remembered little after that as the fall of ground struck him and extinguished both men's lamps. In a few minutes he was able to summon help. His brother was covered with several rocks, none of which weighed more than 20 pounds. There was no sign of life. The back of the stope from which the rock fell could be reached by the hand. After the fall of ground a hidden graphite slip, which the workmen could not detect when they were barring down, was revealed. About 400 pounds of rock fell.

On December 13th, 1951, Lancelot Phillips, Canadian, aged 51 years, married, employed as a miner by Vancouver Island Base Metals Limited at the Twin J mine near Duncan, died as a result of injuries received when he was struck by a fall of ground in R-3 raise. R-3 raise was being driven to connect the 265 level of the Tyee workings with the 425 level of the Richard III workings, about 45 feet vertically above. It was being driven by square-setting through the backfill of an old stope. There were two compartments. The raise had been advanced five floors to approximately the level of the sill of the old Richard III 425 level, and the ground had been excavated over the manway to make room for another set of timber, when Phillips and his partner came on shift. Phillips went to the top of the raise to measure for timber while his partner collected tools, etc., from three sets below. The helper heard a fall of ground which caused rock to come down the manway. He went up and found Phillips at the top of the last set trapped by loose muck and timber. He endeavoured to extricate him but, being unable to do so, summoned help. While rescue operations were going on another cave occurred, further crushing the trapped man in spite of all that could be done to protect him. The old backfill was well consolidated and stood up well while work was going on. Old timbers in the backfill were sound, but possibly timbers exposed to the air in the 425 level had rotted and given way when the raise was advanced to the floor of that level. Phillips was an experienced miner and was particularly good at the type of work he was doing.

The following accidents are not included in the tables of fatal accidents and accidents involving loss of time.

On August 4th, 1951, Ian C. S. McLeod, employed by the Department of Mines and Technical Surveys, Ottawa, was fatally injured at the abandoned Pellaire mine by the explosion of approximately five boxes of detonators. McLeod and his partner were at the mine to get details of the position of the buildings for a topographic map. They discovered a considerable number of detonators scattered on the road in front of the warehouse and proceeded to gather them in a heap to destroy them. When about five boxes had been collected, McLeod inserted one end of a 4-foot fuse into a cap which was put into the middle of a full box. He was attempting to light the fuse with matches when the explosion occurred. It is probable that the explosion was caused by either a spark from a match falling into the end of an upturned cap or by stepping on a loose detonator.

On August 29th, 1951, James R. Hooper, employed as a swamper at the Tulsequah Chief mine of Tulsequah Mines Limited, was fatally injured by the frame of a bulldozer blade on a tractor used in constructing a road from the Tulsequah Chief mine to the mill. Hooper was attempting to block up the caterpillar track with a 4-foot pole in order to tighten the track master-pin which was loose. He was kneeling on the ground beneath the A-frame of the bulldozer blade when the blade came down, and he was struck by the frame and pinned to the ground.

FATAL ACCIDENTS AND ACCIDENTS INVOLVING LOSS OF TIME

Eleven fatal accidents and 348 accidents involving a loss of time of seven days or more 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 parts of the body injured. The eleven 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	7	1.9
Breaking of staging, ladders, etc.	5	1.4
Falls of ground	78	21.7
Falling or flying material	17	4.7
Falls from ladders, staging, etc.	9	2.5
Lifting and handling material	76	21.2
Machinery and tools	93	25.9
Slipping	43	12.0
Run of ore or waste	11	3.1
Burns and shock	4	1.1
Miscellaneous	16	4.5
Totals	359	100.0

Accidents Causing Death or Injury Classified as to Occupation of Those Injured

Occupation	Number of Accidents	Percentage of Total
Underground—		
Barmen	1	0.3
Chutemen	6	1.7
Haulagemen	42	11.7
Miners	152	42.3
Muckers	53	14.8
Timbermen	13	3.6
Trackmen and pipe-fitters	3	0.8
Miscellaneous	24	6.7
Surface—		
Shops	12	3.3
Mill	11	3.1
Surface, general	42	11.7
Totals	359	100.0

Accidents Causing Injuries Classified as to the Parts of the Body Injured[1]

Location	Number of Accidents	Percentage of Total
Head and neck	14	4.0
Eyes	14	4.0
Trunk	53	15.2
Back	57	16.4
Arms	25	7.2
Hands and fingers	68	19.5
Legs	66	19.0
Feet	39	11.2
Toes	9	2.6
Shock	2	0.6
Gas poisoning	1	0.3
Totals	348	100.0

[1] The eleven fatal accidents have been omitted from this table.

DANGEROUS OCCURRENCES

The following dangerous occurrences were reported as required by section 9 of the "Metalliferous Mines Regulation Act" and investigated by the Inspectors of Mines:—

On January 19th, 1951, at the junction of 39-Q-4 Sub A and Sub B in the Sullivan mine, two miners on afternoon shift had drilled and blasted the last round in a short sublevel which was driven to connect the two draw-hole raises. Some of the holes drilled had broken through. The two draw-hole raises were approximately 35 feet apart and were connected with other draw-hole raises driven from the main sublevels. A nearly vertical raise breaks into the sublevels at the junction of Sub A and Sub B. A scraper-hoist is located directly behind this raise. Apparently when the round was blasted, one or more of the holes were cut off and a large rock containing powder came down the draw-hole raise and came to rest on the slide near the hoist, where it exploded. There was a powder-box directly behind the hoist containing five or six sticks of powder. The explosion of the powder in the rock caused the powder in the box to explode, either by concussion or by a flying rock fragment striking the box. All connections to the hoist were broken and the ladders and pipe in 39-Q-4R manway damaged. No one was injured. Powder should not have been stored near the hoist.

On February 10th, 1951, at the Cariboo Gold Quartz mine, the hoistman was hoisting the cage-tender and diamond drillers to the 1500 level. He was hoisting in balance with a load of ballast in the bucket. He shut the controller off too soon, with the result that the hoist gained speed, damaging the rotor and stator winding to such an extent that it was necessary to replace the motor. No one was injured. The hoistman was replaced by another man. Recommendations as to additional equipment which would prevent a repetition of this occurrence have been made.

On February 27th, 1951, at 42-1-10 chute in 4203 drift south in the Sullivan mine, workmen using an acetylene torch saw flames near the wing part of the chute. They immediately investigated and found jets of flame coming from the hose connection to the low-pressure gauge on the acetylene-cylinder. Attempts to close the main valve failed because of the heat. A 2½-gallon soda-acid extinguisher also failed to put out the fire. The oxygen-cylinder was moved a safe distance from the burning acetylene-cylinder, and the gas burned itself out. Damage was done to the hoses and valves, and one of the chute posts was badly charred. No one was injured.

On June 29th, 1951, at the Jackpot mine southeast of Ymir, a heavy rush of sand and water was encountered while driving an exploratory adit. The face was 504 feet from the portal. The adit was driven through dolomite, limestone, and argillite. About 250 feet from the portal a dry watercourse up to 2 feet in width had been encountered, and the adit was swung 9 degrees to the right to avoid it. The ground was considered good. A small amount of water was coming from near the face, but no more than might be expected. The face at 504 feet from the portal was drilled and blasted, and the crew retreated from the mine. The blast was followed by a rush of dolomite sand and water which came out of the portal and filled the adit to a depth of a few inches at the portal and 5 feet at the face. A mucking-machine, two cars, and the drilling equipment were buried. An investigation revealed a narrow open watercourse about 2 inches wide which led to a larger opening, and it was calculated that more than 300 tons of sand flowed into the adit. No one was injured.

On July 19th, 1951, on the 4,350-foot level of No. 8 mine, Britannia, a fire occurred in the battery of a battery locomotive as the motorman disconnected the charging plug from the charging-plug receptacle. A flash occurred of sufficient intensity to ignite inflammable material (possibly machinist's waste) in the battery-box. The warning light showing that the battery was "on charge" was not working, and the motorman considered it safe to disconnect the charging lead. The fire was brought under control by a carbon-dioxide extinguisher from No. 8 hoist-room, but not before considerable damage was done to the battery. No one was injured. Ansul No. 4 dry chemical extinguishers have been installed in all underground charging-stations.

On August 6th, 1951, a fire was discovered in a seal in 36123 drift right of the Sullivan mine. On August 3rd a mine-rescue crew temporarily repaired the gunite seal by placing rubber belting over the door. On August 6th a mechanical failure of the 3821 fan was discovered. Patrols and inspections were made for fume leakage at a number of gunite seals while work was being done to divert the fumes to 39102 drift. Fume was discovered issuing from the seal in 36123 drift right, proving that there was a positive pressure behind the seal caused by the failure of the fan. Mechanical ventilation was restored, and the fumes diverted to 39102 drift fume-control route. A little later two ventilation engineers, travelling along 39129 drift north, discovered a fire burning in the 36123 drift right seal. This was reported to the mine-rescue room. Mine-rescue personnel equipped with all-service gas masks found the door of the seal blazing and a large volume of air flowing through the door. They were able to extinguish the fire with water. The door was completely destroyed, with little damage to other parts of the gunite seal. The opening in the seal was made air-tight with "lumnite." A new gunite seal was constructed 2 feet from the original. In future no combustible material of any sort is to be used for even temporary repairs on fume doors.

From August 1st to 13th, 1951, in the 39-Q4-1 stope of the Sullivan mine there was an occurrence of hot ore. Muck temperature increased from 120 degrees Fahrenheit on August 1st to a maximum of 220 degrees Fahrenheit on August 13th and 14th. The Q-4 pillar, enclosed by gravel fill, had been blasted in April, 1951. An estimated 270,000 tons was broken, and 60,000 tons was drawn by August 1st. Heating was localized in the proximity of draw-holes Nos. 8 to 12, inclusive, in Sub A slusher-drift. These draw-holes had been hung up for some time, and bulldoze charges wrapped in asbestos paper, placed in wet sacks and blasted with primacord and short fuse, were used to start them running. Two cased diamond-drill holes were drilled into the ore above the hang-up, and water was introduced through them to cool the ore. These holes were blasted on August 14th, and the blast brought down a large amount of gravel backfill into Nos. 10 and 12 draw-holes. On August 15th muck temperatures were back to normal and there was no further evidence of heating. An open fissure, locally known as a "watercourse," is adjacent to the Q-4 stope. Marcasite is usually present in these watercourses, and the rapid oxidation of it may account for the abnormal temperatures.

On August 9th, 1951, in No. 8 shaft at the Britannia mine, the trap-door on the cage-head was apparently unhooked accidentally while loading pipe on the cage, and fell into the closed position as the cage was being moved to the 4100 level. In closing it caught on a shaft timber and displaced the cage in such a manner that both shaft guides were broken or wrenched loose. No one was injured.

On September 1st, 1951, at the pump station on the 375 level of the Bluebell mine at Riondel, the air became so deficient in oxygen that it was impossible for the pumpmen to attend the pumps. In order to prevent the level from flooding, a crew equipped with Chemox self-contained breathing apparatus entered the workings, serviced the pumps, and rearranged the ventilation to overcome this condition. This work was undertaken by trained mine-rescue personnel from the mine, assisted by the mine-rescue instructor from Nelson with the mobile mine-rescue unit. The pumps draw from a reservoir formed by impounding water in a crosscut behind a low dam. The air in this area is deficient in oxygen and contains an excessive amount of carbon dioxide. Gas samples have been analysed containing as much as 9.9 per cent carbon dioxide. This gas may be given off by the strata or may be the result of oxidation. The new ventilation system is designed to eliminate the hazard.

On September 10th, 1951, at the Paradise mill of Sheep Creek Gold Mines Limited, the operator entered the fine-ore bin, without notifying anyone and without a safety belt or rope, to free a hang-up. The ore caved and trapped him. He was discovered and was removed with some difficulty after being trapped about four hours. He was uninjured.

On October 22nd, 1951, at the Emerald Glacier mine, a fire started in the dry-house and completely destroyed a building housing the dry and warehouse. No one was injured and no other buildings burned.

On December 17th, 1951, at the Victor mine near Sandon, the night-shift crew, proceeding to work at the bottom of a winze being sunk from the No. 5 level, was overcome by " gas " and reported that they were barely able to ascend the 75-foot ladder to the level. Blasting-gases were not suspected as the previous shift had mucked out the winze. The winze was blown out with compressed air, and no further trouble experienced. However, on December 18th a crew entering a stope on the No. 4 level was overcome in a similar manner. No one was permanently affected. The workings were investigated by the Inspector on December 19th, and air samples were taken from both the stope and winze. An analysis of these samples showed slightly more than normal carbon dioxide, practically normal oxygen content, and no carbon monoxide. It is suspected that a quantity of carbon dioxide was released from the bottom of the winze, where a fault was encountered. This gas could have been forced up the winze by compressed air and carried by the ventilating current up a raise to No. 4 level, where it could collect in the stope in which the second occurrence was reported.

On December 19th, 1951, at the No. 2 shaft of the Pioneer mine, the hoistman was hoisting muck from the 2200 level pocket to the 900 level dump in balance. On completing hoisting from the 2200 pocket, the cage-tender boarded the east cage and belled it to the surface. The hoistman forgot that the cages were not in proper balance for hoisting to the surface and proceeded to try to do so without making any change. He also evidently neglected to watch the west cage indicator dial and disregarded the warning bell on the west side. The limit switch for the west cage was tripped, but not before the cage struck the sump loading-pocket, and about 10 feet of slack cable was released before the drums were halted. Although the hoistman's negligence was directly responsible, the setting of the lower limit switch on the west side was faulty for operation at high speed. The setting was adjusted to work satisfactorily.

On December 24th, 1951, at the Tulsequah Chief mine near Tulsequah, two miners, lighting a round in an ore-pass raise, were caught at the face by a premature blast. The raise was 101 feet long and was driven on a slope of 53 degrees. The men were knocked down the raise to the chute but were able to climb up the raise 20 feet and get to the door between the chute and the manway and descend to the drift before the rest of the round went off. Neither was seriously injured. A careful investigation and questioning of the men brought out the fact that they had an extra primer left after the round was loaded. To dispose of this, they cut off most of the fuse (9.4 feet) and put the primed cartridge in the collar of one of the holes. The standard length of capped fuse provided is 12 feet. While the men were spitting the round, they must inadvertently have lit the short fuse. All but four holes had been lit when it went off with the described results.

PROSECUTIONS

On October 11th, 1951, at the Sullivan mine, a track boss neglected to satisfactorily guard the entrance to a place where shots were being fired. He was charged under section 20, Rule 42 (*a*), of the " Metalliferous Mines Regulation Act " as follows: " That he unlawfully did commit a careless act with an explosive or fuse in that he failed to effectively guard an entrance to a place where blasting was to be done." He pleaded guilty and was fined $25 and $2 costs.

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 1947, 1948, 1949, 1950, and 1951:—

	1947 Total	1948 Total	1949 Total	1950 Total	1951 Total	1951	
						Mines	Quarries
High explosives (lb.)	5,464,900	6,209,950	7,022,000	7,318,962	9,162,179	8,762,003	400,176
Blasting-caps	1,780,700	1,816,000	2,082,400	2,518,200	2,570,600	2,312,000	258,600
Electric blasting-caps	117,650	61,150	146,760	65,725	163,920	147,070	16,850
Delay electric blasting-caps (short period)					232,375	219,000	13,375
Delay electric blasting-caps (sure fire)	55,700	78,800	36,170	110,269	105,950	105,950	
Primacord (feet)	258,000	417,000	421,000	460,000	283,000	281,000	2,000
Safety fuse (feet)	13,722,100	16,053,900	16,838,400	19,934,700	19,832,300	18,488,300	1,344,000
Ignitercord (feet)					151,700	151,700	
Ignitercord connectors					100,900	100,900	

Several points in this table are worthy of special mention.

For the first time a substantial number of short-period delay electric blasting-caps has been used in coal mines, metal mines, and quarries in British Columbia. New blasting techniques made possible by these caps have been largely responsible for the success of multiple shooting in coal mines, with its attendant increase in safety and efficiency, and have resulted in better fragmentation and increased breakage per pound of explosives in metal mines and quarries.

The use of Ignitercord and connectors for blasting-cap and safety-fuse primed rounds in metal mines marks the introduction of a new blasting method which should result in improved safety and efficiency.

UNDERGROUND DIESEL EQUIPMENT

During 1951 diesel-driven equipment suitable for underground use in metalliferous mines was introduced in British Columbia. Installations included haulage locomotives, trucks, and caterpillar-type bulldozers. The companies using this equipment have taken steps to provide ventilation, and proper inspection and maintenance to ensure its safe operation. The advent of this equipment is another step forward in safe and economical mining.

AIR-SAMPLING

Air samples were taken wherever conditions indicated the possibility that noxious gases might be present or that the oxygen content might be below normal, and also to check determinations made by methane detectors, carbon-monoxide detectors, and flame safety lamps. A number of samples was also taken to check the atmosphere where diesel equipment was being operated and to test the carbon-monoxide content of the diesel exhausts. Thirty-nine samples were taken and analysed for oxygen, nitrogen, carbon dioxide, carbon monoxide, sulphur dioxide, methane, hydrogen, etc. This is eight more than the number taken in 1950. The increase was due to the necessity of sampling to ensure safe underground diesel operation.

DUST AND VENTILATION

Problems in dust-control and ventilation have continued to receive the attention of mine operators and Government departments. Complete dust counts and ventilation surveys were made in fifty-two of the more important mines by the Silicosis Branch of the Workmen's Compensation Board.

In addition, the crushing plants and assay offices of thirty-five operating mills were checked for dust conditions. Fifty-five complete surveys were made in all. Some of the larger operations are equipped with facilities for doing this work and keep a check on dust conditions in their mines by this means. Over-all dust counts were generally found to be below the range where a hazard is thought to exist. In some cases, as a result of these surveys, recommendations were made as to methods of improving ventilation and suppressing dust, and the carrying-out of the recommendations was followed by lower dust counts. The results of these dust and ventilation surveys are available to the inspection staff and are of considerable assistance to it. In general, a conscientious effort is being made by mine management to eliminate, as far as possible, this hazard.

Aluminium-therapy treatment for the prevention of silicosis is available at nearly all mines of any size where a silicosis hazard exists.

MINE-RESCUE, SAFETY, AND FIRST AID

During 1951 the mine-rescue stations at Cumberland, Princeton, and Fernie were fully maintained, with modern equipment and an instructor qualified in mine-rescue and first-aid work at each station. Each station is equipped with several sets of McCaa and Gibbs 2-hour oxygen machines, one set of Chemox 1-hour oxygen machines, all-service gas masks, methane and carbon-monoxide detectors of the latest type, an H.A. inhalator, and a complete supply of first-aid equipment. Supplies and facilities for charging and servicing this equipment are also maintained.

The Nanaimo mine-rescue station, opened and equipped in 1913, was closed permanently on August 31st, 1951. The great reduction in coal-mining activity in the area resulting from the closing of the White Rapids mine in 1950 and the depletion of the reserves in the No. 10 South Wellington made it no longer practical to maintain this station. In order to serve the Bright mine and several small operators in the area, a complete set of McCaa 2-hour apparatus is kept at the Bright mine. This equipment is serviced periodically by the instructor in Cumberland. Some of the equipment was sent to other stations in the Province, and the remainder stored in the station. The building was made available as a headquarters for the local civil defence organization.

Training in the use of mine-rescue equipment is given at the stations to all who apply for it, and 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 value of teamwork in mine-rescue operations. In addition, the instructors held first-aid classes at the stations and at the mines in their areas, as well as visiting some of the more remote mining areas to give instruction in both mine-rescue and first aid.

The mobile mine-rescue unit and the instructor first stationed at Nelson in 1950 proved to be a very valuable asset to the mining operations in that area. First-aid classes were held at Ainsworth, Kaslo, Zincton, Retallack, Sandon, Salmo, H.B. mine, and Canadian Exploration Company mines. Examinations were held at these places, and ninety-nine candidates successfully passed for St. John Ambulance certificates and higher awards, including industrial certificates. In addition, there were thirty-six who registered for the classes and who took all or part of the training but did not take the examination.

Classes in mine-rescue work were held at the H.B. mine, Salmo; the Canadian Exploration Company mines; the Reeves MacDonald mine; and the Bluebell mine. Thirty-three candidates took the full course and passed the examination set by the Department of Mines.

During the year the equipment was also used to assist in giving first aid to five men whose boat upset in the west arm of Kootenay Lake, in overcoming a carbon-dioxide condition at the Bluebell mine, and in exploring the Noonday adit at Sandon and the Euphrates adit near Hall Siding, both of which were deficient in oxygen.

The Sullivan and Copper Mountain mines each have one or more sets of McCaa 2-hour machines, and complete sets of Chemox oxygen apparatus are maintained at Hedley, Bridge River, Wells, and Britannia. These sets are periodically checked by one of the mine-rescue instructors.

Teams trained at mines remote from the stations are visited and examined by one of the regular instructors. The Inspector of Mines and the instructor for the district arrange the course of instruction and conduct the examinations. The equipment at these mines is checked periodically by the instructor to see that it is always in serviceable condition.

A certificate of competency in mine-rescue work is granted to each man who takes the full training course and passes the examination set by the Department of Mines. During 1951, in addition to the regular teams in training, ninety-five men took the full training course and were granted certificates of competency, as follows:—

Cert. No.	Name	Where Trained
2479	Lucien Tellier	Extension.
2480	T. Bunka	Nickel Plate.
2481	A. Dzuris	Nickel Plate.
2482	George Kent	Nickel Plate.
2483	S. Kurmey	Nickel Plate.
2484	F. W. Leipert	Nickel Plate.
2485	Ernest R. Smith	Nickel Plate.
2486	R. Smith	Nickel Plate.
2487	R. F. Smith	Nickel Plate.
2488	H. G. W. Wood	Nickel Plate.
2489	Oscar Hoffmann	Bevan.
2490	Jack Webber	Bevan.
2491	John Herbert Webber	Bevan.
2492	Bernard Brett	Bevan.
2493	Millar D. Clarkson	Bevan.
2494	Charles Frame	Bevan.
2495	Thomas Harry Turner	Kimberley.
2496	Albert Eykelbosh	Kimberley.
2497	Elvin Albert Wolloch	Marysville.
2498	Dominic Patrick Roche	Kimberley.
2499	Alvin Ohnstad	Kimberley.
2500	William Edward Walsh	Kimberley.
2501	William Howard Childress	Kimberley.
2502	Halldor S. Arnfinnson	Kimberley.
2503	Robert Hugh Cameron	Kimberley.
2504	Lawson Stuart Sims	Kimberley.
2505	Frederick H. Giles	Kimberley.
2506	Joseph Howard Bennett	Victoria.
2507	P. Burns	Copper Mountain.
2508	Wallace V. Card	Copper Mountain.
2509	S. Chapman	Copper Mountain.
2510	H. J. Hill	Copper Mountain.
2511	Elwood G. Hough	Copper Mountain.
2512	J. H. Lawrence	Copper Mountain.
2513	Paul E. Proulx	Copper Mountain.
2514	D. J. Silbernagel	Copper Mountain.
2515	A. R. Wells	Copper Mountain.
2516	Alec J. Richardson	Salmo.
2517	William O. Warren	Salmo.
2518	John Duval	Salmo.
2519	Chris F. Nargaard	Salmo.
2520	Peter Rollick	Salmo.
2521	Roy G. McLeish	Salmo.
2522	George W. Emerson	Salmo.
2523	James H. Eastman	Salmo.
2524	Ralph P. Mason	Salmo.
2525	Hubert V. Maxwell	Salmo.
2526	Steven Semeniuk	Remac.
2527	David Sloan	Salmo.
2528	Clive W. Ball	Salmo.
2529	Melvin A. Olson	Salmo.
2530	James B. Magee	Salmo.
2531	Harold R. Chenoweth	Salmo.
2532	Gilaer Beland	Salmo.
2533	Gunnar Adolphson	Salmo.
2534	Alois Schmid	Remac.
2535	Frank R. Jones	Remac.
2536	George E. Sodja	Remac.
2537	Nicholas Pochay	Remac.
2538	Gerald Camroux	Remac.
2539	Horace J. Kozar	Remac.
2540	Sigurd Flodstrom	Remac.
2541	Andrew Kowey	Remac.
2542	William R. Selby	Riondel.
2543	Joseph S. Williams	Riondel.
2544	Benjamin C. Ramage	Riondel.
2545	John G. McGillivray	Riondel.
2546	Lawrence Kniert	Riondel.
2547	Raymond A. Nelson	Riondel.
2548	Herman Nielsen	Riondel.
2549	Allan Morrison	Bralorne.
2550	James Lee	Bralorne.
2551	James Greer	Bralorne.
2552	R. Jaeger	Bralorne.
2553	W. J. Morrison	Wells.
2554	J. Taylor	Wells.
2555	G. Wyse	Wells.
2556	L. A. Donaldson	Wells.
2557	Edwin G. Haggerstone	Bralorne.
2558	William Harrison	Britannia.
2559	John Balfour McLaren	Kimberley.
2560	Charles Wesley Davies	Kimberley.
2561	Gordon Stuart Wilson	Kimberley.
2562	Robert Penman Rose	Kimberley.
2563	John Anderson Boyd	Kimberley.
2564	Charles Frederick Pettie	Kimberley.
2565	James McFarlane	Kimberley.
2566	Frank Wallace Griswold	Kimberley.
2567	Arthur W. C. Jeffery	Kimberley.
2568	William Arthur Case	Kimberley.
2569	Thomas Daniel Boone	Kimberley.
2570	Joseph Moore	Kimberley.
2571	A. Edgar Langston	Kimberley.
2572	Chester Bonora	Cumberland.
2573	William High	Cumberland.
2574	William Angelo Lozza	Fernie.

The Mine Safety Associations in the different centres in the Province, sponsored by the Department of Mines and aided by company safety engineers, Inspectors of Mines, and mine-rescue instructors, continued to encourage and promote mine-rescue and first-aid work and safety education in their respective districts.

First-aid and mine-rescue competitions were held in Nanaimo, Princeton, Fernie, Kaslo, and Lillooet. The problems for these competitions are set by the Mines Department, and the judges are chosen from the staff of Inspectors and mine-rescue station attendants.

At Nanaimo a total of five teams competed in the mine-rescue competition held by the Vancouver Island Mine Safety Association. These were from No. 10 mine at South Wellington (two teams), No. 8 mine at Cumberland (two teams), and Tsable River mine. The winning team was the "A" team from No. 8 mine, Cumberland, captained by Leonard Cooper.

At Princeton a total of four teams competed in the mine-rescue competition held by the Similkameen Valley Mine Safety Association. There were two teams from the Granby Company's mine at Copper Mountain and two teams from the Nickel Plate mine of Kelowna Hedley Mines Limited. The winning team was the No. 2 team from Copper Mountain, captained by D. Parsons.

At Fernie a total of six teams competed in the mine-rescue competition held by the East Kootenay Mine Safety Association. Two of these teams represented the Michel Colliery, one Coal Creek, one Fernie, and two the Sullivan mine at Kimberley. The teams representing Kimberley were chosen by holding a local elimination competition. The winning team was the Coal Creek team, captained by David Brown.

At Kaslo the West Kootenay Mine Safety Association held its first annual mine-rescue competition. A total of four teams competed—one from the Bluebell mine at Riondel, one from the Emerald mine at Salmo, one from the Reeves MacDonald mine at Remac, and a visiting team from Nickel Plate mine at Hedley. This last team had taken part and placed second in the Similkameen Valley Mine-rescue Competition at Princeton. All other teams were novices competing for the first time. The winning team was from the Emerald mine of the Canadian Exploration Company Limited and was captained by J. Eastwood. A suitable shield was donated by the Department of Mines for annual mine-rescue competitions held by the West Kootenay Mine Safety Association.

At Lillooet a total of five teams took part in the mine-rescue competition held by the Central British Columbia Mine Safety Association. These included two teams from the Bralorne mine, and one each from Pioneer, Island Mountain, Cariboo Gold Quartz, and Britannia. The winning team was from Britannia and was captained by W. Harrison.

At all the meets except the one held at Lillooet, competitions in first-aid work, as well as mine-rescue, were staged. In all these competitions, events were held for women and juniors, and other industries and organizations not necessarily directly connected with mining also participated.

Local first-aid competitions were held at the Bralorne and Britannia mines. At Bralorne, teams from Bralorne and Pioneer mines competed, and in both competitions events were held for women and juniors.

A local competition in both mine-rescue and first aid was held at Kimberley for those directly connected with operations by "Cominco."

The participation of women, juniors, and those not directly connected with the industry is very commendable and does much to create interest in this important work.

RYAN TROPHY

The John T. Ryan Regional Safety Award for the metal mine with the lowest accident record for 1951 was won by the Consolidated Mining and Smelting Company's Sullivan mine at Kimberley and concentrator at Chapman Camp. The award was presented to the men and officials of the company at the annual mine-rescue and first-aid competition of the East Kootenay Mine Safety Association that was held in Fernie on June 16th, 1951.

The award for coal mines was won by the Elk River Colliery of the Crow's Nest Pass Coal Company Limited and was presented on the same occasion as the metal-mine award.

PRODUCTION

The output of the collieries is given in short tons. The gross output of the coal mines of the Province for the year 1951 was 1,824,384 tons, an increase of 67,717 tons or 3.8 per cent from 1950; 389,410 tons of the total output came from strip mines at Michel, Tent Mountain, and Princeton.

Vancouver Island collieries produced 539,147 tons, a decrease of 36,081 tons or 6.2 per cent from 1950.

The Northern District production was 30,896 tons, an increase of 5,775 tons or 22.9 per cent over 1950.

The Nicola-Princeton District production was 4,840 tons, a decrease of 13,089 tons or 73.0 per cent from 1950.

The East Kootenay District production was 1,249,501 tons, an increase of 111,112 tons or 9.7 per cent over 1950.

Coal-mining

By Robert B. Bonar, Senior Inspector of Coal Mines

CONTENTS

OUTPUT AND PER CAPITA PRODUCTION, 1951

Colliery and Mine	Gross Output Mined during Year (Tons)	Days Worked	Total Number of Employees	Daily Output per Employee (Tons)	Yearly Output per Employee (Tons)	Number of Employees Underground	Daily Output per Underground Employee (Tons)	Yearly Output per Underground Employee (Tons)
Comox Colliery (No. 8 mine)	214,060	249	400	2.15	535	322	2.67	665
Tsable River Colliery	120,568	239	152	3.31	793	137	3.68	880
South Wellington No. 10 mine	155,772	250	107	5.82	1,455	83	7.50	1,877
Bright mine	40,041	250	57	2.81	702	50	3.20	801
Chambers mine	1,667	170	4	2.44	417	3	3.26	556
Loudon mine	1,050	209	5	1.00	210	5	1.00	210
Lewis mine (Timberlands)	813	197	2	2.06	406	2	2.06	406
Deer Home mine	314	71	2	2.21	157	2	2.21	157
Wellington mine (Carruthers)	596	192	2	1.55	298	2	1.55	298
Stronach mine	*1,806*	*228*	*7*	*1.13*	*258*	*5*	*1.58*	*361*
Furnace Portal mine	359	39	2	4.60	180	2	4.60	180
Cassidy mine	1,876	216	5	1.73	375	4	2.17	469
Biggs mine	225	81	2	1.39	112	2	1.39	112
Taylor Burson mine (Jackson No. 1)	1,652	123	4	3.35	413	3	4.47	550
Coldwater mine	899	194	4	1.15	225	3	1.54	300
Black mine (strip)	4	20	1	......	......	......	......	......
Old Princeton Colliery (strip)	367	64	2	......	......	......	......	......
Blue Flame	1,690	100	6	2.81	281	5	3.38	338
Collins Gulch mine	228	50	3	1.52	76	2	2.28	114
Bulkley Valley Collieries	27,697	270	48	2.14	577	40	2.56	692
Reschke mine	1,688[1]	164	7	1.47	241	5	2.05	337
Peace River mine[2]	......	......	......	......	......	......	......	......
Gething mine No. 3	1,511	165	5	1.83	302	4	2.28	377
Elk River Colliery	312,860	231	366	3.70	855	280	4.83	1,117
Michel Colliery (underground)	547,602	234	676	3.46	810	499	4.70	1,097
Michel strip mine	303,856	......	44	......	......	......	......	......
Hillcrest Mohawk Collieries (strip)	85,183	......	......	......	......	......	......	......

[1] Estimated. [2] No report.

COLLIERIES OF VANCOUVER ISLAND INSPECTION DISTRICT

The output of Vancouver Island collieries was 539,147 tons. Of this amount, 142,463 tons or 26.4 per cent was lost in preparation for market, and 3,425 tons or 0.6 per cent was used by the operating companies as fuel under boilers, etc. The total sales amounted to 391,687 tons, and 1,572 tons was put on stocks. Of the amount sold in competitive market, 330,039 tons was sold in Canada, 2,975 tons sold in the United States, and 58,673 tons to other foreign countries.

COLLIERIES OF THE NICOLA-PRINCETON DISTRICT

The gross total of 4,840 tons produced in the collieries of the Nicola-Princeton District was sold in Canada.

COLLIERIES OF THE NORTHERN DISTRICT

A total of 31,103 tons was sold in Canada from the Northern District; 207 tons was taken from stock held over from 1950, the gross output for 1951 being 30,896 tons.

COLLIERIES OF THE EAST KOOTENAY DISTRICT

The gross output of the collieries in the East Kootenay District was 1,249,501 tons. Of this amount, 107,559 tons or 8.6 per cent was lost in preparation for the market, 15,977 tons or 1.2 per cent was used as fuel under company boilers, etc., and 236,871 tons was used in making coke. Of the amount sold in competitive market, 811,733 tons was sold in Canada and 77,936 tons sold in the United States.

Output and per Capita Production in Various Districts, 1951

District	Gross Output Mined during Year (Tons)	Total Number of Employees at Producing Collieries	Yearly Output per Employee (Tons)	Number of Men Employed Underground in Producing Collieries	Yearly Output per Underground Employee (Tons)
Vancouver Island District	539,147	745	723	617	873
Nicola-Princeton District	4,469	16	279	14	319
Northern District	30,896	60	515	49	630
East Kootenay District	860,462	1,042	825	779	1,104
Whole Province	1,434,974	1,863	770	1,459	983

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.

Output per Man-shift, Underground Mines, 1941–51

Year	Man-shifts[1]	Tonnage	Average per Man-shift (Tons)
1941	623,970	1,802,353	2.89
1942	662,505	1,938,158	2.92
1943	773,088	1,786,152	2.31
1944	703,384	1,767,989	2.51
1945	627,110	1,518,673	2.42
1946	596,631	1,463,640	2.45
1947	496,727	1,485,476	2.99
1948	434,074	1,281,530	2.95
1949	520,188	1,589,131	3.05
1950	460,159	1,481,813	3.22
1951	442,170	1,434,974	3.24

[1] Includes both surface and underground workers.

The following tables show 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, 1951—Production and Distribution, by Collieries and by Districts (in Short Tons)

Mine	Gross Output	Washery Loss	Net Output	Used under Companies' Boilers, etc.	Used in Making Coke	Stocks: On Hand First of Year	Stocks: On Hand Last of Year	Stocks: Added To	Stocks: Taken From	Sales: In Canada	Sales: In U.S.A.	Sales: Elsewhere	Sales: Total Sales
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)	214,060	57,068	156,992	1,746	......	1,506	1,851	345	......	123,691	1,578	29,632	154,901
Tsable River Colliery	120,568	31,792	88,776	987	......	1,483	1,677	194	......	69,946	893	16,756	87,595
South Wellington No. 10 mine	155,772	40,221	115,551	570	......	1,163	614	......	549	105,006	415	10,109	115,530
Bright mine	40,041	13,382	26,659	122	......	357	2,025	1,668	......	22,604	89	2,176	24,869
Chambers mine	1,667	......	1,667	......	......	......	......	......	......	1,667	......	......	1,667
Loudon mine	1,050	......	1,050	......	......	......	......	......	......	1,050	......	......	1,050
Lewis mine (Timberlands)	813	......	813	......	......	......	......	......	......	813	......	......	813
Deer Home mine	314	......	314	......	......	......	......	......	......	314	......	......	314
Wellington mine (Carruthers)	596	......	596	......	......	......	......	......	......	596	......	......	596
Stronach mine	1,806	......	1,806	......	......	......	......	......	......	1,806	......	......	1,806
Furnace Portal mine	359	......	359	......	......	......	......	......	......	359	......	......	359
Cassidy mine	1,876	......	1,876	......	......	406	320	......	86	1,962	......	......	1,962
Biggs mine	225	......	225	......	......	......	......	......	......	225	......	......	225
Totals, Vancouver Island District	539,147	142,463	396,684	3,425	......	4,915	6,487	2,207	635	330,039	2,975	58,673	391,687
Nicola-Princeton District													
Taylor Burson mine (Jackson No. 1)	1,652	......	1,652	......	......	......	......	......	......	1,652	......	......	1,652
Coldwater mine	899	......	899	......	......	......	......	......	......	899	......	......	899
Black mine (strip)	4	......	4	......	......	......	......	......	......	4	......	......	4
Old Princeton Colliery (strip)	367	......	367	......	......	......	......	......	......	367	......	......	367
Blue Flame mine	1,690	......	1,690	......	......	......	......	......	......	1,690	......	......	1,690
Collins Gulch mine	228	......	228	......	......	......	......	......	......	228	......	......	228
Totals, Nicola-Princeton District	4,840	......	4,840	......	......	......	......	......	......	4,840	......	......	4,840
Northern District													
Bulkley Valley Collieries	27,697	......	27,697	......	......	307	100	......	207	27,804	......	......	27,904
Reschke mine	1,688	......	1,688	......	......	......	......	......	......	1,688	......	......	1,688
Peace River mine[2]	......	......	......	......	......	......	......	......	......	......	......	......	......
Gething mine	1,511	......	1,511	......	......	......	......	......	......	1,511	......	......	1,511
Totals, Northern District	30,896	......	30,896	......	......	307	100	......	207	31,103	......	......	31,103
East Kootenay District													
Crow's Nest Pass Coal Co. Ltd.—													
Elk River Colliery	312,860	26,561	286,299	4,032	......	88	......	......	88	240,009	42,346	......	282,355
Michel Colliery	851,458	70,776	780,682	11,945	236,871	637	150	......	487	496,763	35,590	......	532,353
Hillcrest Mohawk Collieries (strip)	85,183	10,222[1]	74,961	......	......	......	......	......	......	74,961	......	......	74,961
Totals, East Kootenay District	1,249,501	107,559	1,141,942	15,977	236,871	725	150	......	575	811,733	77,936	......	889,669
Grand totals for Province	1,824,384	250,022	1,574,362	19,402	236,871	5,947	6,737	2,207	1,417	1,177,715	80,911	58,673	1,317,299
Coke													
Crow's Nest Pass Coal Co. Ltd.—													
Michel Colliery	170,646	......	......	......	......	22,186	20,383	......	1,803	92,984	79,465	......	172,449

[1] Estimated. [2] No report.

Collieries of British Columbia, 1951—Men Employed, Distribution by Collieries and by Districts

Mine	Supervisory and Clerical			Miners			Helpers			Labourers			Mechanics and Skilled Labour			Boys			Total Men Employed		
	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)	21	10	31	214		214				72	34	106	12	34	46	3		3	322	78	400
Tsable River Colliery	9		9	88		88				33	8	41	7	7	14				137	15	152
South Wellington No. 10 mine	5		5	41		41				22	10	32	15	14	29				83	24	107
Bright mine	4		4	32		32				10	4	14	4	3	7				50	7	57
Chambers mine	1		1	2		2								1	1				3	1	4
Loudon mine	1		1	4		4													5		5
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	1		1	4		4					1	1		1	1				5	2	7
Furnace Portal mine				1		1													1		1
Cassidy mine	1		1	3		3								1	1				4	1	5
Biggs mine				1		1													1		1
Totals, Vancouver Island District	44	10	54	395		395				137	57	194	38	61	99	3		3	617	128	745
Nicola-Princeton District																					
Taylor Burson mine (Jackson No. 1)	1		1	3		3													4		4
Coldwater mine	1		1	2		2								1	1				3	1	4
Black mine (strip)		1	1																	1	1
Old Princeton Colliery (strip)		2	2																	2	2
Blue Flame mine	1		1	5		5													6		6
Collins Gulch mine				2		2													2		2
Totals, Nicola-Princeton District	3	3	6	12		12								1	1				15	4	19
Northern District																					
Bulkley Valley Collieries	4	2	6	16		16	20	1	21		3	3		2	2				40	8	48
Reschke mine	1	1	2	5		5													6	1	7
Peace River mine[1]																					
Gething mine	1		1	4		4													5		5
Totals, Northern District	6	3	9	25		25	20	1	21		3	3		2	2				51	9	60
East Kootenay District																					
Crow's Nest Pass Coal Co. Ltd.—																					
Elk River Colliery	19	17	36	150		150	42		42	34	52	86	35	12	47		5	5	280	86	366
Michel Colliery	31	27	58	221		221	119		119	65	97	162	63	50	113		3	3	499	177	676
Michel strip mine		6	6								8	8		30	30					44	44
Hillcrest Mohawk Collieries (strip)		1	1								1	1		13	13					15	15
Totals, East Kootenay District	50	51	101	371		371	161		161	99	158	257	98	105	203		8	8	779	322	1,101
Grand totals for Province	103	67	170	803		803	181	1	182	236	218	454	136	169	305	3	8	11	1,462	463	1,925

[1] No report.

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 so as to maintain a uniform product—one with the highest possible calorific value. A second practice followed at many modern plants is blending the different grades or sizes, or the products from the different seams, to form a fuel for a specific purpose, such as stoker coal and coke.

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 capacity of the plant is 2,000 tons in eight hours.

The raw coal is transported from the rotary dump by belt-conveyor to the picking-table, then carried directly by a 42-inch belt-conveyor to the screens whereby the coal is sized and the —¼-inch slack removed. When necessary the coal from the picking-table may be switched to the 500-ton steel bin that was completed this year, for storage and blending. This bin, together with the original 300-ton bin, is used in storing, temporarily, a portion of the afternoon-shift coal to allow the preparation plant to remain idle on that shift. 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 high-ash 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 and vibrating screens prior to being transported to the rock-removing jigs. All sizes above ¼-inch are treated on three Vissac jigs, and those below ¼-inch are diverted to an American Coal Cleaning pneumatic table. 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 degrees Fahrenheit. To keep the liberation of dust to a minimum in subsequent handlings, the coal, as it is loaded into railway cars, is sprayed with hot oil.

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-conveyor, which in turn transports the coal to a 2-deck 6- by 14-foot Ty-Rock screen that has 1¼-inch and 3/16-inch perforations whereby the coal is sized to +6-inch, 1¼- to 3/16-inch, and —3/16-inch. All sizes above 3/16-inch are treated by two Vissac jigs for the removal of rock, and the —3/16-inch is diverted to four Masco wet-type cleaning-tables.

The coarser 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 differences 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 Bright mines.

The coal is brought to the plant in railway cars from the respective mines and is dumped on to a feeder conveyor of the plate type that transports the coal to a Hummer screen, wherein the —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 1951, 1,925 persons were employed in and about the coal mines of the Province, a decrease of 336 from 1950.

Because the 5-day week is in force throughout the Province at the larger mines, and the legal holidays, the maximum number of working-days is rated at 254. In the Vancouver Island District approximately 2.85 per cent of the possible working-days was lost because of the lack of demand for coal and other minor causes. In the East Kootenay District the loss of working-days averaged 8.6 per cent, due mainly to the shortage of railway cars during the late fall and winter months.

COMPETITION FROM COAL PRODUCED OUTSIDE OF BRITISH COLUMBIA

During 1951 the shipment of Alberta coal to British Columbia totalled 898,533 tons, coke shipped was 205 tons, and briquettes 35,858 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
1942	652,222	1947	899,403
1943	963,000	1948	945,700
1944	678,960	1949	891,132
1945	868,396	1950	873,558
1946	982,413	1951	898,533

Of the 1,317,299 tons of British Columbia coal marketed, 359,658 tons was sold for industrial uses in Alberta, Saskatchewan, Manitoba, Ontario, and Yukon Territory; 420,942 tons was sold for railroad use in Canada; 79,169 tons was exported to the United States; and 14,642 tons was sold for ships' bunkers. The amount sold for domestic and industrial uses in the Province was 442,888 tons.

ACCIDENTS IN AND AROUND COAL MINES

During 1951, 1,925 persons were employed in and around coal mines, including strip-mining operations. Six fatal accidents occurred during the year, as compared with five during 1950. The number of fatal accidents per 1,000 persons employed is 3.11, compared with 2.21 in 1950, 0.43 in 1949, 2.04 in 1948, 0.82 in 1947, 1.73 in 1946, 2.05 in 1945, 1.06 in 1944, 2.80 in 1943, and 4.23 in 1942. The average for the 10-year period is 2.03.

The number of fatal accidents per 1,000,000 tons of coal produced during 1951 is 3.2, compared with 2.8 in 1950.

The following table shows the collieries at which fatal accidents occurred during 1951, with comparative figures for 1950:—

Name of Company	Name of Colliery	1951	1950
Crow's Nest Pass Coal Co. Ltd.	Michel Colliery	3	2
Crow's Nest Pass Coal Co. Ltd.	Elk River Colliery	2	1
Canadian Collieries (D.) Ltd.	Tsable River	1	....
Canadian Collieries (D.) Ltd.	No. 8 mine, Comox Colliery	....	1
Canadian Collieries (D.) Ltd.	White Rapids	....	1
Totals		6	5

The following three tables classify the fatal accidents in coal mines in 1951, as to cause, as to quantity of coal mined per accident, and as to inspection districts.

Fatal Accidents Classified as to Cause

Cause	1951 Number	1951 Per Cent	1950 Number	1950 Per Cent
By falls of roof and coal	3	50.00	1	20.00
By mine cars and haulage (underground)	1	16.66	1	20.00
By falling while carrying rail	....	....	1	20.00
By coal-cutter haulage pin pulling out and striking man	....	....	1	20.00
By falling off icy railway car	....	....	1	20.00
Asphyxiated by methane gas	1	16.66	....	....
Asphyxiated by being covered with coal from blowout	1	16.66	....	....
Totals	6	100.00	5	100.00

Fatal Accidents Classified as to Quantity of Coal Mined

Cause	1951 Number of Fatal Accidents	1951 Coal Mined per Fatal Accident[1]	1950 Number of Fatal Accidents	1950 Coal Mined per Fatal Accident[1]
		Tons		Tons
By falls of roof and coal	3	478,324	1	1,481,435
By mine cars and haulage (underground)	1	1,434,974	1	1,481,435
By falling while carrying rail	....	....	1	1,481,435
By coal-cutter haulage pin pulling out and striking man	....	....	1	1,481,435
By falling off icy railway car	....	....	1	1,481,435
Asphyxiated by methane gas	1	1,434,974	....	....
Asphyxiated by being covered with coal from blowout	1	1,434,974	....	....
Average	1	239,162	1	296,287

[1] Excludes coal from strip mines.

NOTE.—There were no fatal accidents in strip-mining operations in the years 1951 and 1950.

Fatal Accidents Classified as to Inspection Districts

District	Number of Deaths from Accidents: Falls of Roof and Coal	Mine Cars and Haulage	Falling while Carrying Rail	Coal-cutter Haulage Pin Striking Man	Falling Off Railway Car	Asphyxiated by Methane Gas	Asphyxiated by Being Covered with Coal	Totals 1951	Totals 1950
Vancouver Island	....	1	....	....	....	....	....	1	2
Nicola-Princeton	....	....	....	....	....	....	....	....	....
East Kootenay	3	....	....	....	....	1	1	5	3
Northern	....	....	....	....	....	....	....	....	....
Province, 1951	3	1	....	....	....	1	1	6	....
Province, 1950	1	1	1	1	1	....	....	....	5

Ratio of Accidents

District	Accident Death Rate: Per 1,000 Persons Employed 1951	Per 1,000 Persons Employed 1950	Per 1,000,000 Tons of Coal Mined 1951	Per 1,000,000 Tons of Coal Mined 1950
Vancouver Island	1.34	2.15	1.85	3.47
Nicola-Princeton	......	......	......	......
East Kootenay	4.79	2.55	5.81	2.63
Northern	......	......	......	......
Province, 1951	3.22	......	4.11	......
Province, 1950	......	2.21	......	2.84

During 1951 there were six fatal accidents—all connected with actual operations in underground coal mines.

On February 16th, 1951, Ruggero Berdusco, miner, was fatally injured at Michel Colliery when he was struck by a fall of rock. Berdusco was using an air-pick at a coal face when the rock fell. It broke one of seven forepoles supporting the roof ahead of the last set of timbers before striking him. Death was almost instantaneous.

On June 11th, 1951, Paul Stratton, miner at Michel Colliery, was fatally injured when he was struck by a fall of rock. Stratton and two partners were engaged in erecting a post when rock fell and struck him on the head. Death was almost instantaneous. The presence of a 2½-foot downthrow fault in the roof contributed to the fall of rock.

On June 25th, 1951, Marco Borsato, bratticeman at Michel Colliery, was asphyxiated by methane gas. He had been ordered by his fireboss to erect a fence at the entrance to a split and had partially completed same when, for some reason not apparent, he went up the split about 200 feet, where he was overcome by gas. Borsato was dead when found shortly after the shift was finished.

On October 10th, 1951, Silvio Puppin, miner, was fatally injured when a fall of rib coal jammed him against a shaker-conveyor that he was helping to install in No. 9 mine, Elk River Colliery.

On November 20th, 1951, Robert Robertson, rope-rider at the Tsable River mine, was fatally injured when he was crushed between a car and a temporary post. He died early the following morning.

On November 27th, 1951, Andrew Gasparotto, miner at Elk River Colliery, was asphyxiated when he was covered by a fall of coal from a face. The coal was abnormally thick due to an upthrow fault, and the dislodgment was apparently due to a face bump. Artificial respiration and the use of a Pulmotor were unsuccessful in reviving him.

Including the above-noted fatal accidents, 525 accidents involving loss of seven days or more 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 three tables classify the accidents in coal mines in 1951 as to occupation of the men involved, as to cause, and as to injury. The fatal accidents are included in the totals.

ACCIDENTS CLASSIFIED AS TO OCCUPATION

Occupation	Number of Accidents	Percentage of Accidents
Underground—		
Miners	257	49.0
Drillers and facemen	12	2.3
Conveyormen and muckers	24	4.6
Haulagemen	75	14.3
Trackmen and mechanics	12	2.3
Supervisors	25	4.8
Timbermen	14	2.6
Coal-cutters	17	3.2
Miscellaneous	29	5.5
Surface—		
Shops	11	2.1
Surface	19	3.6
Preparation and coke-ovens	19	3.6
Miscellaneous	11	2.1
Totals	525	100.0

Accidents Classified as to Cause

Cause	Number of Accidents	Percentage of Accidents
Fall of ground	132	25.1
Fall of material and flying material	55	10.5
Lifting and handling equipment and material	128	24.4
Machinery and tools	53	10.1
Slipped and tripped	96	18.3
Falling off staging and platforms	9	1.7
Miscellaneous	52	9.9
Totals	525	100.0

Accidents Classified as to Injury

Injury	Number of Accidents	Percentage of Accidents
Head and neck	35	6.7
Eyes	19	3.6
Trunk	79	15.1
Back	72	13.7
Arms	33	6.3
Hands and fingers	124	23.6
Legs	107	20.3
Feet	35	6.7
Toes	21	4.0
Totals	525	100.0

EXPLOSIVES

The following table shows the quantity of explosives used in coal mines during 1951, 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 (Pounds)	Coal Mined (Tons)	Total Number of Shots Fired	Average Tons of Coal per Pound of Explosive Used	Average Pounds of Explosive per Shot Fired
Comox Colliery (No. 8 mine)	50,390	214,060	77,650	4.24	0.65
Tsable River Colliery	47,900	120,568	66,500	2.51	0.72
South Wellington No. 10	44,200	155,772	44,650	3.51	0.99
Bright mine	15,541	40,041	19,750	2.57	0.78
Chambers mine	500	1,667	900	3.33	0.55
Loudon mine	1,800	1,050	1,730	0.58	1.04
Lewis mine (Timberlands)	1,600	813	1,600	0.50	1.00
Deer Home mine	180	314	350	1.74	0.51
Wellington mine (Carruthers)	650	596	1,060	0.91	0.61
Stronach mine	1,950	1,806	1,900	0.92	1.02
Furnace Portal mine	180	359	240	2.00	0.75
Cassidy mine	350	1,876	850	5.35	0.41
Biggs mine	120	225	160	1.87	0.75
Totals for district	165,361	539,147	217,340	3.26	0.76

Nicola-Princeton District

Colliery	Quantity of Explosives Used (Pounds)	Coal Mined (Tons)	Total Number of Shots Fired	Average Tons of Coal per Pound of Explosive Used	Average Pounds of Explosive per Shot Fired
Taylor Burson mine	85	1,652	85	19.43	1.00
Coldwater mine	550	899	1,050	1.63	0.52
Black mine (strip)	......	4	......	......	......
Old Princeton Colliery (strip)	100	367	100	......	......
Blue Flame	350	1,690	700	4.83	0.50
Collins Gulch	150	228	150	1.52	1.00
Totals for district	1,235	4,840	2,085	3.92	0.59

Northern District

Colliery	Quantity of Explosives Used (Pounds)	Coal Mined (Tons)	Total Number of Shots Fired	Average Tons of Coal per Pound of Explosive Used	Average Pounds of Explosive per Shot Fired
Bulkley Valley Collieries	11,000	27,697	12,800	2.51	0.86
Reschke mine	550	1,688	550	3.07	1.00
Peace River mine	......	......	......	......	......
Gething mine	945	1,511	1,525	1.59	0.62
Totals for district	12,495	30,896	14,875	2.47	0.84

East Kootenay District

Colliery	Quantity of Explosives Used (Pounds)	Coal Mined (Tons)	Total Number of Shots Fired	Average Tons of Coal per Pound of Explosive Used	Average Pounds of Explosive per Shot Fired
Elk River Colliery	30,800	312,860	35,645	10.15	0.86
Michel Colliery	74,950	851,458	69,228	11.36	1.08
Hillcrest-Mohawk Collieries (strip)	......	85,183	......	......	......
Totals for district	105,750	1,249,501	104,873	11.81	1.00
Totals for Province	284,841	1,824,384	339,173	6.40	0.83

Quantity of Different Explosives Used

	Lb.
Monobel of different grades	277,250
Permissible rock powder	7,591
Total	284,841

MACHINE-MINED COAL

During the year 1951 mining-machines produced approximately 868,166 tons or 60.5 per cent of the total output from underground mining. All strip-mine coal is removed by mechanical means.

District	Number Driven by		Type of Machine Used	
	Electricity	Compressed Air	Chain Undercutting	Puncher Type
Vancouver Island	....	27	23	4
Nicola-Princeton	....	6	....	6
Northern District	2	2	2	2
East Kootenay	2	42	18	26
Totals	4	77	43	38

In addition to the above, 211 air-picks were used in the mines of the Crow's Nest Pass Coal Company.

SAFETY LAMPS

There were 2,121 safety lamps in use in the mines of the Province. Of this number, 172 were flame safety lamps and 1,949 were approved electric lamps, mostly of 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 lamps up to and including Model P, carrying the Approval Certificate No. 26 of the United States Bureau of Mines; Model R-4, Approval No. 29.

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.

The Davis M.L. type pneumatic electric lamp.

ELECTRICITY

Electricity is used for various purposes on the surface at eight coal mines and underground at six. A total of 18,920 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 by the use of a flame safety lamp.

Although it has been necessary for the District Inspector to issue orders prohibiting blasting on several instances, the ventilation in general, as found during inspection visits, was adequate to meet requirements.

METHANE DETECTION

The principal instruments used to detect small percentages of methane gas in the mines are the Burrell gas-detector and the M.S.A. detector.

Regular tests are made on every shift in the working-places and roadways by the firebosses and other mine officials, principally by means of the flame safety lamp. Every candidate for a miner's certificate must show, over and above other necessary qualifications, that he has a thorough knowledge of the flame safety lamp, of handling it safely, and of the method of testing for methane gas before he is given a certificate.

MINE-AIR SAMPLES

In addition to regular tests made 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 return airways of the various splits, so that a complete record may be kept of the condition of the air passing through the mine. Air samples are also taken by the Inspectors and mine officials when there is an abnormal issuance of gas in working-places. During 1951 thirty-one samples were taken.

INSPECTION COMMITTEES

The provisions of the "Coal-mines Regulation Act," section 65, General Rule 19, require that an inspection committee of workmen shall inspect the mine 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 for the district. The work of these committees is valuable and assists in furthering the interests of safety at the various mines.

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 adequately carried out. Large quantities of limestone dust are used continually in the larger mines to combat this hazard. It is used in the roadways, working-places, and for the tamping of shots.

Dust samples are taken regularly from roof, side, and floor of mine roadways and analysed. The reports of the analyses are forwarded to the District Inspector. In 1951, 1,308 dust samples from the various mines were analysed, and in all these samples the incombustible content was well over the 50 per cent as required by the "Coal-mines Regulation Act."

DIESEL LOCOMOTIVES

Early in August, 1950, the first diesel underground locomotive to be used in any mine in British Columbia made its trial runs in No. 9 mine, Elk River Colliery, The Crow's Nest Pass Coal Company Limited.

The locomotive is a 15-ton 100-horsepower North British type, and is fully permissible for use in coal mines. To date its performance has been satisfactory.

MILLI-SECOND DELAY DETONATORS

In February, 1951, an amendment to the "Coal-mines Regulation Act" was passed to allow, with the permission of the Chief Inspector of Mines, more than one shot to be fired at a time in any coal mine or district of a mine. The amendment was endorsed by the industry.

Early in May, 1951, experiments with milli-second delay detonators were conducted at No. 4 mine, Elk River Colliery, The Crow's Nest Pass Coal Company Limited, by officials of the British Columbia Department of Mines, the coal company, and Canadian Industries Limited.

In the latter part of May, 1951, and also in December, 1951, further experiments with milli-second delay detonators were conducted at the Tsable River mine, the Canadian Collieries (Dunsmuir) Limited, by officials of the company, and the British Columbia Department of Mines.

The conclusions reached from these experiments are as follows: That the method provides for a safer and more economical operation of coal blasting; that, although more powder was being detonated at one time over the one-shot-at-a-time method, there was a definite lessening of concussion felt and a reduction in the over-all amount of powder required.

The above method is coming into general use at the mines of both The Crow's Nest Pass Coal Company Limited and the Canadian Collieries (Dunsmuir) Limited.

DANGEROUS OCCURRENCES

On April 8th, 1951, the watchman at the Elk River Colliery discovered a small fire in the pick-breaker room that is adjacent to the preparation plant. The watchman, using extinguishers, subdued the fire promptly. The origin of the fire was not ascertained.

At the commencement of the night shift on August 19th, 1951, smoke was discovered in the No. 3 Raise district, "B" South mine, Michel Colliery. Subsequent investigation revealed that two drive belts on a small auxiliary fan in the district were badly charred due to frictional heating. No active fire was found, and the cause was attributed to a loose key on the turbine pulley drive shaft that allowed the belts to work out of alignment. The smoke was soon cleared by the ventilation and the workmen allowed to proceed to their duties.

On December 17th, 1951, an electric coal-cutter was being flitted from the face of No. 1 Left off No. 8 Incline, No. 9 mine, Elk River Colliery, when one of the cutter bits punctured the trailing cable, thus causing a ground in the power system and causing the main breaker at the bottom of the incline to kick out. A bright flash about 3 inches long was observed.

BUMPS AND BLOWOUTS

On January 10th, 1951, a minor bump occurred in No. 5 Split off No. 7 Right room, "B" Seam, Slope district, Michel Colliery. A miner was slightly injured, and the floor near the face of the split was heaved about 12 inches, which caused a few posts to be broken.

On March 29th, 1951, a blowout occurred at the face of No. 7 Left room, Slope district, No. 3 mine, Elk River Colliery, following the usual warnings, which enabled the workmen at the face to retire to a place of safety. A considerable quantity of methane gas was released from the coal, which necessitated withdrawal of all workmen from the district. The gas travelled in explosive quantity in the ventilating current for an hour following the outburst and diminished to 1 per cent at the end of two hours. Work was resumed in the place twelve hours later. Fifty tons of fine coal was found to have been pushed out from the face, and another 50 tons of loose coal was also loaded before the solid coal was reached.

On April 13th, 1951, a bump centring around the No. 4 West roadway occurred at No. 1 East mine, Elk River Colliery. This was followed by several minor bumps in the same locality on April 14th and 16th. No person was injured, but there was a general heaving of the tracks 1½ to 2 feet for a distance of 200 feet, and a fall of roof for 15 feet on the haulage slope.

On May 7th, 1951, a blowout occurred at the face of No. 3 Split off No. 7 Left room, Slope district, No. 3 mine, Elk River Colliery. No one was injured, although a considerable quantity of methane gas was liberated from the coal. When work was recommenced eight hours later, it was found that 25 tons of coal had been expelled from the face by the blowout.

On October 29th, 1951, a minor bump occurred near the face of No. 8 Left room, "B" Seam, Slope district, Michel Colliery. The floor was heaved about 18 inches, and a few posts were broken. A miner was slightly injured.

As reported previously in this report, under fatal accidents, a miner was asphyxiated by a fall of coal on November 27th, 1951, at the face of No. 8 Incline, No. 3 mine, Elk River Colliery. The coal was abnormally thick at the face due to a 15-foot upthrow fault, and the dislodgment of the coal was apparently due to a face bump. The absence of fine coal, with its concomitant gas, supports the face-bump theory, as does the suddenness of the incident. The customary warning, knocking of the face, given by impending outbursts, was absent.

PROSECUTIONS

Date	Colliery	Occupation of Defendant	Offence Charged	Judgment
Jan. 6	Michel (Crow's Nest Pass Coal Co. Ltd.)	Fireboss	Failure to adequately warn workmen prior to blasting	Fined $20 and costs.

SUPERVISION OF COAL MINES

During 1951 seventeen companies operated thirty mines, employing 1,460 men underground. In the supervision of underground employees there were 7 managers, 14 overmen, and 93 firebosses, or approximately 1 official for every 12 men.

"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	No. 8 mine and Tsable River mine, Comox Colliery (Cumberland)	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.
Old Wellington	No. 9 mine (Wellington)	Canadian Collieries (D.) Ltd.
Chambers-Extension	Chambers (Extension)	R. H. Chambers.
Cassidy-Wellington	Cassidy mine (Cassidy)	A. H. Carroll.
Taylor Burson	Jackson No.1 mine (Princeton)	Taylor Burson Coal Co. Ltd.
Hat Creek	Hat Creek (Lillooet)	Canada Coal and Development Co. Ltd.
Bulkley Valley	Bulkley Valley (Telkwa)	Bulkley Valley Collieries.
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
Coldwater	Coldwater No. 3 mine (Merritt)	S. Gerrard.
Black Prince	Black mine (Princeton)	R. B. Savage.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS

FIRST-, SECOND-, AND THIRD-CLASS CERTIFICATES AND MINE SURVEYORS' CERTIFICATES

The Board of Examiners, formed on July 10th, 1919, consists at present of H. C. Hughes, Chief Inspector of Mines, chairman; Edward R. Hughes, Inspector of Mines, member; and Robert B. Bonar, Senior Inspector of Coal Mines, secretary and member.

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. The examinations are held at least once a year, and more often if necessary. Three examinations were held in 1951 on the following dates: May 16th, 17th, and 18th at the Fernie, Cumberland, and Nanaimo centres; August 15th at the Telkwa centre; and on November 17th at the Cumberland and Fernie centres.

The total number of candidates at these examinations is as follows: For first-class certificates, 1 (passed); for second-class certificates, 5 (3 passed); for third-class certificates, 15 (11 passed); for mine surveyors' certificates, 4 (3 passed).

The following is a list of the candidates who were successful in the various classes:—

First class: James E. Morris.

Second class: James W. Brown, Alfred J. Garraway, and Arnold Webster.

Third class: William High, Vans H. Hulbert, Joseph T. Hinskens, Clyde Lewis, George Mack, Harry Miller, Charles E. Sutton, Samuel A. Scott, John A. Thomson, Lucien Tellier, and David Thewlis, Jr.

Mine surveyor: Philip D. Larbalestier, Glyn Parry, and Robert Williams.

In addition to the above, an interchange certificate was granted without full examination to the following candidate who held coal-mine official certificates of equal rating from other Provinces or from Great Britain:—

Third-class: Ferguson Grant.

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 1951 there were thirty-six candidates for coal-miners' certificates, all of whom were successful.

In addition to the certificates granted above, substitute certificates were issued to those who had lost their original certificates.

Permits to act as coal-miners, as provided by the Act, have been granted to younger men by Inspectors in their respective districts. This method allows promising men with less than one year's experience underground to work at the coal face as miners under the guidance of an experienced miner.

The Board of Examiners desires to thank the different coal-mining companies for the use of their premises for holding examinations where necessary.

Registered List of Holders of Certificates of Competency as Coal-mine Officials

First-class Certificates of Competency Issued under " Coal-mines Regulation Act, 1877, 1897 "

Name	Date	Name	Date
Browitt, Benjamin	Aug. 3, 1901	Norton, Richard Henry	Aug. 26, 1889
Coulthard, R. W.	Jan. 21, 1904	Randle, Joseph	Jan. 18, 1888
Cunliffe, John	Aug. 3, 1901	Richards, James A.	Oct. 17, 1902
Hardy, Joseph	Dec. 17, 1896	Roaf, J. Richardson	Jan. 21, 1904
Horrobin, William	May 1, 1882	Simpson, William G.	June 12, 1899
Manley, H. L.	Jan. 21, 1904	Wright, H. B.	Jan. 21, 1904
Matthews, John	Jan. 8, 1889		

First-class Certificates Issued under " Coal-mines Regulation Act Further Amendment Act," 1904, 1911, 1919

Baxter, Andrew	June 10, 1911	Fraser, Norman	Mar. 4, 1905
Bennett, John	Dec. 30, 1926	Freeman, H. N.	May 1, 1909
Biggs, J. G.	July 22, 1908	Frew, Wm. B.	July 6, 1932
Bonar, Robert (Jr.)	Dec. 15, 1932	Galloway, C. F. J.	July 22, 1908
Brace, Tom	May 13, 1915	Gardner, Harold H.	Feb. 10, 1947
Bridge, Edward	July 22, 1908	Gascoyne, Rowland B.	May 21, 1914
Brown, Robert Joyce	May 13, 1915	Gee, Archibald R.	Jan. 20, 1944
Caufield, Bernard	May 1, 1909	Gilham, John	Jan. 5, 1925
Chapman, William	Dec. 20, 1938	Glover, Francis	Oct. 31, 1912
Church, James A. H.	June 10, 1911	Hanson, Wm. B.	Dec. 9, 1930
Clark, Henry Wilton	Oct. 9, 1943	Henderson, Robert	Nov. 27, 1909
Cochrane, James	July 9, 1945	Hewlett, Howe	May 27, 1913
Cox, Richard	May 13, 1915	Higgins, Alexander	Dec. 19, 1918
Crawford, John	Sept. 28, 1946	Hodge, William K.	June 16, 1925
Cumberford, James	Oct. 7, 1938	Howden, Archibald	May 27, 1913
Cunningham, John Howard	May 9, 1912	Howells, Nathaniel	Oct. 28, 1911
Davidson, John M.	Sept. 20, 1948	Hughes, Edward R.	Dec. 29, 1936
Davies, David	June 10, 1911	Hughes, John C.	May 17, 1917
Davies, Stephen	Nov. 15, 1917	Humphries, Clifford	June 10, 1911
Davies, Thos. Owen	May 21, 1914	Hunter, Alex. B.	July 8, 1916
deHart, J. B.	May 17, 1917	Huntrods, Eustace S. F.	May 19, 1922
Devlin, E. H.	Dec. 30, 1926	Jackson, Thos. R.	Nov. 9, 1907
Dickson, James	Oct. 31, 1912	James, Anthony R. C.	Apr. 11, 1950
Dinsdale, William	July 16, 1948	Johnston, John	June 30, 1928
Dutton, Joseph A.	Aug. 17, 1948	Johnstone, William W.	July 10, 1947
Elliott, John B.	June 30, 1928	Lawrence, Stanley J.	Jan. 4, 1943
Emmerson, Joseph	Nov. 9, 1907	Leighton, Henry	May 9, 1912
Fairfoull, Robert	June 10, 1911	Littler, James	Dec. 2, 1929
Foster, William R.	Dec. 31, 1925	Mackinnon, Hugh G.	May 19, 1922
France, Thos.	Nov. 22, 1906	Macauley, D. A.	June 10, 1911

Registered List of Holders of Certificates of Competency as Coal-mine Officials—*Continued*

First-class Certificates Issued under "Coal-mines Regulation Act Further Amendment Act," 1904, 1911, 1919—Continued

Name	Date	Name	Date
Marshall, Thomas	July 15, 1946	Rolfe, Emrys	Dec. 15, 1932
McCulloch, James	Sept. 10, 1910	Roper, William	May 13, 1915
McDonald, Edward A.	Nov. 28, 1949	Russell, John	May 21, 1914
McDonald, John	Oct. 3, 1919	Shenton, T. J.	Sept. 10, 1910
McDonald, Leslie M.	Jan. 8, 1949	Simpson, Edward O. T.	July 16, 1948
McKay, Walter	Jan. 20, 1944	Smith, A. E.	Oct. 28, 1911
McLean, Michael D.	June 16, 1925	Smith, Joseph	July 22, 1908
McVicar, Samuel	May 1, 1909	Smith, Thos. Edwin	Dec. 19, 1918
Mazey, William John	Oct. 31, 1912	Spicer, J. E.	Oct. 28, 1911
Miard, Henry Ernest	May 9, 1912	Stevens, L. C.	Nov. 27, 1909
Millar, John K.	Nov. 22, 1906	Stewart, R. T.	Sept. 10, 1910
Miller, Andrew Anderson	Oct. 31, 1912	Strang, James	June 10, 1911
Miller, Henry	July 17, 1948	Stubbs, Clement	July 21, 1929
Montgomery, John W.	May 1, 1909	Touhey, James	May 21, 1914
Mordy, Thomas	Sept. 10, 1910	Vincent, Thomas C.	June 24, 1924
Morgan, Dewi R.	May 30, 1949	Walker, William	May 16, 1918
Morgan, Evan H.	June 21, 1944	Wallbank, J.	Sept. 10, 1910
Murray, George	June 21, 1921	Whittaker, John	Dec. 19, 1918
Newbury, Arthur	June 21, 1920	Whittaker, William C.	Apr. 6, 1938
Ovington, John	May 27, 1913	Williams, John Samuel	Dec. 19, 1918
Peacock, Frank David	Oct. 28, 1911	Williams, Thos. B.	May 17, 1917
Penman, Hugh	May 21, 1914	Williams, Thos. H.	Nov. 22, 1906
Pettigrew, Robert	June 1, 1933	Wilson, Ridgeway R.	Nov. 15, 1917
Phelan, Arthur	May 27, 1913	Wilson, Thos. M.	Dec. 23, 1927
Powell, J. W.	June 10, 1911	Wylie, John	July 20, 1908
Quinn, John Graham	July 8, 1916	Yates, Frank	Dec. 31, 1925
Ramsay, Peter Millar	May 16, 1918	Young, David B.	Dec. 6, 1943
Reger, Frederick W.[1]	Mar. 18, 1949		

[1] Issued in lieu of certificate dated July 6th, 1932, destroyed by fire.

Second-class Certificates of Service

Name	Date	No.	Name	Date	No.
Hunt, John	Mar. 4, 1905	B 13	Powell, William Baden	Mar. 4, 1905	B 16
Millar, J. K.	Mar. 4, 1905	B 10			

Second-class Certificates of Competency Issued under "Coal-mines Regulation Act Further Amendment Act, 1904"

Adams, Wm. Henry	June 24, 1935	B 286	Bushell, J. P.	May 1, 1909	B 81
Almond, Walter	Nov. 15, 1917	B 213	Caufield, Bernard	Oct. 23, 1906	B 30
Alstead, Robert	June 24, 1924	B 257	Caufield, John	July 8, 1916	B 199
Anderson, James J. E.	July 12, 1946	B 306	Cawthorne, L.	May 1, 1909	B 93
Archibald, William	Nov. 22, 1922	B 250	Challinor, Jno. Thomas	May 27, 1913	B 169
Barlow, Benjamin Robt.	Dec. 19, 1918	B 229	Challoner, Jno. Arthur	May 21, 1914	B 178
Bastion, Albert	Nov. 21, 1923	B 256	Chapman, Wm.	June 10, 1927	B 268
Baudoux, Stirling A.	Mar. 24, 1952	B 319	Chester, Daniel	July 24, 1943	B 299
Bell, John	May 17, 1917	B 212	Christie, John	July 18, 1938	B 290
Beveridge, William	June 21, 1920	B 233	Churchill, James	July 22, 1908	B 65
Bevis, Nathaniel	Sept. 10, 1910	B 123	Clark, Robt.	June 21, 1921	B 242
Biggs, John G.	Nov. 2, 1907	B 40	Clarkstone, Wm. W.	May 21, 1914	B 180
Bonar, Robt. B.	June 30, 1928	B 270	Cochrane, James	July 22, 1942	B 298
Brace, Tom	Nov. 27, 1909	B 96	Cochrane, Thomas	Jan. 16, 1941	B 297
Bridge, Edward	Oct. 23, 1906	B 33	Commons, Wm.	Sept. 10, 1910	B 115
Brown, George	Dec. 19, 1918	B 225	Corbett, Garner S.	June 30, 1928	B 272
Brown, James L.	Oct. 28, 1911	B 136	Corrigan, Harry	July 19, 1947	B 309
Brown, James W.	Dec. 15, 1951	B 318	Coupland, George	May 16, 1918	B 217
Brown, John C.	Oct. 23, 1906	B 39	Crawford, David	May 1, 1909	B 88
Brown, John Todd	May 9, 1912	B 150	Cunliffe, Thomas	May 1, 1909	B 78
Brown, R. J.	Oct. 28, 1911	B 134	Cunliffe, Thomas H.	July 20, 1949	B 312
Brown, Robert	May 21, 1914	B 183	Dando, John	May 27, 1913	B 164
Brown, Robert Sneddon	May 13, 1915	B 196	Davey, William H.	July 5, 1950	B 314
Brown, William Gold	Dec. 19, 1918	B 228	Davies, J. C. H.	June 15, 1934	B 285
Brownrigg, John H.	May 17, 1917	B 124	Davies, Stephen	Sept. 10, 1910	B 113

Registered List of Holders of Certificates of Competency as Coal-Mine Officials—*Continued*

Second-class Certificates of Competency Issued under " Coal-mines Regulation Act Further Amendment Act, 1904 "—Continued

Name	Date	No.	Name	Date	No.
Dennis, Fred W.	May 21, 1914	B 174	Mather, Thomas	June 10, 1911	B 127
Devlin, Ernest H.	May 21, 1914	B 179	Matusky, A.	May 1, 1909	B 91
Dewar, Alexander	Oct. 31, 1912	B 162	Mayer, Ralph Waldo	May 9, 1912	B 144
Dickenson, Clifford	May 13, 1915	B 189	Mazay, W. J.	Nov. 27, 1909	B 101
Dinsdale, William	June 26, 1944	B 301	Miard, Hy. E.	Sept. 10, 1910	B 107
Dockrill, Arthur H.	Jan. 16, 1941	B 296	Middleton, Robert	July 22, 1908	B 72
Dunn, Jas. W.	July 5, 1932	B 282	Mitchell, Henry	July 8, 1916	B 201
Dunsmuir, John	Nov. 14, 1905	B 26	Morgan, Daniel	Nov. 21, 1923	B 254
Dykes, J. W.	May 1, 1909	B 77	Morgan, Irvine	July 18, 1938	B 291
Eccleston, Thomas (Jr.)	June 24, 1940	B 294	Morgan, John	Nov. 2, 1907	B 43
Eccleston, Wm.	May 1, 1909	B 87	Morgan, William	Dec. 19, 1918	B 224
Fairfoull, James	May 21, 1914	B 186	Morris, James E.	Jan. 9, 1951	B 315
Fairfoull, R.	May 1, 1909	B 83	Morton, Robert W.	July 22, 1908	B 59
Fairley, James	July 5, 1950	B 313	Murray, George	Oct. 3, 1919	B 232
Finlayson, James	July 29, 1905	B 21	Musgrave, J.	May 1, 1909	B 90
Foster, W. R.	Nov. 27, 1909	B 102	Myers, Peter	May 9, 1912	B 149
Frame, Muir A.	July 23, 1946	B 308	McDonald, J. A.	Oct. 28, 1911	B 133
France, Thos.	May 14, 1905	B 27	McDonald, John	May 27, 1913	B 172
Francis, David M.	May 21, 1914	B 182	McFegan, W.	Nov. 31, 1909	B 106
Francis, Enoch	May 1, 1909	B 86	McGarry, Martin	Oct. 31, 1912	B 156
Francis, James	July 22, 1908	B 63	McKay, Walter	June 30, 1926	B 262
Frater, George	July 8, 1916	B 204	MacKinnon, Hugh G.	Dec. 22, 1921	B 243
Freeman, Henry N.	Nov. 2, 1907	B 45	McLaughlin, Alex	May 13, 1915	B 191
Frew, Wm. M.	June 10, 1927	B 269	McLean, Michael D.	June 21, 1920	B 234
Garbett, Richard	Oct. 31, 1912	B 161	McMillan, D.	June 10, 1911	B 125
Garraway, Alfred J.	July 30, 1951	B 316	McNay, Carmichael	May 9, 1912	B 151
Gething, Lloyd M.	Aug. 23, 1948	B 311	McPherson, James E.	July 22, 1908	B 73
Gilham, John	June 21, 1920	B 237	Newbury, Arthur	May 21, 1914	B 184
Gourlay, Robert	Dec. 19, 1918	B 227	Nicholl, Joseph O.	Dec. 31, 1925	B 261
Gray, David	May 1, 1909	B 76	Osborne, Hugh	Dec. 14, 1920	B 239
Gray, George	July 8, 1916	B 207	Ovington, John	Nov. 2, 1907	B 52
Greenwell, Archibald	May 16, 1918	B 220	Park, William	June 21, 1920	B 238
Gregory, Wm.	June 16, 1931	B 278	Parkinson, T.	May 1, 1909	B 80
Hamilton, Robert N.	May 21, 1914	B 175	Parnham, Charles	Nov. 2, 1907	B 49
Hampton, Abel E.	July 16, 1948	B 310	Pettigrew, Robt.	Dec. 15, 1931	B 281
Hastings, Andrew P.	Dec. 19, 1918	B 223	Quinn, John	May 9, 1912	B 146
Hayes, Thomas O.	July 24, 1943	B 300	Ramsay, Peter Millar	May 17, 1917	B 209
Henderson, Robert	July 22, 1908	B 60	Rankin, Geo.	Nov. 27, 1909	B 103
Hodge, William K.	Jan. 5, 1925	B 259	Raynes, M. T.	Oct. 28, 1911	B 139
Holliday, William	Dec. 19, 1918	B 230	Rear, Albert E.	June 15, 1934	B 283
Hopkins, Harry	June 16, 1930	B 276	Reid, Wm.	Oct. 28, 1911	B 132
Horrocks, Abner G.	June 10, 1911	B 130	Renny, James	Oct. 28, 1911	B 140
Howells, Nathaniel	Nov. 27, 1909	B 97	Richards, Samuel	May 9, 1912	B 152
Hughes, Edward R.[1]	Sept. 28, 1931	B 280	Rigby, John	July 29, 1905	B 29
Hughes, John C.	Sept. 10, 1910	B 109	Roberts, Ebenezer	Sept. 10, 1910	B 117
Hutton, Isaac	May 21, 1914	B 185	Robinson, William	July 22, 1908	B 69
Hutton, John	May 9, 1912	B 154	Rogers, George	May 1, 1909	B 79
Hynds, John	May 18, 1922	B 247	Roper, William	May 9, 1912	B 141
Hynds, William	Dec. 14, 1920	B 240	Rowbottom, Thomas	May 16, 1918	B 222
Jackson, Thos. R.	Mar. 4, 1905	B 5	Russell, John	Nov. 2, 1907	B 47
James, David	Nov. 2, 1907	B 58	Scarpino, Francis	Dec. 19, 1918	B 226
Jarrett, Fred	May 1, 1909	B 84	Shanks, David	Oct. 31, 1912	B 159
John, Francis	July 8, 1916	B 200	Shaw, Thomas John	May 27, 1913	B 166
Johnston, John	June 10, 1927	B 267	Smith, John	Oct. 3, 1919	B 231
Johnstone, William W.	July 9, 1945	B 304	Smart, Robert K.	Nov. 22, 1922	B 248
Jones, Samuel	May 16, 1918	B 221	Stafford, Matthew	June 10, 1911	B 131
Jones, William T.	July 22, 1908	B 66	Stewart, John	July 21, 1929	B 274
Jordan, Thos.	Nov. 27, 1909	B 104	Stewart, J. M.	May 1, 1909	B 95
Kirkwood, John R.	Oct. 31, 1912	B 160	Stobbart, Jacob	May 9, 1912	B 153
Knowles, James E.	Oct. 28, 1911	B 137	Stockwell, William	Nov. 2, 1907	B 56
Lancaster, Peter	Dec. 20, 1938	B 292	Strang, Thomas	Oct. 31, 1912	B 158
Lander, Frank	May 13, 1915	B 195	Stubbs, Clement	May 18, 1922	B 245
Lawrence, Stanley J.	Dec. 9, 1940	B 295	Sutherland, John	May 16, 1918	B 218
Lazaruk, Stephen	July 20, 1944	B 302	Taylor, Robt.	Dec. 30, 1926	B 265
Lee, Robert John	Sept. 10, 1910	B 110	Taylor, Thomas	July 8, 1916	B 203
Littler, Jas.	June 10, 1927	B 266	Thomas, Daniel W.	Nov. 22, 1922	B 249
Littler, Matthew	Oct. 31, 1912	B 157	Thompson, Joseph	Sept. 10, 1910	B 114
Luck, George	June 10, 1911	B 128	Tonge, Thomas	July 22, 1908	B 71
Mason, Joseph	May 13, 1915	B 193	Touney, James	May 9, 1912	B 147
Massey, H.	Nov. 27, 1909	B 99	Touhey, William	July 8, 1916	B 205

[1] Substituted for No. B 279, June 16th, 1931.

Registered List of Holders of Certificates of Competency as Coal-mine Officials—*Continued*

Second-class Certificates of Competency Issued under "Coal-mines Regulation Act Further Amendment Act, 1904"—Continued

Name	Date	No.	Name	Date	No.
Vaughan, John Henry	July 12, 1939	B 293	Williams, Watkin	Sept. 10, 1910	B 118
Virgo, John	May 1, 1909	B 89	Wilson, Joseph	June 30, 1928	B 271
Waddington, Daniel M.	June 16, 1931	B 277	Wilson, Richard B.	Jan. 16, 1945	B 303
Walker, William	May 13, 1915	B 192	Wilson, Robinson	May 21, 1914	B 177
Webster, Arnold	Aug. 23, 1951	B 317	Wilson, Thomas	July 22, 1908	B 74
Webster, James S.	June 24, 1924	B 258	Wood, Thos. James	May 21, 1914	B 176
Weir, James	July 31, 1945	B 305	Worthington, Joseph	May 1, 1909	B 85
Williams, John Samuel	Nov. 15, 1917	B 215	Yates, Frank	Nov. 22, 1922	B 251

Third-class Certificates Issued under "Coal-mines Regulation Act Further Amendment Act, 1904," Section 38, Subsection (2), in Exchange for Certificates Issued under the "Coal-mines Regulation Act Amendment Act, 1901."

Ashman, Jabez	Feb. 5, 1907	C 131	Miller, Thos. K.	Feb. 21, 1905	C 74
Barclay, Andrew	Apr. 27, 1904	C 19	McKinnon, Arch'd	Apr. 3, 1905	C 102
Barclay, James	Apr. 27, 1904	C 20	Myles, Walter	Apr. 3, 1905	C 100
Barclay, John	Apr. 17, 1905	C 111	Nash, Isaac	June 1, 1904	C 120
Bowie, James	May 13, 1905	C 116	Neave, Wm.	Oct. 12, 1904	C 43
Campbell, Dan	Mar. 29, 1905	C 93	Nelson, James	Apr. 27, 1904	C 16
Carroll, Harry	Mar. 29, 1905	C 98	Nimmo, Richard E.	Apr. 18, 1911	C 133
Clarkson, Alexander	Apr. 27, 1904	C 18	Power, John	Sept. 8, 1920	C 142
Collishaw, John	Feb. 7, 1905	C 68	Price, Jas.	Nov. 8, 1904	C 50
Davidson, David	Apr. 3, 1905	C 106	Rafter, Wm.	Mar. 29, 1905	C 95
Dobbie, John	Nov. 27, 1905	C 126	Roughead, George[1]	Jan. 30, 1907	C 810
Dudley, James	Mar. 22, 1905	C 114	Ryan, John	Dec. 28, 1904	C 59
Dunsmuir, John	Mar. 29, 1905	C 90	Shenton, Thos. J.	July 25, 1904	C 30
Eccleston, Wm.	Mar. 15, 1905	C 80	Shepherd, Henry	June 13, 1904	C 26
Fagan, Daniel	Apr. 6, 1905	C 109	Smith, Geo.	Mar. 29, 1905	C 84
Farquharson, John	Apr. 27, 1904	C 17	Stauss, Chas. F.	Feb. 9, 1905	C 69
Findlayson, James	June 6, 1904	C 25	Steele, John	June 4, 1913	C 137
Gibson, Edward	May 30, 1905	C 118	Stewart, Daniel W.	May 16, 1904	C 23
Green, Francis	Oct. 11, 1904	C 38	Stewart, Duncan H.	Mar. 28, 1904	C 4
Handlen, Jas.	June 16, 1904	C 122	Stewart, John	Apr. 3, 1904	C 104
Hescott, John	Jan. 16, 1905	C 62	Stobbart, Jacob	Feb. 21, 1905	C 73
John, David	Nov. 8, 1904	C 49	Sullivan, John	July 4, 1916	C 139
Johnson, Geo.	May 9, 1904	C 124	Summers, Joseph	May 17, 1920	C 141
Johnson, Wm. R.	Mar. 1, 1905	C 75	Thomas, John	Mar. 29, 1905	C 97
Lander, Frank	Jan. 9, 1905	C 61	Vater, Charles	Apr. 6, 1904	C 6
Miard, Harry E.	Mar. 3, 1905	C 76	Wilson, Austin	Feb. 7, 1905	C 67
Middleton, Robt.	Feb. 11, 1905	C 71			

[1] Issued in lieu of No. C 130, destroyed by fire.

Third-class Certificates Issued under "Coal-mines Regulation Act Further Amendment Act, 1904"

Adams, Wm. H.	Dec. 9, 1930	C 845	Baguley, James	Dec. 2, 1929	C 829
Adamson, Wm.	Dec. 22, 1921	C 721	Bain, James	May 27, 1913	C 546
Allan, Archie M.	Jan. 7, 1947	C 969	Bainbridge, James	Nov. 21, 1922	C 744
Almond, Walter	July 22, 1908	C 286	Baker, Ralph	July 16, 1948	C 980
Alstead, Robt.	June 21, 1921	C 719	Bankhead, Hugh	July 9, 1945	C 954
Ambrosi, Antonio	June 16, 1930	C 843	Barber, Walter H.	Jan. 20, 1944	C 943
Anderson, James J. E.	Dec. 17, 1945	C 958	Barker, Robert	June 10, 1911	C 415
Anderson, John	Oct. 28, 1911	C 437	Barlow, B. R.	May 1, 1909	C 337
Anderson, John E.	June 24, 1940	C 919	Barr, Samuel	June 10, 1927	C 809
Anderson, Robt.	Oct. 14, 1914	C 599	Barrass, Robt.	June 30, 1926	C 795
Angell, William	May 21, 1914	C 591	Bastion, Albert	May 30, 1923	C 750
Apponen, Fred	June 29, 1946	C 963	Batchelor, Harry	Jan. 20, 1944	C 945
Arbuckle, John	May 13, 1915	C 622	Bate, Horace	Dec. 30, 1926	C 802
Archibald, Geo.	May 21, 1914	C 569	Bateman, Joseph William	Oct. 28, 1913	C 551
Archibald, Thomas	Oct. 28, 1911	C 454	Beard, Henry C.	May 30, 1923	C 751
Ball, Alfred	May 17, 1917	C 635	Beeton, D. H.	May 1, 1909	C 338
Bann, Thomas	Oct. 31, 1912	C 494	Bell, John	May 9, 1912	C 477
Baggaley, J.	July 22, 1908	C 300	Bennett, Andrew M.	Nov. 15, 1917	C 661

Registered List of Holders of Certificates of Competency as Coal-Mine Officials—*Continued*

Third-class Certificates Issued under "Coal-mines Regulation Act Further Amendment Act, 1904"—Continued

Name	Date	No.	Name	Date	No.
Bennett, John	Oct. 14, 1914	C 597	Clarkson, Hugh G.	May 17, 1922	C 736
Bennie, William W.	July 18, 1938	C 895	Clarkson, James M.	July 10, 1947	C 973
Beveridge, Wm.	June 10, 1911	C 396	Clarkson, Robert	June 21, 1920	C 696
Biggs, James	June 1, 1933	C 858	Clarkstone, Wm. W.	Oct. 28, 1911	C 431
Biggs, Thomas	Oct. 28, 1911	C 449	Cleaves, Walter	May 9, 1912	C 475
Birchell, Richard	Oct. 1, 1907	C 266	Clifford, William	July 22, 1908	C 313
Blakemore, Roydon E.	Dec. 27, 1934	C 869	Cloke, Chas. E.	June 16, 1925	C 782
Blas, Emil	June 24, 1924	C 774	Coates, Frank	June 16, 1925	C 789
Blewett, Ernest	July 22, 1908	C 298	Cochrane, James	June 24, 1940	C 914
Blinkhorn, Thomas	Dec. 19, 1918	C 681	Coldgrove, Charles Henry	Dec. 19, 1918	C 679
Bobchak, Daniel	Jan. 26, 1944	C 946	Coldwell, Daniel	May 17, 1917	C 639
Bond, Frank	June 30, 1926	C 797	Commons, William	July 22, 1908	C 304
Bowie, James I.	May 6, 1936	C 873	Cooper, John Andrew	Dec. 19, 1918	C 689
Boyce, James A.	July 29, 1949	C 988	Cooper, Leonard	Dec. 16, 1937	C 887
Bradley, Wilfred	May 17, 1922	C 733	Cope, Frank	Oct. 28, 1913	C 549
Bradley, William	July 22, 1908	C 291	Corbett, Garnet S.	Dec. 23, 1927	C 812
Brett, Leonard	July 10, 1947	C 975	Corrigan, Harry	July 18, 1938	C 901
Bridge, Edward	July 29, 1905	C 223	Corrigan, James P.	Jan. 10, 1944	C 940
Brisco, F.	July 22, 1908	C 309	Coulthard, James	June 10, 1911	C 407
Briscoe, Fred S.[1]	July 7, 1937	C 878	Coupland, David	June 21, 1921	C 713
Broderick, Harold D.	July 9, 1945	C 955	Craig, Robert T. S.	Aug. 2, 1946	C 967
Broderick, Matthew	Jan. 21, 1913	C 525	Crawford, David	Mar. 4, 1905	C 208
Brown, Arthur A.	Oct. 14, 1914	C 596	Cullen, Alex	July 21, 1929	C 824
Brown, David G.	July 12, 1946	C 965	Cunliffe, Thos.	Oct. 1, 1907	C 265
Brown, George	July 8, 1916	C 626	Cunliffe, Thos. H.	Dec. 20, 1938	C 903
Brown, George A.	Dec. 14, 1920	C 706	Cunningham, G. F.	Nov. 11, 1905	C 229
Brown, James	Sept. 10, 1910	C 364	Cuthell, George W.	Dec. 2, 1929	C 832
Brown, James	June 10, 1911	C 412	Dabb, Owen	May 21, 1914	C 578
Brown, James	July 8, 1916	C 625	Dando, John	May 9, 1912	C 465
Brown, James M.	Jan. 4, 1943	C 930	Davey, George	June 21, 1921	C 718
Brown, Jas. Miller	May 13, 1915	C 615	Davey, William H.	June 29, 1946	C 962
Brown, James Weir	July 16, 1948	C 979	Davidson, Hugh	May 9, 1919	C 464
Brown, John	Sept. 10, 1910	C 392	Davies, Evan Thomas	May 9, 1912	C 463
Brown, Matthew	July 5, 1932	C 854	Davies, John H. C.	May 17, 1922	C 729
Brown, Robert	Oct. 28, 1911	C 451	Davis, William	May 1, 1909	C 339
Brown, Robert D.	June 10, 1911	C 423	Dean, Alexander	June 10, 1944	C 931
Brown, Robert S.	June 10, 1911	C 408	Dean, Andrew	Dec. 19, 1918	C 688
Brown, William Gold	July 8, 1916	C 629	Dean, John[2]	Jan. 31, 1944	C 952
Bryden, Thomas	June 16, 1930	C 842	Dean, Joseph	May 13, 1915	C 611
Bullen, Thomas	Sept. 10, 1910	C 379	Delprato, Joseph	June 16, 1930	C 837
Bushell, Jas. P.	Oct. 1, 1907	C 264	DePaoli, Celiste	July 29, 1949	94
Cairns, Andrew	June 10, 1911	C 420	Derbyshire, A.	June 10, 1911	C 401
Cairns, John	July 16, 1948	C 981	Dewar, Alex	Sept. 10, 1910	C 369
Cairns, Robert	May 27, 1913	C 539	Devlin, Edward	Oct. 23, 1906	C 241
Caldwell, Peter	June 21, 1921	C 715	Devlin, Ernest Henry	May 27, 1913	C 538
Calverly, Joseph	Sept. 10, 1910	C 375	Devlin, John	Oct. 3, 1919	C 693
Camamile, Hollis	Oct. 28, 1911	C 443	Devoy, William	May 17, 1917	C 638
Campbell, Andrew	Nov. 27, 1917	C 651	Diamond, René J.	July 5, 1950	99
Campbell, Samuel	Nov. 15, 1917	C 662	Dickenson, Clifford	May 27, 1917	C 532
Carroll, George	Nov. 21, 1922	C 746	Dickie, Leslie	Nov. 20, 1923	C 762
Carruthers, Robert	Dec. 22, 1933	C 859	Dingsdale, Geo.	Oct. 28, 1911	C 459
Carson, George	Mar. 17, 1917	C 663	Dinsdale, William	Dec. 27, 1934	C 868
Catchpole, Charles	July 29, 1905	C 227	Dixon, Frank B.	July 9, 1945	C 953
Caufield, John	May 1, 1909	C 321	Dockrill, Arthur H.	Dec. 20, 1938	C 904
Challoner, Arthur	Oct. 28, 1911	C 433	Dockrill, Frank M.	June 15, 1934	C 865
Chambers, Ralph H.	Dec. 14, 1920	C 709	Doherty, J. S.	May 1, 1909	C 340
Chapman, John	May 30, 1923	C 753	Donelan, Lawrence	June 29, 1946	C 960
Chapman, Wm.	Dec. 22, 1921	C 720	Doney, John	Mar. 4, 1905	C 211
Chapple, Allison D.	Aug. 19, 1947	C 978	Donnachie, John	June 10, 1911	C 425
Cheetham, Ben	July 22, 1908	C 311	Dorrance, Orlin William	Jan. 21, 1913	C 517
Chester, Daniel	Dec. 20, 1939	C 912	Doratty, Robert O.	July 5, 1950	C 992
Chester, John	Oct. 28, 1911	C 440	Douglas, D. B.	Oct. 23, 1906	C 235
Christie, John	Dec. 20, 1928	C 820	Dow, And. Y.	May 21, 1914	C 587
Cimolini, Primo	June 24, 1940	C 915	Drybrough, Robert	June 21, 1920	C 701
Cimolini, Romeo	Jan. 4, 1943	C 929	Dunlop, Thomas S.	June 26, 1944	C 948
Cimolini, Sero J.	Jan. 4, 1943	C 928	Dunn, Andrew	Jan. 7, 1936	C 871
Clark, John William	July 20, 1949	C 986	Dunnigan, Richard	June 21, 1921	C 716
Clark, Walter Pattison	May 9, 1912	C 480	Dunsmore, Alexander	Dec. 9, 1930	C 847
Clarke, Harry W. Wilton	Feb. 14, 1948	89	Dwarkin, L.	July 5, 1950	100

[1] Substituted for No. C 309, July 20th, 1908.
[2] Substituted for No. C 617, June 2nd, 1915.

Registered List of Holders of Certificates of Competency as Coal-mine Officials—*Continued*

Third-class Certificates Issued under "Coal-mines Regulation Act Further Amendment Act, 1904"—Continued

Name	Date	No.	Name	Date	No.
Dykes, Joseph W.	Oct. 1, 1907	C 248	Hannah, Archibald	Dec. 2, 1929	C 834
Easton, Andrew B.	July 18, 1938	C 893	Hanson, T. H.	July 8, 1908	C 280
Ebert, Henry R.	Jan. 16, 1941	C 926	Hardy, Edward	June 21, 1920	C 694
Eccleston, John J.	May 30, 1923	C 757	Hart, Daniel M.	May 17, 1922	C 730
Eccleston, Thomas	June 16, 1930	C 841	Harvey, Thomas	May 9, 1912	C 466
Eckersley, John	June 15, 1934	C 866	Harwood, Fred	Sept. 10, 1910	C 384
Edwards, John	May 27, 1913	C 542	Hayes, Ernest	Dec. 2, 1929	C 830
Elliott, John	May 27, 1913	C 541	Heaps, Robert	Sept. 10, 1910	C 373
Elliott, John B.	Dec. 23, 1927	C 811	Hemer, Herbert	Oct. 14, 1914	C 595
Elmes, Levi	July 5, 1932	C 856	Hendry, James	May 9, 1912	C 471
Evans, D.	July 22, 1908	C 284	Herd, William	Dec. 19, 1918	C 682
Ewing, Robert	May 13, 1915	C 608	Hetherington, Geo.	July 21, 1929	C 825
Fairfoull, James	Oct. 28, 1911	C 453	Heycock, James E.	July 5, 1932	C 852
Fairley, James	Jan. 24, 1940	C 916	Heycock, William J.	Dec. 29, 1936	C 876
Farrow, John William	Dec. 19, 1918	C 683	Heyes, Edward	May 1, 1909	C 320
Ferryman, Henry	June 21, 1920	C 697	Heyes, Thos. O.	Jan. 7, 1936	C 870
Fitzpatrick, T. J.	Oct. 2, 1911	C 452	High, William	July 11, 1951	C 997
Flockart, David	Jan. 21, 1913	C 531	Hilton, Arthur	Dec. 2, 1929	C 831
Ford, Allen	Oct. 28, 1911	C 445	Hilton, Mathias	Dec. 19, 1918	C 825
Forsyth, William	June 16, 1930	C 836	Hilton, R. G.	Sept. 10, 1910	C 376
Fowler, Robert	Oct. 31, 1912	C 495	Hindmarsh, John G.	June 30, 1926	C 799
Fowler, Samuel	July 7, 1941	C 921	Hindmarsh, Peter	May 30, 1923	C 755
Frame, Muir	July 12, 1939	C 906	Hinskens, Joseph T.	Jan. 2, 1952	C 1007
Francis, David Morgan	Oct. 28, 1913	C 558	Hodge, William K.	Nov. 20, 1923	C 761
Francis, James	Oct. 1, 1907	C 250	Hodson, R. H.	Mar. 4, 1905	C 216
Frater, George	May 13, 1915	C 616	Holdsworth, William	May 16, 1918	C 671
Frater, Joseph	July 21, 1929	C 828	Holland, Alwin	Oct. 12, 1949	96
Freeman, H. N.	Nov. 14, 1905	C 230	Holley, Thomas W.	July 2, 1943	C 932
Frew, Joseph	June 26, 1944	C 947	Holliday, William	July 8, 1916	C 634
Frew, William M.	May 30, 1923	C 752	Hopkins, Harry	Dec. 31, 1925	C 791
Frobisher, Martin	Jan. 16, 1945	C 950	Horbury, Joseph W.	June 10, 1911	C 406
Frodsham, Vincent	July 22, 1908	C 282	Hornquist, Eric F.	Feb. 10, 1947	88
Furbow, John	Jan. 21, 1913	C 528	Horrocks, A. G.	May 1, 1909	C 324
Gabriel, Ernest P.	May 17, 1922	C 739	Howells, Nathaniel	May 1, 1909	C 316
Gall, Louis	Jan. 20, 1944	C 942	Hughes, Edward R.	Dec. 9, 1930	C 844
Garbett, Richard	Sept. 10, 1910	C 377	Hughes, Edward R.	Aug. 12, 1949	95
Garraway, Alfred J.	July 5, 1950	C 993	Hughes, Isaac R.	June 18, 1936	C 874
Gascoyne, Rowland B.	Jan. 21, 1913	C 513	Hughes, Sydney S.	July 2, 1943	C 938
Geater, Jas. Gordon	May 21, 1914	C 573	Hulbert, Vans H.	July 13, 1951	C 1000
Gee, Archibald R.	Jan. 10, 1944	C 939	Hunchuk, William	July 12, 1939	C 907
Gething, Lawrence C.	July 16, 1948	C 982	Hunt, Sydney (Jr.)	July 24, 1940	C 913
Gething, Quentin F.	June 29, 1946	C 959	Hunter, Peter M.	June 30, 1926	C 798
Gibson, Munro M.	Dec. 27, 1931	C 850	Hunter, Thomas	June 16, 1925	C 786
Gigliotti, Frank	July 20, 1949	C 985	Hutchinson, Lawrence	July 2, 1943	C 937
Gilham, John	May 13, 1915	C 623	Hutchison, Ben	Nov. 14, 1905	C 232
Gillies, William	May 16, 1918	C 668	Hutchison, Fred	Nov. 27, 1909	C 358
Gilmour, Hugh M.	July 18, 1938	C 896	Hynd, John	Dec. 14, 1920	C 707
Girou, Roger	Jan. 27, 1947	C 972	Hynds, William	July 8, 1916	C 632
Glen, James	Oct. 28, 1911	C 435	Ireson, John	Oct. 31, 1912	C 507
Gordon, Davis John	May 9, 1912	C 474	Irvine, David	June 10, 1911	C 413
Graham, James D.	Sept. 1, 1948	91	Jack, John	May 21, 1914	C 582
Graham, James D.	Aug. 17, 1949	C 989	Jackson, Harry	June 24, 1924	C 776
Grant, Ferguson	Oct. 29, 1951	C 1005	James, Thos.	May 21, 1914	C 588
Gray, George	May 9, 1912	C 467	Jardine, Geo. Edward	Jan. 21, 1913	C 521
Greenhorn, John	May 21, 1914	C 575	Jarrett, Fred J.	Oct. 1, 1907	C 256
Gregory, Richard J.	July 5, 1950	98	Jenkins, John	Sept. 10, 1910	C 390
Gregory, William	May 30, 1923	C 756	Jenkinson, Jonathan	Dec. 23, 1927	C 813
Gregson, John B.	Dec. 31, 1925	C 790	John, Howell	July 22, 1908	C 305
Griffiths, Edward	Oct. 31, 1914	C 508	Johnston, Fred	Dec. 30, 1926	C 803
Groat, Ed. Murray	Nov. 20, 1923	C 764	Johnston, Robert	May 9, 1912	C 479
Gunnell, James	Oct. 31, 1912	C 505	Johnstone, William W.	July 18, 1938	C 894
Gunniss, Matthew	May 9, 1912	C 460	Jones, Alf. Geo.	May 21, 1914	C 584
Guy, George	June 16, 1931	C 848	Jones, Douglas M.	June 15, 1934	C 861
Haile, Joseph G.	May 17, 1922	C 731	Jones, Samuel	Mar. 4, 1905	C 544
Hall, James	May 17, 1922	C 742	Jones, Samuel	May 27, 1913	C 518
Halsall, J.	July 22, 1908	C 307	Jones, William E.	Jan. 21, 1913	C 556
Hamer, Joseph	Dec. 9, 1930	C 846	Jones, William T.	Oct. 28, 1913	C 221
Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550	Joyce, Walter	Nov. 27, 1909	C 361
Hampton, Abel E.	Jan. 7, 1936	C 872	Judge, Peter	Sept. 10, 1910	C 391
Hampton, Samuel	Nov. 15, 1917	C 650	Karner, Joseph	Dec. 29, 1936	C 877
Hancock, Arthur	Nov. 15, 1917	C 656	Keenan, Wm. James	June 10, 1911	C 426

Registered List of Holders of Certificates of Competency as Coal-Mine Officials—*Continued*

Third-class Certificates Issued under "Coal-mines Regulation Act Further Amendment Act, 1904"—Continued

Name	Date	No.
Kelly, Ernest	May 17, 1917	C 646
Kelly, Francis	June 16, 1930	C 839
Kemp, Wm.	Oct. 14, 1914	C 594
Kirkeberg, H. S.	Nov. 27, 1909	C 350
Kirkham, Alfred	Oct. 28, 1913	C 559
Kirkpatrick, Hugh	June 26, 1944	C 944
Klejko, Steve	Dec. 14, 1920	C 703
Kniert, Kenneth F.	Sept. 28, 1946	C 968
Knowles, Joseph	July 10, 1947	C 974
Krall, John	July 29, 1949	C 987
Krall, Thomas F.	July 2, 1943	C 936
Kraus, Joseph	July 2, 1943	C 934
Kusnir, Paul	July 5, 1950	C 994
Lancaster, George H.	July 16, 1948	90
Lancaster, Peter	Dec. 16, 1937	C 888
Larner, Ralph	July 7, 1941	C 924
Larbalestier, Philip D.	July 30, 1951	104
Lazaruk, Steve	June 30, 1928	C 815
Leeman, T.	May 1, 1909	C 345
Leonard, Leon D.	Jan. 16, 1941	C 925
Leroy, Alfred J.	Jan. 26, 1950	97
Lester, Frank	May 17, 1922	C 734
Lewis, Benj. J.	Sept. 10, 1910	C 386
Lewis, Clyde	Jan. 2, 1952	C 1006
Lewis, Glyn	July 12, 1939	C 909
Leyward, Paul	May 17, 1917	C 637
Lindsay, William	May 17, 1917	C 642
Linn, George Y.	May 17, 1922	C 737
Litherland, David	June 30, 1928	C 816
Littler, Albert	July 2, 1943	C 933
Littler, James	June 30, 1926	C 792
Littler, Matthew	June 10, 1911	C 417
Littler, Robert	June 10, 1911	C 418
Littler, Robert (Jr.)	July 18, 1938	C 898
Livingstone, Alex	Oct. 28, 1911	C 436
Lloyd, Thomas	May 17, 1922	C 740
Louden, William D.	July 7, 1941	C 923
Loxton, George	June 10, 1911	C 428
Loxton, John	June 10, 1911	C 416
Luck, George	May 1, 1909	C 318
Lynch, Stewart	Oct. 28, 1911	C 432
Mack, George	Sept. 10, 1951	C 1004
Mackie, John	June 10, 1911	C 421
Magielka, John	June 24, 1940	C 918
Maki, Hannes	July 7, 1941	C 922
Makin, J. Wm.	Sept. 10, 1910	C 385
Malone, John	May 21, 1914	C 585
Manifold, A.	May 1, 1909	C 336
Marrs, John	May 17, 1917	C 640
Marsh, Daniel Parks	May 27, 1913	C 543
Martin, James	June 10, 1911	C 398
Mason, Joseph	July 22, 1908	C 297
Massey, Henry	May 1, 1909	C 317
Mather, Thomas	July 22, 1908	C 293
Matusky, Andrew	Oct. 1, 1907	C 259
Maxwell, Alfred W.	July 7, 1937	C 881
Maxwell, Geo.	May 21, 1914	C 571
McAlpine, John	Mar. 4, 1905	C 217
McArthur, John Malcolm	May 17, 1917	C 648
McArthur, Robert	Dec. 22, 1921	C 723
McCann, Thomas	July 12, 1939	C 910
McCourt, John	Oct. 14, 1914	C 605
McCourt, Thos.	Dec. 30, 1926	C 805
McCulloch, James	May 1, 1909	C 315
McDonald, Allen	June 30, 1928	C 817
McDonald, John	Oct. 28, 1911	C 448
McFagen, Alexander	May 9, 1912	C 490
McFegan, W.	May 1, 1909	C 319
McGarry, Martin	May 1, 1909	C 326
McGrath, James	July 8, 1916	C 630
McGregor, Gregor	Jan. 20, 1944	C 941
McGuire, Thomas	Oct. 28, 1913	C 553
McInnis, John C.	July 7, 1937	C 885
McIntyre, Neil	May 21, 1914	C 574
McKay, Walter	Nov. 20, 1923	C 763
McKenzie, Peter	June 10, 1911	C 427
McKibben, Matthew	May 21, 1914	C 580
McKinley, John	Oct. 28, 1914	C 442
McLachlan, Alex.	June 10, 1912	C 419
McLaren, John	May 30, 1923	C 754
McLaughlin, James	May 9, 1912	C 485
McLean, M. D.	Sept. 10, 1910	C 389
McLellan, William	Mar. 4, 1905	C 219
McLeod, James	July 22, 1908	C 296
McLeod, John	May 13, 1915	C 609
McMeakin, James	May 13, 1915	C 612
McMillan, D.	Sept. 10, 1910	C 363
McMillan, Edward	Oct. 31, 1912	C 493
McMillan, Neil	Nov. 15, 1917	C 654
McNay, Carmichael	July 22, 1908	C 306
McNeill, Adam L.	July 22, 1908	C 281
McNeill, Robert	Sept. 10, 1910	C 387
McVeigh, Francis	July 5, 1932	C 855
McWhirter, Archibald	June 30, 1926	C 794
Meek, Matthew	May 9, 1912	C 484
Menduk, Stanley	June 29, 1946	C 964
Menzies, Frederick	Dec. 14, 1920	C 704
Merrifield, George	Oct. 23, 1906	C 239
Miles, John	June 10, 1911	C 414
Miller, Frederick	July 21, 1929	C 823
Miller, Harry	Aug. 29, 1951	C 1003
Mitchell, Charles	May 1, 1909	C 322
Mitchell, Henry	Sept. 10, 1910	C 366
Montgomery, Brockwell	Dec. 17, 1946	87
Moore, George	Oct. 23, 1906	C 242
Moore, John	May 1, 1909	C 335
Moreland, Thomas	July 22, 1908	C 299
Morgan, Cornelius	Dec. 22, 1921	C 725
Morgan, Irving	July 7, 1937	C 885
Morgan, John	June 24, 1924	C 773
Morgan, William	May 17, 1917	C 636
Morris, David	May 9, 1912	C 472
Morris, Thomas B.	July 12, 1946	C 966
Murdoch, Jno. Y.	May 21, 1914	C 564
Murray, Robt.	June 30, 1926	C 796
Myers, Peter	Oct. 28, 1911	C 446
Nash, George F.	Dec. 22, 1921	C 727
Nash, George William	May 17, 1917	C 565
Nee, Wm. R.	Dec. 22, 1921	C 724
Neen, John R.	Dec. 16, 1937	C 889
Neilson, William	May 9, 1912	C 481
Nelson, Horatio	Oct. 1, 1907	C 263
Nicholson, James	May 9, 1912	C 469
Nimmo, James	May 9, 1912	C 461
Norris, Joshua	Oct. 28, 1913	C 557
Nuttall, Wm.	June 16, 1925	C 780
Oakes, Robert	Oct. 31, 1912	C 498
O'Brien, Reginald	June 26, 1940	C 917
Odgers, Eli	Jan. 21, 1913	C 523
O'Neill, Henry J.	Oct. 25, 1948	C 983
Osborne, Hugh	Oct. 28, 1913	C 555
Oswald, Geo. L.	Sept. 10, 1910	C 370
Owen, Thomas[3]	May 1, 1909	C 347
Park, William	Dec. 19, 1918	C 684
Parker, John H.	June 15, 1934	C 864
Parker, L.	May 1, 1909	C 341
Parkinson, James Wm.	Nov. 15, 1917	C 655
Parkinson, T.	July 22, 1908	C 289

[3] Issued as substitute for No. C 342.

Registered List of Holders of Certificates of Competency as Coal-mine Officials—*Continued*

Third-class Certificates Issued under "Coal-mines Regulation Act Further Amendment Act, 1904"—Continued

Name	Date	No.
Parkinson, Thomas	June 24, 1924	C 769
Parks, Alexander	Jan. 21, 1913	C 519
Parrott, Jas. E.	May 21, 1914	C 590
Parry, Glyn	July 30, 1951	103
Parson, Herbert	May 13, 1915	C 621
Parsons, Albert	June 10, 1927	C 808
Pasiaud, Roger A.	July 18, 1938	C 897
Patrick, Andrew	June 16, 1931	C 849
Pearson, Jonathan	May 9, 1912	C 473
Penman, Hugh	Oct. 28, 1913	C 552
Perry, Lorne B.	July 12, 1939	C 911
Pettoello, Mario J.	Jan. 7, 1947	C 970
Phillips, James	Nov. 21, 1922	C 749
Phillips, Richard S.	May 17, 1917	C 620
Pickup, A.	July 22, 1908	C 310
Plant, Samuel	Nov. 14, 1905	C 233
Pollock, John	May 30, 1923	C 760
Poole, Samuel	May 27, 1913	C 536
Price, Walter	Sept. 10, 1910	C 371
Protti, Samuel	Mar. 17, 1950	C 991
Quayle, Alex. B.	Jan. 5, 1925	C 778
Queen, John	July 12, 1939	C 908
Queen, Peter	Jan. 16, 1941	C 927
Quinn, John	Oct. 28, 1911	C 429
Radford, Albert	May 21, 1914	C 579
Rallison, James	May 30, 1923	C 759
Rallison, R.	July 22, 1908	C 279
Rankin, George	July 22, 1908	C 275
Rankin, Wm. Shaw	May 9, 1912	C 489
Raynor, Fred	Oct. 1, 1907	C 257
Rear, Albert E.	June 10, 1927	C 807
Reid, Thos.	May 21, 1914	C 592
Reid, Wm.	June 10, 1911	C 403
Reilly, Thomas	July 22, 1908	C 303
Renney, Jas.	Nov. 27, 1909	C 354
Richards, James	Nov. 1, 1907	C 249
Richards, Samuel	Oct. 23, 1906	C 244
Richardson, J. H.	Oct. 28, 1911	C 458
Rigby, John	July 29, 1905	C 225
Roberts, Arthur	June 24, 1924	C 772
Roberts, Ebenezer	May 1, 1909	C 327
Robertson, Thomas H.	July 7, 1937	C 883
Robinson, Asa	June 16, 1925	C 787
Robinson, Michael	May 1, 1909	C 332
Robson, James	June 16, 1925	C 788
Roper, William	July 22, 1908	C 274
Rowbottom, Thomas	Oct. 31, 1914	C 492
Royle, Edward	Oct. 31, 1912	C 506
Russell, Robert	Nov. 27, 1909	C 351
Salvador, Cirino	July 7, 1950	C 995
Sanders, Henry	June 15, 1934	C 863
Saunders, Eustace L.	Jan. 21, 1913	C 520
Scales, Joseph	May 17, 1922	C 738
Scarpino, Francis	May 17, 1917	C 649
Scott, Henry	July 22, 1908	C 294
Scott, Samuel A.	Aug. 29, 1950	101
Seddon, James	Oct. 3, 1919	C 824
Shanks, David	Sept. 10, 1910	C 372
Sharp, James	May 1, 1909	C 325
Sharpe, Henry	June 16, 1925	C 783
Shaw, Robert	June 1, 1933	C 857
Shea, Thomas J.	Dec. 22, 1921	C 722
Shields, Thomas	May 16, 1918	C 667
Shipley, John W.	Oct. 28, 1911	C 456
Shooter, Joseph	Oct. 1, 1907	C 261
Shortman, J.	May 1, 1909	C 331
Sim, James	Dec. 14, 1920	C 711
Simister, Frederick	June 26, 1944	C 949
Simister, J. H.	Nov. 27, 1909	C 353
Simister, W.	May 1, 1909	C 334
Simms, Hubert Allan	Jan. 21, 1913	C 526
Sinclair, William	Jan. 21, 1913	C 527
Slee, Thomas	June 30, 1926	C 793
Smellie, John	May 29, 1923	C 758
Smith, A. E.	Sept. 10, 1910	C 367
Smith, John Watterson	May 16, 1918	C 665
Smith, Joseph	Mar. 4, 1905	C 207
Smith, Richard Beveridge	Oct. 28, 1913	C 561
Smith, Thos. J.	Oct. 1, 1907	C 271
Smith, Thomas	May 9, 1912	C 486
Smith, Thomas	Dec. 14, 1920	C 705
Sockett, James C.	Jan. 16, 1945	C 951
Somerville, Alexander	July 7, 1937	C 884
Sopwith, Reginald Scott	Jan. 21, 1913	C 512
Southern, John C.	July 9, 1945	C 956
Sparks, Edward[4]	Oct. 1, 1907	C 314
Spencer, G.	May 1, 1909	C 329
Stafford, M.	Sept. 10, 1910	C 382
Starr, Wallace	May 9, 1912	C 488
Staton, Edward	May 21, 1914	C 581
Steele, Walter	Oct. 28, 1911	C 439
Stewart, George	May 27, 1913	C 534
Stewart, James B.	June 16, 1925	C 785
Stewart, James M.	Oct. 23, 1906	C 240
Stewart, John	Dec. 30, 1926	C 801
Stockwell, William	Oct. 23, 1906	C 238
Stone, Wm. C.	June 21, 1921	C 714
Strachan, John	Oct. 14, 1914	C 604
Strang, James	May 13, 1915	C 614
Strang, Thomas	June 10, 1911	C 400
Surtees, Edward	June 16, 1930	C 835
Sutherland, John	May 27, 1913	C 545
Sutton, Charles E.	July 30, 1951	C 1002
Sweeney, John	May 17, 1922	C 735
Taylor, Charles M.	Mar. 4, 1905	C 213
Taylor, Henry	Dec. 20, 1928	C 818
Taylor, Hugh	Jan. 21, 1913	C 530
Taylor, Jonathan	Dec. 19, 1918	C 680
Taylor, J. T.	Oct. 28, 1911	C 447
Taylor, Leroy	Sept. 10, 1910	C 381
Taylor, Reginald T.	June 18, 1936	C 875
Taylor, Robert	June 21, 1920	C 695
Taylor, Robert K.	July 10, 1947	C 976
Taylor, Thomas	May 21, 1914	C 577
Taylor, Thomas	July 7, 1937	C 882
Tellier, Lucien	July 13, 1951	C 999
Tennant, Joseph	June 24, 1924	C 770
Thacker, Geo.	May 27, 1913	C 537
Thewlis, David	July 2, 1943	C 935
Thewlis, David (Jr.)	July 11, 1951	C 998
Thomas, Edward J.	Jan. 16, 1950	C 990
Thomas, John B.	Nov. 14, 1905	C 231
Thomas, Thomas	Sept. 10, 1910	C 365
Thomason, Charles	Nov. 15, 1917	C 657
Thompson, Joseph	Oct. 1, 1907	C 269
Thompson, Thomas	Oct. 1, 1917	C 267
Thomson, Charles	June 24, 1924	C 765
Thomson, John A.	July 14, 1951	C 1001
Tiberghien, Alphonse	June 15, 1934	C 867
Touhey, William	May 27, 1913	C 547
Tully, Thomas	May 9, 1912	C 468
Tyne, Elijah	May 9, 1912	C 476
Unsworth, John	June 16, 1925	C 784
Uphill, Vernon R.	June 15, 1934	C 862
Valentine, Wilfrid	July 21, 1929	C 826
Vardy, Robt.	May 21, 1914	C 570
Vaton, Harry	July 5, 1932	C 853
Vaughan, John Henry	Oct. 28, 1913	C 560
Verkirk, William	Jan. 7, 1947	C 971
Vincent, Thomas C.	Nov. 21, 1922	C 745

[4] Issued in lieu of No. C 255, destroyed by fire.

Registered List of Holders of Certificates of Competency as Coal-Mine Officials—*Continued*

Third-class Certificates Issued under "Coal-mines Regulation Act Further Amendment Act, 1904"—Continued

Name	Date	No.	Name	Date	No.
Volpatti, Benjamin A.	June 29, 1946	C 961	Williams, Arthur E.	Nov. 8, 1948	92
Waddington, D. M.	June 10, 1927	C 806	Williams, Cadwalader	June 16, 1930	C 838
Wakulchik, Michael S.	July 20, 1945	C 957	Williams, John Sam	June 10, 1911	C 404
Walker, George	July 8, 1916	C 633	Williams, Robert	July 14, 1951	102
Walker, Jas. Alexander	Oct. 31, 1912	C 496	Williams, Watkin	June 22, 1908	C 301
Walker, Robert C.	May 17, 1922	C 728	Wilson, John M.	Dec. 16, 1937	C 890
Walker, Wm.	May 21, 1914	C 586	Wilson, Joseph	June 24, 1924	C 767
Wallace, Fred	Oct. 1, 1907	C 260	Wilson, Joseph	June 30, 1928	C 814
Waller, Wm. E.	July 5, 1932	C 851	Wilson, Joseph R.	July 18, 1938	C 902
Walls, John	Dec. 14, 1920	C 710	Wilson, Robinson	June 10, 1911	C 397
Walsh, James (Jr.)	July 19, 1947	C 977	Wilson, Thomas M.	Oct. 1, 1907	C 272
Wardrop, James	Oct. 31, 1912	C 504	Wilson, William	Oct. 1, 1907	C 262
Watson, George	July 22, 1908	C 288	Wilson, William	May 17, 1917	C 647
Watson, John	May 17, 1922	C 743	Winstanley, H.	July 22, 1908	C 283
Watson, Joseph	Jan. 21, 1913	C 515	Wintho, Thomas A.	July 29, 1905	C 222
Watson, Reginald V.	July 20, 1949	C 984	Witherington, George	Oct. 28, 1913	C 554
Watson, William	Oct. 22, 1906	C 246	Wood, Francis E.	Dec. 16, 1937	C 886
Watson, William	May 17, 1917	C 645	Wood, Thos. James	Oct. 31, 1912	C 491
Webb, Herbert	Oct. 28, 1911	C 457	Worthington, J.	July 22, 1908	C 295
Webster, Arnold	Apr. 12, 1951	C 996	Wright, John	May 21, 1914	C 593
Webster, James Stewart	Dec. 19, 1918	C 685	Wright, Robert	May 21, 1914	C 589
Weir, James	July 7, 1937	C 880	Wright, William	Jan. 21, 1913	C 522
West, James Gloag	May 16, 1918	C 676	Wynne, Thomas M.	Dec. 9, 1940	C 920
Whalley, William	Dec. 19, 1918	C 686	Yates, Frank	May 17, 1922	C 732
Whittaker, John (Jr.)	July 18, 1938	C 891	Yates, John	June 16, 1930	C 840
Wilkinson, Edward	Oct. 28, 1911	C 438	Yeowart, Hudson	June 24, 1924	C 771
Williams, Arthur	Dec. 20, 1938	C 905	Young, Alexander	May 16, 1918	C 666

Mine Surveyor Certificates Issued under the "Coal-mines Regulation Act Amendment Act, 1919"

Andersen, Thormod	Jan. 10, 1944	85	Lawrence, Stanley J.	Dec. 20, 1939	82
Anderson, Harry C.	May 19, 1922	59	Lindoe, Luke	June 21, 1921	41
Baile, Wynne Jeffreys	Oct. 3, 1919	16	MacDonald, John	May 19, 1922	46
Bapty, Harry	Dec. 16, 1942	83	McKenzie, Frank	June 10, 1927	66
Bonar, Robert B.	Dec. 30, 1926	64	Miard, Harry Ernest	Oct. 3, 1919	2
Bowerman, Everard S.	Dec. 14, 1920	39	Munro, David L.	Dec. 16, 1939	79
Brehaut, Cecil H.	Dec. 16, 1937	80	Owen, Wm. Arthur	Oct. 3, 1919	10
Buckham, Alexander F.	June 26, 1944	86	Pettigrew, Robt.	Dec. 9, 1930	75
Caufield, Bernard	May 19, 1922	54	Priest, Elijah	May 19, 1922	53
Corbett, Garnett S.	May 19, 1922	49	Rafter, Wm.	May 19, 1922	51
Cox, Richard	May 19, 1922	57	Reger, Frederick Wm.[1]	Mar. 18, 1949	93
Crosscombe, James S.	May 31, 1923	60	Richards, Chas. Clifton	Oct. 3, 1919	19
Daniell, Geo. W. B.	Oct. 3, 1919	29	Richards, James A.	Oct. 3, 1919	15
Davis, Gerald D.	Oct. 3, 1919	28	Richmond, Alexander M.	Jan. 25, 1943	84
Delaney, James	Oct. 3, 1919	21	Ridley, James	Oct. 3, 1919	18
Dickson, James	Oct. 3, 1919	3	Roaf, Jos. R.	Oct. 3, 1919	14
Drewry, Wm. Stewart	May 19, 1922	56	Rutherford, John A.	Dec. 2, 1929	70
Edwards, Jas.	June 10, 1927	65	Sandland, Joseph	May 31, 1923	61
Freeman, Harry N.	May 19, 1922	47	Schjelderup, Vilhelm	July 21, 1929	69
Gardner, Harold H.	June 16, 1930	72	Stewart, R. T.	Nov. 17, 1923	62
George, Frank J.	May 19, 1922	48	Strachan, Robert	June 21, 1920	36
Graham, Morton H.	Dec. 20, 1938	81	Stropkay, John	June 16, 1931	76
Gregory, P. W.	Nov. 17, 1919	32	Townsend, Neville F.	Nov. 17, 1919	31
Heaney, Chas. J.	June 16, 1930	73	Vallance, Wm. Dixon	Oct. 3, 1919	8
Hepburn, James T.	Dec. 14, 1920	37	Verkirk, Lucas	June 21, 1921	42
Holdsworth, William	Oct. 3, 1919	9	Waddington, Geo. W.	June 21, 1920	35
Holmes, Terence C.	June 16, 1930	74	Williams, John S.	Dec. 15, 1932	78
Howden, Archibald	May 19, 1922	55	Williams, Paul E. R.	Dec. 2, 1929	71
Hughes, Edward	Dec. 14, 1920	38	Wilson, Arthur Rupert	Oct. 3, 1919	13
Hunter, George	Oct. 3, 1919	30	Wilson, Chas. James	Oct. 3, 1919	22
Jackson, Thos. R.	May 19, 1922	43	Wilson, Hartley Paul	Oct. 3, 1919	24
King, Alfred Geo.	Oct. 3, 1919	27	Wilson, R. Robinson	Oct. 3, 1919	12
Kneen, Percy	Dec. 20, 1928	67	Wilton, Douglas D.	May 19, 1922	59
Lancaster, Peter	Oct. 3, 1919	23	Wright, Austin	Dec. 14, 1920	40
Lauderbach, Wilfrid P.	June 16, 1925	63			

[1] Issued in lieu of certificate dated October 3rd, 1919, destroyed by fire.

NOTES ON COAL MINES

VANCOUVER ISLAND INSPECTION DISTRICT

By A. R. C. James

The output of coal during 1951 from the Vancouver Island inspection district was 539,147 tons, a decrease of 6.5 per cent from the 1950 output. This decrease has resulted from the declining output of the Nanaimo coalfield, where the remaining workable deposits are very limited indeed. The decline in production from this area amounted to 21 per cent from 1950.

The output from the Cumberland mines reached 334,628 tons, an increase of 7.8 per cent over the 1950 output, and the highest output since 1944. Production from the Tsable River mine showed a very satisfactory increase over last year, while No. 8 mine has maintained its position as the largest producer on the Island.

The total of all fatal and serious accidents was the same as in 1950, but there was only one fatal accident this year, compared with two in 1950. There were eight serious accidents. Of these fatal and serious accidents, three were due to falls of roof or sides, two (including one fatal) involved mechanical haulage, two were caused by underground machinery, and two were due to other causes. Five of these accidents could probably have been avoided had reasonable care and forethought been used.

In addition to the above, 330 minor accidents were reported and investigated, representing an 8.5-per-cent decrease from the figure for 1950.

No dangerous occurrences were reported during 1951.

The annual mine-rescue and first-aid meet organized by the Vancouver Island Mine Safety Association was held at Nanaimo on June 2nd. Five teams competed in the rescue competition, and a high standard of performance was maintained. The winning team was the No. 8 mine "A" team captained by L. Cooper, and the No. 10 mine team captained by J. Gilmour came second.

Canadian Collieries (Dunsmuir) Limited

F. Ronald Graham, chairman of the board, Vancouver; Norman R. Whittal, president, Vancouver; Harry R. Plommer, managing director, Nanaimo; E. O. T. Simpson, general superintendent, Cumberland; W. Johnstone, district superintendent, Cumberland; W. Frew, district superintendent, Nanaimo. During 1951 this company operated No. 10 mine at South Wellington, Bright mine at Cassidy, and No. 8 and Tsable River mines in the Cumberland district. 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, F. Johnston, J. McArthur, and T. McCann, firebosses. This mine, covering a large area of the Douglas seam, was within a few weeks of closing down by the end of 1951 due to depletion of reserves. During the year the extraction of the remaining pillars proceeded rapidly, and in December the final pillars on the main slope were being worked.

Since it went into production thirteen years ago, the mine has produced well over 2½ million tons of coal from the Douglas seam. The percentage of coal recovered during the extraction of the pillars has been very high due to the efficient organization of the work. Production during this final year was maintained at 155,772 tons over a working period of 250 days. The number of employees in December was eighty-three underground and twenty-four on the surface.

The extensive pillar extraction has caused very severe crushing on many of the roadways, and constant repairs have been necessary to keep them open. Apart from this unavoidable difficulty, working conditions in general were found to be fairly satisfactory in the course of inspections. Ventilation was found to be generally satisfactory and the mine normally quite free of accumulations of methane.

The remaining areas of the mine which were worked during 1951 were naturally damp, and no further dust samples were taken. Thirty-five tons of rock dust was used for tamping shots and for general application before shot-firing.

First-aid requirements have been maintained at a satisfactory standard. In addition to the main first-aid room adjacent to the lamp-room, emergency stations were located at suitable points both underground and on the surface.

Fifty-nine accidents were reported and investigated. None of these was serious.

Bright Mine, Cassidy.—W. Frew, manager; J. Wilson, overman; H. Brodrick, M. Brodrick, A. Dunn, and J. Unsworth, firebosses. The mine is in Sections 1 and 2, Range 7, in the Cranberry district, near Cassidy, approximately 9 miles south of Nanaimo. Operations were begun in April, 1950, when the old Granby No. 2 slope was dewatered and reopened with the intention of working the Douglas seam immediately to the south of the old Granby No. 2 workings. The old slope (which now forms the main slope of the new mine) had been driven due south from the surface outcrop down the full dip of the seam. It was 400 feet long, and the old Granby workings had extended this distance down the dip from the surface. Beyond this point there was known to be an area of unworked Douglas coal, and it is this area which is now being opened up by the new mine. The general structure of the area is synclinal, and it is probably bounded on the southeast by a large downthrow fault. The conditions here have been found to be typical of the Douglas seam and include frequent floor-rolls and variations in seam thickness from *nil* to 15 feet or more. The overlying strata consist of sandy shales, sandstones, and conglomerate.

The mine has been developed vigorously during the year in order to supplement the declining output from No. 10 mine. Production for 1951 amounted to 40,041 tons over a working period of 250 days. The number of employees in December was fifty underground and seven on the surface.

The method of working is the room-and-pillar system, and the coal is hand-loaded into cars. At present there is no pillar extraction as the mine is entirely in the development stage. Total development drivage during the year amounted to 6,221 feet.

The main slope has been driven to a point 1,000 feet from the surface portal; however, the ground immediately to the west of the main slope was found to be barren and, therefore, development work has been mainly to the east and southeast of the main slope. A main diagonal slope has been driven from a point on the main slope just inby the old Granby workings and has been advanced 810 feet southeast. Levels, counter levels, and crosscuts have been developed from this diagonal. By the end of the year some six headings had reached points underneath the north bank of Haslam Creek, which flows across the area in an easterly direction. The surface cover along the line of the creek ranges in thickness from 75 to 150 feet. After drilling to prove adequate solid cover, permission was given to the company to drive its No. 2 right heading underneath the creek; this was completed by December 17th. Further development in this direction is continuing with a view to finding out the extent of the workable field.

A considerable amount of work was done on the surface during the early part of the year to equip the mine for handling an output of 300 to 400 tons per day. A rebuilt Ledgerwood geared hoist, driven by a 60-horsepower electric motor, was installed to haul the trips up the main slope. A tipple and 70-ton storage bunker were erected. The entire output is at present being trucked from the mine to the coal-preparation plant. To provide power for underground operations, a Canadian Ingersoll-Rand 23- by 14½- by 12-inch XVHE-2 air compressor having a capacity of 1,500 cubic feet of air per minute was brought from the old White Rapids mine and installed during March. This compressor is driven by a 300-horsepower synchronous motor.

The main return airway of the mine, which had in part to be driven through very difficult ground in the old workings, was completed early in April. A small Sirocco fan, belt-driven by a 30-horsepower motor, was then installed and put into operation on May 9th. This fan is at present circulating 30,000 cubic feet of air per minute at a water-gauge of 0.5 inch, which is sufficient for the requirements of the mine.

Underground water, draining through the Granby workings, is handled by three Cameron single-stage centrifugal pumps driven by 60-horsepower electric motors. A pump-room has been built at the entrance of a level near the top end of the main diagonal. This drainage level is connected with the old workings by horizontal bore-holes drilled through the coal rib, and a concrete dam has been built near the outby end so as to form a permanent sump.

The mine is naturally damp throughout, and it has not been considered necessary to take dust samples. Five tons of rock dust was used during 1951 for tamping shots.

First-aid requirements have been maintained at a satisfactory standard.

Conditions in the mine were usually found satisfactory in the course of inspections. Twenty-four accidents were reported and investigated; none was classed as serious.

Nine minor accidents were reported from the various surface departments of the company in Nanaimo during 1951 and were investigated.

Chambers No. 4 Mine, Extension

R. H. Chambers and associates, operators; R. H. Chambers, fireboss. This mine is in the Extension district, and the Wellington seam is being worked. The workings are confined to a small barrier pillar between the old Extension No. 1 and No. 3 mines. Operations throughout 1951 were entirely pillar extraction, and the workings are now close to the bottom of the main slope. Production in 1951 amounted to 1,667 tons over a working period of 170 days with a crew of four men. Working conditions were found fairly satisfactory during the course of inspections, and no accidents were reported.

Deer Home No. 2 Mine, Extension

R. H. Hamilton and associates, operators; R. H. Hamilton, fireboss. This mine is near the old Vancouver slope in the Extension district and is operating in a small section of outcrop pillars left in the Wellington seam when the old Extension No. 3 mine was abandoned. Work is confined to pillar extraction. Production in 1951 amounted to 314 tons over a working period of seventy-one days with a crew of two men. General working conditions were found fairly satisfactory during the course of inspections. No accidents were reported.

Furnace Portal Mine, Harewood

J. Biggs, operator and fireboss. This mine is at the base of Harewood Ridge, about 1 mile south of the Chase River reservoirs, and is operated in a small area of outcrop pillars left in former workings. This mine was worked out and production ceased at the end of March. Production in 1951 was 359 tons over a working period of thirty-nine days with a crew of three men.

Biggs' Mine, Harewood

J. Biggs, operator and fireboss. After the closing-down of the Furnace Portal mine Mr. Biggs began in April to open up an old prospect slope in a coal seam which outcrops at the foot of a conglomerate bluff approximately half a mile south of the Chase River reservoirs and 100 yards east of the Harewood road. This short prospect slope was originally driven many years ago by Canadian Collieries (Dunsmuir) Limited.

The slope was easily accessible for a distance of 90 feet, but beyond this point it was flooded. Mr. Biggs obtained permission to use a small electric single-stage centrifugal pump, and with this he was able to drain the slope to a point 150 feet from the portal. At 130 feet from the portal he found a crosscut 40 feet long which connected with a partly caved counter slope which went to the surface.

The seam, which lies approximately on the horizon of the Wellington seam at the base of the Extension formation, has proved to be very much broken up by floor-rolls, patches of sheared dirty coal, and lenticular masses of shale within the seam section. The thickness of the coal varies from a knife edge to 6 feet, and the general dip of the measures is about 6 degrees east. The roof of the seam consists of a massive bed of conglomerate.

Mr. Biggs cleared out the counter slope and established a ventilation circuit through the mine. He then erected a tipple on the surface and installed a small gasoline-driven hoist. In July he began to mine coal from those places where the seam section appeared promising. A total output of 225 tons was produced over a period of eighty-one working days with a crew of two men.

By the beginning of October it had become evident that there was no easily accessible area where the seam was sufficiently free from disturbances to make it worth while to continue working. The mine was therefore abandoned at the end of October.

No. 7 Mine, Cassidy

J. McKellar and associates, operators; L. Dickie, fireboss. This mine is at Cassidy, on Range 7, Section 2, and the eastern 500 feet of Range 6, Section 2, in the Cranberry district. It commenced production at the end of 1949 and operates in a seam which lies 50 to 60 feet stratigraphically above the Douglas seam. This seam is a purely local deposit and appears to lie in a small basin. From the outcrop it dips 20 degrees in a southerly direction. At a point on the diagonal slope 250 feet from the outcrop it begins to flatten out, and 300 feet from the outcrop it is quite level. The seam is 7 feet thick and contains two rock bands of variable thickness. The upper band is as much as 6 inches thick, while the lower one is as much as 1½ feet thick. Both the roof and floor of the seam are a strong conglomerate.

A main slope has been driven southwest down the pitch of the seam for 260 feet. During 1950 three levels were developed to the right of the main slope, and a short counter slope was driven through to the surface for ventilation purposes. During 1951 a new diagonal slope was set off to the left of the main slope and has been driven for a distance of 200 feet in a direction south 15 degrees east. Three short levels have been driven to the left off this diagonal, and one to the right. Approximately 440 feet were driven during the year. Production amounted to 1,876 tons for a working period of 216 days with a crew of five men.

The coal is mined by blasting it off the solid, and a Huwood compressed-air-operated rotary drill is used to drill the shot-holes. The coal is hand-loaded into cars, which are hauled to the surface by a small gasoline-driven hoist. Power is supplied by a Jaeger gasoline-driven portable air compressor of 75 cubic feet capacity.

General working conditions were found satisfactory in the course of inspections, and no accidents were reported during the year.

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 No. 8 mine was abandoned by Canadian Collieries (Dunsmuir) Limited. The seam outcrops along the side of a ridge immediately to the south of the Nanaimo River at a height of 540 feet above sea-level, and the coal measures dip southward at about 8 degrees.

In May, 1951, Messrs. Wilson and Lewis began to develop another part of this outcrop in Range 1, Section 2, of the Cranberry district, 1,700 feet west of their existing slope. There is here an area of Wellington coal about 1 acre in extent, bounded on the west by an upthrow thrust fault which also formed the western boundary of the old No. 8 mine workings. At present less than half this coal is accessible due to the flooding of the old mine. The seam in this area is over 6 feet thick, including two thin rock bands.

A tipple was built at the new mine-site, and a small gasoline-driven jigging screen erected to sort the coal into lump, nut, pea, and fine sizes. A slope was driven 60 feet in the coal and is connected with the water-level outlet from the old mine by a 90-foot crosscut.

Total production from both these operations in 1951 was 813 tons over a working period of 197 days with a crew of two men.

Conditions were found generally satisfactory in the course of inspections. No accidents were reported during the year.

Timberlands Prospect

During the latter half of 1950 Arthur Newbury began prospecting in the Timberlands area along the western outcrop of the Wellington seam between Nanaimo River and McKay Lake. Most of the easily minable coal in the Wellington seam in this area was worked from the old Timberlands No. 8 mine, which was operated from 1926 to 1928 and from 1941 to 1944. However, various blocks of coal were left along the outcrop. The old Timberlands No. 8 mine operated in a basin or syncline about 45 acres in extent. The seam was from 3 to 8 feet thick and of good quality. On the western edge of this basin, where Mr. Newbury is prospecting, the Wellington seam outcrops between two major thrust faults which run from northwest to southeast. The coal measures between these faults are heavily tilted, with the result that the seam dips about 45 degrees or more in a northeasterly direction. The old Timberlands mine workings did not in general extend beyond the eastern of the two faults, except for one limited and apparently not too successful attempt to work the steep coal between the faults in 1926.

During the fall of 1950 Mr. Newbury decided to drive a slope from a point about 600 feet west of the Timberlands road and 16 miles by road from Nanaimo. His intention was to locate the unworked pillars left by the old 1926 workings. In the first part of 1951 the ground was cleared ready for starting the slope, surface buildings were erected, and machinery was installed. An air compressor of about 250 cubic feet capacity driven by a 25-horsepower electric motor was installed, together with a geared hoist driven by a 20-horsepower motor. Later in the year a 100-ton coal-bunker was erected, together with a small jigging screen for sorting the coal into lump, nut, stoker, and slack sizes.

The driving of the slope was started in July, 1951. After passing through a small rib of outcrop coal about 5 feet thick, the slope entered a heavily caved gob. About 200 feet from the portal the edge of a coal pillar was located. The measures were dipping at 45 degrees, while the slope was crossing the pitch at about 25 degrees. At this time heavy rains caused the slope to be flooded, and at the year's end the water had not been removed, although an electric centrifugal pump was being installed to dewater the slope.

Two men were engaged in this work. There was no coal production during 1951 from this prospect.

North Wellington (49° 124° S.E.)

Loudon's No. 5 Mine

W. Loudon and associates, operators; W. Loudon, fireboss. This mine is about 3 miles southwest of Wellington and is on the opposite side of the ridge from the old No. 9 mine. It operates in a small area of coal near the outcrop in the No. 2 or Upper Wellington seam. Production in 1951 amounted to 1,050 tons over a working period of 209 days with a crew of five men. Working conditions were usually found satisfactory in the course of inspections. No accidents were reported during the year.

Carruthers and Wakelam No. 3 Mine

R. B. Carruthers and W. Wakelam, operators; R. B. Carruthers, fireboss. This mine is near the Loudon mine and is also in the No. 2 or Upper Wellington seam adjacent to the abandoned workings of the No. 9 mine. Production in 1951 amounted to 596 tons in a working period of 192 days with a crew of two men. Working conditions were found satisfactory in the course of inspections. No accidents were reported during the year.

Stronach No. 2 Mine

C. Stronach, operator; H. Gilmour, fireboss. This mine is in a section of the No. 2 or Upper Wellington seam adjacent to the old No. 9 mine. Most of the output during 1951 has come from pillar extraction. Production amounted to 1,806 tons over a working period of 228 days with a crew of seven men. Working conditions were usually found satisfactory in the course of inspections, and no accidents were reported.

COMOX (49° 124° N.W.)

Canadian Collieries (Dunsmuir) Limited

No. 8 Mine, Comox Colliery, Cumberland.—J. S. Williams, manager; J. Weir, overman; L. Cooper and J. W. Smith, shift-bosses; T. Robertson, A. Dean, A. Maxwell, D. Waddington, T. Shields, A. Jones, J. Vaughan, F. Coates, C. Williams, P. Queen, J. Queen, J. Clarkson, T. Wynne, J. Knowles, J. Christie, F. Dixon, and J. Hamer, firebosses. This mine is 600 feet north of the Lake Trail road 2½ miles southwest of Courtenay. It is now the largest coal-producing mine on Vancouver Island, with an average output of 894 tons per day. The whole of the output is obtained from the No. 2 seam, which has an average thickness of 3 feet 9 inches, including rock bands, and lies 700 feet below the surface at the shafts. The seam dips 6 degrees in a northeasterly direction. It is reached by two shafts, each 1,000 feet deep, which penetrate to the lower or No. 1 seam, where operations are at present suspended due to heavily faulted ground. The mine is worked entirely by the longwall system. In December six longwall faces were in operation; five of these were 240 feet long, and one 300 feet long. Production in 1951 amounted to 214,060 tons over a working period of 239½ days with a crew of 322 men employed underground and 78 on the surface.

During 1951 the management maintained the policy started in 1949 of replacing shaker-conveyors with belt-conveyors on the faces, and of displacing secondary haulages in favour of troughed-belt gate-conveyors which transport the coal to loading points close to the main haulage. Huwood 26-inch bottom-belt-loading-type face-conveyors are now used on all the longwall faces except one. Four Huwood 30-inch troughed-belt gate-conveyors are in operation on the loading roads; the longest of these is delivering the coal at a point 1,200 feet from the face.

Two Goodman duckbill units and two Joy loaders have worked steadily on development work during 1951. A total of 1,820 feet of longwall face has been developed, and of this total, 920 feet was in production at the year-end. The principal areas of development have been in the No. 2 Dip section on the south side of the mine and in the North Main level section. An important development has been the starting of a new main dip slope off the Main level on the north side. This new slope, it is hoped, will facilitate the working of a substantial area of coal on the dip side of the North Main level. At the year-end it had been driven 540 feet.

An additional pump was installed near the shaft bottom during 1951 to pump water to the surface. This is a 5-stage Alan turbine pump of 750-gallons-per-minute capacity and driven by a 200-horsepower electric motor. This new installation was made to reduce the operating hours of the existing pump and to provide a convenient stand-by in the event of a breakdown.

An underground electrical distribution substation was installed and put into operation in December. It consists of one incoming and five outgoing panels, with space for additional panels as required. The plant is situated in a concrete-lined fireproof housing 200 feet from the shaft bottom on the South Main level.

Working conditions were found fairly satisfactory in the course of inspections, apart from occasions when small emissions and accumulations of methane were encountered. Until the above conditions were remedied, blasting was invariably suspended. The main airways of the mine were found to be fairly satisfactory. At the last inspection in

December, air measurements showed a total of 160,649 cubic feet of air per minute passing in the main returns for the use of 322 men in the full three-shift period of twenty-four hours. An air sample taken in December at the upcast shaft bottom indicated 0.33 per cent methane in the general body of the return air. One hundred and eight samples of dust were taken from the various roadways during 1951; all the samples showed a higher incombustible content than the minimum set by the "Coal-mines Regulation Act." One hundred and seventy tons of limestone dust was used during the year; 118 tons was used for treating roadways, and the remainder was used on the faces and for tamping shots. Water sprays are used on the belt-conveyor systems for keeping down air-borne dust.

First-aid arrangements have been maintained at a satisfactory standard, and twenty-one employees are qualified to render first aid to the injured. A well-equipped first-aid room is available on the surface.

Two mine-rescue teams of six men have attended periodic practices at Cumberland mine-rescue station. One of these two teams was formed and trained during the year and made a very good showing at the mine-rescue competition at Nanaimo.

One hundred and sixty-two accidents were reported and investigated, the total number of accidents being the same as for 1950. Six of these were classed as serious, and the remainder as minor accidents.

Tsable River Mine.—S. J. Lawrence, manager; T. Eccleston, overman; W. Bennie, M. Brown, A. Cullen, M. Frobisher, W. High, L. Hutchinson, and J. Thomson, firebosses. The mine is situated on the left bank of Tsable River, approximately 5 miles west of Buckley Bay. It operates in the upper or westerly portion of the Tsable River coalfield, which is separated from the lower or easterly part by a buried ridge of volcanic rocks

The Tsable River Colliery tipple.

which project up into the coal-bearing Comox formation. Both these parts of the Tsable River field are separated from the Cumberland coalfield by a large "want," the seams having been eroded and coarser sediments deposited in their place. The seam section being worked ranges in thickness from 6 to 10 feet and contains several bands of shale of varying thickness. The roof strata consist of sandy shales and sandstones. The measures dip at 9 degrees in a northerly direction, but in the most recent inby workings in the new diagonal heading the gradient of the strata is almost level, suggesting that the workings have reached the bottom of a syncline.

As developed at present the mine broadly comprises (1) a main slope and three parallel counter slopes driven at 90-foot centres on the full dip of the seam for 3,000 feet from the portal, (2) a series of pairs of levels driven to the right and left off the main slope at approximately 450-foot intervals, and (3) new development roadways to penetrate disturbed ground and meet the altered direction of dip of the seam.

Early in 1950 a 20-foot upthrow thrust fault was encountered at the lower end of the main slope, about 3,000 feet from the portal. The left counter slope was driven through the fault, and the ground beyond the fault explored for a distance of 900 feet. The coal was of good thickness, except on the west side of the slope, where thick rock bands made the seam unworkable by present methods. The dip of the seam in this area was found to be very low, however, and in a northeasterly direction instead of northwesterly as hitherto. The main slope and haulage were therefore not extended beyond the fault, although the other two counter slopes were driven forward and considerable development work was done. As a result of this and other development work, it was found that there was a wide belt of disturbed ground, consisting of faults and rolls, extending across the east side of the property from southeast to northwest. Beyond this disturbed ground, in the northeast sector of the property, seemed to lie the largest reserves of coal. Furthermore, the direction of full dip of the seam was also veering over in that direction. In April, 1951, it was therefore decided to set off a diagonal slope from the right main return slope at a point just inby No. 4 Right level. The new diagonal was set off at an angle of 50 degrees with the main slope, following a direction almost due northeast. By the end of the year this diagonal had been advanced 900 feet and had passed through approximately 300 feet of disturbed ground to find regular seam conditions beyond, as had been expected.

The dip of the seam continued in a northeasterly direction, but beyond the disturbed ground it decreased rapidly until the seam was practically level. The coal in this area has proved to be as much as 11 feet thick, including three rock bands totalling about 12 inches. Further development work is proceeding in this part of the mine with a view to extending the main slope haulage there.

Total development during 1951 amounted to 11,885 feet of drivage, which includes slopes, diagonals, counter slopes, levels, counter levels, and crosscuts. In most cases, coal is conveyed from the faces by shaker-conveyors to a convenient loading point on one of the levels, where it is loaded into cars. Four Goodman duckbill units are used, and four Anderson Boyes shortwall coal-cutting machines. Twelve Climax compressed-air-operated rotary drills are used for drilling shot-holes.

Where conditions are unfavourable for undercutting the coal by machine, it is blasted off the solid. During the last month of the year the use of milli-second delay-action detonators was adopted on a limited scale for this purpose. The results have been generally favourable, and the use of these detonators is to be extended as soon as more equipment is delivered.

In addition to development work, the extraction of coal pillars between Nos. 2 and 3 Right levels was continued throughout 1951. It is estimated that 85 per cent of the available coal is being recovered in these operations.

Total production in 1951 amounted to 120,568 tons (an increase of 25 per cent over the total for 1950) over a working period of 239 days with a crew of 137 men employed underground and 15 on the surface.

A new sump pump and pumping station were constructed during the year in an old roadway between the main and travelling slopes. A 7-stage Mather & Platt turbine pump of 350-gallons-per-minute capacity driven by a 75-horsepower electric motor was installed in this station and went into service in July.

Conditions in the mine have generally been found satisfactory in the course of inspections. Ventilation was satisfactory, and frequent tests made with a safety lamp during inspections failed to reveal any methane. An air sample taken in December revealed only 0.03 per cent methane in the general body of the air in the main return airway. The fan circulates 44,000 cubic feet of air per minute at a water-gauge of 3 inches.

Although the workings are generally damp, 90 tons of limestone dust was used during the year for tamping shots and dusting the coal faces.

First-aid arrangements have been maintained at a satisfactory standard. A well-equipped first-aid room is provided on the surface, and an ambulance car is kept at the mine in constant readiness for an emergency. Three qualified industrial first-aid attendants are employed—one on each shift—and sixteen other employees hold first-aid certificates.

A mine-rescue team of six men is maintained, which attends periodic practices at the mine-rescue station at Cumberland.

Sixty-seven accidents were reported and investigated, a 22-per-cent increase over the 1950 total. One of these was fatal, two were serious, and the remainder minor.

Eighteen minor accidents were reported from the various surface departments of the company in the Cumberland area and 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 their reports were forwarded to the office of the District Inspector through the courtesy of these committees.

NICOLA-PRINCETON INSPECTION DISTRICT

By E. R. Hughes

Only small-scale coal-mining operations were conducted in this district during 1951. The total production was much less than that declared in 1950, which, at that time, had the lowest recorded output for any full year since coal-mining operations were commenced in 1907. The only mining operation at the end of 1951 was at the Blue Flame mine near Princeton, operated by the Taylor Burson Coal Company Limited, and the Coldwater No. 5 mine at Merritt. Joseph P. Wukelick employed from two to four men to hand-strip coal from a surface excavation at the old Princeton colliery during the first two months of the year, and in January, R. B. Savage and partners removed 4 tons of coal from the Black mine strip-pit. Underground exploration was continued by the Collins Gulch Collieries Limited south of Tulameen. The Taylor Burson Coal Company Limited discontinued work at the Jackson mine in May and started prospecting for a better seam in the vicinity of the old Blue Flame mine. After efforts on the surface proved unsuccessful, work was started on rehabilitating the underground workings, and coal production from this property was resumed in August. S. Gerrard and partners discontinued the extraction of pillars at the Coldwater No. 3 mine in May, and after doing some surface prospecting in other parts of the property, they commenced, in June, to develop a hitherto unworked part of the No. 5 seam, lying between the abandoned No. 1 and No. 4 mines.

No accidents to workmen were reported from the coal mines in this district during 1951. 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 9th. Four teams competed in the mine-rescue event, which was won by a Copper Mountain team captained by D. Parsons.

PRINCETON (49° 120° S.W.)

Taylor Burson Coal Company Limited

Jackson No. 1 Mine.—James Fairley, overman; Arthur Hilton, fireboss. This mine is on the south half of Lot 88, 4½ miles southwest of Princeton. The property is held by C. H. Jackson, Kelowna, under a lease granted under the provisions of the "Coal and Petroleum Act." In an agreement with Mr. Jackson the Taylor Burson Coal Company Limited obtained a lease in 1947 to mine coal from the property.

The portal of the main adit is at an elevation of 3,047 feet at the southwest corner of Lot 88. The seam in which work has been done is reached through a cross-measure adit driven 170 feet southeasterly from the surface at the tipple. Contact with the seam is made at right angles to the strike at a point 20 feet from the southern boundary of the property, and all underground development has been northward from the adit. The face of the main level had been advanced to a point 1,285 feet northeasterly from the cross-measure adit when operations were suspended at the end of April. Following the closing of this mine, the company directed its efforts towards finding another seam in the southern part of the coalfield.

Blue Flame Mine.—James Fairley, overman; Arthur Hilton, Thomas Bryden, and John Magielka, firebosses. This mine is about 10 miles by road south of Princeton and about three-quarters of a mile west of the Hope-Princeton Highway at Lamont Creek. The mine was formerly operated by the Wilson Mining and Investment Company Limited but was closed from April, 1937, until the Taylor Burson Coal Company Limited started work at the property in the spring of 1951. Several open-cuts were made on the surface in the vicinity of the eastern limits of the abandoned workings in unsuccessful efforts to find the seam outcrop under conditions that would permit economical mining from a new opening. In July a start was made to rehabilitate the old haulage slope, and the water was pumped out to a point about 150 feet down the slope from the portal, where a new level was started to the east, cutting through the pillar formed above the old Main East level. This roadway was continued easterly on the strike of the seam, and at the end of the year the face had been advanced to a point about 260 feet from the haulage slope. Crosscuts were driven to the rise of the new level, and connections were made for ventilation.

Coal-cutting is done with compressed-air-operated post-type punching-machines. After cutting, the coal is blasted and is hand-loaded into mine cars which are then hauled to the surface by a small compressed-air-operated hoist. A small tipple has been built near the portal, from which trucks haul the coal for sale in Princeton and district. At the end of 1951 fourteen men were employed, and the production of coal for the month of December was 808 short tons.

Princeton Colliery No. 1 Mine

Joseph P. Wukelick employed a crew of from two to four men to hand-strip coal from a surface excavation formerly made by Mannix Ltd. on the site of the old Princeton Colliery's No. 1 mine on Lot 1822, adjoining the village of Princeton to the south. Operations were confined to mining coal by hand during January and February. The amount of coal mined during these two months was 332 tons. Operations were suspended at the end of February and were not resumed during 1951.

Black Mine

In January, 1951, R. B. Savage and partners, under an arrangement with the owners, Francis Glover annd J. S. Ney, mined and removed 4 tons of coal from the Black mine strip-pit on Lot 87, 6 miles southwest of Princeton and about half a mile south of the Jackson No. 1 mine, on the site of the former underground workings known as the Black mine. The underground workings had been completely removed by the stripping operations of Mannix Ltd. during 1948 and 1949. In September, J. S. Ney did two days' bulldozing near the northern boundary of Lot 87 in an unsuccessful attempt to find the continuation of the Black seam in that area.

Hewitt Prospect

In April, 1951, Arthur W. Hewitt, Princeton, obtained a licence under the provisions of the "Coal Act" to mine coal from a portion of Lot 1133, Yale Division of Yale District. The area comprises 57.9 acres and covers the most easterly 20 chains as measured along the southerly boundary of Block A of Lot 1133. Part of this area covers the most westerly workings of the abandoned Tulameen No. 3 mine. Surface prospecting resulted in coal being found, and an adit was advanced into the seam. In September the face of the adit had been advanced 97 feet northeasterly into the hillside, when an order was issued prohibiting further underground work until a plan was made showing the position of the prospect in relation to the abandoned workings. Work had not been resumed at the end of 1951. No coal was produced for sale, and the owner was the only person employed.

Coalmont (49° 120° S.W.)

Collins Gulch Prospect

Francis Glover, manager; Thomas Bryden, fireboss. This prospect is at Collins Gulch, 2 miles south of Tulameen and 2 miles west of Coalmont. The property is owned by Collins Gulch Collieries Limited and is reached by a truck-road branching off the Blakeburn road south of Coalmont. The face of the upper adit was advanced during the summer and fall months. When work was suspended for the winter season, the face of the adit had reached a point about 110 feet from the portal. A total of 194 tons of coal was produced during August, September, and October. Three men were employed.

Merritt (50° 120° S.W.)

Coldwater Coal Mines

This property, formerly owned by the Middlesboro Collieries Limited, is about 1 mile south of the city of Merritt. During 1951 the property was operated by S. Gerrard and partners; Robert Murray, fireboss. Activities during the first half of the year were confined to the extraction of pillars from the Coldwater No. 3 mine. Because the seam was only 28 to 30 inches thick, it was decided to look elsewhere on the property for a better seam. Some open-cutting was done on the hillside immediately to the west of the No. 3 mine portal, but the results of this work were not sufficiently favourable to warrant continued development. In June a new adit was started on the hillside between the portals of the abandoned No. 1 and No. 4 mines and about 3,100 feet west of the No. 3 mine. This new opening is in the No. 5 seam, and the object of the development is to mine the coal left by the former operators between the old No. 5 seam workings and the surface. At the end of the year the face of the adit level had been advanced along the strike of the seam a distance of about 180 feet, and a raise had been driven to the surface for ventilation.

Coal is blasted from the solid and is then hand-loaded into 1-ton cars which are hand-trammed along the level to the tipple. 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 total production of coal for 1951 was 1,134 short tons. In December 143 short tons was produced and five men were employed.

EAST KOOTENAY INSPECTION DISTRICT

By D. R. Morgan

The coal-mining operations in this district are confined to the Crowsnest Pass area, the chief producer being The Crow's Nest Pass Coal Company Limited, with head office at Fernie. Other production was obtained by Hillcrest Mohawk Colliery Company, of

Bellevue, Alta., from their open-cast mine on the interprovincial boundary at Tent Mountain. As shown by statistics, there was an increase in the production of coal from the district during 1951 despite a shortage of skilled miners underground. The increase was due to the fact that the collieries worked more days than in 1950.

Regarding accidents, three fatal accidents occurred at Michel Colliery and two at Elk River Colliery, of which two were caused by falls of roof at the coal face, two by falls of coal at the face, and one by entering an irrespirable atmosphere. This is an increase of two over the 1950 total and is far from encouraging. Eight other serious accidents and 345 comparatively minor accidents were reported and investigated. This is a slight increase over the 1950 figure, but there was no material change in the number of shifts lost due to the accidents. No accidents were reported from the British Columbia side of the strip mine at Tent Mountain.

A successful competition was held under the direction of East Kootenay Mine Safety Association at Fernie on June 16th. Six teams from Fernie, Michel, and Kimberley competed in the mine-rescue competition, and the shield was won by Coal Creek No. 1 team, captained by David Brown. In the first-aid competitions there were 145 competitors, and the men's first-aid cup and shield were won by the Sullivan mine (North Section) team of Kimberley. Presentation of the Ryan Trophy was made that day to Elk River Colliery for the best safety record in 1950 for the coal-mines section of British Columbia. Safety awards were also presented to the M.F. & M. Railway and to The Crow's Nest Pass Coal Company sawmill at Michel, which are closely connected with the collieries.

The Crow's Nest Pass Coal Company Limited

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. This company operates two collieries in the district, the Michel Colliery at Michel and the Elk River Colliery at Coal Creek, the former being the larger operation.

Elk River Colliery.—(49° 114° S.W.) James Littler, manager. The coal measures at Coal Creek where this colliery is situated are divided by a valley, the seams outcropping on each side and dipping to the east. The colliery is comprised of five mines, all on the south side of the valley, each being driven from the outcrop and operating in a different seam.

The coal from the mines is treated for market on the site, in a modern preparation plant capable of treating more than 2,000 tons of coal per 8-hour shift.

To segregate the coals for blending, a 500-ton capacity steel bunker (mentioned in the British Columbia Minister of Mines Report for 1950) was completed during the year, together with the necessary screens and conveyors. This and a 300-ton bunker already available provide ample storage for the coal from all the mines and permit the preparation plant to be operated on a single-shift basis.

Following preparation, the coal is transported 4 miles to Fernie by the M.F. & M. Railway, operated by a subsidiary company of The Crow's Nest Pass Coal Company Limited, for distribution to market.

The combined underground operations of the colliery are under the direct supervision of three overmen, one shiftboss, and fifteen firebosses. A synopsis of the mines follows.

No. 1 East Mine.—Carmichael McNay, overman; Leonard Brett and John Cairns, firebosses.

The mine is operated by the room-and-pillar system in the No. 1 seam. It is the oldest working mine at the colliery and was for many years the largest. Subsequent extraction of pillars on the retreating system and withdrawal from " bump " areas have now reduced it to a skeleton of its former self, and its life is limited. Extraction of the pillars left during the earliest working of the mine continues, but the major producing section at the present time is a comparatively small panel of workings developed to the south of No. 1 West roadway.

The mine is still an important producer at the colliery, and the coal ranges in thickness from 12 to 25 feet, of which the upper 12 feet is worked and is of good quality. Owing to the friability of the coal, it is worked to advantage by pneumatic picks, and no shot-firing operations are necessary. All the coal is loaded directly into cars by hand, and the cars are hauled by horses to partings, where they are formed into trips. The entire production of the mine is then brought from these gathering points by a compressed-air hoist to the end of an endless rope system, now only 450 feet from the mine portal, which lowers the trips on a surface incline to the level of the old Coal Creek tipple. From there it is taken by steam locomotive to the Elk River preparation plant, 4,000 feet away.

The mine is ventilated by an electric Sirocco double-inlet fan producing 92,000 cubic feet of air per minute. Of this quantity, 63,000 cubic feet is supplied to the working faces and the remainder is circulated through abandoned workings. Very little gas is given off by the coal, and the ventilation on the whole was good throughout 1951. It was further improved by driving another airway to the surface from the panel of workings off No. 1 West roadway.

No. 4 Mine.—Arnold Webster, shiftboss. This mine is operated in the No. 4 seam and is worked by a crew of eleven men on a single-shift basis. All production during the year was obtained from the extraction of pillars on the retreating system in a panel of workings off an incline inby the old No. 3 incline.

The seam of coal averages 8 feet in thickness and has a pitch of 15 degrees. The coal is of good quality, but the erratic distribution of ash and frequent occurrence of thin rock bands complicate the preparation for market. The shale roof conditions are variable and necessitate systematic close timbering.

Rooms 12 feet wide are driven on a slight inclination in favour of the load to the right and left of the incline, and are connected by splits 12 feet wide driven on the full pitch. These splits later form longwall faces for extracting the pillars that, with the exception of occasional shots, are extracted efficiently by pneumatic picks. Prior to May the rooms and splits were driven by radial-punching machines but, following tests carried out by the management in conjunction with the Department of Mines, the coal is now shot off the solid by milli-second delay-action detonators. This, as expected, has proved safer and more efficient than the single-shot method. The coal is conveyed from the rooms, splits, and longwall faces by shaker-conveyors to the incline, down which it is transported by a series of belt-conveyors to a loading point on the main entry. The coal is loaded into cars and hauled by horses to the mine portal, a short distance from the tipple rotary dump.

General conditions were found to be satisfactory throughout 1951, and little gas is given off by the coal. The mine is ventilated by a double-inlet Sirocco fan which produces 30,000 cubic feet of air per minute at a 1-inch water-gauge. In the winter months the fan is reversed to act as a blower to prevent the formation of ice on the main entry.

No. 9 Mine.—Daniel Chester, overman; Ralph Larner, John Sweeney, William Waller, Albert Littler, James Corrigan, and Ralph Baker, firebosses.

The coal of the No. 9 seam, in which this mine operates, is of excellent quality, is normally 9 feet thick, and is overlain by a hard sandstone roof. A number of geological difficulties have been experienced throughout the year, and efforts to develop on a large scale have been disappointing. The seam in the main development levels, although of good quality, continues to be thin and contains a thick rock band.

Despite these difficulties, the mine has maintained its position as major producer at the colliery. It is operated by the room-and-pillar system, and most of the production during 1951 was obtained from the extraction of pillars in the No. 5 slope section, where conditions are normal. Following the abandonment of No. 6 incline panel because of the poor-grade coal encountered, Nos. 7 and 8 inclines were developed to counteract the loss in production. It was decided to introduce electricity into these workings, and considerable expense has been entailed in acquiring the correct type of flameproof equipment; the operation has been satisfactory to date. Heavy roof movement, however, is being experienced in this locality, and considerable repair work has to be done to maintain the roadways. The electricity is transmitted into the mine at 6,600 volts and transformed to 550 volts in a substation on the main level at the bottom of No. 8 incline.

To maintain a high production from the mine, development of the No. 8 seam has commenced. The No. 8 seam, which underlies the present seam, was traced by bore-holes drilled from the mine. At 4,200 feet from the portal a rock tunnel 380 feet long was driven from the No. 9 main level to connect the two seams. At present, operations consist of a single roadway, from which a rock raise will be driven to the No. 2 airway, No. 9 mine, to form a return airway for the new project.

The coal throughout the No. 9 mine is cut by chain coal-cutting machines or radial-punching machines or is blasted off the solid by milli-second delay detonators. It is conveyed to loading points on the level or rooms by shaker, chain, and belt conveyors, where it is loaded into cars. From the slope section, these cars, after being formed into trips, are hauled to the main level by a compressed-air hoist at the top of the slope. The entire production of the mine is hauled from these gathering points on the main level by a North British 100-horsepower diesel locomotive. When not in use, the locomotive is stored outside the portal of the mine in a shed that is suitably heated to protect the engine against severe winter weather.

The mine for the greater part of the year was ventilated by a Jeffrey centrifugal fan, producing 50,000 cubic feet of air per minute at a 2-inch water-gauge. In view of expanded development in the mine, it was found necessary to increase the quantity of air, and a new Joy axivane fan was installed in October; it produces 75,000 cubic feet of air per minute at a 6-inch water-gauge. The fan is driven by a 100-horsepower a.c. electric motor and, if required, the capacity of the fan can be increased to 100,000 cubic feet of air per minute.

No. 3 Mine.—James Anderson, overman; Roger Girou, David Brown, James Brown, Thomas B. Morris, William Verkirk, and Kenneth Kniert, firebosses.

This mine, operating in the No. 3 seam, is one of the major producers at the colliery. The seam is 17 feet thick where normal and is considerably thicker at the inner end of the main levels. During mining operations only the top 10 feet is worked, and the average pitch is 20 degrees. It is gassy and requires a strong current of air to dilute the gasses effectively. The coal is friable and is generally mined with pneumatic picks, but where necessary radial-punching machines are used. Only occasional shots are required. Most of the production in 1951 was obtained from the No. 4 incline and No. 1 slope sections, these sections being operated by the room-and-pillar systems. Rooms are driven 14 feet wide on the strike of the seam and splits 12 feet wide on the pitch. The splits later form longwall faces for extracting the pillars.

In the No. 4 incline section, at the highest elevation of the mine, the roof, owing to close jointing and the presence of faults, requires very close attention to its support. The pillars are extracted on the retreating system, and the coal is loaded on to shaker-conveyors. It is later transferred to belt-conveyors, which convey it to a loading point on the main entry.

In the slope section the roof conditions are more favourable, although some faulted ground was found in the lower section and, as reported in more detail under " Dangerous Occurrences," two outbursts of gas occurred during 1951. The major production from this section was obtained from extraction of pillars on the retreating system, which was commenced early in the year. The coal is transported by shaker and belt conveyors to loading points in the rooms, and the loaded cars are hauled in trips up the slope by a compressed-air hoist to a parting on the main entry. From this parting the trips are hauled to the mine tipple by an Atlas battery locomotive.

In the inner section of the mine the only operation was the advancement of Nos. 7 and 8 inclines to the west of the main entry, preparatory to developing a panel of workings in that locality. Before any large-scale development can be carried out, however, it will be necessary to drive airways to connect with the Nos. 1 and 2 return airways on the outby side.

The mine is ventilated by an electric Jeffrey aerodyne fan which produces 90,000 cubic feet of air per minute in the mine at a water-gauge of 1.8 inches. In general, the ventilation was fairly good throughout 1951.

No. 8 Mine.—Harry Miller, fireboss. This is a new operation driven to develop a mine in the No. 8 seam. The portal of the mine, which was commenced in September, is 2,500 feet east of the Elk River preparation plant and is at the same elevation as the portal of the old No. 2 mine. As yet the mine is in a prospect stage, and the roadway, which will ultimately become the main intake airway, was driven through 90 feet of surface gravel before the seam of coal was reached. Operations at present are confined to a single-shift basis.

During 1951, 2,550 pounds of CXL-ite, 28,250 pounds of Polar Monobel No. 4, and 35,645 electric detonators were used in all mines at the colliery in coal and rock blasting. Seven misfired shots were reported.

To neutralize the coal dust, 175 tons of limestone dust was applied to the underground roadways of the mines. Monthly samples of the 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 at all mines by the miners' inspection committees, and a copy of each inspection was forwarded 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 in order.

MICHEL COLLIERY. ✛ (49° 114° N.W.) William Chapman, manager; Irving Morgan, senior overman; John Whittaker, afternoon shiftboss; Stephen Lazaruk, night shiftboss.

This colliery is the major coal-producer in the East Kootenay District and comprises five mines operating in three seams and a coal-stripping operation on the west flank of Baldy Mountain, 2½ miles northwest of Michel.

In operation at the colliery are the by-product plant and coke-ovens. There are thirty-six Curran-Knowles ovens used, and at the end of 1951 200 beehive ovens were in production. An additional battery of sixteen Curran-Knowles ovens will be built in the near future, and the concrete foundation for its installation was completed during the year. Other construction included the erection of a coke screening plant of structural steel and an extension to the dry-breeze bin.

The underground mines, with the exception of "A" North mine, are developed to the right and left of a pair of rock tunnels, along one of which the coal is hauled by compressed-air locomotives to a modern preparation plant.

The combined underground operations are under the direct supervision of five overmen, two shiftbosses, and twenty-four firebosses. A synopsis of the mines follows.

"A" East Mine.—William Gregory, overman; Frank McVeigh, Harry Saunders, Richard Hughes, John Krall, and Thomas Taylor, firebosses.

This mine, which operates on the left side of the tunnels in the "A" seam, is on the eastern limb of the Michel syncline. The seam averages 10 feet thick and dips 20 degrees in a southwesterly direction. The coal is of good quality and is friable and gassy; the roof is weak and requires careful attention on the part of all concerned in its support. The mine is operated by the room-and-pillar method of working, and the pillars are extracted on the retreating system.

Apart from a small main pillar extraction above the main level at the inby end, all production for the year was obtained from the No. 1 slope section. Here rooms are driven in pairs to the left and right of the slope and, up to the present, pillars are being extracted only between the left side rooms. Very little advancement was made with the No. 1 slope and counter roadways, operations having been concentrated on the development of the rooms.

The coal in the rooms is generally cut by compressed-air shortwall coal-cutters and loaded by duckbill-equipped conveyors. The pillars are extracted by the shortwall method and, as the coal is quite friable, pneumatic picks are used to advantage, with only occasional shots being necessary. In these working-places the coal is loaded by hand into shaker-conveyors and transferred to loading points on the rooms by shaker, chain, and belt conveyors. From these loading points the coal is transported in trips of cars by compressed-air hoists to the top of the slope and later by compressed-air locomotives to a parting in the main tunnel.

The mine, together with the slope district in the " B " South mine, is ventilated by a Jeffrey aerodyne fan which produces 120,000 cubic feet of air per minute at a 3.8-inch water-gauge. Of this quantity, 75,000 cubic feet is circulated to this mine and, in general, the ventilation was found fairly good. Small accumulations of gas found on a few occasions near the roof at some of the working-places can be attributed to defective bratticing. Difficulties were also experienced on some occasions in conducting the ventilation to the faces of some of the pillar extractions owing to leakage of air through open goaves.

"A" South Mine.—Harry Corrigan, overman. As reported in the British Columbia Minister of Mines Report for 1950, production of coal from this mine was suspended during that year owing to depletion of the reserves. A small crew of men was employed in the early part of 1951 completing the operations of sealing the roadways, and the mine is now abandoned.

"A" West Mine.—Harry Corrigan, overman; Reginald Taylor, Robert Taylor, Mario Petoello, James Walsh, and Frederick Simister, firebosses.

This mine, which also operates in the "A" seam, is on the eastern limb of the Michel syncline. It is the largest producing mine at the colliery. During 1951 the major production was obtained from the No. 4 belt-road section. Extraction of pillars from the No. 2 belt-road section, which has been an important producer over a long period, was completed in July, and the men were transferred to other parts of the colliery. Operations were carried out in a section known as No. 3 belt-road for a short while to counteract the loss of production from No. 2 belt-road section. It was found, however, that the men could be absorbed elsewhere, and this operation was discontinued for the present.

The No. 4 belt-road section comprises three pairs of inclines with the necessary crosscuts for ventilation, which are driven to develop a large district towards the northern outcrop of the seam. All the inclines were driven to the surface gravel during 1951, and pillars are now being extracted off the inclines. This section is also being developed by six raises, which are driven to the west of No. 1 incline.

In general, the roof is weak and requires careful attention to its support. The inclines and crosscuts are mined by shortwall coal-cutters and blasted usually with millisecond delay detonators. The broken coal is then loaded by duckbill loaders on to chain and shaker conveyors, to be transferred to a loading point on the main west level by a series of belt-conveyors. All the production of the mine is loaded at this point, and large trips are hauled to a parting in the rock tunnel by compressed-air locomotives.

The mine is ventilated by an electric Sirocco double-inlet fan which produces 65,000 cubic feet of air per minute at a 1.4-inch water-gauge. This quantity was found to be generally satisfactory throughout 1951.

No. 3 Mine.—Harry Corrigan, overman; Roger Pasiaud, fireboss. This mine in the No. 3 seam is being developed on the western limb of the Michel syncline. The seam is 5½ feet thick, hard, of good quality, and has a fairly strong shale roof. The average inclination varies from 35 to 40 degrees but is steeper in places. Four raises are being driven on the pitch and will ultimately reach the northern outcrop to provide the necessary airways before any large-scale operations can be commenced.

Very little advancement was made with the raises during 1951, operations having been concentrated on other parts of the colliery. The influx of surface water during seasonal changes made handling of the wet coal difficult in the early part of the year, and the mine was idle for ten weeks. During this period the loading-chutes were transferred from the No. 1 raise to the drier No. 4 raise.

The mine operated on a single-shift basis. The coal was mined by radial-punching machines until May, when the Chief Inspector of Mines permitted mining by multiple blasting. Since then the coal has been blasted off the solid by milli-second delay detonators. Satisfactory results have been obtained, and the coal is conveyed by shaker-conveyors and angle chutes to a loading point on the main level.

The mine is ventilated as a separate split by the same fan as "A" West mine, and the ventilation was found satisfactory throughout 1951.

" B " South Mine (No. 3 Incline and Nos. 1 and 3 Raise Districts).—James Morris, overman; Henry Eberts, Sidney Hughes, Paul Kusnir, Vans Hulbert, Thomas Slee, Fred Nash, David Thewlis, Sr., and Thomas Krall, firebosses.

This mine is in the " B " seam on the western limb of the Michel syncline. The seam averages 5½ feet in thickness, is of excellent quality, has a strong shale roof and an inclination of 30 degrees. Extraction of pillars in the No. 1 Raise district was completed during 1951, and all production is now obtained from the No. 3 Raise and No. 3 Incline districts.

The No. 3 raise panel was developed rapidly to counteract the loss in production due to the depletion of reserves of the No. 1 raise panel. Rooms are driven in pairs on both sides of the raise, and the coal is cut and loaded by shortwall coal-cutters and duck-bill loaders. The pillars are extracted by longwall coal-cutters, and the coal is conveyed by a series of conveyors and chutes to a loading point on the main south level. The district is ventilated by a Sheldon fan which produces 30,000 cubic feet of air per minute at a 1.05-inch water-gauge. Some difficulties were experienced at the left side rooms during development owing to sluggish ventilation, but they were overcome later when a connection was obtained at a higher elevation to the airways in the No. 1 Raise district.

In the No. 3 Incline district, operations consist entirely of pillar extraction, including the incline pillars. The pillar coal is cut by longwall coal-cutting machines and pneumatic picks and is conveyed to a loading point on the main south level by shaker, chain, and belt conveyors. The loaded coal from both panels is transported in large trips to a parting in the rock tunnel by compressed-air locomotives. The district is a separate split to the No. 3 Raise district and is ventilated by natural means. Very little gas is given off by the coal in this panel, and the ventilation was found to be generally satisfactory throughout 1951.

" B " South Mine (Slope District).—Walter MacKay, overman; John McInnes, Harry Batchelor, Ferguson Grant, and Thomas Owen, firebosses.

This district is situated to the dip of the main south level, and major operations are the extraction of pillars. The coal is friable and gassy and is worked to advantage by pneumatic picks, no shot-firing operations being needed, except an occasional shot in rock work. The coal is loaded and conveyed to loading points in the rooms and hauled in trips of cars to the main south level by a compressed-air hoist. Operations were commenced during 1951 to enlarge the No. 3 slope, inby this district, preparatory to developing another slope district on the completion of the present workings.

The district is ventilated by the same fan as the "A" East mine but is on a separate split. Difficulties were experienced on several occasions during the year owing to sluggishness of the ventilation. This was improved by erecting an aircrossing over the haulage slope and dispensing with ventilation doors on that slope. Because of large areas of uncaved goaves in the district, it was apparent that an increase of ventilation was necessary, and a booster fan was placed in the return roadway to assist the ventilation.

"A" North Mine.—David Thewlis, Jr., fireboss.

This is a new operation driven to develop a mine in the "A" seam. It is on the north side of Michel valley, approximately half a mile east of the preparation plant. As reported in the British Columbia Minister of Mines Report for 1950, drill-holes were bored to trace this seam, and operations to develop the mine commenced in June. It is in a prospect stage, and the roadway now being driven will ultimately become the return airway. The seam was reached after advancing 50 feet through gravel and rock, and the roadway was turned to follow the level course of the seam. A crosscut was begun at the end of 1951 that will follow the pitch of the seam down to a predetermined elevation, and the proposed main entry will be driven out to the surface.

Conditions encountered to the present seem favourable. The coal is mined with pneumatic picks or blasted and dumped into a 25-ton capacity wooden bunker outside the mine portal. From there it is transported by truck along the old Erickson strip-mine road to the Michel preparation plant. Operations are on a single-shift basis, and ventilation is supplied by a small temporary fan placed outside the mine.

During 1951, 73,500 pounds of Monobel No. 4, 1,450 pounds of CXL-ite, and 69,228 electric detonators were used at the colliery in coal and rock blasting. Eight misfired shots were reported.

Four hundred and fifty tons of limestone dust was applied to roadways at the various mines to minimize the coal-dust hazard and for tamping shots.

Monthly examinations were made by the miners' inspection committees at all mines, and copies of their reports were forwarded to the District Inspector's office 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 and found in order.

Baldy Mountain Strip Mine.—Patrick Dalton, foreman. The coal deposit in this locality is of considerable size, ranging in thickness from 60 to 100 feet. It is of fairly good quality, although some sections have inferior coking properties. The coal is loaded by a diesel-driven 2½-cubic-yard shovel and conveyed in trucks for 4½ miles along a company road to the colliery tipple.

The coal was loaded from the higher elevation of the seam. Considerable overburden has been removed to the west to expose the seam farther down the mountainside, where a roadway was prepared for hauling coal when loading operations are transferred to that point.

Prior to August, stripping and mining operations were carried out by the firm of Mannix Ltd., Calgary, Alta., on a contract basis with the Crow's Nest Pass Coal Company. Since the termination of the contract in August, operations have been continued by Emil Anderson Construction Company.

Extensive diamond drilling was done during the summer on Baldy Mountain at the northern extension of the present pit with a view to extending stripping operations. The results of the drilling were satisfactory.

Conditions were found to be generally satisfactory throughout 1951.

Hillcrest Mohawk Collieries Limited

Henry Miller, general superintendent, Bellevue, Alta. Coal has been obtained at various times during 1951 in this company's stripping operation on the interprovincial boundary at Tent Mountain, near Corbin. The major operation of the mine is in Alberta, but the seam, which is 100 feet thick and dips 65 degrees, crosses the boundary for a short distance into British Columbia before outcropping on the mountainside. As the quantity of coal available on the British Columbia side did not warrant building extensive roads for its recovery, an arrangement was made in 1950 by the property-owners, The Crow's Nest Pass Coal Company, for Hillcrest Mohawk Collieries to operate the extension.

The working method employed involves taking 18-foot lifts along the strike of the seam and removing the rock hangingwall. The coal is loaded by power-shovels and transported by trucks to the company's preparation plant at Bellevue, Alta.

NORTHERN INSPECTION DISTRICT

By A. R. C. James

Telkwa (54° 127° N.E.)

Bulkley Valley Collieries Limited Company office, Telkwa. F. M. Dockrill, managing director; A. H. Dockrill, superintendent. This property is on Goat Creek, about 7 miles southwest of Telkwa. The market is confined to the district between Prince George and Prince Rupert, the coal being transported by truck from the mines to the Canadian National Railway at Telkwa. Two mines have been in operation during 1951; the No. 2 mine has been worked to meet local demand for domestic coal between Hazelton and Burns Lake, while all the output from the new No. 3 mine has been supplied to the Columbia Cellulose plant at Prince Rupert.

No. 2 Mine.—A. Robinson, fireboss. This mine is on the west bank of Goat Creek, about 270 feet above river level. The workings are in the Betty seam, which dips northwestward at 7 degrees. The seam 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 a roof.

Operations during the year were confined to pillar extraction. The mine was closed between March and September. During the working months a crew of seven men was employed underground, producing 400 tons monthly. The methods of working this mine have been described in previous Annual Reports. Conditions in the mine were found satisfactory in the course of inspections, and no accidents were reported.

No. 3 Mine.—H. Bankhead, F. Bond, and George Mack, firebosses. This mine, which began production at the end of 1950, is in the Betty seam on the east side of Goat Creek, about 7 miles from Telkwa. The main slope portal at the outcrop of the seam is on a steep hillside on the east side of the creek valley 300 feet above the creek. The thickness of the seam ranges from 9 feet 6 inches to 12 feet, including three thin rock bands totalling 3 to 7 inches thick. It dips at an average of 12 degrees in an easterly direction from the outcrop.

The main slope has been driven 450 feet from the surface outcrop down the full dip of the seam. Two parallel counter slopes, driven at 90-foot centres, have been advanced 190 and 225 feet respectively from the surface. Pairs of levels have been set off to the right from the main slope at 200-foot intervals. The first pair of levels has been driven 320 feet along the strike of the seam, and a series of six rooms, each 20 feet wide and separated by 15-foot pillars, has been driven 140 feet to the rise. All work off the first pair of levels is now temporarily stopped, and a second pair of levels is being driven. Total amount of development work completed during 1951 amounted to 3,000 feet, including main slope and counter slopes, levels, crosscuts, and rooms.

The mine is worked, so far as is practicable, by mechanized room-and-pillar system. Where conditions are suitable, the coal is cut by a Mavor & Coulson modified longwall coal-cutter fitted with a 7-foot jib. Shot-holes are drilled with Siemens Schuckert E47 rotary electric drills, of which there are two in use. The coal is conveyed from the faces of the rooms by Mavor & Coulson 15-inch scraper chain-conveyors. These deliver on to a Mavor & Coulson 26-inch flat belt-conveyor in the level, which in turn delivers on to the main slope conveyor, which is a Mavor & Coulson 24-inch troughed-belt gate-conveyor driven by a 10-horsepower electric motor. The main slope conveyor drops the coal on to a gravity chute at the surface, whence it goes to the storage bin 250 feet below the mine portal.

All the machinery, both underground and on surface, is electrically driven, and the underground electrical plant is of modern Buxton-certified flameproof design. Power is purchased from the British Columbia Power Commission at 440 volts.

Conditions at the mine were found generally satisfactory in the course of inspections. No methane was detected. The mine is at present ventilated by means of a temporary fan which circulates approximately 4,000 cubic feet of air per minute. Production during December amounted to 2,600 tons, with a crew of thirty men.

Cariboo

Bowron River (53° 121° N.W.)

Bowron Coal Company Limited

D. Wells, president. This company holds a coal lease on Lot 9596, on the Bowron River about 30 miles due east of Prince George. The company established a camp on the east side of Bowron River in 1947, and between 1947 and 1950 explored coal seams exposed on the west bank of the river on Lot 9593. Activities in 1951 have been confined to maintaining the road into the property from Buckhorn Lake.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1948, pp. 233–240.]

Peace River (56° 122°)

Peace River Coal Mines Ltd.

Lloyd Gething and associates, operators; A. D. Chapple, fireboss. This property is on Larry Creek, on the western slope of Portage Mountain, at the upper end of the Peace River canyon, about 18 miles by road from Hudson Hope. The mine, known as Canyon No. 1, operated in the Murray seam in the lower portion of the Gething formation. The seam outcrops near the top of the vertical wall of the Peace River canyon and on the rising ground to the south of Larry Creek. It is 7 feet 2½ inches thick, including 6- and 4½-inch bands of clay ironstone, and dips 3½ degrees southwestward.

The present company, which began working the seam in 1944, ceased operations permanently in July, 1951, and all plant and machinery was dismantled, and the mine abandoned.

The layout and method of working this mine have been described in previous Annual Reports. Work done in 1951 included (1) the advancement of the main haulage level to a point 250 feet southeast of the intersection with No. 6 incline, (2) the driving of two rooms to the rise from the main haulage level, both of these being parallel with and southeast of No. 6 incline. The first of these rooms was set off 100 feet southeast of the intersection of No. 6 incline and the main haulage level, and was driven 28 feet wide for 300 feet. The second room was set off 45 feet southeast of the first room and had been driven 16 feet wide for 220 feet at the time of abandonment. The writer visited the working-faces shortly after the closing-down of the mine and noted that the mining conditions appeared to be good and that there had been no recent change in the nature and thickness of the seam. The roof, consisting of 4 feet of carbonaceous shale overlain by sandstone, was the same as in other parts of the mine.

A crew of six men was employed at the mine, and the average monthly output was 350 tons.

Conditions at the mine were found generally satisfactory in the course of inspections. No methane was detected. No accidents were reported.

King Gething Mines

Quentin F. (King) Gething, operator and fireboss. This property is on Lot 1039, on the southeastern slope of Portage Mountain at an elevation of 2,300 feet; it is about 12 miles by road from Hudson Hope and 72 miles from Fort St. John. The present mine, known as the King Gething No. 3 mine, was started in 1949. The seam being worked is from 6 to 8 feet thick and occurs in the lower part of the Gething formation. The coal measures dip 16 degrees in an easterly direction and form part of the eastern limb of the Bullhead anticline.

The mine has been developed by means of two parallel levels driven due north along the strike of the seam from the surface outcrop. The lower level forms the main haulage level. The upper level was commenced at a point 75 feet to the rise of the main level, but this distance between the levels was later increased to 100 feet. The levels have been connected by a series of raises driven at 50- to 70-foot intervals from the main level.

The main level has now been driven 505 feet from the portal, and the upper level 270 feet. The levels are connected by five raises, and two others are partly driven. A total of about 580 feet of development work was done in 1951.

The coal is blasted from the solid. Mechanical equipment consists of a drill and a Sullivan jackhammer. Power is supplied by a small air compressor of 60 cubic feet capacity driven by a 25-horsepower gasoline motor. The coal is hand-loaded into mine cars and hand-trammed out of the mine to the tipple.

Average monthly production during 1951 was 170 tons. In November three men were employed.

Conditions in the mine were found satisfactory in the course of inspections. No methane was detected. No accidents were reported.

Reschke Coal Ltd.

Company office, Fort St. John. J. Reschke, operator and fireboss. This property is situated at about 2,600 feet elevation on a steep hillside on the southwest slope of Butler Ridge, about 23 miles by road from Hudson Hope and 83 miles from Fort St. John. The seam worked is from 4 feet 6 inches to 5 feet thick and contains two rock bands in the top 6 inches. Both roof and floor are a hard sandy shale. The seam dips 43 to 47 degrees due west and is on the western limb of the Danish Creek anticline.

The mine has been developed from two parallel levels driven due north along the strike of the seam from the surface outcrop. The lower level forms the main haulage level and intake airway, and the upper level, 330 feet to the rise, provides a return airway and an alternate means of egress. The lower level has now been driven for a total distance of 970 feet from the portal, and the upper level 460 feet.

The coal is mined from a series of 30-foot wide rooms set off from the lower level at 50-foot centres and driven on the full pitch of the seam to a point where they connect with the upper level. Eighteen rooms have been worked. Pillars of coal 15 feet wide are left between the rooms to support the roof.

The coal is cut with two Ingersoll-Rand R47 radial-punching machines and is transported by gravity chutes into cars on the main level, from which it is brought out of the mine by horses or trammed by hand. Mechanical equipment includes two Davis compressed-air-operated rotary coal drills and a jackhammer. Power for this equipment is supplied from an air compressor driven by a 100-horsepower diesel engine.

During the summer the operator decided to try to increase production in the winter months by installing an electric longwall coal-cutting machine to cut the coal in the rooms. This installation was completed in October, but at the time of the writer's last inspection in November, considerable difficulty was being experienced in operating the machine under conditions prevailing at the mine.

The coal-cutter is a Mavor & Coulson Samson 1926-type model H machine with a 6-foot overcutting jib. The machine has been fitted with a modern B.E.S.A. socket for use with a trailing cable plug of the same type.

An American Motors 3-phase a.c. generator of 100 kw. capacity, driven by a 140-horsepower diesel engine, supplies power from the surface. One thousand feet of single-wire-armoured lead-insulated cable has been installed in the main level, and this is connected at the inby end with a modern British-Thompson-Houston gate-end switch unit. Individually screened cab-tire-sheath trailing cable carries the current from the gate-end switch to the coal-cutter. All underground equipment is of permissible type.

The mine was closed down for five months during the spring and summer, 1951, owing to lack of demand. Production has also been low during the last few months of the year because of the difficulties with the coal-cutting machine, reported above, and shortage of labour. Average monthly output for the working months was about 300 tons for a crew of five men.

Conditions were found fairly satisfactory in the course of inspections, and no methane was detected. No accidents were reported.

REPORT ON GOAT CREEK COAL AREA

By J. M. Black

Location and Access

Goat Creek flows northward into Tenas (Mud) Creek close to its confluence with Telkwa River, 4 miles southwest of Telkwa. The area examined includes the valley of Goat Creek from 2 to 4 miles from its mouth. Telkwa is a settlement on the Canadian National Railway and on the highway between Prince George and Prince Rupert; a good motor-road extends southwestward from it about 7 miles to the mines in the area.

History

Coal was discovered in Telkwa valley about 1900, but mining did not begin in Goat Creek valley until 1918. There has been some production almost every winter since 1918, and in recent years production has been maintained the year round. Production before 1930 came from the McNiel mine in the north part of the area; production since 1930 has come from mines of Bulkley Valley Collieries Limited. One mine was almost worked out in 1942, at a time when coal was needed urgently and, as a result, the Federal Government financed the drilling of seven holes in 1943 and 1944. Additional drilling was done in 1946, 1950, and 1951. Total production from the mines of the area is about 180,000 tons of coal, used chiefly for domestic purposes. There is a growing demand for coal for industrial use in the Prince Rupert area, chiefly to supply power for the celanese plant of the Columbia Cellulose Company Limited.

Three weeks in September were spent in the field. A map of Bulkley Valley Collieries Limited, with a scale of 1 inch to 200 feet, was available and was extended by plane-table mapping near the mines and drill-holes, and elsewhere by pace and compass traverses. (*See* Fig. 20.)

General Description

The part of Goat Creek valley mapped, about half a mile wide and 200 to 400 feet deep, includes three mines of Bulkley Valley Collieries Limited and the McNiel mine. Most of the valley slopes are gentle, but in a few places, generally where bedrock is close to the surface, the slopes are steep. The valley is incised in a gently rolling upland 2,300 to 2,900 feet in altitude. Most of the area is covered with overburden of gravel and till.

The overburden at some points is more than 200 feet thick but as a rule is much less. Outcrops are scarce, except in the bed of Goat Creek. Fair stands of timber on some of the slopes are being logged.

General Geology

A thin-bedded sedimentary series, consisting of interbedded mudstones, sandstones, and coal seams, underlies the area.

Mudstones constitute about two-thirds of the series. Coal seams form a minor part of the series, but in a group of beds referred to here as the coal measures, coal is more abundant, and as much as 20 per cent of the core from some holes drilled through the coal measures is coal. The other beds are sandy and, in general, constitute almost one-third of the series. The beds are lenticular, and a section may differ from another section 100 feet away as to the number, kind, and sequence of beds. Some beds become thinner and pinch to the vanishing point, whereas others become thicker.

The top of the series is not exposed and at only one point is the underlying rock exposed; the thickness is not known. The results from drilling, however, show that over much of the area the series is at least a few hundred feet thick. It extends in all directions beyond the limits of the area mapped.

The mudstones consist of clay particles adhering together in beds or laminæ and are grey to black in colour. As a rule, the beds are less than an inch thick, although some are a few feet thick. The mudstones weather readily and do not outcrop unless partly protected by beds more resistant to weathering. Mudstone in diamond-drill core which is not protected from weathering loses its shape and becomes mud in about a year.

The sandstones are mostly grey and brown and weather to a rusty colour. They range from gritty beds with particles an eighth of an inch across to fine silty beds gradational to mudstone. A few of the coarse beds have a greenish tinge. Most of the beds are a few inches thick, but some are about 1 foot thick. The sandstones are fairly resistant to weathering and project on exposed surfaces as a series of ribs.

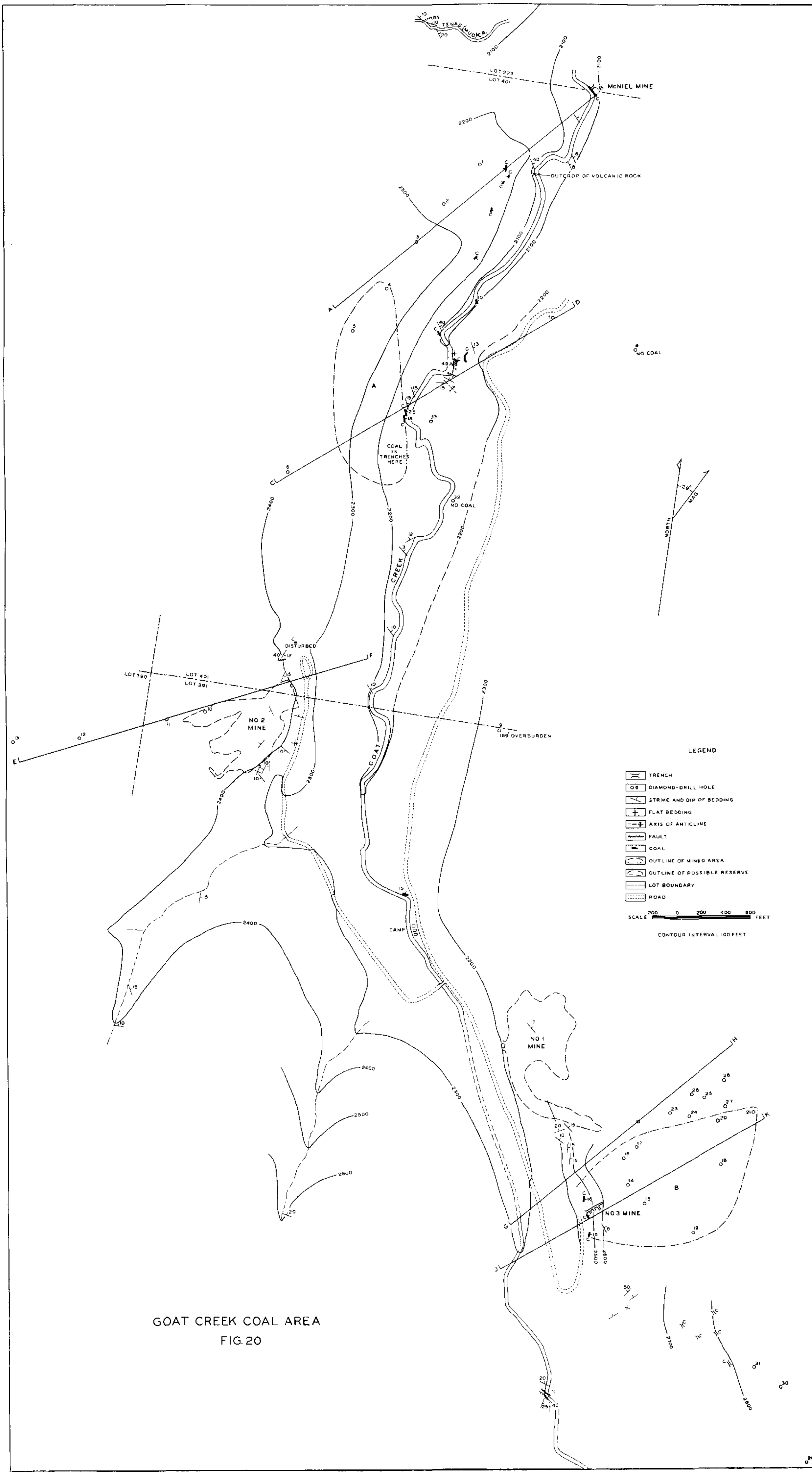
The coal is mostly in seams interbedded with the other beds. A minor amount occurs as fragments in sandy beds, and some mudstone beds contain coaly material. The seams range from paper thin to 14 feet and possibly more in thickness. Some of the seams mined contain two partings of a few inches of bony shaly material. There are various proportions of bright and dull coal in a single seam. In general, the coal has a high heat value, and it is classified by MacKay* as a high-grade, high-volatile bituminous coal. According to Dickson,† two samples tested in 1926, presumably from the McNiel mine, had good coking qualities. Very little gas is present in the mines, and at times none is detected.

One outcrop of rock underlying the sedimentary series was found in Goat Creek in the northern part of the area. It is massive, grey-green, and tuffaceous and is part of the Hazelton group.

The contact between this outcrop and the overlying beds is not exposed, but the apparent thickness of the series below a major coal seam near this outcrop is considerably less than the known thickness at other points. It would thus appear that the surface of the volcanic rocks is irregular, and that an erosion interval preceded the deposition of the sedimentary series.

The sedimentary series was once thought to be part of the Skeena series and to be probably Lower Cretaceous in age. The Skeena series comprised widespread and numerous isolated occurrences of sedimentary rocks believed to overlie the Hazelton, but similar beds occur at several horizons in the Hazelton group, and the series is now considered‡ to be part of the Hazelton group, which is of Jura-Cretaceous age.

* Coal Reserves of Canada Reprint of Chapter 1 and Appendix A of Report of Royal Commission on Coal, 1946, p. 51.
† *B.C. Dept. of Mines*, Bull. 14, 1941, p. 16.
‡ *Geol. Surv. Canada*, Preliminary Map 44–23, 1944.



GOAT CREEK COAL AREA

FIG. 20

Numerous dykes intrude the sedimentary series, and dykes mark the limits of mining in some of the mines. One dyke exposed in Goat Creek strikes northwestward and is almost vertical. It is slightly displaced by a bedding-plane fault.

Structure

Most of the beds dip at low to moderate angles to the northeast, but locally they diverge considerably from that attitude, and some beds intersected by diamond-drill holes dip as much as 45 degrees. Several gentle folds have been recognized and are described with the property on which they occur.

Faults are common; two are exposed near Goat Creek in the central part of Lot 401, and several are exposed just north of the portal of No. 2 mine. The faults near Goat Creek dip moderately westward, and the hangingwall of each appears to have moved down relative to the footwall. The faults north of No. 2 mine dip northwestward and also appear to represent a normal movement. There has been movement along bedding planes in many places. In places, beds have been fractured and stringers of carbonate occur in the fractures. Faults have limited mining in parts of the area because of displacement of the seams and squeezing of the coal.

Bulkley Valley Collieries Limited Company office, Telkwa. F. M. Dockrill, mine manager; A. H. Dockrill, secretary and mine superintendent. Capital: 250 shares, $100 par value. This is a private company mining coal on a royalty basis on property comprising six Crown-granted lots—Nos. 388 to 392 and 401. The six lots include all the area mapped, except a small part of Lot 223 in the extreme north.

Most of the employees live in Telkwa, 7 miles from the mines, and a small camp at the property includes a dry, a shop, an office, and accommodation for about six employees. About thirty men are employed. Power is supplied to the property by the British Columbia Power Commission.

F. M. Dockrill started mining on a royalty basis in 1930. Bulkley Valley Collieries Limited was formed in 1937 and has since been in continuous production. Production first came from No. 1 mine, on the east slope of the valley, which was opened in 1930 and abandoned in 1943. No. 2 mine, on the west slope, was opened in 1943, and there has been some production from it every year, but only a few pillars remain to be mined. No. 3 mine, on the east slope, was opened in 1950, and most of the production will soon come from it. Production to the end of 1951, according to company figures, is as follows:—

Period	Mine	Tons
1930–43	No. 1	61,232
1943–51	No. 2	90,558
1950–51	No. 3	23,460

The production in December, 1951, was about 100 tons per day from No. 2 mine and 20 tons per day from No. 3 mine.

When it became known that the recoverable coal in No. 1 mine would be removed by 1943, the Dominion Government, because of the wartime demand for coal, arranged for the drilling of nine holes to determine the extent of seams exposed on the banks of Goat Creek in the northern part of Lot 401. At about the same time the management found a minable seam by stripping, and developed it as No. 2 mine. Another seam was found by stripping in 1950 and was drilled and opened up as No. 3 mine the same year. Several holes were drilled in 1951 to determine the position and extent of seams exposed in the southeast and north central parts of the area.

On Figures 20 and 21 the holes are numbered in the order in which they were drilled, but in property records each series of holes is numbered separately. The following table gives the property number of each hole, followed by the year it was drilled or the year the drilling of that series of holes was started, and also gives the numbers used on the accompanying figures:

Mine No.	Report No.	Mine No.	Report No.
1 (1943)	1	5 (1950)	18
2 „	2	6 „	19
3 „	3	7 „	20
4 „	4	8 „	21
5 „	5	9 „	22
6 „	6	10 „	23
7 „	7	11 „	24
8 „	8	12 „	25
9 „	9	13 „	26
1 (1946)	10	14 „	27
2 „	11	15 „	28
3 „	12	1 (1951)	29
4 „	13	2 „	30
1 (1950)	14	3 „	31
2 „	15	4 „	32
3 „	16	5 „	33
4 „	17		

The cores from holes Nos. 1 to 9 have been discarded; the other cores have been left in boxes piled near the holes. The core boxes are not sheltered, and some boxes of core have been upset. As a rule, mudstone core in the upper boxes of each pile has partly disintegrated to clay. For these reasons, the cores could not be logged completely by the writer, and for parts of cores that could not be examined, the position and thickness of coal has been taken from logs prepared by the management.

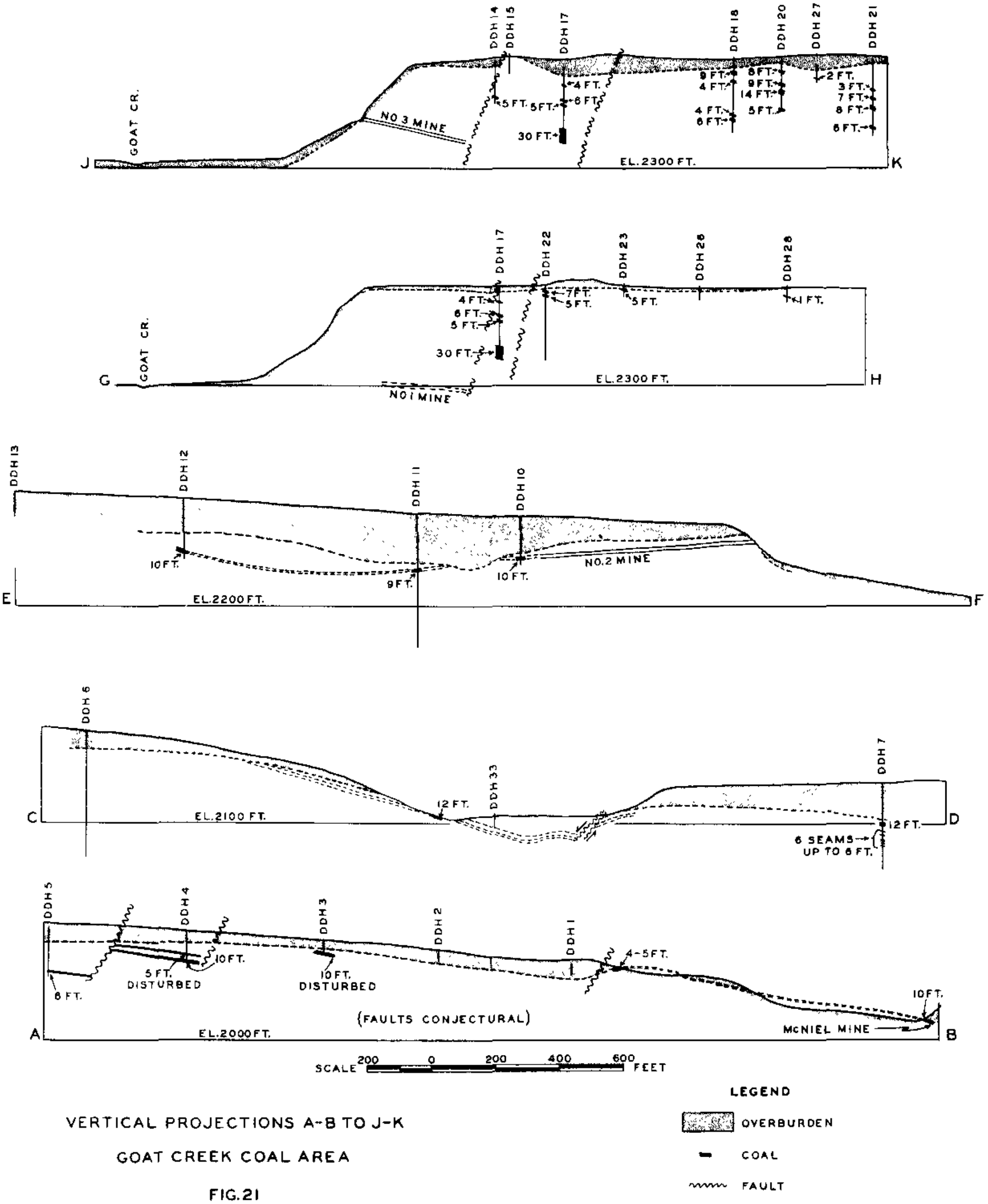
The mines are developed by slopes driven from the outcrop on the full dip of the seam. Rooms are driven off the slope on the strike of the seam for a predetermined distance, and the pillars are drawn on the retreat. The mines as a rule are free of gas.

The coal seams and the rocks interbedded with them constitute the coal measures which have an intermediate position in the series. Beds underlying and overlying the coal measures are so similar in appearance that it has not been possible to distinguish between them.

The coal measures outcrop on both slopes of the valley and extend over most of the area. In some of the western part of the area only one seam is present, whereas in the eastern part of the area numerous seams are presnt and the measures are as much as 200 feet thick. It appears that the number of seams increases and the measures thicken towards the east. In each of the four mines in the area a single seam has been mined or is being mined, but it is not possible to correlate a seam from one mine to another because of the lack of outcrops and of marker beds and because of the lack of uniformity of the coal measures.

The beds underlying the coal measures have probably the most extensive distribution. These beds presumably underlie all the area except where volcanic rocks outcrop on Goat Creek. Drill hole No. 6 penetrated 350 feet of sedimentary beds, presumably below the coal measures, without reaching the basal volcanics, and therefore the underlying beds at this point appear to be more than 350 feet thick. In the northern part of the area, where volcanic rocks outcrop, the underlying beds appear to be thinner and are possibly only about 100 feet thick. The beds include mudstone and sandstone and include some fragments of coal, but in Tenas (Mud) Creek there are some gritty beds which are probably near the base of the series.

Information about the coal measures is more complete than for the beds overlying or underlying the measures, even though there are few outcrops, because of the data



VERTICAL PROJECTIONS A-B TO J-K

GOAT CREEK COAL AREA

FIG. 21

available from the numerous drill-holes. Some beds are lenticular and pinch out and others appear, with the result that a section may differ considerably from another section only 100 feet away. The thickness of seams, and the number and thickness of beds separating seams, also varies widely. In some holes drilled through the measures only one seam was cored, but in others numerous seams were intersected, and in hole No. 18 fifteen seams were cut. The maximum known thickness of the coal measures as indicated by drilling east of No. 3 mine is about 200 feet.

Only a few seams are cut in holes west of Goat Creek, but the reason for this is unknown. Possibly the upper part of the coal measures is eroded, or fewer seams formed in the western part of the basin in which the coal measures accumulated. More work is necessary to prove either possibility, although the second is more probable. Conditions in the basin in which the measures accumulated may have been more favourable for coal formation in the east than in the west.

The beds overlying the coal measures are probably partly eroded from much of the area. Little information about their thickness is available, but the maximum thickness known is at hole No. 5 and hole No. 21; in each of these about 100 feet of sedimentary beds overlie the highest seams cored.

The series is not wholly exposed at any point, and the total thickness is not known. The figures given for the coal measures and the beds below and above total 650 feet, but the maximum thickness may be considerably greater than this. The thickness at the north end of the area, where the beds below the coal measures are only about 100 feet thick, may be considerably less than 650 feet.

Most of the beds dip northeastward, and most dip at less than 20 degrees. However, on limbs of folds and near faults the beds dip more steeply or in other directions. The beds of No. 2 mine are folded gently into a syncline that plunges westward. Near Goat Creek in the central part of Lot 401 the beds are folded in a gentle anticline on the west limb of which, and at some near-by faults, the beds dip westward. Some beds cored in the drill-holes dip more than 20 degrees, and some dip 45 degrees or possibly more, but because of lack of knowledge as to the direction of dip it was not possible to recognize other structures. Faults exposed near Goat Creek and north of No. 2 mine dip moderately, and the hangingwall of each appears to have moved downward relative to the footwall.

The extent and correlation of the coal seams can be considered only for limited parts of the area because of the considerable distance separating exposures and drill holes and the uncertainty of continuity of seams in a series in which the number and thickness of beds varies considerably. Five vertical projections, named from north to south *AB*, *CD*, *EF*, *GH*, and *JK*, will be referred to (*see* Fig. 21). The plane of each projection is normal to the strike of the beds exposed near it or to the strike of a seam that has been or is being mined. Intersections of coal in holes drilled near the line of projection have been projected along the line of strike to the projection.

Projection *AB* is based on little data and is largely conjectural. The attitude of the seams cored in holes Nos. 3, 4, and 5 is not known, but if they dip northeastward about parallel to the regional dip, the projection may be nearly correct, and the series is probably disrupted by faults of which those shown are conjectural. However, the seams exposed in the trenches at about 2,225 feet altitude dip slightly westward, possibly indicating that the beds are dragged near a fault or are on the western limb of an anticline. If it is a broad fold, the seams cored in holes Nos. 3, 4, and 5 may be on the west limb and may dip westward, instead of eastward as indicated, and the area near the three holes may be underlain by a seam or seams not disrupted by faults.

Projection *CD* is based on one drill-hole (No. 7) and on exposed seams and faults in and near Goat Creek where some stripping has been done. The rest of the projection is conjectural. The main seam exposed at Goat Creek is 10 to 12 feet thick, and its projected extension westward indicates that it underlies the surface for possibly 600 to

700 feet along the line of the projection and that most of it may be within 50 feet of the surface. Coal has been exposed by trenches 400 feet south of line *CD*, and coal occurs in the core from holes Nos. 4 and 5 drilled about 800 feet north of line *CD*. One of the seams cored in hole No. 4 is about 10 feet thick. It appears probable, therefore, that much of area *A* on Figure 20 may be underlain by a seam of economic importance that may be close enough to the surface to be strip-mined.

In hole No. 7, seven seams were cut, indicating that the coal measures extend northeast of the hole and possibly thicken in that direction. The uppermost seam is close to the surface of the sedimentary series, but possibly higher seams have been eroded. It is 12 feet thick and may be the same as the main seam exposed at Goat Creek.

Projection *EF* shows that the coal measures are eroded or are much thinner and contain fewer seams in the western than in the eastern part of the area. Coal cored in holes Nos. 11 and 12 may be part of the seam that is being mined, and the seam may be gently folded, as indicated. However, some of the beds cored in these holes dip at greater angles than is indicated by the distribution of coal, and a gentle fold may be simulated by breaking of the seam by a fault or series of faults into segments with rude horizontal alignment.

The seam in No. 2 mine, named the Betty, is 10 to 12 feet thick and includes two partings of bony, sandy material, each 1 to 3 inches thick, about 5 and 10 feet respectively above the floor. Three samples were taken from the seam: the first included the lower 6 feet, the second the next 4 feet, including two shaly beds each 1½ inches thick, and the third the upper 20 inches of the exposed seam. These contained respectively 12,980, 11,110, and 12,630 British thermal units per pound. The average for the exposed section of the seam is 12,290 British thermal units per pound.

The limit of advance in No. 2 mine was reached some years ago; the inner workings have been abandoned, and pillars near the entries are being mined. The northern limit of mining was a squeeze in the seam at some faults, and the western limit was at an erosion channel. As indicated on projection *EF*, erosion of the seam may have been confined to a comparatively narrow channel. The beds above the seam are fractured mudstone which breaks into slabs unless continuously supported; consequently, the upper part of the seam is not mined but is left in place.

No. 1 mine was abandoned in 1943 after coal had been mined within the area outlined on Figure 20. It is now inaccessible. The area from which coal was mined is greater than that at No. 2 mine, but the recovery of coal was less. The seam, also named the Betty, is, according to the management, similar to the seam in No. 2 mine and, like it, contains two rock partings. It is 10 to 14 feet thick, except near numerous faults and some dykes, where it is broken and squeezed. The seam dips about 17 degrees northeastward as a rule, although locally it diverges considerably from this attitude.

No. 3 mine is now the main source of coal. A main slope has been driven 325 feet to the northeast in the seam. Although the seam dips as much as 20 degrees, the average dip on the slope is 12 degrees. The seam is fractured but is not disrupted in that distance. It is also named the Betty seam, is 10 to 14 feet thick, and includes two partings of sandy mudstone in the lower half and consists of many bands of dull and shiny coal. In places the seam has slips parallel to the bedding. Pyrite is common. The upper 1 to 2 feet is left in place because the overlying mudstone tends to break off in slabs unless continuous support is provided. Three samples were taken from this seam: one across the lower 27 inches, including 2 inches of clayey material; a second across 55 inches, including 1 inch of clayey material; and a third across the upper 54 inches of the exposed seam. An estimated 18 inches of coal above was not sampled and is not mined. The three samples contained 12,090, 12,850, and 12,220 British thermal units per pound respectively, and the average for the seam is 12,450 British thermal units per pound.

The extent of the seam that may be minable from the present entry is not known. Rooms driven southeastward from the slope have not encountered faults that disrupt the seam, but some of the coal cored in numerous holes drilled to the east is broken and slickensided. An area designated *B* on Figure 20 may be underlain by a seam or seams of economic importance.

Projections *GH* and *JK* are discussed together because they are close to one another, and a comparison of the two projections helps to clarify the effects of fault movements. On these two projections are indicated all the holes drilled near-by, except Nos. 16, 19, 24, and 25. No core was recovered from No. 16, and omission of the other three does not materially change the projections. Some seams are not indicated on projections *GH* and *JK* because of lack of space. Those omitted are in hole 15, seams one-half, 1, and 1¼ feet thick at depths of 5, 28, and 37 feet respectively; in hole 17 a seam 1 foot thick at 92 feet; in hole 18, seams 2, 1½, 3, 2, 1, 3, 2, 5, and 1 feet thick at depths of 26, 90, 93, 101, 132, 145, 149, 160, and 171 feet respectively; in hole 20, seams 2, 1½, 4, and 3½ feet at depths of 84, 166, 170, and 180 feet respectively; in hole 21, seams 1, 2, and 1½ feet thick at depths of 163, 165, and 173 feet respectively.

If the seam in No. 1 and No. 3 mines is the same, as is possible, it is apparent from a comparison of the projections that the segment in No. 3 mine has been uplifted nearly 100 feet relative to the segment in No. 1 mine. If it is assumed that the seam cut in the upper part of hole No. 22 is the same as that in the lower part of hole No. 17, since each possibly is the lowest of a sequence of several seams, then the segment at hole No. 22 has been uplifted nearly 200 feet relative to the segment at hole No. 17. If these are segments of the seam in No. 1 mine, the total uplift between No. 1 mine and No. 22 hole is about 300 feet. Some of this movement could presumably have taken place along some of the faults that dragged and squeezed the coal at the limits of mining in No. 1 mine.

The segments to the east may be beyond a zone of faults, and the numerous seams cored in holes 17 to 21 possibly are not disrupted to the same extent as the seams in the fault zone.

The number, location, and attitude of the faults and the direction of movement along them is unknown. The faults shown diagrammatically on projections *GH* and *JK* indicate upthrow to the east because that is the net observed effect. They are shown as normal faults because most of the known faults are normal.

A red shale produced by burning of coal outcrops west of holes Nos. 14, 15, and 16, and red shale and ash were encountered in these holes. Thirty feet of coal cored at the bottom of hole No. 17 is much fractured and slickensided and possibly represents a seam thickened by faulting and folding.

Coal occurs southeast of No. 3 mine and is exposed in several trenches for a length of about 400 feet. The beds overlying the coal at the trenches have been eroded, and the thickness of the seam is not known. The attitude is not apparent. Three holes (Nos. 29 to 31) drilled to depths of about 100 feet south and east of the exposures did not encounter coal. The holes were not drilled more deeply because the purpose of the drilling was to locate a seam near the surface. If the measures here dip eastward 15 degrees or more, about parallel to the regional dip, the holes are not deep enough to intersect the projected extension of the seam (or seams) exposed.

Inspection of Electrical Equipment and Installations at Mines and Quarries

By L. Wardman, Electrical Inspector of Mines

CONTENTS

ELECTRICAL POWER

During 1951 electrical power was used at sixty-eight properties for mining, concentrating, coal preparation, and quarrying.

Lode Mines

The electrical power consumed monthly at the lode mines amounted to approximately 41,000,000 kwh. Thirty-four per cent of this power was produced by privately owned power plants, while the remainder was purchased from public utilities.

The potential electric-power plant capacity in kva. is as follows:—

	Kva.
Steam turbine	23,050
Diesel engine	16,436
Hydro-electric	14,472
Total	53,958

In addition to the above-mentioned electric-power plant capacity, there is over 9,000 horsepower produced for driving mechanical equipment such as air compressors without conversion to electric power. This power is produced as follows:—

	Horsepower
By diesel engines	6,915
By water power	1,933
By gasoline engines	387
Total	9,235

The connected load for the various operations at the metal mines is approximately as follows:—

	Horsepower
Shaft hoists	5,890
Slusher hoists	4,820
Ventilation	2,600
Pumping	3,065
Sink-float	1,030
Compressed air	16,760
Crushing	8,575
Milling	37,080
Workshops	2,870
Miscellaneous	16,300
Total	98,990

For surface and underground haulage at the metal mines there were in use 117 battery locomotives, 99 trolley locomotives, and 2 diesel locomotives.

Placer Mines

Electrical power was used at two placer mines for lighting and at a third for lighting and power. All power is produced by privately owned plants, as follows:—

	Kva.
Diesel engine	150
Hydro-electric	600
Total	750

The connected load is as follows:—

	Horsepower
Shaft hoists	40
Ventilation	5
Compressed air	75
Separation	12
Workshops and miscellaneous	50
Total	182

One battery locomotive is used for underground haulage.

Quarries

Only a very small amount of electrical power is used in the quarries for the removal of rock and for electric blasting.

Coal Mines

During 1951 electrical power was used for operations at ten coal mines and prospects. Electrical power was used underground at seven mines, one more than in 1950. The distribution of electrical horsepower used at these mines is as follows:—

Surface

	Horsepower	
Compressed air	7,940	
Ventilation	1,315	
Hoisting	2,055	
Haulage	613	
Coal washing	2,945	
Coal screening	313	
Pumping	563	
Coke production	878	
Miscellaneous	403	
Total		17,025

Underground

Haulage	547	
Pumping	825	
Coal-cutters	260	
Conveyors	218	
Miscellaneous	45	
Total		1,895
Total for surface and underground		18,920

Three battery locomotives and one diesel locomotive are used for haulage.

MINE ELECTRICAL INSTALLATIONS

Following is a brief general description of new electrical installations and of alterations and improvements to existing installations. Also included are recommendations made at the time of inspection, for improvements which will bring the electrical installations up to the standards prescribed in the Canadian Electrical Code.

LODE MINES

ATLIN

Fourth of July Creek (59° 133° N.W.)

Atlin Ruffner Mines (B.C.) Limited.—A 3-kva. a.c. generator driven by a D-315 Caterpillar diesel engine was installed late in 1951 mainly for lighting the camp. A 5-horsepower motor was installed to run a crusher and pulverizer.

TAKU RIVER (58° 133° N.W.)

Polaris-Taku (Taku River Gold Mines Ltd.).—Early in 1951 operation of this mine was suspended. The underground electrical equipment, with the exception of the electric hoist, was removed.

Tulsequah Mill (Tulsequah Mines Limited)

In the spring of 1951 The Consolidated Mining and Smelting Company acquired a lease on the Polaris-Taku Mining Company's mill to mill the ore from the Big Bull and Tulsequah Chief mines. The mill circuit was remodelled, and new cells were added to make a suitable circuit for the Big Bull ore. The new equipment installed consisted of the following: One small 4-cell Gardner-Denver flotation unit driven by two 5-horsepower 440-volt motors; one copper flotation unit consisting of eight cells driven by four 1.5-horsepower 440-volt motors.

To increase the filtering capacity, the following equipment was transferred from the cyanide plant: No. 1 thickener with ¾-horsepower motor; No. 2 thickener with 2-horsepower motor; a compressor with 10-horsepower motor; a vacuum pump with 10-horsepower motor; an Emco filter with ¾-horsepower motor; a blower driven by a ½-horsepower motor; and two diaphragm pumps each driven by ¾-horsepower motors.

All new equipment was installed in accordance with electrical code regulations.

Several grounding conductors required replacing on the old equipment, and the neutral of several lighting transformers required grounding.

Big Bull (Tulsequah Mines Limited)

New electrical installations consist of a 156-kva. 550-volt 60-cycle a.c. Westinghouse generator driven by direct-connected 205-horsepower Ruston diesel, a 25-horsepower pump on the 4700 level, and a 3-horsepower charging unit on the 5000 level. The new generator is identical with the original one installed in 1949 (Annual Report, 1949, p. 317). A suitable back-out switch was required for the hoist limit-switch circuit.

Tulsequah Chief (Tulsequah Mines Limited).—Details of the electrical equipment at this mine are given in the 1950 Annual Report of the Minister of Mines. No alterations or additions were made during 1951. The new installations were found to be made in accordance with Canadian Electrical Code regulations.

PORTLAND CANAL (56° 130° S.E.)

Salmon River

Silbak Premier Mines Limited and Indian Mines (1946) Ltd.—No alterations were made in the electrical installations during 1951. At the time of inspection there was a considerable amount of temporary wiring to be replaced with permanent wiring, several grounding conductors were required on non-current-carrying metal parts of the electrical equipment, the hoist controller-handle latch required repairing, and the No. 4 level locomotive controller interlocking mechanism required repairing.

ALICE ARM (55° 129° N.W.)

Torbrit Silver Mines Limited

No new electrical installations were made in connection with the mining and milling operations. A 41-kw. electric range and a 31-kw. electric range were installed in the camp cookery. To supply the extra load, three 25-kva. 440–220-volt transformers were installed. During the inspection of the electrical equipment it was found that a blasting-switch opened by a spring was in use; this is not an approved type of switch.

Two 400-ampere fused motor-circuit switches were overheating. These switches were supplying two 150-horsepower motors drawing approximately 150 amperes.

HAZELTON (55° 127° S.W.)

Silver Standard Mines Limited

A new 10-kw. 440–220/110-volt transformer was installed in the lower camp area to take care of the extra load created by several new bunk-houses. A new power-house was built on the old compressor-house site. The walls are of pumice block and the roof of 2- by 4-inch lumber laid on edge. A 300-horsepower Petter diesel engine direct-connected to a 245-kva. 440-volt 60-cycle 3-phase alternator was installed. Provision was made for a duplicate unit, which has been received but not installed. A 500-cubic-feet-per-minute Broom-Wade compressor V-belt driven by a 125-horsepower Allis-Chalmers motor was installed, and provision was made for a second unit of the same size, which is on hand but has not been installed.

A hoist formerly used at the Vidette mine was purchased for the main shaft. It is driven by a 50-horsepower 440-volt 3-phase Westinghouse motor. A 2-stage reversible aerofoil fan driven by a direct-connected 5-horsepower motor was installed to ventilate the shaft. A second Mancha trammer was purchased and put into service on the 1300 level.

The above-mentioned equipment was not ready for inspection when the second inspection trip in 1951 was made. On some of the old installations which had been revised, two lock-nuts and a bushing were not used, as is required, and grounding conductors had not been installed where necessary. A disconnecting switch rated at 30 horsepower was in use on the 50-horsepower ball-mill motor circuit. This was later replaced with a switch rated at 50 horsepower. Attention had been given to the other faults mentioned before the second inspection was made. At the second inspection in 1951 it was found that repairs were required to the locomotive controller latch.

Rocher Deboule (Western Uranium Cobalt Mines Limited)

The building of a mill and the development of 1,200 horsepower of hydro-electric power was commenced, but was not completed by the end of 1951. A 1,200-kva. diesel-engine-driven electric plant was installed late in the year to supply power until the hydro-electric plant is completed and to act as a stand-by thereafter. The diesel-engine-driven electric plant has been built adjacent to the hydro-electric plant, which is on Juniper Creek 6 miles from the mine. This plant will also supply the Red Rose mine with power.

From the power plant to the junction where the Red Rose power-line is connected in, the transmission-line will consist of three No. 2/0 B. & S. gauge conductors. Each line from the junction will consist of three No. 1/0 B. & S. gauge conductors. The transmission voltage will be 6,600 volts.

A small water-wheel-driven generator was used for lighting during the summer.

Red Rose (Western Uranium Cobalt Mines Limited).—The old mill on the property was renovated and new machinery installed. Twenty horsepower will be used for crushing, 86 horsepower for milling, 2 horsepower for workshop machinery, and 5 horsepower for miscellaneous work.

Smithers (57° 127° N.E.)

Cronin Babine Mines Limited

The greater part of the summer was spent in building a road to the property over which to take the machinery for a new mill. Plans of the mill have been prepared, and it is intended to install the following: A 2- by 7-foot adjustable-stroke coarse-ore feeder with ratchet drive, driven by a 2-horsepower motor; a single-deck 2- by 6-foot Niagara screen, cable suspended, driven by a 2-horsepower motor; a 3- by 10-foot picking-belt driven by a 2-horsepower motor; a dust exhaust fan driven by a 1-horsepower motor; an 8- by 12-inch Barron jaw crusher driven by a 7½-horsepower motor; a 16-inch by 66-foot conveyor to fine-ore bin, driven by a 2-horsepower motor; a 12-inch Denver adjustable-stroke fine-ore feeder driven by a ½-horsepower motor; a 4½-foot by 32-inch Hardinge ball mill driven by a 25-horsepower motor; an 8- by 12-inch Denver duplex jig driven by a ¾-horsepower motor; a 2-foot 4-inch by 14-foot 6-inch rake classifier driven by a 1-horsepower motor; six No. 15, 24- by 24-inch lead flotation cells driven by three 3-horsepower motors; eight No. 15, 24- by 24-inch zinc flotation cells driven by two 7½-horsepower motors; two 1-inch concentrate pumps driven by two 1½-horsepower motors, one for lead and the other for zinc; a 2-inch Wilfley sump pump driven by a 2-horsepower motor; a 6-foot 6-inch disk filter driven by a 3-horsepower motor; a 14- by 7-inch vacuum pump driven by a 10-horsepower motor; a blower driven by a 1½-horsepower motor; a filtrate pump driven by a 3-horsepower motor; and a water-pump driven by a 10-horsepower motor. All the above-mentioned motors will operate on 440 volts potential. There will be several cone and wet-type reagent feeders driven by fractional horsepower 110-volt motors.

The power plant for the mill will consist of the following: A 3-cylinder 165-horsepower 360-r.p.m. style V.A. Fairbanks-Morse diesel engine driving through a V-belt drive a 125-kva. 100-kw. at 80 per cent power factor, 480-volt 3-phase 60-cycle 900-r.p.m. Kato generator complete with 125-volt exciter, and with panel board containing voltmeter, ammeter, rheostat, and automatic voltage regulators mounted on the generator; and a 4-cylinder, size 4, class V.Q.B., Ruston Hornsby diesel engine driving a Westinghouse 3-phase 60-cycle 75-kva. 440-volt 1,200-r.p.m. a.c. generator.

Cariboo

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

Cariboo Gold Quartz Mining Company Limited

A new 125-horsepower motor and new switchgear were installed to replace the 75-horsepower motor which was damaged when a hoistman allowed the hoist to overspeed. A larger motor was installed because the acceleration of the hoist was too slow on heavy loads with the 75-horsepower motor. A speed governor was manufactured in the machine-shop and installed on the hoist, where it is giving satisfactory service as an overspeed control. A new 75-horsepower motor and pump were installed underground.

During the inspection of the hoist installation it was found adequate overload protection was required on the motor circuit-breaker.

Inspection of the other electrical installations showed that some bonding conductors were required on various pieces of equipment. This matter was given prompt attention by the electrical staff.

Island Mountain Mines Company Limited

Some details of the electrical installations at this mine were given in the Minister of Mines Annual Report for 1946. Details of the larger hoist which was installed late in 1950 are given in the 1950 Annual Report. No major alterations or additions have been made to the electrical installations in 1951. Inspection of the hoist showed that the "simplex" control required modifying for a slower hoist speed than had been used previously at the Berens River Mines. New parts were ordered, and these modifications made.

BRIDGE RIVER (50° 122° N.W.)

Bralorne Mines Limited

The 250-horsepower Crown shaft hoist motor was replaced with a 300-horsepower 440-volt wound-rotor motor to give the additional power required for the increased depth of shaft. The 600-kva. 2,300–4,600-volt step-up transformer which was installed in the Empire hoist-room in 1950 was connected to the mine primary circuit so that now the primary distribution voltage is 4,600 volts.

Inspection of the underground electrical installations showed that some maintenance work was required, also that some switchgear required to be protected from moisture, and several motor terminal boxes required replacing. The surface and mill installations were found to be generally satisfactory.

Pioneer Gold Mines of B.C. Limited

No new electrical equipment was installed during 1951. The latest inspection of the electrical installations showed that the non-current-carrying metal parts of a welder which was used underground required grounding, much bonding around concentric knockouts and across flexible conduit was required, and a ground detecting device was required for the secondary system supplied by the 1300 level transformer-station.

The mill electrical installations have been considerably improved with respect to compliance with code standards.

Wayside (L.A.P. Mining Company Limited)

The following electrical work was done during 1951: A new office was built and wired for lighting and a new compressor-house was built to replace the one which burned down. In the compressor-house will be installed a 350-cubic-feet-per-minute Ingersoll-Rand compressor driven by a 100-horsepower 2,300-volt wound-rotor motor. To supply this motor with 2,300-volt power, a 2,300-volt transmission-line will be built from the substation to the compressor-house.

In the blacksmith-shop a new 30-ampere 110-volt service and wiring were installed for lighting. Also installed was a 30-ampere 440-volt 3-phase service for an electric welder.

The electric shop was moved to give 50 feet of clearance from the portal. A new 30-ampere 110-volt service and wiring were installed for lighting. A 30-ampere 440-volt 3-phase circuit was installed which will be used for the testing of electrical equipment.

A new 440-volt 3-phase service was installed in the pump-house for the 10-horsepower pump motor.

The mill equipment and the electric power and lighting circuits were overhauled and rearranged. The old Hadsel mill was replaced with a crusher driven by a 15-horsepower motor. The connected mill load is 200 horsepower.

COPPER MOUNTAIN (49° 120° S.W.)

The Granby Consolidated Mining Smelting and Power Company Limited

The ore in this mine is worked in blocks, which makes it necessary to move periodically the underground slusher hoists, power cables, transformers, and switchgear from worked-out blocks to new ore blocks. Electrical work done as the result of such moves consisted of the wiring in of six ventilating fans and six 50-horsepower Ingersoll-Rand model 4MMD slusher hoists as follows: A 40-horsepower fan at No. 8 level main drift south; a 40-horsepower fan at No. 25 chute in 20 drift No. 8 level; a 40-horsepower fan at No. 4 level surface raise; a 40-horsepower fan at A-14 slusher drift No. 5 level; a 40-horsepower fan at 90 drift on No. 5 level; a 25-horsepower fan at 93 crosscut on No. 6 level; two slusher hoists at the 17 block above No. 5 level; one on the A-14 block on No. 5 level; two at the 122-E block above No. 6 level; and one at the 63-165 block on No. 7 level.

The 250-horsepower motor and controls on the 5 level shaft hoist were replaced with a 400-horsepower motor and controls.

Approximately 7,000 feet of 2,500-volt primary cable was installed underground to supply present and future requirements.

At Voight's camp gravel pit a 50-horsepower slusher, a 20-horsepower slusher, and a 40-horsepower conveyor were installed. To supply these motors, a 3-phase 300-kva. 13,200–440-volt transformer was installed and connected to the 13,200-volt Granby line.

Inspection of the No. 2 hoist showed that an adjustment of the Lilly control linkage which regulates the automatic operation of the brakes was required to give smooth deceleration in the high-speed zone and a quick deceleration in the retardation zone.

Inspection of the trolley-locomotive track showed that a large number of bonds was required.

Bonds and grounds were required on the non-current carrying parts of several pieces of equipment, otherwise the condition of the mill electrical installations was satisfactory.

HEDLEY (49° 120° S.E.)

Nickel Plate and French (Kelowna Mines Hedley Limited)

New installations at the Nickel Plate mine during 1951 were as follows: A 3,000-volt 3-conductor No. 6 B. & S. gauge varnished-cambric lead-sheathed double-steel-tape-armoured jute-wrapped power cable, 1,500 feet long, was installed from the Morning hoist-room to the 4150 level to provide additional power for hoisting; in connection with this cable a bank of three 15-kva. 2,300–440-volt transformers was installed on the 4150 level to transform the potential from 2,300 to 440 volts, and an Atlas battery locomotive and charging set was placed in service. At the French mine a 7½-horsepower Sullivan type 2-drum slusher unit was installed.

It was found during inspection of the electrical equipment that water was seeping into the transformer-vault, that a lock was required on the transformer-vault door, and that the exposed terminals on the 2,200-volt pothead in the transformer-vault required guarding.

Examination of the blasting-circuits showed that an excessive amount of single-conductor blasting lead wire was in use between the blasting area and the twin-conductor blasting-cable.

The condition of the electrical installations at the concentrator and the French mine was found to be satisfactory.

FAIRVIEW CAMP (49° 119° S.W.)

Fairview (The Consolidated Mining and Smelting Company of Canada, Limited).—No major changes or alterations were made to the electrical installations in 1951. During inspection of the electrical equipment the following unsatisfactory conditions were found: A switch was required on the underground electric fan-motor circuit; the workmanship on splices in the underground cable required improving; and the locomotive controller-handle latch and catch required repairing.

BEAVERDELL (49° 119° S.E.)

Highland-Bell Limited.—No new electrical installations were made during 1951. The condition of the electrical equipment at the mine was found to be satisfactory. At the mill a number of switches required marking to indicate circuits controlled and a ground-detecting device for indicating ground faults was required to bring the installation up to code standards.

ROSSLAND (49° 117° S.W.)

Midnight and I.X.L. (Kootenay Central Mines Limited).—There was very little activity at this property during 1951, and no use was made of the electric hoist and pumps.

Bluebird (Rossland Mines Limited).—There was very little activity at this property during 1951, and no changes were made to the electrical installations, which consist of electric-motor-driven compressor and transformers.

NELSON

Eagle Creek (49° 117° S.E.)

Kenville Base Metal Concentrator (Emerald Glacier Mines Limited)

This concentrator is now operated by the Emerald Glacier Mines Limited for milling ore from the Emerald Glacier property at Tahtsa Lake. Details of the equipment at this property are given in the 1947 Annual Report of the Minister of Mines. To handle the Emerald Glacier ore, an 8-cell Denver flotation machine driven by four 10-horsepower motors was installed. The mill installations were found to be within Canadian Electrical Code standards when inspected on November 17th, 1951.

SALMO (49° 117° S.E.)

Erie Creek

Arlington

A new mill was built on the site of the old Arlington mill by A. Shrieves and associates for milling dump ore. The equipment installed is as follows: A double-drum scraper powered by an 80-horsepower gasoline engine; a 20-inch coarse-ore conveyor driven by a ¾-horsepower 440-volt G.E. motor; a 9- by 12-inch jaw crusher driven by a 4-cylinder gasoline engine; a 16-inch fine-ore conveyor driven by a ¾-horsepower 440-volt motor; a 4-foot by 18-inch Duplex Don classifier driven by a 2-horsepower 440-volt English Electric motor; a 6- by 5-foot conditioner driven by a 3-horsepower 440-volt motor; six sub-A Weining cells driven by three 7½-horsepower English Electric motors; and a lime feeder driven by a ¼-horsepower 110-volt motor.

The main power plant, which is a 180-horsepower G.M. diesel, drives by belts a 75-kva. 440-volt 900-r.p.m. generator; a 110-volt exciter; a Hardinge 6-foot by 24-inch ball mill; and a Roots blower, capacity 1 cubic foot per r.p.m.

A 6-cell Union Iron Works flotation machine built by Vancouver Engineering Works was on the property but was not connected.

At the time of inspection the electrical work was not completed.

ASPEN CREEK

H.B. (The Consolidated Mining and Smelting Company of Canada, Limited)

A 300-horsepower 2,200-volt synchronous motor driving a compressor was installed in a new compressor-house at the mill-site. A 50-horsepower 2,200-volt induction motor driving a fan for ventilation of the new 2800 level main haulage tunnel was installed near the 2800 level portal. This is a temporary installation while driving the 2800 level tunnel. A temporary 2,300-volt power-line was run from the old mine camp to the mill-site to supply power to the above-mentioned motors and the camp buildings.

Two 40-kva. 2,080–575-volt transformers connected in open delta were installed to supply the 550-volt induction motors. One 15-kva., three 25-kva., and one 37½-kva. 2,300–115/230-volt transformers were installed about the camp for lighting.

A change-house, a garage, an office, a warehouse, and a machine-shop were built and wired.

It is expected that a mill will be built in 1952. A substation containing three 1,000-kva. 66,000–2,200-volt transformers, one 3-pole switch, 1-set lightning arresters, three 60-kva. disconnects, and 2,200-volt switchgear with tripping battery will be built. Also there will be three 2,200–575-volt transformers for supplying mill motors.

It is proposed to install a 100-horsepower hoist. To supply the hoist motor, three 50-horsepower slusher-hoist motors, and fan motors, a 3-conductor No. 2/0 B. & S. gauge 2,300-volt paper-insulated lead-sheathed wire-armoured cable will be installed along the 2800 level tunnel and up the service shaft to a 600-kva. 2,200–575-volt substation on the 3300 level.

Iron Mountain

Jersey, Emerald, Feeney, and Dodger (Canadian Exploration Limited)

A new tungsten mill and increased mining operations involved the following electrical work done in 1951: New overhead 2,300- and 440-volt distribution-lines were built to supply the electrical equipment at the mill and mines. To supply the mill equipment, a substation consisting of six 200-kva. 2,300–440-volt single-phase transformers was installed. At the Emerald tungsten mine a substation consisting of three 25-kva. 2,300–440-volt single phase transformers was installed. The Jersey substation now consists of two 75-kva. 2,300–440-volt single-phase transformers in open delta and a 25-kva. lighting transformer. At the Jersey townsite ten 37½-kva., one 25-kva., and three 15-kva. single-phase 2,300–110/220-volt transformers are in use for lighting. At the Jersey compressor-station three 100-kva. 2,300–440-volt power transformers and one 15-kva. 2,300–440-volt lighting transformer are now in use. At the Emerald townsite two 37½-kva. and one 15-kva. single-phase 2,300–110/220-volt lighting transformers have been installed. At the Emerald office three 25-kva. 2,300–440-volt power transformers and one 25-kva. 2,300–110/220-volt lighting transformer have been installed. The tramway substation consists of three 25-kva. 2,300–440-volt power transformers and one 15-kva. lighting transformer. The transport-office substation consists of three 25-kva. 2,300–440-volt power transformers and one 15-kva. 2,300–110/220-volt lighting transformer. At the Emerald camp three 25-kva. and two 15-kva. 2,300–110/220-volt lighting transformers were installed. At the upper, central camp three 5-kva. 2,300–110/220-volt lighting transformers have been installed.

In the Jersey compressor-house there are three 2,300-volt synchronous motors of 500, 250, and 200 horsepower respectively, each driving a direct-connected air compressor.

A new compressor-house was built and a new air compressor driven by a 200-horsepower 2,300-volt synchronous motor installed for the Emerald mine.

An air compressor driven by a 75-horsepower motor was installed for the Feeney tungsten mine and put into operation in August, 1951. A similar unit was put into operation at the Dodger mine in December.

The underground 2,300-volt distribution system in the Jersey mine was put into service. This project was commenced in 1950 and is mentioned in the 1950 Annual Report. The main 2,300-volt distribution centre and four transformer-stations were completed. Three stations each have a capacity of 45 kva., while the fourth has a capacity of 90 kva.

The tungsten mill was completed and put into operation. The crushing plant connected load is 260 horsepower, and the mill connected load is 460 horsepower.

NELWAY (49° 117° S.E.)

Reeves MacDonald Mines Limited

During 1951 a hoist driven by a 100-horsepower 2,300-volt wound-rotor motor was installed at the top of the inclined shaft on 2250 level. The substation on 2250 level adjacent to the hoist-room, consisting of six 25-kva. 2,300–460/230-volt transformers for supplying 440-volt power to slusher-hoist motors, was completed. The installation of the 2,300-volt 3-conductor No. 2/0 B. & S. gauge varnished-cambric lead-sheathed armoured cable from 2650 level to 2250 level was completed. A 9-conductor rubber-insulated armoured signal cable was installed from 2650 level to 1900 level.

The condition of the electrical equipment at the November inspection was found to be satisfactory. The temporary electrical wiring which had been done in order to get the mill operating had been replaced with permanent wiring.

SOUTH KOOTENAY LAKE (49° 116° S.W.)

Pilot Bay

Pilot Bay Concentrator

J. Asher and G. L. Green moved their mill from the Highland property at Ainsworth to a site near the old smelter at Pilot Bay late in 1950. Power is produced by a 225-horsepower Grey marine diesel which drives by belts a 5- by 6-foot cylindrical Llewellyn ball mill, a classifier and a 30-kw. 440-volt 3-phase Canadian Westinghouse generator, and 4-kw. exciter. The remainder of the equipment is driven by 440-volt electric motors and consists of the following: A Union Iron Works flotation machine driven by six 3-horsepower motors; a cleaning cell driven by a 5-horsepower motor; a thickener driven by a 3-horsepower motor; a filter driven by a 3-horsepower motor; and a lake pump driven by a 7-horsepower motor.

NORTH KOOTENAY LAKE (49° 116° N.W.)

Riondel

Bluebell (The Consolidated Mining and Smelting Company of Canada, Limited)

The building of a 500-ton concentrator was begun but will not be completed until early in 1952. Power will be supplied from the South Slocan–Kimberley power-line. By the end of 1951 a new office, dry, and warehouse had been built. The major equipment in the mill will consist of the following: A ball mill driven by a 250-horsepower motor; a rod mill driven by a 250-horsepower motor; a rod-mill feed conveyor driven by a 2-horsepower motor; a classifier driven by a 7½-horsepower motor; a conveyor to fine-ore bin driven by a 20-horsepower motor; two classifier-to-conditioner pumps, each driven by a 7½-horsepower motor; a bank of lead flotation cells driven by eight 10-horsepower motors; a bank of zinc flotation cells driven by ten 10-horsepower motors; two zinc-concentrate pumps, each driven by a 3-horsepower motor; a lead-sump pump driven by a 2-horsepower motor; a zinc-sump pump driven by a 2-horsepower motor; two conditioners, each driven by a 5-horsepower motor; a lead thickener driven by a 1½-horsepower motor; a zinc thickener driven by a 1½-horsepower motor; a 5- by 5-foot drum filter driven by a 1-horsepower motor; a 5- by 5-foot drum filter cake release driven by a 1-horsepower motor; two tailings pumps, each driven by a 7½-horsepower motor; a sump pump driven by a 2-horsepower motor; two filtrate pumps, each driven by a 1-horsepower motor; a blower driven by a 1½-horsepower motor; two lead-concentrate pumps, each driven by a 3-horsepower motor; and two vacuum pumps, each driven by a 50-horsepower motor.

The crushing plant will consist of the following: A jaw crusher driven by a 100-horsepower motor; a Ross feeder driven by a 3-horsepower motor; a 30-inch belt-conveyor between the jaw crusher and cone crusher driven by a 10-horsepower motor; a Symons cone crusher driven by a 100-horsepower motor; a 5- by 10-foot double-deck Ty-rock screen driven by a 10-horsepower motor; and a 5-horsepower motor generator set for supplying a 24- by 30-inch magnet.

In the compressor-house three compressors will be installed with capacities of 150, 250, and 300 horsepower. A 200-horsepower hoist will be installed on the surface for the new inclined shaft. The loading-dock will be equipped with a 75-horsepower loading-crane.

The 400-horsepower Fairbanks-Morse diesel and direct-connected 375-kva. 550-volt Westinghouse generator installed in 1949 will be kept as a stand-by unit.

Three 1,000-kva. 60,000–575-volt transformers will be used to step down the potential for the mill, crushing-plant compressor, and hoist motors. For distribution to the townsite, dock, and mine pumps, three 200-kva. 575–2,200-volt transformers will be used to step up the potential. Three 100-kva 2,200–575-volt transformers will be used to supply the existing underground load.

Three 2,000-ampere air circuit-breakers having a rupturing capacity of 7,500 amperes and equipped with instantaneous trip for short-circuit protection will be used on the three 575-volt main feeders. Oil circuit-breakers will be used on the branch circuits supplying the large motors, the mill, the crushing plant, and the shops.

Ainsworth (49° 116° N.W.)

Yale Lead & Zinc Mines Limited

Details of the equipment installed on this property early in 1951 are as follows:—

Crushing Plant.—A 400-ampere service supplies the following: A 2-horsepower motor driving a 36-inch by 6-foot sorting-belt; a 30-horsepower motor driving a 15- by 25-inch jaw crusher; a 3-horsepower motor driving an 18-inch by 52-foot conveyor; a 2-horsepower motor driving a Dillon screen; a 2-horsepower motor driving an 18-inch by 34-foot by-pass conveyor; and the sink-float plant.

Later in the year, use of the sink-float plant was discontinued, and a 22-inch cone crusher driven by a 25-horsepower motor was installed at the end of the by-pass conveyor.

Mill.—The mill service supplies the following: A 2-horsepower motor driving a 24-inch Wemco sand preparation mixing conditioner; a 1½-horsepower motor driving an 18-inch fine-ore feeder; a 125-horsepower motor driving a 7- by 3-foot Hardinge ball mill; a 7½-horsepower motor driving a 38- by 38-inch Denver unit cell; a 3-horsepower motor driving a 36-inch 19-foot 3-inch Wemco classifier; three 5-horsepower motors driving six Denver No. 18 32- by 32-inch lead flotation cells; a 3-horsepower motor driving a 6- by 5-foot zinc conditioner; four 5-horsepower motors driving four 44- by 44-inch Fagergren zinc rougher flotation cells; two 3-horsepower motors driving two 44- by 44-inch Fagergren zinc cleaner flotation cells; two 3-horsepower motors driving a 1½-inch lead-concentrate pump and a 1½-inch zinc-concentrate pump; a 1-horsepower motor driving a mill-sump pump; two ¾-horsepower motors driving two 16- by 8-foot thickeners; two 1-horsepower motors driving two diaphragm pumps; a 2-horsepower motor driving a thickener; a 15-horsepower motor driving a vacuum pump; a 1-horsepower motor driving a blower; a 2-horsepower motor driving a filtrate pump.

The sink-float plant contains the following equipment: A 15-horsepower motor driving a 3-inch medium circulating pump; a 1½-horsepower motor driving a medium circulating pump; a 5-horsepower motor driving a screen; a 1½-horsepower motor driving a cone; a 1½-horsepower motor driving a magnetic separator; a 2-horsepower motor driving a densifier; a 3-horsepower motor driving a bucket elevator; and a 3-horsepower motor generator set.

A bank of three 100-kva. 11,500–460/230-volt transformers was added to the main transformer-station, with the primaries star connected to the City of Nelson power-lines.

The following recommendations were made at the last inspection in 1951: Replace temporary wiring in transformer-station and battery-charging station (some of the temporary wiring seen at the initial previous inspection had been replaced), and repair controller-handle latches on battery locomotives.

Kootenay Florence (Western Mines Limited)

This property has been bought from Ainsmore Consolidated Mines, Limited, by Western Mines Limited. No alterations have been made to the electrical installations; however, the expanded operations will require some additions when more power can be obtained. The City of Nelson can supply only a limited amount of power to its customers along Kootenay Lake. With the exception of one switch, the electrical installations were found to be within the prescribed standards.

Keen Creek (49° 117° N.E.)

Cork Province (Base Metals Mining Corporation Limited)

The mill was completed early in 1951. Details of the power plant and mill equipment are given on page 293 in the Minister of Mines Annual Report for 1950. A 5-horsepower locomotive-battery charger has been installed for charging a 1½-ton battery locomotive used on the main haulage level. The voltage regulation underground was very poor, so a step-up transformer was installed. A 1-horsepower fan motor was installed in the crushing plant. At the last inspection in 1951 it was found that improvement in bonding and grounding of electrical equipment was necessary to bring the electrical installations up to standard.

Retallack-Three Forks (50° 117° S.E.)

Whitewater (Kootenay Belle Gold Mines Limited)

Early in 1951 the old flotation cells were replaced with fifteen new ones, using the old flotation-cell motors, which entailed rearrangement of the branch circuits to the motors. At the first inspection in 1951 the following conditions were found: Three pump switches were mounted under a floor through which water dripped on to them; several of the thermal relays in these switches were equipped with two heating elements, only one of which could affect the bi-metal release element; the flotation switches required reidentifying; and some bonding and maintenance were required.

At the last inspection in 1951 the above-mentioned conditions had been corrected, and only some knock-out holes required closing to bring the electrical installations up to code standards.

Lucky Jim (Zincton Unit, Sheep Creek Gold Mines Limited)

A 200-kva. 440-volt generator driven by a 275-horsepower 277-r.p.m. Fairbanks-Morse diesel was installed in the power-house. A 25-horsepower pumping unit was installed on No. 11 level and also a 5-horsepower locomotive-battery charging unit. Inspection of the electrical equipment revealed the absence of grounding conductors on the non-current-carrying metal parts of some of the equipment, unused knock-out holes which required closing, and the interlock on the controller on the main-haulage locomotive not in operating condition.

Sandon (49° 117° N.E.)

Silversmith (Carnegie Mines Limited)

The Silversmith hydro-electric plant was put into operation to supply power to the mine, and a 2,200-volt line was built between the power plant and the mine. The voltage is stepped down to 230 volts to supply lights and a locomotive-battery charging motor-generator set at the mine. A 1½-ton battery locomotive is used for haulage. The building of a second 2,200-volt line to the mill-site has been commenced.

Richmond Eureka (Kootenay Belle Gold Mines Limited)

Early in 1951 a sink-float plant was built for treating the dump material prior to hauling it to the Whitewater mill. The equipment installed consists of the following: A scraper hoist driven by a 20-horsepower motor; a vibrating feeder powered by a 1½-horsepower motor-generator set; a crusher driven by a 25-horsepower motor; a conveyor driven by a 3-horsepower motor; a conveyor driven by a 1½-horsepower motor; a cone driven by a 3-horsepower motor; a screen driven by a 5-horsepower motor; a screen driven by a 1½-horsepower motor; a classifier driven by a 2-horsepower motor; a conveyor driven by a 3-horsepower motor; a conveyor driven by a 2-horsepower motor; a magnetic separator driven by a 1½-horsepower motor; a 1½-inch pump driven by a 3-horsepower motor; a 3-inch pump driven by a 15-horsepower motor; a 2-inch pump driven by a 10-horsepower motor; a 2-inch pump driven by a 5-horsepower motor; and an air compressor driven by a 25-horsepower motor. The power plant consists of a 150-horsepower 6-cylinder Murphy diesel driving a 90-kw. 440-volt 60-cycle a.c. generator.

The electrical equipment was installed in a workmanship-like manner, and it was only necessary to have a small improvement made in the method of grounding the crusher-motor service panel.

Cody Reco Mines Limited

A mill building was built on this property and a 250-kva. 440-volt 1,200-r.p.m. Westinghouse a.c. generator direct-connected to a 275-horsepower Marine diesel was installed. The proposed milling equipment to be installed in 1952 is as follows: A ball mill driven by a 175-horsepower motor; a compressor driven by a 125-horsepower motor; a crusher driven by a 50-horsepower motor; a vacuum pump driven by a 10-horsepower motor; a filter driven by a 1-horsepower motor; a filterate pump driven by a 1-horsepower motor; two diaphragm pumps, each driven by a 1-horsepower motor; two thickeners, each driven by a 2-horsepower motor; two concentrate pumps, each driven by a 2-horsepower motor; a bank of flotation cells driven by seven 5-horsepower motors; a classifier driven by a 3-horsepower motor; a ball-mill conveyor driven by a 2-horsepower motor; a coarse-ore conveyor driven by a 2-horsepower motor; and a crusher conveyor driven by a 2-horsepower motor. Two 75-kw. a.c. generators driven by D-13000 Caterpillar diesels will be added to the power plant.

Carnation (Kelowna Mines Limited).—Operations at this mine were suspended, and all equipment was dismantled and taken to Hedley.

Victor (Violamac Mines (B.C.) Limited)

The milling equipment was rearranged this year, and a new D-13000 112-horsepower 900-r.p.m. Caterpillar diesel driving a direct-connected 220-volt 125-kva. 3-phase 60-cycle generator was installed to supply power. The unit installed in 1950 is no longer in service. The milling equipment is as follows: A ball mill driven by a 30-horsepower motor; a jig driven by a 3-horsepower motor; a zinc-concentrate pump driven by a 1-horsepower motor; zinc flotation cells driven by a 5-horsepower motor; lead flotation cells driven by a 3-horsepower motor; a lead-concentrate pump driven by a 1-horsepower motor; a fine-ore feeder driven by a 1-horsepower motor; a conveyor driven by a 2-horsepower motor; a filterate pump driven by a 1-horsepower motor; and a filter driven by a 1-horsepower motor. The remainder of the equipment is driven from a line shaft by a 30-horsepower motor. The former arrangement was given in the Annual Report for 1950.

The rearranged installation was found to be satisfactory, except that a number of bonding conductors was required across concentric knock-outs and across flexible conduit.

SLOCAN LAKE (49° 117° N.E.)

Bosun (New Santiago Mines Limited).—This mine was operated intermittently during 1951. No alterations were made to the electrical installations, which were found to be satisfactory at the time of inspection.

Western Exploration Company Limited

A new sink-float plant of the drum-type was installed in the mill. It consists of the following units: A drum separator driven by a 7½-horsepower motor; a screen driven by a 5-horsepower motor; a densifier driven by a 2-horsepower motor; a clean media pump driven by a 20-horsepower motor; a media return pump driven by a 5-horsepower motor; a magnetic separator driven by a 1½-horsepower motor; a dewatering classifier driven by a 2-horsepower motor; a conditioning screen driven by a 5-horsepower motor; an elevator driven by a 5-horsepower motor; and a magnetic-separator tailings pump driven by a 5-horsepower motor.

In connection with the sink-float plant a 25-horsepower cone crusher was installed. With the exception of the jaw crusher and one conveyor, the equipment in the crushing plant has been removed.

In the mill the old flotation cells were replaced with new ones, using the old motors.

At the first inspection in 1951 it was found that the new switchgear in the sink-float plant required marking to indicate circuits controlled and that a number of bonding conductors were yet to be installed. This work had been completed at the time of the last inspection in 1951.

Van Roi (Van Roi Consolidated Mines Limited)

A mill was built during the summer of 1951. It contains the following equipment: A coarse-ore feeder driven by a 3-horsepower motor; a 3- by 6-foot Ty-rock screen driven by a 3-horsepower motor; a 10- by 20-inch jaw crusher driven by a 20-horsepower motor; an 18-inch conveyor driven by a 1-horsepower motor; a 3- by 10-foot Ty-rock screen driven by a 5-horsepower motor; two 18-inch conveyors, each driven by a 3-horsepower motor; a 6- by 4-foot drum separator driven by a 7½-horsepower motor; a 4- by 16-foot screen driven by a 5-horsepower motor; a magnetic separator driven by a 1½-horsepower motor; a 1½-inch Wemco pump driven by a 5-horsepower motor; a 4-inch Wemco pump driven by a 20-horsepower motor; a densifier driven by a 1½-horsepower motor; a 2-inch Wemco sump pump driven by a 7½-horsepower motor; a 24-inch sand preparation machine driven by a 2-horsepower motor; a fine-ore feeder driven by a 1-horsepower motor; a 36-inch Wemco classifier driven by a 3-horsepower motor; a 6-foot by 4-foot Union Iron Works ball mill driven by a 75-horsepower motor; five 36-inch Fagergren lead flotation cells, each driven by a 3-horsepower motor; one 36-inch Fagergren lead flotation cell driven by a 2-horsepower motor; a Denver sand pump driven by a 3-horsepower motor; a 5- by 6-foot Wemco conditioner driven by a 3-horsepower motor; a 1¼-inch Wemco sand pump driven by a 2-horsepower motor; two 36-inch Fagergren zinc flotation cells, each driven by a 2-horsepower motor; six 36-inch zinc flotation cells, each driven by a 3-horsepower motor; a Denver sand pump driven by a 5-horsepower motor; a 1¼-inch Wemco sand pump driven by a 2-horsepower motor; a blower driven by a 5-horsepower motor; and a vacuum pump driven by a 15-horsepower motor.

The sink-float plant had not been put into operation by the end of 1951; however, the crushing plant and mill were in operation.

The power plant consists of the following: A D-13000 Caterpillar engine direct-connected to a 90-kw. a.c. generator; a D-17000 Caterpillar engine direct-connected to a 75-kw. a.c. generator; a D-17000 Caterpillar engine and a belt-driven 90-kw. American Motors a.c. generator. Power is produced and used at 440 volts.

At the time of the last inspection in 1951 bonding and grounding were yet to be completed and the switchgear required marking to indicate circuits controlled. The electrical work was in general well executed.

NORTH LARDEAU (50° 117° N.E.)

Spider (Sunshine Lardeau Mines Limited)

In October, 1951, plans of the proposed electrical layout for a mill were received and approved. It is expected that the mill will be built in 1952. The proposed equipment is as follows: A 30-inch by 6-foot 6-inch adjustable-stroke ore feeder driven by a 2-horsepower motor; a 9- by 16-inch Denver jaw crusher driven by a 20-horsepower motor; a sirocco exhaust-fan driven by a 1-horsepower motor; a 16-inch by 6-foot 6-inch fine-ore feeder driven by a 1-horsepower motor; a 5- by 5-foot Denver ball mill driven by a 60-horsepower motor; a 30-inch by 15-foot 6-inch Akins classifier driven by a 2-horsepower motor; a 2- by 2-inch S.R.L. classifier overflow pump driven by a 1-horsepower motor; a No. 250 Denver unit cell driven by a 5-horsepower motor; a 1-inch pump driven by a 1-horsepower motor; a bank of six Denver 24- by 24-inch lead flotation cells driven by three 3-horsepower motors; a 1½-inch lead-concentrate pump driven by a 1½-horsepower motor; a 5- by 5-foot Denver zinc conditioner driven by a 3-horsepower motor; a bank of eight Denver zinc flotation cells driven by four 3-horsepower motors; a 1½-inch zinc-concentrate pump driven by a 2-horsepower motor; a 13B Wilfley pilot table driven by a ¼-horsepower 110-volt motor; a 1-inch mill sump pump driven by a 1-horsepower motor; a 4-foot 2-disk Denver lead filter driven by a 1-horsepower motor; a 4-foot 3-disk Denver zinc filter driven by a ¾-horsepower motor; a 10- by 5-inch vacuum pump and blower driven by a 7½-horsepower motor; and a filtrate pump driven by a 1-horsepower motor. All the above-mentioned motors will operate on 440 volts potential. The power plant will consist of a 10-cylinder Vivian diesel driving a 170-kw. a.c. generator.

KIMBERLEY (49° 115° N.W.)

Sullivan (The Consolidated Mining and Smelting Company of Canada, Limited)

The following is a summary of the electrical work done during 1951 at the Sullivan mine and concentrator. The installation of the 6900 feeder cable down No. 1 shaft and along 3904 crosscut was completed. This cable consisted of 1,040 feet of 3-conductor 300,000-c.m. 8,000-volt varnished-cambric lead-sheathed cable, armoured with individually neoprene-covered steel wire, on the slope, and 1,000 feet of similar cable, except with paper insulation, on the level. This cable replaced a cable in 39-H-1 B raise which was subject to corrosion from sulphur-dioxide-contaminated atmosphere.

Two 200-horsepower 550-volt motors and controls were installed on the two new extension conveyor units for the 3902 conveyor system. Two 3-conductor 500,000-c.m. 1,000-volt paper-insulated lead-sheathed drained-type steel-wire-armoured cables approximately 850 feet long supply the motors. The control wiring for these units consists of two multi-conductor polyvinyl chloride insulated steel-wire-armoured cables. A single conductor 500,000-c.m. dry-type 1,000-volt paper-insulated lead-covered cable was installed down the 3902 conveyor incline to supply power to the north ends of the levels below 3350 level.

A substation consisting of two 300-kva. type L.N.S. Askarel-filled 6,900/2,300–575-volt 3-phase transformers was installed on the 2850 level. These transformers are fed from the 6,900-volt power cable which was extended down 3902 incline from 3350 level. The primary protection on the transformers consists of G. & W. gang-operated oil-filled switches. The secondaries are connected to a common bus, from which are supplied three 400-ampere 600-volt 35-mva. Cemco air circuit-breakers mounted in cubicles and dead-front-operated.

The relocation of the 2,300-volt tie line between the north and south end stations on the 3900 level was completed. To feed this cable, 1,100 feet of new 3-conductor 300,000-c.m. 4,000-volt paper-insulated steel-wire-armoured cable was installed along 3904 crosscut from No. 1 shaft and 1,000 feet of 300,000-c.m. 4,000-volt varnished-cambric steel-wire-armoured cable was installed in the shaft.

The installation of electrical equipment in the 2850 crushing plant was completed. One 150-horsepower jaw-crusher motor and controls, one 75-horsepower Ty-crusher motor and controls, one 25-horsepower conveyor motor and controls, one 5-horsepower Ross feeder motor and controls, and two 7½-horsepower grizzly motors and controls were installed.

The 500-horsepower Vulcan hoist motor and controls were dismantled and moved from 3901 winze to No. 2 shaft hoist-room, where they were reinstalled and will be put in operation early in 1952. Approximately 1,000 feet of 3-conductor No. 3/0 B. & S. gauge 4,000-volt paper-insulated lead-sheathed steel-wire-armoured cable was installed from 3911 crosscut to the No. 2 shaft hoist-room to supply the 2,300-volt power needed. A 7-conductor No. 10 B. & S. gauge 600-volt polyvinyl chloride insulated and jacketed steel-wire-armoured cable will be installed in the shaft for signal circuits.

A 3-conductor No. 4/0 B. & S. gauge 1,000-volt drained-type paper-insulated lead-sheathed cable will be installed in No. 2 shaft to supply 550-volt power to each level. On each level G. & W. type "WA" 3-way junction boxes will be installed and the power taken off through 3-pole safety switches. The cable will be protected by a 300-ampere 3-pole 600-volt "nofuz" breaker.

For 250-volt d.c. power 1,300 feet of single-conductor 1,000,000-c.m. 1,000-volt polyvinyl chloride insulated and jacketed cable, armoured with individually neoprene-covered steel wire, will be installed in No. 2 shaft to supply trolley circuits at the various levels.

A small substation in 3610 drift north, consisting of two 250-kva. 2,300–440-volt transformers, was dismantled, as it was no longer needed.

Approximately 1,000 feet of 3-conductor 300,000-c.m. 8,000-volt varnished-cambric lead-sheathed steel-wire-armoured cable which was not damaged by sulphur dioxide was salvaged from 39-H-1 B raise, and 600 feet of it was installed from the collar of No. 1 shaft down to 3900 level. This completed the replacement of the temporary installations in No. 1 shaft. The power-supply for No. 1 shaft area will be changed from 2,200 to 6,600 volts when the proper oil circuit-breaker arrives.

Seven 60-horsepower 550-volt electric scraper hoists and attendant switchgear were installed at various locations in the mine. Several additional electric motor-driven pumps and controls were installed at the 39120 pumping-station.

On the surface 2 miles of 66-kv. No. 4 B. & S. gauge copper overhead line was built between the 3700 portal and No. 1 shaft substations; approximately an equivalent length of similar line was strung on the poles carrying the 6,900-volt line between the 3700 portal and concentrator substation.

The three 300-kva. 66,000/23,000-volt transformers were moved from the old to the new Sullivan Hill substation.

In the 3800 underground crushing plant, two 250-horsepower 550-volt motors and controls for the second Symons crusher were installed.

The switch-room in the sink-float plant was enlarged to accommodate two 100-horsepower automatic reduced-voltage starters which had originally been installed outside the switch-room. Several magnetic switches which had supplied sink-float plant motors were also moved into this room.

To supply the tin plant, a new feeder switch was installed in the concentrator substation and 450 feet of 3-conductor 1,000,000-c.m. paper-insulated lead-sheathed cable was run between the substation and tin plant.

A 50-horsepower motor and controls were installed for a pump at the new lead-concentrate stocking pond.

Ten 10-horsepower motors and controls were installed for an M.S. machine and two 10-horsepower motors and controls for pumps for " lead roughing " machines on the primary ball-mill floor.

A 60-horsepower motor and controls were installed to drive the Symons cone crusher which was installed to crush the float material prior to its being used for backfill. In connection with this installation, the 550-volt feeder cable was extended up No. 620 conveyor gallery to a new distribution centre on the tripper floor.

Several obsolete motor safety switches were replaced with switches of adequate horsepower rating.

At the first inspection of the mine electrical equipment in 1951, it was found that the overspeed device on the 3901 hoist did not operate satisfactorily when the hoist was allowed to overspeed. This defect was corrected on the spot. Other faults found were: Neoprene coating of armouring not removed where it was gripped in clamps at splice boxes, thus breaking continuity of ground; some switchgear required marking to indicate circuits controlled; and the size of lamps used for heating in wooden cabinets was too large. All the above-mentioned faults were found to be corrected at the time of the second inspection in 1951. However, several other faults were found at that time. The shield of one of the cables serving a scraper was in use as a ground return for trolley lighting; also water-pipes and air-lines were in use for the same purpose; and in one section of the mine improper methods of attaching grounds were in use.

At the first inspection of the mill in 1951 two 100-horsepower reduced-voltage starters were found to be under water drips. These starters were moved into the switch-room, as mentioned previously. At the second inspection in 1951 no faults were found.

Fort Steele (49° 115° N.W.)

Kootenay Base Metals Limited

In September, 1951, plans of the proposed electrical layout for a mill were received and approved. The equipment will consist of the following: A 24-inch by 7-foot flat-belt adjustable-stroke ore feeder driven by a 2-horsepower motor; a 10- by 16-inch Type H Denver jaw crusher driven by a 20-horsepower motor; a dust exhaust-fan driven by a 1-horsepower motor; a 16-inch by 66-foot conveyor driven by a 2-horsepower motor; an 18-inch by 16-foot fine-ore feeder driven by a 1½-horsepower motor; a 5- by 6-foot Denver drum and scoop ball mill driven by a 60-horsepower motor; a 30-inch by 17-foot 3-inch Akins classifier driven by a 2-horsepower motor; six No. 15 24- by 24-inch Denver lead-flotation cells driven by three 3-horsepower motors; a 5- by 5-foot Denver zinc conditioner driven by a 3-horsepower motor; eight No. 15 24- by 24-inch Denver zinc flotation cells driven by four 3-horsepower motors; a 1½-inch lead-concentrate pump driven by a 3-horsepower motor; a 1½-inch zinc-concentrate pump driven by a 3-horsepower motor; a 1½-inch mill sump pump driven by a 3-horsepower motor; a 4-foot 5-disk Denver lead-concentrate filter driven by a 1-horsepower motor; a 6½- by 5½-inch vacuum pump driven by a 10-horsepower motor; and a 1-inch filterate pump driven by a 1½-horsepower motor.

The power plant will consist of a 200-horsepower Ruston Paxman diesel and generator, and an 80-horsepower Ruston Hornsby diesel and generator.

Wasa (49° 115° N.W.)

Estella Mines Limited

Plans of the proposed electrical installations were received and approved for the power plant and mill which were built during the summer of 1951. Three generating units installed in the power plant consist of the following: Two 250-kw. (312-kva.) 440-volt 60-cycle a.c. generators and one 148-kw. (185-kva.) 440-volt 60-cycle a.c. generator.

The mill equipment is as follows: A ball mill driven by a 200-horsepower motor; a classifier driven by a 3-horsepower motor; six lead flotation cells driven by three 7½-horsepower motors; a lead conditioner driven by a 3-horsepower motor; ten zinc flotation cells driven by five 7½-horsepower motors; a lead thickener driven by a 1-horsepower motor; a lead thickener pump driven by a 1-horsepower motor; a zinc thickener driven by a 2-horsepower motor; a zinc thickener pump driven by a 3-horsepower motor; a filter driven by a 1½-horsepower motor; a sump pump driven by a 3-horsepower motor; two tables driven by two ½-horsepower motors; a fine-ore feeder driven by a 2-horsepower motor; a vacuum pump driven by a 25-horsepower motor; a filterate pump driven by a 3-horsepower motor; a cone crusher driven by a 60-horsepower motor; a jaw crusher driven by a 40-horsepower motor; two conveyors driven by two 10-horsepower motors; a Dillon screen driven by a 5-horsepower motor; a coarse-ore feeder driven by a 3-horsepower motor; a skip driven by a 10-horsepower motor; and two concentrate conveyors driven by two 3-horsepower motors.

In the assay office there is a sample crusher driven by a 5-horsepower motor, a ball mill and flotation cells driven by three ¼-horsepower motors.

Auxiliary equipment in the power-house is driven by four 4-horsepower motors, three 3-horsepower motors, one 10-horsepower motor, and one 40-horsepower motor. The 40-horsepower motor will drive the fresh-water pump.

Inspection of the above-mentioned installations in November showed the bonding of the non-current-carrying metal parts required completing to bring them up to code standards.

Windermere (50° 116° S.E.)

Paradise (Sheep Creek Gold Mines Limited)

A new U.D. 24 International diesel and direct-connected 80-kw. a.c. Palmer generator were installed at the mill. The U.D. 18 formerly in use will be kept as a stand-by. At the time of the November, 1951, inspection it was found that some temporary wiring had been installed which required replacing with permanent wiring and that some maintenance work was required to bring the electrical equipment up to code standards.

Spillimacheen (50° 116° N.E.)

Silver Giant (Giant Mascot Mines Limited)

Details of the electrical equipment at this mine are given in the 1950 Annual Report of the Minister of Mines. A second 500-horsepower General Motors diesel direct-connected to a 375-kva. 440-volt 3-phase a.c. Electrical Machinery Company generator was installed to supply the necessary power. At the time of the November, 1951, inspection there was some temporary wiring in use which required replacing with permanent wiring.

Field (51° 116° S.E.)

Base Metals Mining Corporation Limited.—No new equipment was installed during 1951. The general condition of the electrical equipment was found to be satisfactory at the time of the November, 1951, inspection.

Revelstoke (51° 117° S.W.)

Mastodon Zinc Mines Limited

In November, 1951, plans of the proposed electrical layout for a mill to be built in 1952 were received and approved. The proposed equipment is as follows: A 30-inch by 8-foot adjustable-stroke ore feeder driven by a 2-horsepower motor; a 10- by 20-inch Denver type J.F.F. primary jaw crusher driven by a 30-horsepower motor; an 18-inch by 24-foot conveyor driven by a 2-horsepower motor; a dust exhaust-fan driven by a 1-horsepower motor; a 3- by 6-foot Dillon model 50 D.D. screen driven by a 3-horsepower motor; a 2-foot Symons cone secondary crusher driven by a 30-horsepower motor; an 18-inch by 70-foot conveyor driven by a 3-horsepower motor; an 18-inch by 18-foot 6-inch adjustable-stroke fine-ore feeder driven by a 1½-horsepower motor; a 6- by 6-foot Vancouver Iron Works combination drum and scoop ball mill driven by a 125-horsepower motor; a 48-inch by 17-foot Akins classifier driven by a 3-horsepower motor; a 4-cell No. 21 38- by 38-inch Denver Sub-A lead flotation machine driven by two 7½-horsepower motors; a 5- by 6-foot Denver zinc conditioner driven by a 3-horsepower motor; an 8-cell No. 21 38- by 38-inch Denver Sub-A zinc flotation machine driven by four 7½-horsepower motors; a 1½-inch lead concentrate pump driven by a 3-horsepower motor; a 2-inch zinc-concentrate pump driven by a 5-horsepower motor; a 1½-inch mill sump pump driven by a 3-horsepower motor; a 14- by 5-inch E.R. 1 Ingersoll-Rand vacuum pump driven by a 15-horsepower motor; a 1½-inch D Jennings filtrate pump driven by a 1-horsepower motor; a 6-foot 5-disk Eimco filter driven by a 1½-horsepower motor; a No. 36 A.F. Roots Connersville blower driven by a 1½-horsepower motor; a conveyor driven by a 1-horsepower motor; and a concentrate slusher driven by a 7½-horsepower motor. All the above-mentioned are 440-volt motors.

Electric power will be produced by a 1,000-horsepower hydro-electric plant on La Forme Creek. Power will be generated at 6,900 volts and stepped down to 440 volts by three substations.

The mill substation and the mine substation will each consist of three 150-kva. 6,900–440-volt transformers. The hoist substation for the incline trams will consist of three 25-kva. transformers.

Howe Sound (49° 123° N.E.)

Britannia Mining and Smelting Co. Limited During 1951 the following additions and alterations were made to the electrical installations: A Pickrose slusher hoist driven by a 42-horsepower motor was installed on 1200 level; two Ingersoll-Rand slusher hoists driven by 30-horsepower motors were installed, one on 1340 level and the other on 2900 level; an Ingersoll-Rand slusher hoist driven by a 30-horsepower motor was moved from 850 level to 980 level; a Sullivan slusher hoist driven by a 7½-horsepower motor was moved from 850 level to 1300 level; an Ingersoll-Rand slusher hoist driven by a 20-horsepower motor was moved from 1050 level to 1340 level; a Sullivan slusher hoist driven by a 75-horsepower motor was moved from 1800 level to 3300 level; a 75-horsepower motor-generator set was installed on 1000 level for d.c. trolley power; and two 5-horsepower motor-generator sets were installed, one on 3500 level and the other on 4650 level for battery charging.

For ventilation purposes a 7½-horsepower Coppus blower was installed on 1800 level, a 60-horsepower motor driving a fan was installed on 1400 level, and a 50-horsepower motor driving a fan was moved from 3500 level to 3300 level.

In the 4100 level yard the new dry building was wired; one 20-horsepower motor driving a planer, two 7½-horsepower and one 50-horsepower motors driving saws were installed in the framing-shed; and a transformer-station housing two 75-kva. 6,900–440-volt transformers was built.

At the mill a lead plant was constructed and thirteen motors, totalling 30½ horsepower, installed to drive tables and pumps. A 25-horsepower motor was installed to drive a pyrite cyclone.

On the surface a garage was built and wired for lighting. Above the Beach camp a sawmill was built, and three motors of 150 horsepower, 125 horsepower, and 12½ horsepower were installed. To supply these motors with 440-volt power, two 200-kva. 6,900–440-volt transformers were installed.

During the inspection of the electrical equipment at the mine in April, 1951, the following unsatisfactory conditions were found: The Victoria shaft hoist and No. 8 shaft hoist reached an excessive overspeed when tested for operation of the overspeed controls. The overspeed devices were adjusted before the inspection was continued. Terminal boxes were required on many of the underground motors. Suitable clamps were required on several trailing cables at terminal boxes. Trolley-guards were required on the 1200 level trolley where it passed under chutes.

During the inspection of the electrical equipment at the mill it was found that some of the electrical equipment was subjected to the corrosive effects of the mill solutions and that several motors required terminal boxes.

A dangerous occurrence took place at 8.15 a.m., July 19th, in the No. 8 mine, at the 4350 level battery-charging station: when the charging plug was removed from a locomotive battery which had been put on charge by the graveyard shift, a flash occurred which ignited combustible material in the battery box. The electrical department reported that the leads behind the charging-plug receptacle had short-circuited when the plug was pulled.

TEXADA ISLAND (49° 124° N.W.)

Little Billie (Vananda Mines (1948) Limited)

No alterations or additions have been made to the electrical equipment during 1951. Power is being produced only for hoisting and pumping. During the December, 1951, inspection it was observed that the back-out switch for the hoist was connected so as to by-pass both upper limit switches in either back-out position when the connection should be such as to by-pass only one in each position. Other faults observed were no grounding conductors for some pieces of electrical equipment and no connectors at terminal boxes on several cables.

VANCOUVER ISLAND

Quinsam Lake

Iron Hill (The Argonaut Co. Ltd.)

Early in 1951 preparations were made to build a crushing plant, separation plant, and power plant. The power plant and crushing plant were put into operation in the summer and the separation plant in the fall. Much temporary wiring, which was later replaced with permanent wiring, was used in order to begin mining and shipping ore as soon as possible.

The power plant consists of the following units: Two 280-kva. 440-volt 60-cycle 3-phase a.c. generators, each driven by twin General Motors diesel engines which develop 280 horsepower; two 280-kva. 440-volt 60-cycle 3-phase a.c. generators, each driven by a 280-horsepower Buda diesel engine; and two 130-kva. 440-volt 60-cycle 3-phase a.c. generators, each driven by a 175-horsepower Buda diesel engine. In January, 1952, a 250-kva. 440-volt 60-cycle 3-phase a.c. General Electric generator driven by a 250-horsepower General Motors diesel engine was added to the power plant.

The crushing plant consists of the following units: A primary crusher driven by a 150-horsepower 2,200-volt motor; two secondary crushers in the middlings recrush circuit, one driven by a 150-horsepower motor, the other by a 125-horsepower motor; four screens driven by a 30-, a 15-, and two 7½-horsepower motors; a 4-horsepower and a 2-horsepower motor-generator sets.

Duncan (48° 123° N.W.)

Twin J (Vancouver Island Base Metals Limited)

No major alterations have been made to the electrical installations at this property. During the inspection of the electrical equipment on July 6th, 1951, it was observed that several switches which had been reconnected required re-marking to indicate the new circuits controlled, that there was a small amount of temporary wiring which required replacing with permanent wiring, and that a number of knock-out holes required closing.

QUARRIES

Blubber Bay (49° 124° N.W.)

Pacific Lime Company Limited.—Only lighting and electric blasting equipment is in use in the quarry. This equipment was found to be in satisfactory condition at the inspection in December, 1951.

British Columbia Cement Company Limited.—Bamberton Quarry (48° 123° N.W.). Blubber Bay Quarry (49° 124° N.W.). The electrical equipment in use at both quarries consists of electric shovels and electric blasting gear. Except for temporary splices in two of the shovel cables, this equipment was found to be satisfactory at the time of inspection.

Indian Arm (49° 122° S.W.)

Gilpin-Nash Limited

A 900-horsepower 600-r.p.m. General Motors twin diesel is used to drive an air compressor and a 52.5-kva. 220-volt 3-phase a.c. generator. The electrical power is used for lighting, for operating a Lincoln arc-welding machine, and for blasting. No approved blasting-switch was in use for blasting. However, such a switch was on order and was installed a few days after the August 7th inspection. The non-current-carrying metal parts of the electrical equipment required grounding.

Kilgard (49° 122° S.W.)

Clayburn Company Limited

Details of the electrical installations are given in the 1948 Annual Report of the Minister of Mines. No alterations or additions have been made to these installations other than to move the electrical equipment to new workings as required. This equipment was found to be in satisfactory condition at the August, 1951, inspection.

Coquitlam (49° 122° S.W.)

Deeks-McBride Limited.—Only an electric shovel is used in the pit. At the August 7th inspection the faults found were an injury to the electric-power cable 50 feet from the shovel and a faulty tripping mechanism on the main oil circuit-breaker.

Fresh Water Sand & Gravel Company Limited.—During 1951 the only electrical equipment in use in the pit was an electric shovel. At the August 7th inspection the only fault found was that the grounding conductor for the shovel had been disconnected.

Lynnmour (49° 123° S.E.)

Road Materials Limited.—The electrical equipment in the pit has been replaced with diesel-powered equipment.

Windermere

Columbia Gypsum Products Inc.

(50° 115° S.W.) The removal of gypsum from the quarry is contracted to Carbon and Ludberg, who are using the following equipment for crushing, conveying, and screening the ore: A crusher driven by a 100-horsepower Murphy diesel engine; a conveyor to screens driven by a 5-horsepower electric motor; two screens driven by 10-horsepower electric motors; a waste conveyor driven by a 7½-horsepower electric motor; and a loading conveyor driven by a 10-horsepower electric motor. Electrical power is produced by a 100-horsepower Caterpillar diesel engine driving a direct-connected 3-phase 440-volt 60-cycle a.c. generator. During inspection of this equipment it was found that all non-current-carrying metal parts required grounding and the wiring generally required improving.

PLACER MINES

Atlin

Spruce Creek (59° 133° N.W.)

Noland Mines Limited

Details of the electrical installations at this mine are given in the 1950 Annual Report of the Minister of Mines. No changes or additions of importance were made during 1951. During inspection of the electrical installations the following unsatisfactory conditions were found: Repair work had been done on the trommel-screen motor circuit and the air-compressor motor circuit, after which the wiring had not been replaced in conduit. Several electrical cords supplying portable equipment were not attached to the terminal boxes with connectors. Several lighting branch circuits were overfused.

Cariboo

Hixon Creek (53° 122° S.W.)

Hixon Placers Inc.

A 40-horsepower Waukesha semi-diesel driving a 200-volt 3-phase generator is used for camp lighting. The wiring in the power plant and workshop was not in conduit, as is required, and the non-current-carrying metal parts of the electrical equipment required grounding.

COAL MINES

Nanaimo (49° 123° S.W.)

No. 10 Mine, South Wellington (Canadian Collieries (Dunsmuir) Limited).—During the summer of 1951 the underground electrical equipment was removed, as the coal which could be mined was practically exhausted. In January, 1952, the mine was closed and the surface electrical equipment removed, with the exception of that in the dry. The dry will be used for the convenience of the workmen at the Bright mine.

Bright Mine, Cassidy (Canadian Collieries (Dunsmuir) Limited)

The following equipment was installed at this mine in 1951: A 300-horsepower synchronous motor driving a compressor; a 30-horsepower motor driving a ventilating fan; a 60-horsepower motor driving a hoist at the top of the main slope; three 60-horsepower motors driving pumps on the main slope; a 15-horsepower motor driving an air compressor; a 10-horsepower motor driving a water-pump; a 3-horsepower motor driving a rotary dump; and a 3-horsepower motor driving a generator for lamp-battery charging.

The 300-horsepower synchronous motor is a 2,200-volt motor; all the others are 440-volt motors. The underground pumps are served by two 625-foot lengths of 3-conductor No. 0 B. & S. gauge rubber-insulated wire-armoured cable.

Power is purchased from the British Columbia Power Commission. The main transformer-station consists of three 200-kva. 13,000–2,200-volt transformers. The mine transformer-station consists of three 50-kva. 2,200–440-volt transformers and one 2,200–220/110-volt transformer.

Inspection of the above installations showed them to be satisfactory except for two minor requirements.

Timberlands Mine

This mine was leased by Newberry and Vlasick early in 1951 and is now called the Newberry and Vlasick Colliery. They have installed on the surface an air compressor driven by a 25-horsepower motor and a hoist driven by a 20-horsepower motor. Permission has been granted for the installation of a pump to dewater the mine.

Biggs Mine.—Permission was granted early in 1951 to install a temporary 3-horsepower pumping unit to dewater the mine for examination. After several months of exploratory work on the coal seam the mine was closed.

COMOX (49° 124° N.W.)

Tsable River Mine (Canadian Collieries (Dunsmuir) Limited).—A new concrete pump-room was built on the left side of the main slope below 4 left level and a pump driven by a 75-horsepower 2,200-volt motor installed. A 3-conductor No. 2 B. & S. gauge 3,000-volt rubber-insulated lead-sheathed galvanized steel-wire-armoured cable with servings every 25 feet was installed from the portal to the pump-room. The only unsatisfactory condition found at the time of inspection was that the pump-room floor around the motor and switchgear was wet.

No. 8 Mine (Canadian Collieries (Dunsmuir) Limited)

A 5-stage 750-gallons-per-minute Alan turbine pump driven by a 200-horsepower 1,500-r.p.m. 2,200-volt direct-connected Canadian General Electric motor was installed in the shaft-bottom pumping-station, bringing the number of pumping units to two. Both units in this station are manually started by means of compensators. A new transformer-room was built on the north side to house the three 20-kva. transformers from the north side charging-station. During the inspection tour the major unsatisfactory condition found was the use of single-pole disconnecting switches on circuits of over 300 volts where externally operated or remote-control equipment is required.

EAST KOOTENAY (49° 114° S.W.)

Michel Colliery (The Crow's Nest Pass Coal Company Limited)

Electrical work done during 1951 was as follows: All motor switchgear for Nos. 1 and 2 by-product ovens was moved to the new overhead switch-gallery which was built in 1950. With this arrangement the switchgear is protected from the deleterious effects of the by-product gases and heat. New high-temperature cables have been installed between the switchgear and motors. The type of cable formerly used deteriorated rapidly under the high temperatures to which it was subjected.

A new General Electric K-143 2,300-volt circuit-breaker having an interrupting capacity of 50,000-kva. was installed in the power-house substation on the town circuit.

The 3,000-foot long power-line to A seam mine fan was rebuilt during the summer.

The lighting fixtures and wiring in the snowshed over the tracks going to the dump were renewed and a new switch centre installed.

Improvements found necessary during the inspection of the electrical installations were as follows: The temporary wiring in the car-repair shop, garage, and machine-shop required replacing with permanent wiring, and an approved service entrance was required for each building mentioned. The distribution centres in the slurry screen room and by-product tipple required improvements.

Elk River Colliery (The Crow's Nest Pass Coal Company Limited)

Electrification of No. 9 mine, which was commenced in 1950, was completed. Details of the surface equipment which supplies the underground equipment are given in the 1950 Annual Report of the Minister of Mines. At the portal a Reyrolle single-unit type "E 1" 6,600-volt flame-proof metal-clad compound-filled switch panel equipped with horizontal withdrawable direct hand-operated oil-immersed circuit-breaker having a rupturing capacity of 25 mva. at 6,600 volts was installed to control the inby supply. The switch is equipped with overcurrent and earth leakage protection.

The main cable from the portal to the portable underground substation is a 3-conductor No. 2 B. & S. gauge 7,000-volt paper-insulated lead-sheathed steel-wire-armoured cable. It was installed in 1,000-foot lengths connected together with 6,600-volt 100-ampere permissible flit plugs. It is supported with rubber belt slings every 10 to 15 feet at a height of 6 or 7 feet off the floor.

The transportable substation consists of a 200-kva. 6,600–575-volt mining-type transportable transformer fitted on the high-tension side with a type "E 1" 200-ampere circuit-breaker. Cable entry is by means of a type "JBR" flit plug to fit the cable mentioned in the previous paragraph.

The 550-volt power from the transformer is fed through two "GA3" 200-ampere 5-mva. rupturing capacity circuit-breakers to the main level and No. 8 incline. The apparatus served by the breaker for No. 8 incline consists of the following: Three chain-conveyors driven by three 20-horsepower motors; four shaker-conveyors driven by four 20-horsepower motors; four drills driven by four 1-horsepower motors; one Becander hoist driven by a 20-horsepower motor; four tuggers driven by four 5-horsepower motors; and two coal-cutters driven by two 50-horsepower motors.

The main level breaker serves a coal-cutter driven by a 50-horsepower motor, a Becander hoist driven by a 20-horsepower motor, a tugger driven by a 5-horsepower motor, and a shaker-conveyor driven by a 20-horsepower motor.

The 600-volt feeder cable is 3-conductor No. 1/0 B. & S. gauge rubber-insulated lead-sheathed steel-wire-armoured cable.

A blending plant was added to the surface equipment for the purpose of blending the coals from Nos. 3 and 9 mines. The following equipment was installed: A scalping screen driven by a 7½-horsepower motor; a short belt driven by a 5-horsepower motor; a belt to bin driven by a 7½-horsepower motor; a flight-conveyor in bin driven by a 15-horsepower motor; a belt to Ty-rock screen driven by a 7½-horsepower motor; a Ty-rock screen driven by a 20-horsepower motor; a belt to cleaning plant handling coarse coal driven by a 7½-horsepower motor; a belt to cleaning plant handling fine coal driven by a 5-horsepower motor; and a flight-conveyor in cleaning-plant gallery.

The temporary wiring in the No. 1 bin, pick-breaker room, and conveyor-belt sheds was replaced with wiring in conduit and a new switch-room added. All wiring was installed in conduit, and gas-proof lighting fixtures were used throughout.

The rotary dump was rewired and a new switch-room built.

To take care of the increased load caused by the new additions, three 10-kva. 2,300–440-volt transformers were installed.

A new 100-horsepower 2,200-volt motor was installed for No. 9 mine fan and a 75-horsepower 2,200-volt motor was installed for No. 3 mine fan.

The cap-lamps were replaced with 400 Edison, Model R4, electric cap-lamps.

During the inspection of the electrical installations the following unsatisfactory conditions were found: Corrosion of the underground-cable armouring had commenced where water was dripping on it. The cable has since been painted with a corrosion-resisting paint. There was a tendency of the operators to allow conveyor motors to get completely buried in coal. The operating temperature of the motor is increased and the daily inspection work is hampered under such conditions. An enclosure was required for the surface substation which supplies 6,600-volt power to the underground electrical system.

A potential dangerous occurrence took place on December 17th, 1951, when a coal-cutter trailing cable was punctured by one of the coal-cutter bits. William Weins, the underground electrician, and his helper, A. Butt, were moving an "AB" 15 coal-cutter from the face of 1 left, 8 incline, No. 9 mine, at the time of the occurrence. At the junction of 1 left and 8 incline, approximately 130 feet from the face of 1 left, the coal-cutter was being hauled under its own power, with the cutting-chain disengaged and the cutter-bar trailing the machine. As the machine moved forward the cutter-chain caught a post, which caused the chain to rotate. One of the bits caught the trailing cable, which was lying over the machine, and punctured it, thereby earthing one of the conductors to the shield and causing a bright flash about 3 inches long. The main breaker at the bottom of the incline, tripped immediately by the earth leakage relay, isolated the coal-cutter circuit and also the circuits supplying two chain-conveyors. Examination of the trailing cable revealed a hole approximately one-eighth of an inch in diameter but no burning of the insulation was observed.

Telkwa (54° 127° N.E.)

Bulkley Valley Collieries Limited

Details of the electrical equipment which was installed were given in the 1950 Annual Report of the Minister of Mines. Unsatisfactory conditions found during inspection of the electrical equipment were two cover-plates on permissible equipment were not properly tightened down, and a grounding conductor was required for the underground-pump motor. Some temporary wiring was in use while awaiting supplies for the permanent wiring.

Peace River (56° 122° S.E.)

Reschke Coal Limited

A 125-kva. 440-volt 60-cycle 3-phase a.c. generator driven by a diesel engine was installed to supply a 60-horsepower model 27HXT Mavor and Coulson coal-cutter. The electrical circuit consists of an overhead line from the power plant to the mine, an armoured cable from the overhead line to the gate-end switch, and a trailing cable from the gate-end switch to the machine.

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, out of print.

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	......	......	1927	Free	......
1897	......	......	1928	Free	$1.00
1898–1900	......	......	1929	Free	......
1901	......	......	1930	50c.	......
1902–1906	......	......	1931	......	......
1907	......	......	1932	......	......
1908	......	......	1933	Free	1.00
1909	50c.	......	1934	Free	1.00
1910	50c.	......	1935	......	1.00
1911	......	......	1936	(1)	1.00
1912	......	......	1937	(1)	1.00
1913	......	......	1938	(1)	1.00
1914	......	......	1939	Free	1.00
1915	50c.	......	1940	Free	1.00
1916	50c.	......	1941	Free	1.00
1917	50c.	......	1942	Free	1.00
1918	Free	......	1943	Free	......
1919	50c.	......	1944	Free	1.00
1920	50c.	......	1945	Free	1.00
1921	Free	......	1946	Free	1.00
1922	50c.	......	1947	Free	1.00
1923	Free	......	1948	Free	1.00
1924	......	......	1949	Free	1.00
1925	......	......	1950	Free	1.00
1926	......	......	1951	Free	1.00

1 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. Out of print.
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.
Mining in British Columbia—an outline of the development of the industry, 1952.

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.) 50 cents.
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. 50 cents.
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.) Out of print.

Bulletin No. 16: Dragline Dredging Methods. (By Stuart S. Holland.) 50 cents.
Bulletin No. 17: An introduction to Metal-mining in British Columbia. (By Officers of the Department.) To be reprinted.
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.)
Bulletin No. 28: Placer Gold Production of British Columbia. (By S. S. Holland.)
Bulletin No. 29: Geology and Ore Deposits of the Sandon Area, Slocan Camp, British Columbia. (By M. S. Hedley.)
Bulletin No. 30: Clay and Shale Deposits in British Columbia. (By J. W. McCammon and J. M. Cummings.)

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 of the Mineralogical Branch.

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

Prospectors working in British Columbia, and schools in British Columbia giving instruction in prospecting or related to prospecting, may obtain sets of specimens for $1.03 each. That price includes the 3-per-cent sales tax. Each set includes sixty identified specimens of rocks and minerals. Most of the specimens are about an inch square. The localities from which the specimens were obtained are not indicated.

When applying for a set of specimens, the prospector should give the number of his free miner's certificate or otherwise indicate that he is seriously interested in prospecting. Sets will be supplied for a class or a school on request from the principal, teacher, or School Board.

Prospectors outside of British Columbia seriously interested in prospecting in British Columbia may be supplied with sets of specimens but will be expected to pay the postage or express charges. The set as packed weighs 3 pounds.

A request for a set of specimens should be addressed to the Chief of the Mineralogical Branch, Department of Mines, Victoria, B.C., and should be accompanied by the proper sum ($1.03).

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 Natural Resources and Industrial Development, 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 Department of Geology and Mineral Industries, 702 Woodlark Building, Portland, 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 Queen's Printer, Victoria, B.C. *See* page 342.)

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.

FREE MINERS' CERTIFICATES

A free miner's certificate must be obtained before a person can prospect for mineral and locate and record mineral claims or locate and apply for placer-mining leases in British Columbia.

Any person over the age of 18, and any corporation incorporated or registered in British Columbia, may obtain a free miner's certificate* upon application and payment of the required fee.†

A free miner's certificate is valid from the date of issue and expires at midnight on the 31st day of May next, or some subsequent 31st day of May (a certificate may be taken out a year or more in advance if desired). A certificate may be obtained for part of a year terminating on May 31st.

The possession of a certificate entitles the holder to enter upon all lands of the Crown, and upon any other lands on which the right to enter is not specifically reserved, for the purpose of prospecting for minerals, locating mineral claims, locating placer-mining leases, and for mining.

If a free miner allows his certificate to lapse, title to his mining property forfeits to the Crown (subject to the conditions set out in the next 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, upon filing in the office of the Mining Recorder a certificate from the Department of Mines that the free miner's certificate of the co-owner has lapsed.

Six months' extension of time is allowed within which to revive title in mining property which has forfeited through the lapse of a free miner's certificate. This privilege is given only if the holder of the property obtains a special free miner's certificate† within six months after the 31st day of May on which his ordinary certificate lapsed.

It is not necessary for a shareholder in a corporation to be the holder of a free miner's certificate. A person does not need a free miner's certificate to hold title in Crown-granted mineral claims.

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* *See* pages 342 and 343 for list of offices from which certificates may be obtained.

† *See* scale of fees on page 334.

Scale of Fees for Free Miners' Certificates

Certificates issued between—	Individual	Company with Capital $100,000 or Less	Company with Capital over $100,000[1]
[2]June 1st and June 18th	$5.00	$50.00	$100.00
June 19th and July 6th	4.75	47.50	95.00
July 7th and July 24th	4.50	45.00	90.00
July 25th and August 11th	4.25	42.50	85.00
August 12th and August 30th	4.00	40.00	80.00
August 31st and September 18th	3.75	37.50	75.00
September 19th and October 7th	3.50	35.00	70.00
October 8th and October 26th	3.25	32.50	65.00
October 27th and November 14th	3.00	30.00	60.00
November 15th and December 2nd	2.75	27.50	55.00
December 3rd and December 20th	2.50	25.00	50.00
December 21st and January 7th	2.25	22.50	45.00
January 8th and January 25th	2.00	20.00	40.00
January 26th and February 12th	1.75	17.50	35.00
February 13th and March 2nd	1.50	15.00	30.00
March 3rd and March 20th	1.25	12.50	25.00
March 21st and April 7th	1.00	10.00	20.00
April 8th and April 25th	.75	7.50	15.00
April 26th and May 13th	.50	5.00	10.00
May 14th and May 31st	.25	2.50	5.00

Special Free Miners' Certificates

[3]June 2nd and November 30th	$15.00	$300.00	$300.00

[1] Fee for a certificate for a company having no authorized capital is $100. For every substitute certificate, $1.
[2] If June 1st is a holiday then next day which is not a holiday.
[3] If June 1st is a holiday then the second day following which is not a holiday.

A statutory declaration, in the form provided, must be completed by an official of a joint-stock company before a free miner's certificate may be issued in its name.

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 any gas are not considered as minerals.*

Size and Methods of Locating Mineral Claims

A mineral claim is a piece of land of which the sides must not exceed 1,500 feet in length and the area must not be more than fifty-one and sixty-five one-hundredths acres. 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 showings 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 at least 4 inches 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. If cairns are used, the required 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 (*see* examples of various methods of laying out mineral claims on page 335).

* 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 any gas under the "Petroleum and Natural Gas Act." These Acts are under the administration of the Department of Lands and Forests, Victoria, B.C.

Upon the No. 1 post the following information must be written:—

(1) No. 1 post:
(2) Initial post:
(3) Direction (approximate compass-bearing) of No. 2 post:
(4) Number of feet lying to the right and number of feet lying to the left of the line from No. 1 to No. 2 post:
(5) The name of the claim:
(6) The name of the locator:
(7) The date of location.

Upon the No. 2 post the following information must be written:—

(1) No. 2 post:
(2) The name of the claim:
(3) The name of the locator:
(4) The date of location.

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.

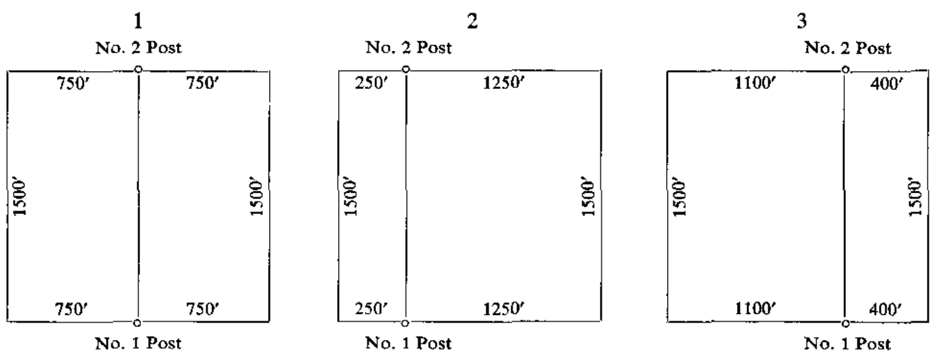
The location-line between Nos. 1 and 2 posts must be distinctly marked—in a timbered locality by blazing trees and cutting underbrush, and in bare country by monuments of earth or rock not less than 2 feet in diameter at the base, and at least 2 feet high—so that the line can be distinctly seen.

Where, from the nature or shape of the ground, it is impossible to mark the location-line of the claim, or if the ground is covered by water, the location-line may be marked by placing legal posts as nearly as possible to it, and noting the distance and direction such posts may be from the location-line, which distance and direction shall be set out on the record of the claim.

During any period of twelve months a free miner may stake and record eight mineral claims within a radius of 10 miles, and may acquire others by purchase. Distance is measured in a straight line or, as commonly expressed, "as the crow flies."

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.

Examples of Various Methods of Laying Out Mineral Claims



Recording

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, if within 10 miles of the record office, one day extra being allowed for each additional 10 miles of distance. If a location is not recorded within the time prescribed in the Act it is open for relocation, but if the immediate former locator wishes to relocate he must obtain the written permission of the Gold Commissioner, for which he shall pay a fee of $10.

A Sub-Mining Recorder may take affidavits and may receive declarations and recording fees under the "Mineral Act" for the mining division for which he is appointed, and the Mining Recorder deals with each document forwarded to him by the Sub-Mining Recorder as if he had received it and the fees in his office on the date of receipt by the Sub-Mining Recorder.

Timber for Mining Purposes

Timber on a mineral claim, if not alienated and if unencumbered at the time of location, may be used by the holder of the claim, but only for mining purposes.

Assessment Work

Mineral claims are held practically on a yearly lease, a condition of which is that during such year assessment work be performed on the claim to the value of at least $100, or a payment of such sum be made to the Mining Recorder. Assessment work must be recorded within a year from the date of recording the claim (and by the anniversary of the date of record of the claim in each year thereafter) or title to the claim is deemed abandoned. If, however, the required assessment work has been performed within the time specified, 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.

Crown Grants

As soon as assessment work to the value of $500 or assessment work and cash combined to the value of $500 has been recorded, which work shall include a survey of the claim, the owner of a mineral claim is entitled to a Crown grant on payment of a fee of $25 and on giving the necessary notices required by the Act. Liberal provisions are also made in the Act for obtaining mill-sites and sites for drains and other facilities for the better working of claims.

For further information consult the "Mineral Act."

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.

An agent may not prospect for, locate, nor record any placer claim or placer leasehold on behalf of his principal unless he holds a valid free miner's certificate and a power of attorney from his principal which has been recorded in the office of the Mining Recorder for the mining division in which the claim or leasehold is situate.

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.

Placer 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, if within 10 miles of the recording office, one day extra being allowed for each additional 10 miles of distance.

Placer-mining Leases

Leases of approximately 80 acres in extent may be granted by the Gold Commissioner of the mining division in which the leasehold is located. The length of an ordinary placer-mining lease shall not exceed one-half mile (2,640 feet) and the width of the leasehold shall not exceed one-quarter mile (1,320 feet).

For further information *see* Part VIII of the "Placer-mining Act."

Examples of Various Methods of Laying Out Placer Leaseholds

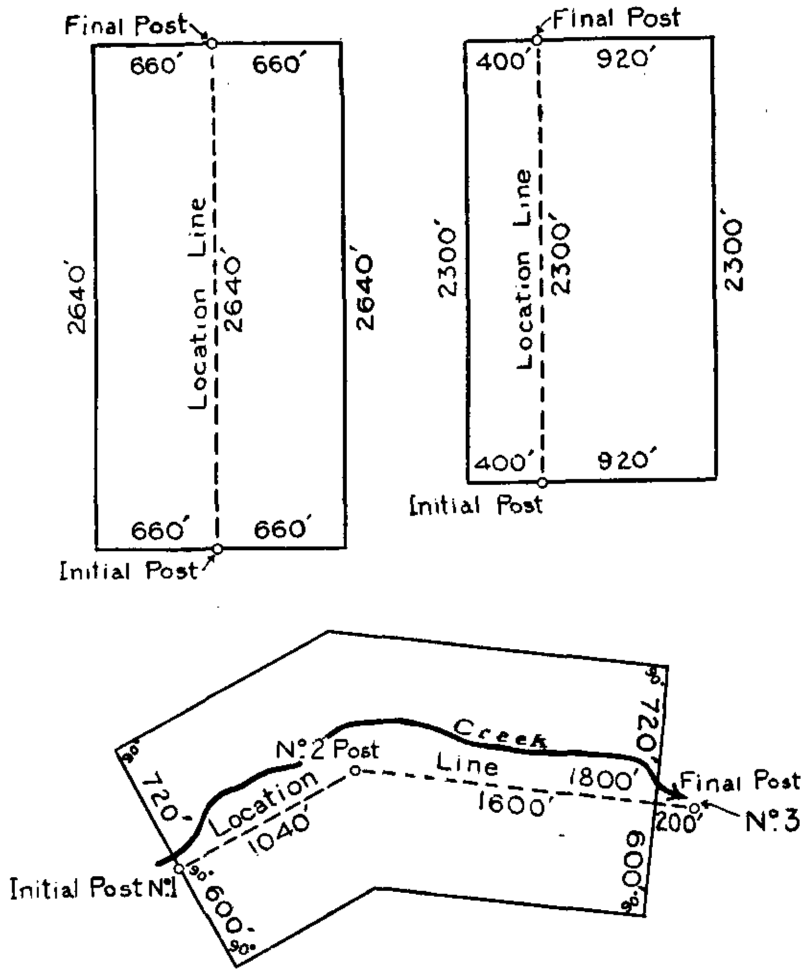


TABLE OF FEES, "MINERAL ACT" AND "PLACER-MINING ACT"

Individual free miner's certificate, annual fee	[1]$5.00
Company free miner's certificate (capital $100,000 or less), annual fee	[1]150.00
Company free miner's certificate (capital over $100,000), annual fee	[1]100.00
Recording mineral claim	2.50
Recording certificate of work, mineral claim	2.50
Recording certificate of work, placer-mining lease	2.50
Grouping notices, "Mineral Act"	.25
Consolidations, "Placer-mining Act"	1.00
Recording abandonment, mineral claim	10.00
Recording abandonment, placer claim	2.50
Recording any affidavit	2.50
Records in "Records of Conveyances" (for one claim or lease)	2.00
For each mineral claim or lease in excess of one	.50
Copies of extracts from records, not exceeding three folios, per copy	2.50
Every folio over three, per folio	.30
Abstract of title for each mineral claim or placer-mining lease	2.50
Filing documents, "Mineral Act"	.25
Filing documents, "Placer-mining Act"	1.00
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
Search of free miners' certificates records from one to three years, each name	.25
For each additional three years, each name	.25
Certificate regarding a free miner's certificate, up to and including three years, each name	.50
For each additional three years, each name	.25

[1] *See* page 334 for fee for unexpired part of year.

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 present 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 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.

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 the 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: Pro-

* Application for lease must be made to the Gold Commissioner for the mining division in which the mineral claim is situate; a list of the offices of the Gold Commissioners is given on pages 342 and 343.

vided 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 Queen'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.

Regulations have been approved by the Lieutenant-Governor in Council governing the locating and recording of mineral claims, of placer-mining leases, and of mining in Class "A" parks.

No holder of a mineral claim in a Class "A" or a Class "C" park may obtain a Crown grant of the surface rights of a mineral claim.

Lands included in Class "C" parks are, with respect to mining, reserved, unless the consent of the Lieutenant-Governor in Council is obtained, and mineral claims shall be subject to such terms, 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 "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	.80
Security Frauds Prevention Act	.30
Coal Sales Act	.15

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	H. W. Harding	H. W. Harding	R. MacGregor.
Sub-office	Nanaimo			W. H. Cochrane.
Sub-office	Quatsino			Axel Hansen.
Sub-office	Tofino			R. R. Barr.
Sub-office	Zeballos			Mrs. M. Kilner.
Atlin	Atlin	B. J. H. Ryley	B. J. H. Ryley	L. D. Sands.
Sub-office	Lower Post			J. W. Stewart.
Sub-office	Pouce Coupe			H. O. Callahan.
Sub-office	Squaw Creek			Mrs. F. Muncaster.
Sub-office	Telegraph Creek			Mrs. M. Dick.
Sub-office	Tulsequah			W. R. Harris.
Cariboo	Barkerville	G. H. Dunlop (Acting)	G. H. Dunlop (Acting).	
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	Miss E. R. Wilkinson.
Sub-office	Beaverdell			L. F. Crump.
Sub-office	Greenwood			S. W. Dobbie.
Sub-office	Oliver			L. M. McKinnon.

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
Kamloops	Kamloops	D. Dalgleish	D. Dalgleish	R. A. McDonnell.
Sub-office	Ashcroft			D. H. Bruce.
Sub-office	Chu Chua			G. M. Fennell.
Sub-office	Salmon Arm			W. T. McGruder.
Liard	Victoria	K. B. Blakey.		
Sub-office	Burns Lake			A. Fisher.
Sub-office	Fort St. James			N. Henry.
Sub-office	Fort St. John			W. A. Munro.
Sub-office	Lower Post			J. W. Stewart.
Sub-office	Pouce Coupe			H. O. Callahan.
Sub-office	Prince George			G. H. Hallett.
Sub-office	Telegraph Creek			Mrs. M. Dick.
Lillooet	Lillooet	E. B. Offin	E. B. Offin	Miss D. M. Eggie.
Sub-office	Haylmore			W. Haylmore.
Nanaimo	Nanaimo	W. H. Cochrane	W. H. Cochrane.	
Sub-office	Alberni			H. W. Harding and R. MacGregor.
Sub office	Alert Bay			D. J. Phillips.
Sub-office	Cumberland			G. W. McFarland.
Sub-office	Quatsino			Axel Hansen.
Sub-office	Vananda			Henry Carter.
Nelson	Nelson	K. D. McRae	K. D. McRae	J. C. Hughes.
Sub-office	Creston			R. S. Allen.
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	G. H. Beley	G. H. Beley.	
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			W. A. Munro.
Sub-office	Hazelton			C. H. Drake.
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	Terrace			W. Warner.
Sub-office	Vanderhoof			George Ogsdon.
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.
Quesnel	Williams Lake	Miss J. Foster	Miss J. Foster.	
Sub-office	Barkerville			G. H. Dunlop.
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			Mrs. L. M. Mapes.
Similkameen	Princeton	Chas. Nichols	Chas. Nichols.	
Sub-office	Hedley			L. A. Doree.
Skeena	Prince Rupert	G. Forbes	G. Forbes.	
Sub-office	Alice Arm			Mrs. E. A. Oliver.
Sub-office	Burns Lake			A. Fisher.
Sub-office	Copper River			L. G. Skinner.
Sub-office	Queen Charlotte			H. R. Beaven.
Sub-office	Stewart			W. S. Orr.
Sub-office	Terrace			W. Warner.
Slocan	New Denver	C. Macdonald (Kaslo).	F. Broughton	Miss M. Butlin.
Sub-office	Slocan			W. E. Graham.
Trail Creek	Rossland	W. L. Draper	W. L. Draper.	
Vancouver	Vancouver	J. Egdell	Mrs. D. White (Deputy).	
Sub-office	Alert Bay			D. J. Phillips.
Sub-office	Powell River			J. V. Gaspard.
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.

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Lode-metal Deposits Referred to in the 1951 Annual Report

The names of the properties are arranged alphabetically within five areas. Each area consists of the mining divisions listed below. The table shows the principal metals produced or indicated in the deposits in 1951:—

Northern British Columbia.—Atlin, Liard.

Central British Columbia.—Cariboo, Clinton, Omineca, Quesnel.

Coast and Islands.—Alberni, Nanaimo, New Westminster, Skeena, Vancouver, Victoria.

South Central British Columbia.—Greenwood, Kamloops, Lillooet, Nicola, Osoyoos, Similkameen, Vernon.

Southeastern British Columbia.—Ainsworth, Fort Steele, Golden, Nelson, Revelstoke, Slocan, Trail Creek.

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Cobalt	Antimony	Molybdenum
Northern British Columbia														
Atlin Ruffner	Atlin	59° 133° N.W.	2	1	...	1	1	...	...	...	...	...	...	...
Black Diamond	Atlin	59° 133° N.E.	...	...	...	...	...	3	...	...	...	...	...	...
Big Bull	Atlin	58° 133° N.W.	1	1	1	1	1	...	...	...	...	...	...	...
Burden	Liard	59° 128° S.E.	...	...	3	...	...	...	...	...	...	...	...	...
Erickson-Ashby	Atlin	58° 133° N.W.	...	3	...	3	3	...	...	...	...	...	...	...
Polaris-Taku	Atlin	58° 133° N.W.	1	2	...	...	...	...	...	...	...	...	...	...
Tulsequah Chief	Atlin	58° 133° N.W.	1	1	1	1	1	...	...	...	...	...	...	...
Central British Columbia														
American Boy	Omineca	55° 127° S.E.	...	3	...	3	3	...	...	...	...	...	...	...
Beveley	Omineca	56° 125° S.E.	...	...	...	3	...	...	...	...	...	...	...	...
Brunswick	Omineca	55° 127° S.W.	...	3	...	3	3	...	...	...	...	...	...	...
Cariboo Gold Quartz	Cariboo	53° 121° S.W.	1	2	...	...	...	...	...	...	...	...	...	...
Cariboo-Hudson	Cariboo	53° 121° S.W.	3	...	...	...	...	3	...	...	...	...	...	...
Cariboo Scheelite	Quesnel	52° 120° N.W.	...	...	...	...	...	3	...	...	...	...	...	...
Cassiar Crown	Omineca	54° 126° N.W.	...	3	3	...	3	...	...	...	...	...	...	...
Copper King	Omineca	57° 124° S.W.	...	...	3	...	...	...	...	...	...	...	...	...
Cronin Babine	Omineca	54° 126° N.W.	2	1	...	1	1	...	...	...	...	...	...	...
Duthie	Omineca	54° 127° N.E.	3	3	...	3	3	...	...	...	...	...	...	...
Emerald	Omineca	53° 127° N.E.	2	1	...	1	1	...	...	...	...	...	...	...
Extension	Omineca	57° 124° S.W.	...	...	3	...	...	...	...	...	...	...	...	...
Fiddler	Omineca	54° 128° N.E.	3	3	3	3	3	...	...	...	...	...	...	...
Free Gold	Omineca	54° 126° N.W.	1	2	...	2	1	...	...	...	...	...	...	...
Glacier Gulch	Omineca	54° 127° N.E.	3	3	...	3	3	...	...	...	...	...	...	...
Island Mountain	Cariboo	53° 121° S.W.	1	2	...	...	...	...	...	...	...	...	...	...
Lakeview	Omineca	54° 126° N.W.	1	2	...	2	1	...	...	...	...	...	...	...
Lead Empire	Omineca	53° 127° N.E.	...	3	...	3	3	...	...	...	...	...	...	...
Lead King	Omineca	55° 127° S.E.	...	3	...	3	3	...	...	...	...	...	...	...
Lorraine	Omineca	54° 126° N.W.	...	3	...	3	3	...	...	...	...	...	...	...
Mamie	Omineca	54° 127° N.E.	3	3	...	3	3	...	...	...	...	...	...	...
Nicholson Creek	Omineca	54° 128° N.E.	...	...	3	...	...	...	...	...	...	...	...	...
Red Rose	Omineca	55° 127° S.W.	...	...	...	...	...	3	...	...	...	...	...	...
Rocher Déboulé	Omineca	55° 127° S.W.	3	3	3	...	...	3	...	...	...	3	...	...
Sil-Van	Omineca	54° 127° N.E.	3	3	...	3	3	...	...	...	...	...	...	...
Silver Standard	Omineca	55° 127° S.W.	2	1	...	1	1	...	2	...	...	...	...	...
Topley Richfield	Omineca	54° 126° N.E.	3	3	...	...	3	...	...	...	...	...	...	...
Coast and Islands														
A.M.	New Westminster	49° 121° S.E.	...	...	3	...	...	...	...	...	...	...	...	...
Anyox	Skeena	55° 129° S.W.	...	...	3	...	...	...	...	...	...	...	...	...
Anyox Metals (Ford)	Alberni	50° 126° S.W.	...	...	...	...	...	...	...	3	...	...	...	...

Shipping Mines.—(1) Metal contributed at least 10 per cent of gross value of the shipment. (2) Metal contribute less than 10 per cent of gross value of the shipment.

Non-shipping Mines.—(3) Metal present, indicated by assay or mineralogical determination.

LODE-METAL DEPOSITS—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Cobalt	Antimony	Molybdenum
Coast and Islands—Continued														
Black Diamond	Skeena	55° 129° N.W.	..	3	..	..	..	..	..	..	..	..	..	..
Blue Grouse	Skeena	55° 129° N.W.	..	3	..	3	3	..	..	..	..	..	..	..
Britannia	Vancouver	49° 123° N.E.	2	2	1	2	1	..	2	..	..	..	..	..
Cascade Falls	Skeena	55° 129° N.W.	3	3	3	3	3	..	..	..	..	..	..	..
Chance	Skeena	55° 129° N.W.	3	3	..	..	..	..	..	..	..	..	..	..
Churchill	Alberni	50° 126° S.W.	..		..	..	..	..	..	3	..	..	..	..
Climax	Skeena	55° 129° N.W.	..	3	..	3	3	..	..	..	..	..	..	..
Columbia	Skeena	55° 129° N.W.	..	3	..	..	..	..	..	..	..	..	..	..
Combination	Skeena	55° 129° N.W.	..	3	3	..	..	..	..	..	..	..	..	..
Copper Cliff	Skeena	55° 129° N.W.	..	..	3	..	..	..	..	..	..	..	..	..
Dan Patch	Skeena	55° 129° N.W.	..	3	3	..	..	..	..	..	..	..	..	..
Danzig	Alberni	49° 126° N.E.	..	..	..	..	3	..	..	..	..	..	..	..
Dolly Varden	Skeena	55° 129° N.W.	..	3	3	3	3	..	..	..	..	..	..	..
Dunwell	Skeena	55° 129° N.W.	3	3	..	3	3	..	..	..	..	..	..	..
Galena	Skeena	55° 129° N.W.	..	3	..	3	..	..	..	..	..	..	..	..
Gibson Girl	Skeena	53° 130° N.E.	..	..	3	3	3	..	..	..	..	..	..	..
Glengarry and Stormont	Alberni	49° 126° N.W.	..	..	..	..	..	..	..	3	..	..	..	..
Gold Reef No. 1	Skeena	55° 129° N.W.	..	3	..	3	3	..	..	..	..	..	..	..
Homestake	Skeena	55° 129° N.W.	3	3	3	3	3	..	..	..	..	..	..	..
Indian Mines	Skeena	56° 130° S.E.	3	3	..	3	3	..	..	..	..	..	..	..
Iron Hill	Nanaimo	49° 125° N.W.	..	..	..	..	..	..	..	3	..	..	..	..
Iron River	Nanaimo	49° 125° N.W.	..	..	..	..	..	..	..	3	..	..	..	..
Last Chance	Skeena	55° 129° N.W.	3	3	..	..	..	..	..	..	..	..	..	..
Little Billie	Nanaimo	49° 124° N.W.	1	2	1	..	..	..	..	..	..	..	..	..
Lucky Four	New Westminster	49° 121° S.W.	..	..	3	..	..	..	..	..	..	..	..	..
Lucky Strike	Skeena	55° 129° N.W.	3	3	3	3	3	..	..	..	..	..	..	..
Lynn Creek	Vancouver	49° 123° S.E.	..	..	..	..	3	..	..	..	..	..	..	..
Marmot Lead and Zinc	Skeena	55° 129° N.W.	..	3	..	3	3	..	..	..	..	..	..	..
Matilda	Skeena	55° 129° N.W.	..	3	..	3	3	..	..	..	..	..	..	..
Moose	Skeena	55° 129° N.W.	3	3	..	3	..	..	..	..	..	..	..	..
Muskateer	Skeena	55° 129° N.W.	..	3	..	3	3	..	..	..	..	..	..	..
North Star	Skeena	55° 129° N.W.	..	3	..	..	..	..	..	..	..	..	..	..
Ouray	Skeena	55° 129° N.W.	3	3	3	3	3	..	..	..	..	..	..	..
Premier Border	Skeena	56° 130° S.E.	1	1	..	1	1	..	2	..	..	..	..	..
Privateer	Alberni	50° 126° S.W.	1	2	..	..	..	..	..	..	..	..	..	..
Progress	Skeena	55° 129° N.W.	..	3	..	3	3	..	..	..	..	..	..	..
Quatsino Copper-Gold	Nanaimo	50° 127° S.E.	..	..	..	..	..	..	..	3	..	..	..	..
Racehorse	Skeena	55° 129° N.W.	..	3	3	..	..	..	..	..	..	..	..	..
Red Point	Skeena	55° 129° N.W.	..	3	3	..	..	..	..	..	..	..	..	..
Second Thought	Skeena	55° 129° N.W.	..	3	..	..	..	..	..	..	..	..	..	..
Silbak Premier	Skeena	56° 130° S.E.	1	1	..	1	1	..	2	..	..	..	..	..
Silver Bell	Skeena	55° 129° N.E.	..	3	..	3	3	..	..	..	..	..	..	..
Silver Horde	Skeena	55° 129° N.W.	..	3	..	3	..	..	..	..	..	..	..	..
Silver Tip	Skeena	56° 130° S.E.	2	1	..	1	1	..	..	..	..	..	..	..
Sooke Copper	Victoria	48° 123° S.W.	..	..	3	..	..	..	..	..	..	..	..	..
Spud Valley	Alberni	50° 126° S.W.	1	2	..	..	..	..	..	..	..	..	..	..
Starlight	Skeena	55° 129° N.W.	3	3	..	..	..	..	..	..	..	..	..	..
Stewart Canal	Skeena	55° 129° N.W.	3	..	3	..	..	3	..	..	..	..	..	..
Summit	Skeena	55° 129° N.W.	..	3	..	3	3	..	..	..	..	..	..	..
Sunnyside	Skeena	55° 129° N.W.	3	3	3	3	3	..	..	..	..	..	..	..
Syndicate	Skeena	55° 129° N.W.	..	3	..	..	..	..	..	..	..	..	..	..
Texada Mines	Nanaimo	49° 124° N.W.	..	..	..	..	..	..	..	3	..	..	..	..
Tiger	Skeena	55° 129° N.W.	..	3	..	..	..	..	..	..	3	..	..	..
Toric	Skeena	55° 129° N.W.	2	1	..	2	2	..	..	..	..	..	..	..
Twin J	Victoria	48° 123° N.W.	2	2	1	2	1	..	2	..	..	..	..	..
Tyee	Skeena	55° 129° N.W.	..	3	..	3	..	..	..	..	..	..	..	..
Vanguard	Skeena	55° 129° N.W.	3	3	3	..	..	..	..	..	..	..	..	..
Velvet	Skeena	55° 129° N.W.	3	3	3	3	3	..	..	..	..	..	..	..
Victory	Skeena	55° 129° N.W.	3	3	..	..	..	..	..	..	..	..	..	..
Wolf	Skeena	55° 129° N.W.	..	3	..	3	..	..	..	..	..	..	..	..
South Central British Columbia														
Attwood Copper	Greenwood	49° 118° S.W.		..	3	..	..	..	..	..	..	..	..	..
Baby's Own	Kamloops	50° 121° N.E.	3	3	3	..	..	..	..	..	..	..	..	..
Bralorne	Lillooet	50° 122° N.W.	1	2	..	..	..	..	..	..	..	..	..	..
Copper Mountain	Similkameen	49° 120° S.E.	2	2	1	..	..	..	..	..	..	..	..	..
Copperado	Nicola	50° 120° S.W.	..	..	3	..	..	..	..	..	..	..	..	..
Dictator	Greenwood	49° 118° N.E.	..	3	..	3	3	..	..	..	..	..	..	..
Dynamo	Greenwood	49° 118° S.W.	..	2	..	1	1	..	..	..	..	..	..	..
El Alamein	Similkameen	49° 120° N.W.	3	..	..	..	..	..	..	..	..	..	..	..
Elizabeth	Lillooet	51° 122° S.E.	3	..	..	..	..	..	..	..	..	..	..	..
Fairview	Osoyoos	49° 119° S.W.	1	..	..	..	..	..	..	..	..	..	..	..

LODE-METAL DEPOSITS—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Cobalt	Antimony	Molybdenum
South Central British Columbia —Continued														
French	Osoyoos	49° 120° S.E.	1	2	2									
Gold Drop	Greenwood	49° 119° S.E.	1	2		1	2							
Golden Contact	Lillooet	50° 122° N.E.	3											
Golden Ledge	Lillooet	50° 122° N.W.	3											
Gray Rock	Lillooet	50° 122° N.W.											3	
Highland-Bell	Greenwood	49° 119° S.E.	2	1		1	1		2					
Iota	Osoyoos	49° 120° S.E.	2	1		1	1							
Iron Mask	Kamloops	50° 120° N.E.			3									
Jensen	Similkameen	49° 120° N.W.		1		1	1							
Lucky Strike	Similkameen	49° 120° N.E.	3	3	3	3	3							
Lucky Todd	Nicola	50° 120° S.W.		3		3	3							
Nickel Plate	Osoyoos	49° 120° S.E.	1	2	2									
Pioneer	Lillooet	50° 122° N.W.	1	2										
Providence	Greenwood	49° 118° S.W.	2	1		1	1							
Queen Bess	Kamloops	51° 120° N.E.		3		3	3							
Silver King	Similkameen	49° 120° N.W.		1		1	1							
Skookum	Vernon	50° 119° S.E.	1	1	2	2								
Waterloo	Greenwood	49° 118° N.E.		3		3	3							
Wayside	Lillooet	50° 122° N.W.	3											
Wellington	Greenwood	49° 119° S.E.		3		3	3							
Yalakom	Lillooet	51° 122° S.E.	3											
Zamora	Greenwood	49° 118° S.W.		1		1	1							
Southeastern British Columbia														
Ajax	Revelstoke	50° 117° N.W.		3		3	3							
Albion	Greenwood	49° 118° S.E.	1	1		2	2							
Alice	Nelson	49° 116° S.W.		1		1	2							
Alps	Nelson	49° 117° S.E.		3		3	3							
Altoona	Slocan	49° 117° N.E.		2		1	1							
Arlington	Nelson	49° 117° S.E.	1	2		1	1							
Arlington	Slocan	49° 117° N.E.	3	3		3	3							
Aspen	Nelson	49° 117° S.E.		3		3	3							
August Fraction	Ainsworth	49° 116° N.W.		2		1	1							
Ayesha	Ainsworth	49° 116° N.W.		2		1	1							
B.N.A.	Ainsworth	49° 117° N.E.		1		1	1							
Bar	Nelson	49° 117° S.E.		3		3	3							
Bayonne	Nelson	49° 116° S.W.	1	1		1	1							
Bell	Nelson	49° 117° S.E.		3		3	3							
Bismark	Ainsworth	49° 116° N.W.		3		3	3							
Black Fox	Ainsworth	49° 117° N.E.		2		2	1							
Black Prince	Nelson	49° 117° N.E.		1		1	1							
Black Rock	Nelson	49° 117° S.E.		3		3	3							
Bluebell	Ainsworth	49° 116° N.W.		3		3	3							
Bluebird	Slocan	49° 117° N.E.		3		3	3							
Bluebird	Trail Creek	49° 117° S.W.	2	1		1	1							
Bosun	Slocan	49° 117° N.E.		1		1	1							
Boy Scout	Fort Steele	49° 116° N.E.	3	3	3	3	3							
Budwiser No. 2	Ainsworth	49° 116° N.W.		2		1	1							
Caledonia	Ainsworth	50° 117° S.E.		3		3	3							
Carey Fraction	Ainsworth	49° 116° N.W.		2		1	1							
Carnation	Slocan	49° 117° N.E.		1		1	1							
Casino Red Cap	Trail Creek	49° 117° S.W.	1	2		1	1							
Chambers	Slocan	49° 117° N.E.		3		3	3							
Charleston	Ainsworth	50° 117° S.E.		1		1	1							
Cork Province	Ainsworth	49° 117° N.E.	2	2		1	1		2					
Cricket	Nelson	49° 116° S.W.		1		1	2							
Daisy Bell	Ainsworth	49° 116° N.W.		2		1	1							
Danira	Ainsworth	49° 116° N.W.		3		3	3							
Deadman	Slocan	49° 117° N.E.		3		3	3							
Delaware	Nelson	49° 116° S.W.		2		1	2							
Delphine	Golden	50° 116° S.E.		3		3	3							
Discovery Fraction	Slocan	49° 117° N.E.		1		1	2							
Dixie	Ainsworth	49° 116° N.W.		2		1	1							
Dodger	Nelson	49° 117° S.E.						3						
Doherty	Ainsworth	50° 117° S.E.		3		3	3							
Dundee	Nelson	49° 117° S.E.	1	2		1	1							
Early Bird	Ainsworth	49° 116° N.W.		2		1	1							

Shipping Mines.—(1) Metal contributed at least 10 per cent of gross value of the shipment. (2) Metal contributed less than 10 per cent of gross value of the shipment.

Non-shipping Mines.—(3) Metal present, indicated by assay or mineralogical determination.

LODE-METAL DEPOSITS—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Cobalt	Antimony	Molybdenum
Southeastern British Columbia —Continued														
Elkhorn	Slocan	49° 117° N.E.		2		1	1							
Emerald	Nelson	49° 117° S.E.						3						
Enterprise	Slocan	49° 117° N.E.	2	1		1	1		2					
Estella	Fort Steele	49° 115° N.W.		2		1	1							
Eureka	Nelson	49° 117° S.E.	3	3										
G.Y.P. Fraction	Revelstoke	50° 117° N.W.		3		3	3							
Galena Farm	Slocan	49° 117° N.E.		2		1	1							
Gold Belt	Nelson	49° 117° S.E.	1	2										
Goodenough	Nelson	49° 117° S.E.	1	2		1	1							
Granite-Poorman	Nelson	49° 117° S.E.	1	1										
H.B.	Nelson	49° 117° S.E.		3		3	3							
Hector	Ainsworth	49° 116° N.W.		3		3	3							
Hercules	Ainsworth	49° 116° N.W.		3		3	3							
Hewitt	Slocan	49° 117° N.E.	2	1		1	1		2					
Highland	Ainsworth	49° 116° N.W.		2		1	1							
Highlander	Ainsworth	49° 116° N.W.	2	2		1	1							
Hilda	Slocan	49° 117° N.E.		3		3	3							
Hope No. 2	Slocan	49° 117° N.W.		2		1	1							
I.X.L.	Trail Creek	49° 117° S.W.	1	2										
Index	Ainsworth	49° 116° N.W.		3		3	3							
International	Nelson	49° 117° S.E.								3				
Iron Cap	Nelson	49° 117° S.E.		3		3	3							
J.G.	Ainsworth	50° 116° S.W.		3		3	3							
Jack Pot	Nelson	49° 117° S.E.					3							
Jackson	Ainsworth	50° 117° S.E.	2	2		2	1							
Jersey	Nelson	49° 117° S.E.		2		1	1		2					
Judylu	Fort Steele	49° 115° N.W.		2		1	2							
Keystone Fraction	Ainsworth	49° 116° N.W.		3		3	3							
Kontiki	Nelson	49° 117° S.E.				3	3							
Kootenay Florence	Ainsworth	49° 116° N.W.	2	2		1	1		2					
Kootenay King	Fort Steele	49° 115° N.W.		3		3	3							
Lakeshore	Revelstoke	50° 117° N.W.		3		3	3							
Last Chance	Nelson	49° 117° S.E.					3							
Laurier	Ainsworth	49° 116° N.W.		2		1	1							
Leadsmith	Slocan	49° 117° N.E.	2	1										
Libby	Ainsworth	49° 116° N.W.		2		1	1							
Little Tim	Slocan	49° 117° N.E.		3		3	3							
Lucky Jim	Slocan	50° 117° S.E.	2	2		2	1		2					
Mammoth	Slocan	49° 117° N.E.	2	1		1	1		2					
Mastodon	Revelstoke	51° 118° S.E.		3		3	3							
Midnight	Trail Creek	49° 117° S.W.	1	2										
Mineral King	Golden	50° 116° S.E.		3		3	3							
Mogul	Golden	51° 118° N.E.		3		3	3							
Mollie Mac	Revelstoke	50° 117° N.W.		3		3	3							
Monarch and Kicking Horse	Golden	50° 116° S.E.		2		1	1							
Monitor	Slocan	50° 117° S.E.		1		1	1							
Montezuma	Ainsworth	49° 117° N.E.		1		1	1							
Moonstone	Ainsworth	50° 116° S.W.		1		1	1							
Motherlode	Ainsworth	50° 117° S.E.		1		1	2							
Nameless Fraction	Ainsworth	49° 116° N.W.		2		1	1							
Nettie L	Revelstoke	50° 117° N.W.		3		3	3							
New Jerusalem	Ainsworth	49° 116° N.W.		3		3	3							
Nicolet	Ainsworth	49° 116° N.W.		2		1	1							
Noah	Ainsworth	49° 116° N.W.		3		3	3							
Noble Five	Slocan	49° 117° N.E.		3		3	3							
Noonday	Slocan	49° 117° N.E.	2	1										
Ottawa	Slocan	49° 117° N.E.	2	1										
Oxide	Nelson	49° 117° S.E.					3							
Palmita	Slocan	49° 117° N.E.		1		1	2							
Paradise	Golden	50° 116° S.E.		2		1	1							
Pataha	Ainsworth	49° 116° N.W.		3		3	3							
Payne	Slocan	49° 117° N.E.		3		3	3							
Queen Bess	Slocan	49° 117° N.E.		3		3	3							
Rambler	Slocan	50° 117° S.E.		2		1	1		2					
Reeves MacDonald	Nelson	49° 117° S.E.		2		1	1		2					
Regal Silver	Revelstoke	51° 117° S.W.		3		3	3							
Republic No. 2	Slocan	49° 117° N.E.		3		3	3							
Richmond-Eureka	Slocan	49° 117° N.E.		1		1	1							
Right Bower	Ainsworth	50° 116° S.W.		1		1	1							
Ruth Hope	Slocan	49° 117° N.E.		1		1	1							

LODE-METAL DEPOSITS—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Cobalt	Antimony	Molybdenum
Southeastern British Columbia—Continued														
St. Patrick	Ainsworth	50° 116° S.W.	...	3	...	3	3	...	...	...	...	...	...	...
Sampson	Revelstoke	50° 117° N.W.		3	...	3	3	...	...	...	...	...	...	...
Scranton	Ainsworth	49° 116° N.W.	2	1	...	1	1	...	...	...	...	...	...	...
Sheep Creek (Queen)	Nelson	49° 117° S.E.	1	2	...	2	2	...	...	...	...	...	...	...
Silver Bear	Ainsworth	49° 116° N.W.	...	3	...	...	...	...	...	...	...	...	...	...
Silver Bell	Ainsworth	49° 116° N.W.	...	3	...	3	3	...	...	...	...	...	...	...
Silver Boy	Ainsworth	49° 116° S.W.	...	3	...	3	3	...	...	...	...	...	...	...
Silver Cup	Revelstoke	50° 117° N.W.	...	3	...	3	3	...	...	...	...	...	...	...
Silver Dollar	Revelstoke	50° 117° N.W.	...	3	...	3	3	...	...	...	...	...	...	...
Silver Giant	Golden	50° 116° N.E.	...	2	...	1	1	...	...	...	...	...	...	...
Silver Leaf	Slocan	49° 117° N.E.	...	1	...	1	1	...	...	...	...	...	...	...
Silversmith	Slocan	49° 117° N.E.	...	1	...	1	1	...	...	...	...	...	...	...
Snowflake	Revelstoke	51° 117° S.W.	...	3	...	3	3	...	...	...	...	...	...	...
Society Girl	Fort Steele	49° 115° S.W.	...	1	...	1	1	...	...	...	...	...	...	...
Speculator	Slocan	49° 117° N.E.	...	1	...	1	1	...	...	...	...	...	...	...
Spider	Revelstoke	50° 117° N.W.	...	3	...	3	3	...	...	...	...	...	...	...
Spokane	Ainsworth	49° 116° N.W.	...	2	...	1	1	...	...	...	...	...	...	...
Spokane	Nelson	49° 116° S.W.	2	1	...	1	2	...	...	...	...	...	...	...
Standard	Slocan	49° 117° N.E.	2	1	...	1	1	...	2	...	...	...	...	...
Star	Ainsworth	49° 116° N.W.	2	1	...	1	1	...	...	...	...	...	...	...
Stewart	Nelson	49° 117° S.E.	...	...	...	...	...	3	...	...	...	...	...	...
Sullivan	Fort Steele	49° 115° N.W.		1		1	1	...	...	...	...	...	...	...
Sun	Nelson	49° 117° N.E.	1	2	...	2	2	...	...	...	...	...	...	...
Sunlight	Ainsworth	49° 116° N.W.	2	1	...	1	1	...	...	...	...	...	...	...
Surprise	Ainsworth	50° 116° S.W.	2	1	...	1	1	...	...	...	...	...	...	...
Sylverite	Slocan	49° 117° N.E.	...	3	...	3	3	...	...	...	...	...	...	...
Talmor	Ainsworth	49° 116° N.W.	...	...	3	3	3	...	...	...	...	...	...	...
Timbasket	Golden	51° 118° N.E.	...	3	...	3	3	...	...	...	...	...	...	...
Utica	Ainsworth	49° 117° N.E.	...	1	...	1	1	...	...	...	...	...	...	...
Van Roi	Slocan	49° 117° N.E.	2	1	...	1	1	...	2	...	...	...	...	...
Victor	Fort Steele	49° 115° N.E.	3	3	...	3	3	...	...	...	...	...	...	...
Victor	Slocan	49° 117° N.E.	2	1	...	1	1	...	2	...	...	...	...	...
Victory	Nelson	49° 117° S.E.		...	...	...	...	3	...	...	...	...	...	3
Vigilant	Ainsworth	49° 116° N.W.	2	2		1	1	...	...	...	...	...	...	...
Vulture	Slocan	49° 117° N.E.	...	3	...	3	3	...	...	...	...	...	...	...
Wagner	Ainsworth	50° 117° N.W.	...	3	...	3	3	...	...	...	...	...	...	...
Waverley	Revelstoke	51° 117° S.W.	...	3	...	3	3	...	...	...	...	...	...	...
White Hope	Slocan	49° 117° N.E.	2	2	...	1	1	...	...	...	...	...	...	...
Whitewater	Ainsworth	50° 117° S.E.	...	1	...	1	1	...	...	...	...	...	...	...
Winona-Boon	Ainsworth	50° 117° S.E.	...	1	...	1	1	...	...	...	...	...	...	...
Wonderful	Slocan	49° 117° N.E.	...	1	...	1	1	...	...	...	...	...	...	...
Woodbury	Ainsworth	49° 116° N.W.	...	2		1	1	...	...	...	...	...	...	...
Young Canuck	Revelstoke	50° 117° N.W.	...	3	...	3	3	...	...	...	...	...	...	...
Yankee Girl	Nelson	49° 116° N.W.	2	2	...	1	1	...	...	...	...	...	...	...

Shipping Mines.—(1) Metal contributed at least 10 per cent of gross value of the shipment. (2) Metal contributed less than 10 per cent of gross value of the shipment.

Non-shipping Mines.—(3) Metal present, indicated by assay or mineralogical determination.

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