Minister of Mines and Petroleum Resources

PROVINCE OF BRITISH COLUMBIA

ANNUAL REPORT

for the Year Ended December 31

1961

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1962

BRITISH COLUMBIA
DEPARTMENT OF MINES AND PETROLEUM RESOURCES
VICTORIA, B.C.

HON. W. K. KIERNAN, *Minister.*

P. J. MULCAHY, *Deputy Minister.*

J. W. PECK, *Chief Inspector of Mines.*

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Major-General the Honourable GEORGE RANDOLPH PEARKES,
V.C., P.C., C.B., D.S.O., M.C.,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Mineral Industry of the Province for the year 1961 is herewith respectfully submitted.

W. K. KIERNAN,
Minister of Mines and Petroleum Resources.

Minister of Mines and Petroleum Resources Office,
March 31, 1962.

Herbert Pearson, mining statistician from 1928 to 1961, died in Victoria on January 15, 1962. He was born in Cheshire, England, in 1896, and served in the Royal Navy from November, 1914, until he was invalided out in 1919. He joined the staff of the Department of Mines in 1921 and became mining statistician in 1928. In 1939 he was transferred to the Bureau of Economics and Statistics and remained the officer responsible for collecting and compiling British Columbia mineral statistics until his retirement on August 31, 1961. He was Acting Director of the Bureau of Economics and Statistics during 1942–43, and thereafter until 1955 was Office Manager.

In his capacity as mining statistician he had frequent contacts with many of the office men in mining companies, and with the staff of the Department of Mines.

From 1915 until hospitalized in 1918, Mr. Pearson served on H.M.S. "Collingwood" in the Atlantic and North Sea areas. That period included the Battle of Jutland. During the 1939 visit of the late King George VI and Queen Elizabeth, Mr. Pearson was presented to His Majesty, who was also on H.M.S. "Collingwood" at the Jutland action.

Mr. Pearson was active in the Canadian Legion, and was president of the Britannia Branch in 1942.

His death came suddenly, only five months after retirement. He is survived by his wife, one son, and four granddaughters.

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ANNUAL REPORT OF THE MINISTER OF MINES AND PETROLEUM RESOURCES, 1961

Introduction

A Report of the Minister of Mines of the Province of British Columbia has been published each year from 1874 to 1959. Beginning in 1960, it is the Report of the Minister of Mines and Petroleum Resources.

The Annual Report records the salient facts in the progress of the mineral industry, also much detail about individual 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 and Petroleum Resources now contains introductory sections dealing with Statistics and Departmental Work, followed by sections dealing with Lode Metals; Placer; Structural Materials and Industrial Minerals; Petroleum and Natural Gas; Inspection of Lode Mines, Placer Mines, and Quarries; Coal; and Inspection of Electrical Equipment and Installations at Mines and Quarries, each with its own table of contents. A table listing the properties described, in geographic groupings, precedes the index.

An introductory review of the mineral 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 exploration or production operations 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 property.

The work of the branches of the Department is outlined briefly in the section on Departmental Work. This section is followed by notes dealing briefly with the work of other British Columbia or Federal Government services of particular interest to the mineral industry of British Columbia. Information concerning mine operations and some of the activities of the Inspection Branch of the Department of Mines and Petroleum Resources is contained in the section on Inspection of Lode Mines, Placer Mines, and Quarries, early in the section on Coal, 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.

Review of the Mineral Industry*

Mineral products of British Columbia had a value of more than $181,000,000 in 1961, only exceeded by the value of more than $190,000,000 in 1956. Prices for copper, lead, and zinc were substantially higher in 1956 than in 1961. Greater production of gold, silver, copper, and zinc and materially higher prices for copper, lead, and zinc gave those five metals a combined value for 1956 nearly $26,000,000 greater than their 1961 value. The 1956 production also included more than $6,000,000 for tungsten, of which there was no production in 1961. In 1961 greater production of iron, asbestos, sulphur, and natural gas and the addition of nickel, petroleum, and liquid by-products of natural gas went a long way toward making up for the decreases in principal metals, tungsten, and coal.

The 1961 total value, $181,079,785, compares favourably with the ten-year average, $167,239,104, and represents a small gain over 1960, $179,595,802. It should be noted that the 1960 figure includes the value of a considerable quantity of copper concentrates carried forward into that year because a strike affecting the Tacoma smelter prevented their shipment in 1959, and that the 1961 figure excludes the value of a considerable quantity of copper concentrates produced at the Craigmont mine, awaiting shipment on December 31st.

The metals gold, silver, copper, lead, and zinc account for 60.4 per cent of the total value of all products in 1961. Other metals, iron, nickel, and by-products of silver-lead-zinc ores, contributed 10.3 per cent; industrial minerals contributed 8.45 per cent; structural materials, 10.95 per cent; and fuels—coal, 3.6 per cent, and natural gas plus oil plus liquid by-products of natural gas, 6.2 per cent.

The United States dollar was at a discount in Canada in the first half of 1961 but was at a premium in the second half and averaged a premium of about 1.3 cents for the twelve months of 1961. This gave British Columbia producers of the principal metals, prices in Canadian funds that were above quotations in United States funds. The United States price for silver advanced sharply in the last six weeks of 1961. The United States price for copper ranged from 26.3 cents to 30 cents a pound; the average for the year in Canadian funds, 28.288 cents a pound, is lower than the 1960 or the ten-year average prices. United States prices for lead and zinc were relatively stable. Lead was steady at 11 cents a pound until the end of October, then fell, and at the end of 1961 was steady at 10.25 cents a pound. Zinc remained between 11.5 and 12 cents a pound. Converted into Canadian funds, the prices for lead and zinc are lower than in 1960 and well below the ten-year average.

Production of lead in 1961 was greater than for any year since 1943; however, the price was the lowest since 1947, and the value of lead produced has been exceeded in four years of the past decade. Increased output of lead came mainly from Fort Steele and Nelson Mining Divisions and from the fuming of current and reclaimed slags at the Trail smelter. Zinc output was below the ten-year average in both quantity and value. Compared with 1960, the zinc output of Fort Steele, Nelson, and Vancouver Mining Divisions decreased and that of Golden Mining Division increased. Copper increased materially in the Nicola Mining Division, but due mainly to stockpile differences the Nicola gain was less than the losses in other mining divisions.

* By Hartley Sargent.

Gold output declined mainly in Lillooet and Osoyoos Mining Divisions because the Pioneer mine did not produce and the French mine was closed in May, 1961.

Developments of recent years indicate that the increased output of copper and iron now assured or partly in effect will result in a substantially increased value for metals in 1962 and a still greater value in 1963. The developments include bringing the Craigmont mine into production in the autumn of 1961, and provision for bringing the Kennedy Lake, Zeballos, and Jedway iron mines and the Sunro, Coast Copper, and Bethlehem copper mines into production in 1962.

The value of industrial minerals, structural materials, and fuels has increased notably in the last decade; their combined value in 1952 was $23,509,504 and in 1961 was $53,102,693. The greatest gain in that period was in industrial minerals, attributable mainly to asbestos and to sulphur. The substantial gain in structural materials is distributed through that group. In the fuels group, coal has declined since 1956, although the 1961 output exceeded that of 1958 and subsequent years. Production of natural gas, liquid by-products of natural gas, and crude petroleum all began during the decade. Since 1959 their combined value has exceeded that of coal, and in 1960 and 1961 the value of natural gas alone exceeded that of coal. The completion late in 1961 of the Western Pacific pipe-line from Taylor on the Peace River to a junction with the Trans-Mountain pipe-line at Kamloops provided for oil and liquid by-products of natural gas from northeastern British Columbia access to refineries serving most of the Province, assuring greatly increased production of oil.

The first commercial production of pig iron in British Columbia began in January, 1961, when the plant of The Consolidated Mining and Smelting Company of Canada, Limited, at Kimberley began producing. The plant operated for most of the year at its rated capacity of 100 tons of pig iron daily. The feed for the new plant is iron residue from part of the iron sulphides separated from the Sullivan ore in the concentrator, and used for making sulphuric acid. The residue is prepared by pelletizing and sintering, and fed to an electric furnace where it is reduced to metallic iron and cast as pig iron. The intention has been announced to expand the plant to produce 300 tons of pig iron a day. Along with this increase will go the doubling of capacity to produce sulphuric acid, and fertilizer made by its use. The production of pig iron does not add materially to the value shown for mineral production, as the credit taken is the value of comparable iron ore less the cost of preparing, the roasting-plant residue, for charging into the electric furnace. The industry thus created is a substantial employer of labour directly, and also provides a market for a substantial quantity of coke breeze from the Crowsnest Pass area and of some dolomite quarried near Bull River.

Developments in lode-mining in recent years have included much activity in the Merritt-Ashcroft area and on Vancouver and Queen Charlotte Islands, including exploration and the preparation of four copper mines and three iron mines for production. By far the greater part of the ore they will produce in the next few years will be mined in open pits. In 1961 the total of ore mined at lode-metal operations amounted to 8,392,161 tons. Of this quantity, more than 3,200,000 tons came from open-pit mines. The proportion from open-pit mines will be substantially greater by the end of 1962, and the total tonnage will also increase. However, it is apparent also that some of the iron mines will develop underground operations. Another change in mining practice is the use of a mixture of ammonium nitrate and fuel oil for blasting, both in underground and open-pit operations. This practice has developed rapidly in a very few years, and the use of conventional explosives has been greatly reduced.

Exploration for lode-metal deposits was carried on vigorously in many parts of the Province. Exploration for iron was mainly on Vancouver Island, Moresby Island, and near Kitimat in the mainland coastal area. Exploration for copper was mainly in the Princeton-Kamloops area, on Vancouver Island, and in the area extending northwesterly from Portland Canal to the middle section of the Stikine River. It is apparent that large quantities of milling-grade ore exist in the latter area. During the year, milling-grade copper ore from Mount Washington on Vancouver Island, from Quadra Island, and from Pender Harbour have been taken to Britannia for custom milling. Interest in molybdenum continued, and work was done on properties at Boss Mountain, in the Smithers and Alice Arm areas, and in several other localities. The Noranda company is driving a long adit on the Boss Mountain property. Silver-lead-zinc exploration was concentrated mainly in the Kootenays, and included work west of the Columbia River, north of Revelstoke. This latter area has received little attention until the past few years. It may be thought of as a continuation of the belt that has been so productive of silver-lead-zinc ore south of Nelson and in the Kootenay Lake area.

Exploration for petroleum and natural gas was directed toward the Palæozoic rocks of the Fernie basin, the Devonian of the Fort Nelson area, the Mississippian of the Rocky Mountain foothills, the Tertiary and Cretaceous strata of the Nanaimo-Bellingham basin, and the Tertiary of Graham Island.

Seismic surveys in northeastern British Columbia were considerably increased compared with 1960, and a marine seismic survey was made near Point Roberts. Geological mapping was done by nine companies in northeastern British Columbia and two in the Fernie-Flathead area, and one company made an underwater geological survey off the east coast of Graham Island. Exploration in northeastern British Columbia included three structural test-holes.

Exploratory drilling included ninety-two wildcat wells in northeastern British Columbia, two in the Vancouver-Chilliwack area, and one on Graham Island. A further 142 holes were drilled as development or outpost wells, making a total of 237 wells drilled. The exploratory drilling in northeastern British Columbia resulted in three discoveries of oil and twenty-two of natural gas. The oil discoveries were in the Triassic Boundary Lake zone, indicating a southward extension of the Boundary Lake field and in the Triassic Halfway formation north of Beatton River. Discoveries of natural gas in Middle Devonian carbonate rocks were made west of the Clarke Lake field (one), north of the Kotcho Lake field (two), and west of Kotcho Lake (one). Discoveries were also made in the Upper Devonian, and in the Mississippian Rundle group in the Kotcho Lake area, and in the Permian Belloy formation west of Fort St. John. A total of eleven gas discoveries were made in Triassic rocks, six in the Halfway formation and five in the Upper Schooler Creek formation, north of Fort St. John, and four discoveries of gas were made in the Bullhead group, 25 to 50 miles north of Fort St. John.

The number of lode-mineral claims recorded in 1961 was 19,064, 7,316 more than in 1960; the number of certificates of work issued was 16,665, 3,508 more than in 1960.

Revenue to the Government from petroleum and natural gas amounted to $15,690,202, including rentals, fees, and miscellaneous, $6,545,301; sale of Crown reserves, $7,641,891; royalties, $1,479,193; and miscellaneous fees, $23,817. Land held for petroleum and natural gas, under permits, leases, licences, and drilling reservations, amounted to 33,925,009 acres.

The average number employed through 1961 in placer, lode, coal, industrial-mineral, and structural-material mining was 11,034. Major expenditures by those branches of the industry included: Salaries and wages, $47,657,250; fuel and electricity, $8,545,316; process supplies (inclusive of explosives, chemicals, drill-steel lubricants, etc.), $16,268,411; Federal taxes, $12,688,742; Provincial taxes, $2,475,567; municipal and other taxes, $2,334,795; levies for workmen's compensation (including silicosis), unemployment insurance, and other items, $2,207,-376. Dividends amounted to $20,720,239. The lode-mining industry spent $30,304,050 in freight and treatment charges on ores and concentrates. Returns from some operators in the metal-mining and industrial-mineral sections of the industry indicate that they spent more than $10,000,000* on roads, new construction, machinery, major repairs, and alterations.

Information supplied by the Canadian Petroleum Association indicates that, exclusive of expenditures for land acquisition and rentals, the petroleum and natural-gas industry spent $59,400,000 in British Columbia. The number directly employed by fifty-two operating and development companies at December 31st was 824. The expenditure is broken down into: Exploration, $41,900,000; development drilling, $11,100,000; capital expenditures, field equipment, secondary recovery, pressure-maintenance projects, etc., $3,100,000; operation of wells, flow-lines, etc., $1,400,-000; taxes, royalties, and other expenses, $1,900,000.

Statistics

The statistics of the mineral industry are collected and compiled and the statistical tables for this Report are prepared by the Bureau of Economics and Statistics, Department of Industrial Development, Trade, and Commerce.

The tabulated statistics are designed to cover mineral production in quantity and value, employment, principal expenditures of the mineral industry, and dividends paid. The data are arranged so as to facilitate comparison of the production records for the various mining divisions, and from year to year (1951, 1958).†

In the 1960 Report, Tables I and II were given new forms, Table VIII has been amalgamated with Table VII, and subsequent tables were renumbered.

From time to time, revisions have been made to earlier figures as additional data became available or errors came to light.

METHODS 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, augmented by some data obtained from the Royal Canadian Mint, from the operators of custom smelters, and from the records of the Petroleum and Natural Gas Branch of the Department of Mines and Petroleum Resources. The values are in Canadian funds. Weights are avoirdupois pounds and tons (2,000 lb.) and troy ounces.

* This does not include expenditures at some of the properties being explored or prepared for production.

† In these notes, references such as (1958) are to this section of the Report of the Minister of Mines for the year indicated, where additional information will be found.

Metals

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, in accordance with the procedures adopted by the Dominion Bureau of Statistics and the Department of Mines and Petroleum Resources.

Placer Gold

The value of placer gold in dollars is obtained from returns received annually from the operators (1958). A fineness of 822½ is taken as the average for crude placer gold (p. A 16).

Lode Metals, Gross and Net Contents, and Calculated Value

The gross contents are compiled from the returns made each year by the producers and for any metal are the total assay contents, obtained by multiplying the assay by the weight of ore, concentrates, or bullion.

The value for each principal metal is calculated by multiplying the quantity (gross for gold, net for silver, copper, lead, and zinc) by the average price for the year. The net contents are calculated by taking a percentage of the gross content: in lead ores and concentrates and zinc concentrates—silver, 98 per cent; lead, 95 per cent; zinc, 85* per cent of the total assay content; and in copper concentrates, 95 per cent of the silver and the total assay content of copper less 10 pounds per ton of concentrates.

Other metals, including by-product metals refined in British Columbia and iron, tin, and tungsten exported as ores and concentrates, are treated similarly, except that quantities and values for several are as reported by shippers for sales in the year. The value of by-product iron ore used in making pig iron at Kimberley has been computed from the value per ton of ore of comparable grade, at the point of export from British Columbia, less the cost of preparing the by-product ore for charging into the pig-iron furnace at Kimberley.

Average Metal Prices

The methods of computing prices have varied because of changing conditions (1958). The prices are now arrived at by methods given in footnotes to the table of average prices on page A 16.

Fuel

Coal

All coal produced, including that used in making coke, is shown as primary mine production (1959, tables renumbered in 1960). Washery loss and changes in stocks, year by year, are shown in the table " Collieries of British Columbia, Production and Distribution by Collieries and by Districts " (p. 253).

* For zinc concentrates shipped to foreign smelters the net contents are calculated as the assay content less eight units of zinc per ton of concentrate.

*Natural Gas**

Commercial production of natural gas began in 1954. The production shown in Tables I, III, and VIIA is the total dry and residue gas sold; that is, the quantity delivered to the main transmission-line. The quantity is net after deducting gas used on leases, metering difference, and gas used or lost in the cleaning plant. The gross well output is shown in Table 11, page 202. The quantity is reported as thousands of cubic feet at standard conditions (standard conditions—14.4 pounds per square inch pressure, 60° F. temperature up to and including the year 1960, and thereafter 14.65 pounds per square inch pressure, 60° F. temperature).

*Natural-gas Liquid By-products**

This heading covers condensate removed from natural gas in preparation for transmission through the main gas pipe-line. The by-products consist of butane, propane, and natural gasoline.

*Petroleum**

Production of petroleum began in 1955, and is shown in Tables I, III, and VIIA. The quantity is " net sales " (*see* Tables 10 and 17, pp. 200 and 221), reported in barrels (35 imperial gallons=1 barrel).

CO-OPERATION WITH DOMINION BUREAU OF STATISTICS

In the interests of uniformity and to avoid duplication of effort, beginning with the statistics for 1925, the Dominion Bureau of Statistics and the various Provincial Departments have co-operated in the collection and processing of mineral statistics.

Producers of metals, industrial minerals, structural materials, coal, and petroleum and natural gas are requested to submit returns in duplicate on forms prepared for use by the Province and by the Dominion Bureau of Statistics.

So far as possible both organizations follow the same practice in processing the data. The final compilation by the Dominion Bureau is usually published considerably later than the Report of the Minister of Mines and Petroleum Resources for British Columbia. Differences between the figures published by the two organizations arise mainly from the facts that the Dominion Bureau bases its quantities of lode metals on returns made by smelter operators, whereas the British Columbia mining statistician uses the returns covering shipments from individual mines in the same period, and the Dominion Bureau uses average prices for metals considered applicable to the total Canadian production, whereas the British Columbia mining statistician uses prices considered applicable to British Columbia production. Peat, included under the classification of fuel by the Dominion Bureau, has not been regarded as mineral or fuel, and accordingly has not been included in the British Columbia statistics of mineral production.

* For petroleum, natural gas, and liquid by-products, production figures are supplied by the Petroleum and Natural Gas Branch of the Department of Mines and Petroleum Resources and are compiled from the monthly disposition report, and Crown royalty statement filed with the Department by the producers.

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 ,,	3.98 ,,	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 ,,	4.68
1947	28.78	35.00	72.000 ,,	20.39 ,,	13.670 ,,	11.230 ,,	5.12
1948	28.78	35.00	75.000 Mont.	22.35 U.S.	18.040 ,,	13.930 ,,	6.09
1949	29.60	36.00	74.250 U.S.	19.973 ,,	15.800 U.S.	13.247 U.S.	6.51
1950	31.29	38.05	80.635 ,,	23.428 ,,	14.454 ,,	15.075 ,,	6.43
1951	30.30	36.85	94.55 ,,	27.70 ,,	18.4 ,,	19.9 ,,	6.46
1952	28.18	34.27	83.157 ,,	31.079 ,,	16.121 ,,	15.874 ,,	6.94
1953	28.31	34.42	83.774 ,,	30.333 ,,	13.265 ,,	10.675 ,,	6.88
1954	27.52	34.07	82.982 ,,	29.112 ,,	13.680 ,,	10.417 ,,	7.00
1955	28.39	34.52	87.851 ,,	38.276 ,,	14.926 ,,	12.127 ,,	6.74
1956	28.32	34.44	89.373 ,,	39.787 ,,	15.756 ,,	13.278 ,,	6.59
1957	27.59	33.55	87.057 ,,	26.031 ,,	14.051 ,,	11.175 ,,	6.76
1958	27.94	33.98	86.448 ,,	23.419 ,,	11.755 ,,	10.009 ,,	7.45
1959	27.61	33.57	87.469 ,,	27.708 ,,	11.670 ,,	10.978 ,,	7.93
1960	27.92	33.95	88.633 ,,	28.985 ,,	11.589 ,,	12.557 ,,	6.64
1961	**29.24**	**35.46**	**93.696 ,,**	**28.288 ,,**	**11.011 ,,**	**11.695 ,,**	**6.80**

[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 into 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.

Table I.—Mineral Production: Total to Date, Latest Decade, and Latest Year

	Total Quantity to Date	Total Value to Date	Total Quantity, 1952–61	Total Value, 1952–61	Quantity, 1961	Value, 1961
Principal Metals		$		$		$
Gold—placer ...crude oz.	5,220,779	96,529,305	75,433	2,119,153	3,416	99,884
„ lode ...fine oz.	15,870,009	460,281,415	2,153,858	73,678,269	159,821	5,667,253
Silver ...oz.	431,160,086	265,076,396	79,491,998	69,031,818	7,373,568	6,908,738
Copper ...lb.	3,012,370,068	503,240,551	353,901,695	110,890,409	31,692,412	8,965,149
Lead ...lb.	13,582,977,263	1,025,568,809	3,082,837,362	409,477,253	384,284,524	42,313,569
Zinc ...lb.	11,453,071,945	956,923,509	4,037,321,654	479,428,074	387,951,190	45,370,891
Totals		3,307,619,985		1,144,624,976		109,325,484
Miscellaneous Metals						
Antimony ...lb.	40,760,499	10,474,104	16,209,012	5,827,480	1,331,297	469,948
Bismuth ...lb.	5,410,349	9,209,919	1,734,298	3,692,690	283,363	637,567
Cadmium ...lb.	27,437,159	39,410,710	13,479,206	21,636,076	907,432	1,451,891
Chromite ...tons	796	32,295				
Cobalt ...lb.	1,730	420				
Iron concentrates ...tons	7,909,076	56,971,285	7,720,764	55,936,557	1,315,188	11,494,260
Magnesium ...lb.	204,632	88,184				
Manganese ...tons	1,724	32,668				
Mercury ...lb.	4,163,662	10,409,609	75	250		
Molybdenite (MoS_2) ...lb.	52,171	46,198	9,023	9,500		
Nickel ...lb.	10,712,030	7,667,255	10,430,577	7,579,531	4,180,677	3,194,037
Palladium ...oz.	749	30,462				
Platinum ...oz.	1,400	134,483	10	844		
Selenium ...lb.	731	1,389				
Tin ...lb.	13,818,533	10,694,786	7,033,140	5,120,750	1,119,350	727,578
Tungsten (WO_3) ...lb.	16,019,324	38,663,751	12,567,014	35,204,550		
Other		3,941,542		3,970,605		676,327
Totals		187,809,060		138,928,833		18,651,608
Industrial Minerals						
Arsenious oxide ...lb.	22,019,420	273,201				
Asbestos ...tons	230,800	64,863,967	230,800	64,863,967	45,113	11,129,704
Barite ...tons	189,860	2,363,886	131,018	2,128,341	17,722	178,316
Bentonite ...tons	791	16,858				
Diatomite ...tons	1,803	45,082	476	14,607	214	8,817
Fluorspar ...tons	35,341	784,964				
Fluxes ...tons	3,660,654	5,967,386	856,256	2,381,413	53,335	190,500
Granules ...tons	161,030	2,154,645	125,913	1,663,453	17,463	253,015
Gypsum and gypsite ...tons	2,124,372	8,787,802	1,150,069	3,186,170	131,000	392,000
Hydro-magnesite ...tons	2,253	27,536				
Iron oxide and ochre ...tons	18,108	155,050				
Magnesium sulphate ...tons	13,894	254,352				
Mica ...lb.	12,822,050	185,818	2,459,300	36,037	250,000	8,025
Natro-alunite ...tons	522	9,398				
Perlite ...tons	1,112	11,120	1,112	11,120		
Phosphate rock ...tons	3,842	16,894				
Sodium carbonate ...tons	10,492	118,983				
Sulphur ...tons	4,518,783	47,713,998	2,182,781	25,645,613	242,377	3,207,284
Talc ...tons	1,805	34,871				
Totals		133,785,811		99,930,721		15,367,661
Structural Materials						
Clay products		43,752,952		18,737,836		2,366,464
Cement		106,680,051		59,858,273		7,118,379
Lime and limestone		30,742,637		14,837,895		1,864,315
Rock[1]		28,426,741		16,123,283		1,016,086
Sand and gravel		101,219,600		67,826,902		7,439,710
Stone		8,621,435		1,389,526		70,300
Not assigned		7,010,452				
Totals		326,453,868		178,773,715		19,875,254
Fuels						
Coal[2] ...tons	135,342,692	563,108,381	11,124,699	76,985,661	919,142	6,247,594
Natural gas—						
To pipe-line ...M s.c.f.	306,191,359	23,689,398	306,191,359	23,689,398	95,967,110	8,818,891
Liquid by-products[3] ...bbl.	3,801,400	2,379,900	3,801,400	2,379,900	1,287,672	892,892
Petroleum crude ...bbl.	3,697,821	7,077,840	3,697,821	7,077,840	997,260	1,900,401
Totals		596,255,519		110,132,799		17,859,778
Grand totals		4,551,924,243		1,672,391,044		181,079,785[4]

[1] Rubble, riprap, and crushed stone.
[2] Quantity from 1836 to 1909 is gross mine output and includes material lost in picking and washing. For 1910 and subsequent years the quantity is that sold and used.
[3] Includes propane, butane, and natural-gasoline shipments.
[4] Does not include 68,834 tons of peat moss valued at $3,534,751.

Table II.—Total Value of Production, 1836–1961

1836–1900	$153,077,874	1955	$174,711,086
1901–10	221,928,930	1956	190,067,465
1911–20	331,995,328	1957	172,895,401
1921–30	532,582,031	1958	146,757,699
1931–40	522,040,932	1959	149,501,696
1941–50	941,577,899	1960	179,595,802
1951	176,330,205	1961	181,079,785
1952	171,309,429		
1953	153,188,210	Total	$4,551,924,243
1954	153,284,471		

Table III.—Quantity and Value of Mineral Products for Years 1952 to 1961

Description	1952		1953		1954		1955		1956	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Principal Metals		$		$		$		$		$
Gold—placer, crude ... oz.	17,554	494,756	14,245	403,230	8,684	238,967	7,666	217,614	3,865	109,450
,, lode, fine ... oz.	251,393	8,615,238	253,553	8,727,294	258,388	8,803,279	242,477	8,370,306	191,743	6,603,628
Silver ... oz.	8,796,720	7,315,088	8,376,953	7,017,709	9,825,153	8,153,108	7,902,145	6,942,113	8,404,600	7,511,443
Copper ... lb.	42,005,512	13,054,893	49,021,013	14,869,544	50,150,087	14,599,693	44,328,031	16,932,549	43,360,575	17,251,872
Lead ... lb.	284,949,396	45,936,692	297,634,712	39,481,244	332,474,456	45,482,505	302,567,640	45,161,245	283,718,073	44,702,619
Zinc ... lb.	372,871,717	59,189,656	382,300,862	40,810,618	334,124,560	34,805,755	429,198,565	52,048,909	443,853,004	58,934,801
Totals ...	—	134,606,323	—	111,309,639	—	112,083,307	—	129,672,736	—	135,113,813
Miscellaneous Metals										
Antimony ... lb.	2,333,239	1,028,025	1,551,043	570,474	1,302,333	382,104	2,021,721	667,776	2,140,432	768,843
Bismuth ... lb.	142,246	312,941	71,298	157,569	225,351	493,519	160,767	356,903	156,753	346,424
Cadmium ... lb.	726,172	1,561,270	787,158	1,550,701	680,734	1,123,211	1,593,591	2,677,233	1,937,927	3,236,338
Indium ... oz.	404	889	6,752	9,588	477	1,278	104,774	232,389	363,192	795,390
Iron concentrates ... tons	900,481	5,474,924	991,248	6,763,105	535,746	3,733,891	610,930	3,228,756	369,955	2,190,847
Mercury ... lb.	—	—	—	—	—	—	75	250	—	—
Platinum ... oz.	2	176	—	—	4	408	—	—	—	—
Tin ... lb.	212,113	250,293	1,092,228	581,746	587,528	280,437	391,228	311,613	756,934	637,792
Tungsten (WO_3) ... lb.	1,434,640	4,565,024	2,168,977	5,950,323	2,172,163	5,752,172	1,914,000	5,460,967	2,264,775	6,351,376
Totals ...	—	13,193,542	—	15,583,506	—	11,767,020	—	12,935,897	—	14,327,010
Industrial Minerals										
Asbestos ... tons	20	23,000	3,102	988,716	8,599	2,920,751	17,187	4,265,971	20,356	6,620,060
Barite ... tons	848	13,408	3,560	52,845	5,056	115,337	9,465	238,825	11,436	287,626
Diatomite ... tons	12	240	—	—	—	—	14	280	40	800
Fluxes (quartz, limestone) ... tons	55,588	141,478	37,358	110,698	39,897	40,804	111,759	208,198	176,311	392,429
Granules (quartz, limestone, granite) ... tons	1,610	21,026	4,620	59,321	4,541	65,507	6,355	73,858	13,220	173,214
Gypsum and products ... tons	91,112	235,453	172,665	387,655	175,480	421,734	149,719	383,934	72,973	391,919
Mica ... lb.	314,000	3,001	604,000	11,338	284,000	5,326	505,300	2,861	200,000	1,100
Perlite ... tons	—	—	1,112	11,120	—	—	—	—	—	—
Sulphur ... tons	182,607	1,745,258	151,954	1,590,055	219,999	2,308,422	216,520	2,624,171	212,885	2,523,190
Totals ...	—	2,182,864	—	3,211,748	—	5,877,881	—	7,798,098	—	10,390,338
Structural Materials										
Brick—common ... No.	830,815	28,248	1,382,883	51,381	1,289,911	35,550	4,853,940	232,139	2,248,447	75,767
,, face, paving, sewer ... No.	2,566,540	121,254	4,307,894	226,459	5,651,262	316,676	3,901,866	248,913	6,913,682	485,176
,, firebrick, blocks ...	—	435,681	—	426,783	—	372,528	—	578,578	—	600,753
Clays ... tons	11,483	51,797	5,226	31,990	6,609	36,425	8,033	46,757	7,985	30,263
Structural tile, hollow blocks ...	—	60,273	—	123,469	—	122,903	—	114,460	—	129,257
Drain-tile, sewer-pipe, flue-linings ...	—	468,110	—	627,097	—	753,297	—	801,019	—	696,385
Pottery—glazed or unglazed ...	—	6,536	—	30,012	—	31,081	—	38,035	—	38,385
Other clay products ...	—	11,296	—	19,267	—	32,697	—	55,514	—	69,659
Cement ...	—	3,603,273	—	5,071,260	—	4,935,298	—	5,474,875	—	6,339,071
Lime and limestone ... tons	321,710	1,552,772	338,005	1,357,958	317,976	1,555,002	318,152	1,711,348	396,012	1,220,792
Rubble, riprap, crushed rock ... tons	739,504	982,792	770,415	1,122,516	920,707	1,253,856	890,613	962,272	2,028,143	2,210,315
Sand and gravel ...	—	3,839,965	—	4,388,594	—	4,850,469	—	4,886,890	—	8,535,348
Stone ... tons	122,308	434,964	2,611	78,252	3,055	99,392	26,079	148,454	35,266	139,150
Totals ...	—	11,596,961	—	13,555,038	—	14,395,174	—	15,299,254	—	20,570,321
Fuel										
Coal[1] ... tons	1,402,347	9,729,739	1,384,138	9,528,279	1,308,284	9,154,544	1,332,874	8,986,501	1,417,209	9,346,518
Natural gas ... M s.c.f.	—	—	—	—	60,883	6,545	168,651	18,130	187,846	20,143
Petroleum, crude ... bbl.	—	—	—	—	—	—	582	480	148,454	299,322
Totals ...	—	—	—	—	—	9,161,089	—	9,005,111	—	9,665,983
Provincial totals ...	—	171,309,429	—	153,188,210	—	153,284,471	—	174,711,086	—	190,067,465

Description	1957 Quantity	1957 Value	1958 Quantity	1958 Value	1959 Quantity	1959 Value	1960 Quantity	1960 Value	1961 Quantity	1961 Value
Principal Metals		$		$		$		$		$
Gold—placer, crude ... oz.	2,936	80,990	5,650	157,871	7,570	208,973	3,847	107,418	3,416	$99,884
„ lode, fine ... oz.	223,403	7,495,170	194,354	6,604,149	173,146	5,812,511	205,580	6,979,441	159,821	5,667,253
Silver ... oz.	8,129,047	7,076,904	7,040,416	6,086,299	6,197,159	5,420,593	7,446,237	6,599,823	7,373,568	6,908,738
Copper ... lb.	31,387,441	8,170,465	12,658,649	2,964,529	16,233,546	4,497,991	33,064,429	9,583,724	31,692,412	8,965,149
Lead ... lb.	281,603,346	39,568,086	294,573,159	34,627,075	287,423,357	33,542,306	333,608,699	38,661,912	384,284,524	42,313,569
Zinc ... lb.	449,276,797	50,206,681	432,002,790	43,234,839	402,342,850	44,169,198	403,399,319	50,656,726	387,951,190	45,370,891
Totals	—	112,598,296	—	93,674,762	—	93,651,572	—	112,589,044	—	109,325,484
Miscellaneous Metals										
Antimony ... lb.	1,360,731	577,344	858,633	284,208	1,657,797	540,276	1,651,786	538,482	1,331,297	469,948
Bismuth ... lb.	145,634	314,569	154,034	308,068	181,843	345,502	213,009	419,628	283,363	637,567
Cadmium ... lb.	1,946,397	3,172,627	1,425,108	2,166,164	1,695,821	2,170,651	1,778,866	2,525,990	907,432	1,451,891
Indium ... oz.	384,360	693,770	75,434	117,677	—	—	—	—	—	—
Iron concentrates ... tons	357,342	2,200,637	630,271	4,193,442	849,248	6,363,848	1,160,355	10,292,847	1,315,188	11,494,260
Molybdenite (MoS_2) ... lb.	—	—	—	—	—	—	9,023	9,500	—	—
Nickel ... lb.	—	—	1,408,490	996,507	1,061,532	743,072	3,779,878	2,645,915	4,180,677	3,194,037
Platinum ... oz.	—	—	4	260	—	—	—	—	—	—
Tin ... lb.	709,102	555,936	795,496	625,260	747,443	627,852	621,718	522,243	1,119,350	727,578
Tungsten (WO_3) ... lb.	1,921,483	5,240,479	690,976	1,884,209	—	—	—	—	—	—
Others	—	—	—	—	—	632,933	—	760,364	—	676,327
Totals	—	12,755,362	—	10,575,795	—	11,424,134	—	17,714,969	—	18,651,608
Industrial Minerals										
Asbestos ... tons	31,714	9,245,800	30,078	8,203,384	33,883	9,742,504	40,748	11,724,077	45,113	11,129,704
Barite ... tons	20,072	433,200	16,144	341,700	23,142	187,368	23,573	279,716	17,722	178,316
Diatomite ... tons	120	2,400	27	540	5	100	44	1,430	214	8,817
Fluxes (quartz, limestone) ... tons	137,433	442,204	90,635	311,630[2]	70,570	248,913	83,370	294,559	53,335	190,500
Granules (quartz, limestone, granite) ... tons	17,295	221,864	22,674	284,330	19,072	254,251	19,063	257,067	17,463	253,015
Gypsum and products ... tons	66,499	142,751	70,498	211,494	112,223	282,030	107,900	337,200	131,000	392,000
Mica ... lb.	180,000	1,200	—	—	—	—	122,000	3,186	250,000	8,025
Sulphur ... tons	228,882	2,887,465	211,300	2,410,395	251,552	3,253,677	264,765	3,095,696	242,377	3,207,284
Totals	—	13,376,884	—	11,763,473	—	13,968,843	—	15,992,931	—	15,367,661
Structural Materials										
Brick—common ... No.	663,828	24,345	427,550	15,125	385,810	11,954	2,262,653	187,673	244,532	14,809
„ face, paving, sewer ... No.	4,660,231	345,081	4,871,562	344,133	5,412,822	428,100	1,775,591	145,091	3,728,779	326,346
„ firebrick, blocks	—	658,873	—	405,485	—	538,566	—	621,865		584,969
Clays ... tons	3,849	29,495	4,105	12,579	6,250	17,001	8,003	22,671	7,908	28,396
Structural tile, hollow blocks	—	200,216	—	122,877	—	149,383	—	83,842	—	45,753
Drain-tile, sewer-pipe, flue-linings	—	697,611	—	639,173	—	680,702	—	616,858	—	686,998
Pottery—glazed or unglazed	—	47,612	—	68,387	—	46,902	—	48,825	—	11,890
Other clay products	—	38,868	—	32,416	—	80,910	—	346,883	—	667,303
Cement	—	7,078,108	—	6,755,619	—	7,049,638	—	6,432,752	—	7,118,379
Lime and limestone ... tons	334,303	1,494,578	269,747	997,819	519,580	1,481,292	565,945	1,602,019	758,882	1,864,315
Rubble, riprap, crushed rock ... tons	2,364,301	4,272,768	1,866,950	2,098,952	1,169,854	1,128,353	1,148,305	1,075,373	1,539,640	1,016,086
Sand and gravel	—	10,503,274	—	8,442,676	—	7,342,698	—	7,597,278	—	7,439,710
Stone ... tons	2,403	236,110	2,141	64,335	13,710	69,710	4,328	48,859	5,400	70,300
Totals	—	25,626,939	—	19,999,576	—	19,025,209	—	18,829,989	—	19,875,254
Fuels										
Coal[1] ... tons	1,085,657	7,340,339	796,413	5,937,860	690,011	5,472,064	788,658	5,242,223	919,142	6,247,594
Natural gas delivered to pipe-line ... M s.c.f.	7,126,346	433,830	58,039,491	3,368,327	64,525,633	3,921,583	80,115,399	7,101,949	95,967,110	8,818,891
Natural-gas liquid by-products[3] ... bbl.	27,964	—	489,458	428,297	816,905	465,063	1,179,401	593,648	1,287,672	892,892
Petroleum, crude ... bbl.	345,320	763,751	506,414	1,009,609	861,165	1,573,228	838,626	1,531,049	997,260	1,900,401
Totals	—	8,537,920	—	10,744,093	—	11,431,938	—	14,468,869	—	17,859,778
Provincial totals	—	172,895,401	—	146,757,699	—	149,501,696	—	179,595,802	—	181,079,785

[1] The quantity of coal is that sold and used. [2] Includes 32 tons of fluorspar mined in 1958. [3] Butane, propane, natural gasoline.

TABLE IV.—MINERAL PRODUCTION VALUE, 1895–1961

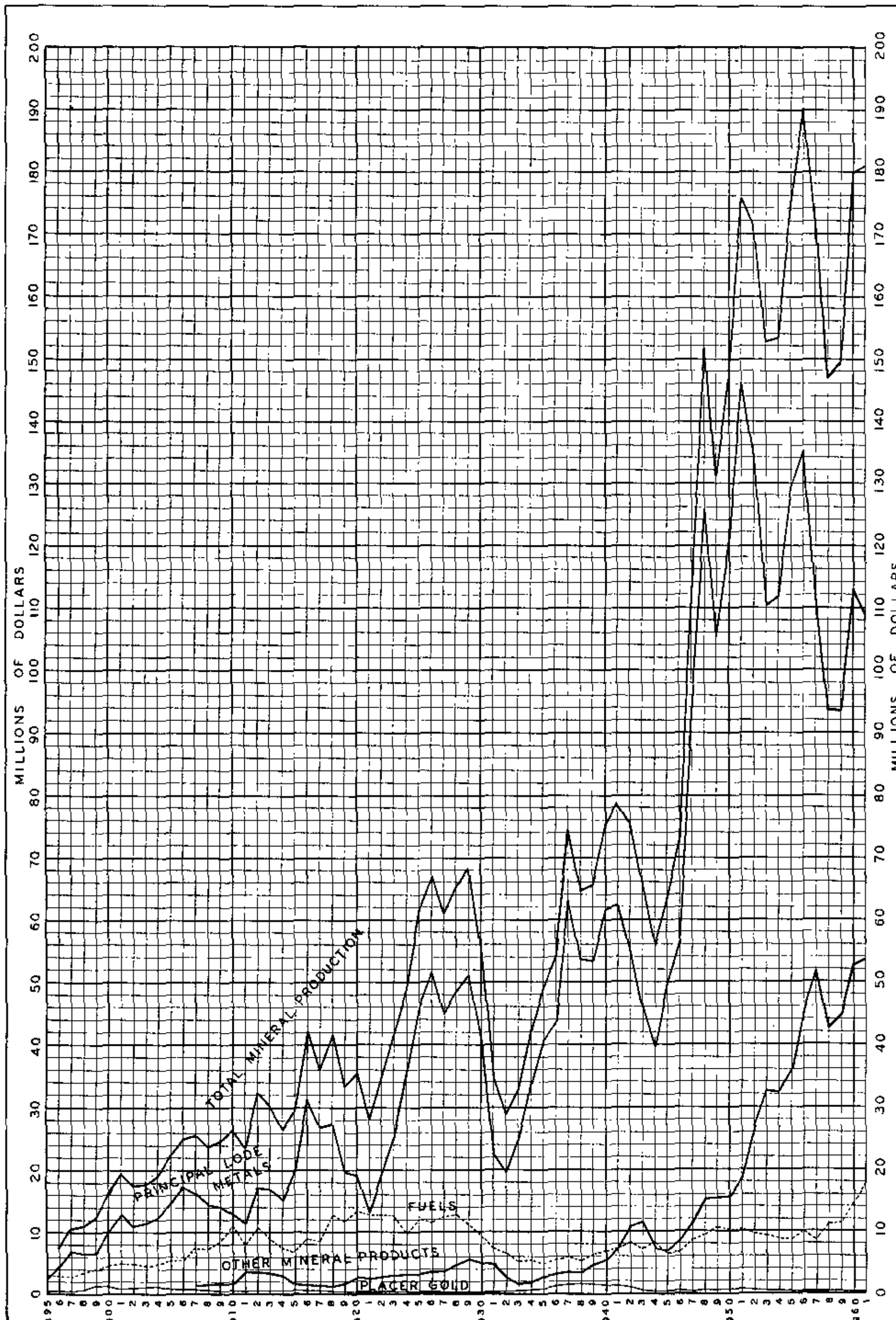

TABLE V.—PRINCIPAL LODE-METALS PRODUCTION, 1911–1961

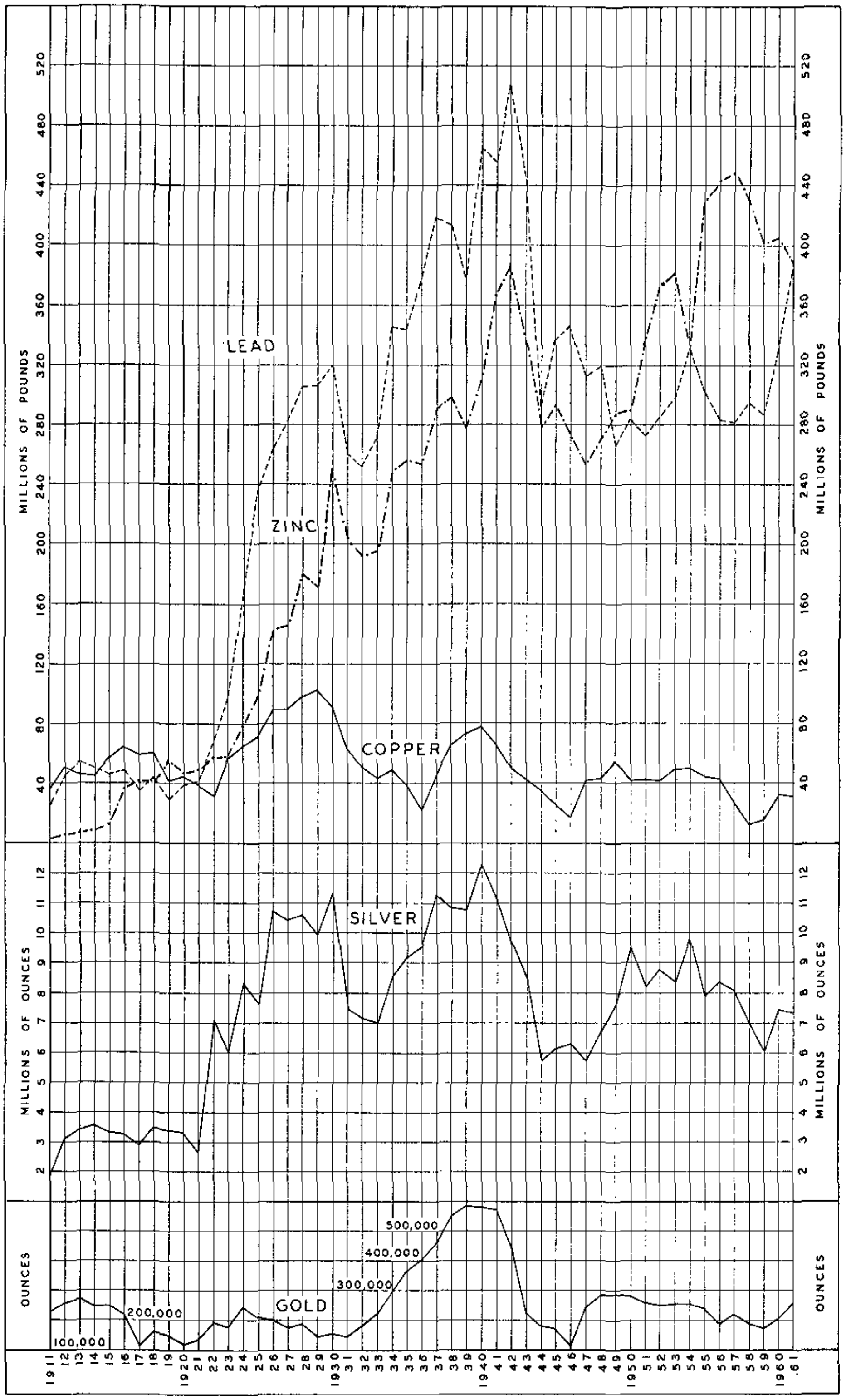

TABLE VI.—PRODUCTION OF PRINCIPAL METALS, 1858–1961

Year	Placer Gold		Gold		Silver		Copper		Lead[3]		Zinc[3, 4]		Total Value
	Quantity[1]	Value	Quantity[2]	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
	Oz.	$	*Oz.*	$	*Oz.*	$	*Lb.*	$	*Lb.*	$	*Lb.*	$	$
1858–86, inclusive	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			643,294
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		139,200	16,288,664
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		17,100	18,449,602
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		46,100	17,090,947
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		99,296	15,223,707
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*

	Oz.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
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
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	145,387	3,005,411	9,960,172	5,278,194	102,793,669	18,612,850	307,999,153	15,555,189	172,096,841	9,268,792	51,839,147
1930	8,955	152,235	160,853	3,325,126	11,328,263	4,322,185	92,362,240	11,990,466	321,803,725	12,638,198	250,479,310	9,017,005	41,445,215
1931	17,176	291,992	146,133	3,020,837	7,550,331	2,254,979	64,134,746	5,365,690	261,902,236	7,097,812	202,071,702	5,160,911	23,192,221
1932	20,400	395,542	181,651	4,263,349	7,150,655	2,264,729	50,608,036	3,228,892	252,007,574	5,326,432	192,120,091	4,621,641	20,100,585
1933	23,928	562,787	223,589	6,394,645	7,021,754	2,656,526	43,149,460	3,216,701	271,689,217	6,497,719	195,963,751	6,291,416	25,619,794
1934	25,181	714,431	297,216	10,253,952	8,613,977	4,088,280	49,651,733	3,683,662	347,366,967	8,461,859	249,152,403	7,584,199	34,786,383
1935	30,929	895,058	365,343	12,856,419	9,269,944	6,005,996	39,428,208	3,073,428	344,268,444	10,785,930	256,239,446	7,940,860	41,557,691
1936	43,389	1,249,940	404,578	14,172,367	9,547,124	4,308,330	21,671,711	2,053,828	377,971,618	14,790,029	254,581,393	8,439,373	45,013,867
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	587,336	21,226,957	10,821,393	4,381,365	73,254,679	7,392,862	378,743,763	12,002,390	278,409,102	8,544,375	55,026,441
1940	39,067	1,236,928	583,416	22,461,516	12,327,944	4,715,315	77,980,223	7,865,085	466,849,112	15,695,467	312,020,671	10,643,025	62,617,336
1941	43,775	1,385,962	571,026	21,984,501	12,175,700	4,658,545	66,435,583	6,700,693	456,840,454	15,358,976	367,869,579	12,548,031	62,636,708
1942	32,904	1,041,772	444,518	17,113,943	9,677,881	4,080,775	50,097,716	5,052,856	507,199,704	17,052,054	387,236,469	13,208,636	57,550,036
1943	14,600	462,270	224,403	8,639,516	8,526,310	3,858,496	42,307,510	4,971,132	439,155,635	16,485,902	336,150,455	13,446,018	47,863,334
1944	11,433	361,977	186,632	7,185,332	5,705,334	2,453,293	36,300,589	4,356,070	292,922,888	13,181,530	278,063,373	11,956,725	39,494,927
1945	12,589	398,591	175,373	6,751,860	6,157,307	2,893,934	25,852,366	3,244,472	336,976,468	16,848,823	294,791,635	18,984,581	49,122,261
1946	15,729	475,361	117,612	4,322,241	6,365,761	5,324,959	17,500,538	2,240,070	345,862,680	23,345,731	274,269,956	21,420,484	57,128,846
1947	6,969	200,585	243,282	8,514,870	5,707,691	4,109,538	41,783,921	8,519,741	313,733,089	42,887,313	253,006,168	28,412,593	92,644,640
1948	20,332	585,200	286,230	10,018,050	6,718,122	5,038,592	43,025,388	9,616,174	320,037,525	57,734,770	270,310,195	37,654,210	120,646,996
1949	17,886	529,524	288,396	10,382,256	7,636,053	5,669,769	54,856,808	10,956,550	265,378,899	41,929,866	288,188,620	38,176,346	107,644,311
1950	19,134	598,717	283,983	10,805,553	9,507,225	7,666,151	42,212,133	9,889,458	284,024,522	41,052,905	290,344,227	43,769,392	113,782,176
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	337,511,324	67,164,754	147,574,900
1952	17,554	494,756	251,393	8,615,238	8,796,720	7,315,088	42,005,512	13,054,893	284,949,396	45,936,692	372,871,717	59,189,656	134,606,323
1953	14,245	403,230	253,553	8,727,294	8,376,953	7,017,709	49,021,013	14,869,544	297,634,712	39,481,244	382,300,862	40,810,618	111,309,639
1954	8,684	238,967	258,388	8,803,279	9,825,153	8,153,108	50,150,087	14,599,693	332,474,456	45,482,505	334,124,560	34,805,755	112,083,307
1955	7,666	217,614	242,477	8,370,306	7,902,145	6,942,113	44,238,031	16,932,549	302,567,640	45,161,245	429,198,565	52,048,909	129,672,736
1956	3,865	109,450	191,743	6,603,628	8,404,600	7,511,443	43,360,575	17,251,872	283,718,073	44,702,619	443,853,004	58,934,801	135,113,813
1957	2,936	80,990	223,403	7,495,170	8,129,047	7,076,904	31,387,441	8,170,465	281,603,346	39,568,086	449,276,797	50,206,681	112,598,296
1958	5,650	157,871	194,354	6,604,149	7,040,416	6,086,299	12,658,649	2,964,529	294,573,159	34,627,075	432,002,790	43,234,839	93,674,762
1959	7,570	208,973	173,146	5,812,511	6,197,159	5,420,593	16,233,546	4,497,991	287,423,357	33,542,306	402,342,850	44,169,198	93,651,572
1960	3,847	107,418	205,580	6,979,441	7,446,237	6,599,823	33,064,429	9,583,724	333,608,699	38,661,912	403,399,319	50,656,726	112,589,044
1961	3,416	99,884	159,821	5,667,253	7,373,568	6,908,738	31,692,412	8,965,149	384,284,524	42,313,569	387,951,190	45,370,891	109,325,484
Totals	5,220,779	96,529,305	15,870,009	460,281,415	431,160,086	265,076,396	3,012,370,068	503,240,551	13,582,977,263	1,025,568,809	11,453,071,945	956,923,509	3,307,619,985

[1] Ounces of crude gold.

[2] Ounces of fine gold.

[3] Revisions have been made in 1958 to some yearly totals for lead and zinc to bring them into agreement with the best records of recoveries of lead and zinc from slags treated at the Trail smelter.

[4] For 1905–08, inclusive, records show shipments of a combined total of 18,847 tons of zinc ore and zinc concentrates of unstated zinc content.

TABLE VIIA.—PRODUCTION, 1960 AND 1961, AND

Division	Period	Placer Gold		Principal Lode Metals	Miscellaneous Metals	Industrial Minerals	Structural Materials
		Quantity[1]	Value				
		Oz.	$	$	$	$	$
Alberni	1960	....	....	511	....	....	84,361
	1961	4	117	5,095	....	....	85,576
	To date	1,617	33,253	11,697,294	....	9,398	1,144,945
Atlin	1960	1,959	54,700	1,156	....	....	22,481
	1961	2,271	66,404	....	....	....	16,050
	To date	734,309	17,344,720	37,483,344	562,122	20,325	291,719
Cariboo	1960	1,634	45,625	666,212	....	4,616	785,135
	1961	645	18,860	720,827	....	16,842	733,870
	To date	2,602,922	53,944,751	39,626,641	23,730	188,262	5,506,368
Clinton	1960	....	....	....	....	....	....
	1961	48	1,404	....	....	....	....
	To date	10,141	242,238	847,454	900	162,427	110,928
Fort Steele	1960	6	168	59,647,970	522,243	643,145	249,941
	1961	12	351	56,145,948	837,578	610,950	249,246
	To date	20,487	467,103	1,601,232,180	10,896,793	5,542,597	4,908,614
Golden	1960	....	....	3,098,048	43,181	616,916	81,596
	1961	....	....	3,557,806	59,539	570,316	114,986
	To date	469	11,268	44,801,748	526,647	4,512,896	1,592,211
Greenwood	1960	....	....	3,842,662	8,823	....	36,885
	1961	18	526	3,592,712	8,822	....	33,876
	To date	5,074	115,662	124,701,692	97,236	2,323,897	839,320
Kamloops	1960	5	139	....	35,968	....	495,977
	1961	1	29	....	....	....	637,651
	To date	27,556	603,620	3,044,836	101,646	6,528,308	8,569,889
Liard	1960	....	....	....	....	12,306,732	208,145
	1961	72	2,105	....	....	12,223,362	216,995
	To date	50,154	1,247,291	6,312	79	67,189,218	1,755,412
Lillooet	1960	30	838	4,815,524	....	....	140,967
	1961	32	936	3,787,608	....	....	132,255
	To date	91,891	1,893,549	126,694,031	48,350	5,129	1,455,157
Nanaimo	1960	....	....	624,206	10,256,879	23,302	1,555,579
	1961	....	....	577,450	11,384,260	19,445	1,907,459
	To date	866	19,300	7,796,247	56,757,509	745,783	33,450,455
Nelson	1960	....	....	12,419,532	712,603	....	106,553
	1961	4	117	15,505,864	909,050	....	183,675
	To date	3,585	88,988	180,283,288	41,428,922	64,126	2,932,999
New Westminster	1960	11	307	392,131	2,645,915	120,441	4,716,804
	1961	16	468	417,194	3,194,037	114,437	5,086,910
	To date	11,608	243,614	1,235,293	7,667,255	787,371	69,582,745
Nicola	1960	....	....	1,589	....	....	22,529
	1961	....	....	1,855,744	....	....	37,031
	To date	234	4,764	2,428,461	....	10,050	495,140
Omineca	1960	179	4,998	33,916	941	....	299,196
	1961	278	8,129	34,002	1,542	....	346,610
	To date	52,932	1,402,660	17,379,510	15,633,718	11,460	3,556,792
Osoyoos	1960	....	....	237,680	....	407,823	684
	1961	....	....	119,560	....	309,573	51,450
	To date	208	4,639	51,051,405	1,020	3,734,302	1,024,656
Revelstoke	1960	....	....	278,186	12,069	....	45,630
	1961	3	88	....	....	....	35,911
	To date	7,582	164,477	11,058,917	185,244	....	1,290,149
Similkameen	1960	3	84	23,549	....	....	71,260
	1961	2	58	....	....	....	73,175
	To date	12,148	288,211	120,061,655	128,661	18,558	2,332,327
Skeena	1960	....	....	467,671	....	....	181,166
	1961	....	....	344,680	....	....	183,562
	To date	4,603	105,569	210,645,048	337,504	1,240,215	7,104,665
Slocan	1960	....	....	6,910,292	151,792	....	109,665
	1961	....	....	5,970,229	167,459	....	61,975
	To date	366	9,397	184,719,885	3,048,364	....	927,532
Trail Creek	1960	2	56	55,803	....	....	66,474
	1961	....	....	86,043	....	....	116,386
	To date	851	24,260	82,871,278	35,774	....	1,837,883
Vancouver	1960	....	....	6,903,597	46,952	56,206	5,018,309
	1961	....	....	4,634,683	....	101,426	4,553,416
	To date	182	5,306	208,476,451	968,758	6,371,700	47,549,908
Vernon	1960	18	503	34	9,500	....	144,814
	1961	10	292	....	....	....	48,131
	To date	2,705	72,282	188,345	9,500	3,978	2,652,402
Victoria	1960	....	....	772,520	....	60	4,390,838
	1961	....	....	....	....	60	4,969,058
	To date	628	15,680	8,775,561	35,437	188,246	114,277,401
Not assigned[4]	1960	....	....	11,288,837	3,268,603	1,813,690	....
	1961	....	....	11,870,155	2,089,321	1,401,250	....
	To date	1,577,661	18,176,703	133,988,804	49,313,891	34,127,565	11,264,251
Totals	1960	[1] 3,847	107,418	112,481,626	17,714,969	15,992,931	18,829,989
	1961	[1] 3,416	99,884	109,225,600	18,651,608	15,367,661	19,875,254
	To date	5,220,779	96,529,305	3,211,090,680	187,809,060	133,785,811	326,453,868

1 Crude gold—equivalent in fine gold: 1960, 3,164 oz.; 1961, 2,817 oz. The year of first recorded production for the major placer-producing mining divisions was: Atlin, 1898; Cariboo, 1858; Lillooet, 1874; Quesnel, 1858.

2 Quantity from 1836 to 1909 is gross mine output and includes material lost in picking and washing. For 1910 and subsequent years the quantity is that sold and used. Year of first production by mining divisions: Cariboo, 1942; Fort Steele, 1898; Kamloops, 1893; Liard, 1923; Nanaimo, 1836; Nicola, 1907; Omineca, 1918; Osoyoos, 1926; Similkameen, 1909; Skeena, 1912.

TOTAL TO DATE, BY MINING DIVISIONS—SUMMARY

Fuels								Division Totals
Coal		Petroleum		Natural Gas (Direct to Pipe-line)		Liquid By-products[3]		
Quantity[2]	Value	Quantity	Value	Quantity	Value	Quantity	Value	
Tons	$	Bbl.	$	M S.C.F.	$	Bbl.	$	$
......	......	......	......	......	......	......	......	84,872
......	......	......	......	......	......	......	......	**90,788**
......	......	......	......	......	......	......	......	12,884,890
......	......	......	......	......	......	......	......	78,337
......	......	......	......	......	......	......	......	**82,454**
......	......	......	......	......	......	......	......	55,702,230
......	......	......	......	......	......	......	......	1,501,588
......	......	......	......	......	......	......	......	**1,490,399**
290	1,100	......	......	......	......	......	......	99,290,852
......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	**1,404**
......	......	......	......	......	......	......	......	1,363,947
674,042	4,618,360	......	......	......	......	......	......	65,681,827
834,718	**5,425,265**	......	......	......	......	......	......	**63,269,338**
53,198,320	230,500,591	......	......	......	......	......	......	1,853,547,878
......	......	......	......	......	......	......	......	3,839,741
......	......	......	......	......	......	......	......	**4,302,647**
......	......	......	......	......	......	......	......	51,444,770
......	......	......	......	......	......	......	......	3,887,870
......	......	......	......	......	......	......	......	**3,635,936**
......	......	......	......	......	......	......	......	128,077,807
......	......	......	......	......	......	......	......	532,084
......	......	......	......	......	......	......	......	**637,680**
15,087	59,765	......	......	......	......	......	......	18,908,064
2,293	21,526	838,626	1,531,049	80,115,399	7,101,949	1,179,401	593,648	21,758,049
2,062	**17,000**	**997,260**	**1,900,401**	**95,967,110**	**8,818,891**	**1,287,672**	**892,892**	**24,071,646**
96,848	675,856	3,697,821	7,077,840	306,191,359	23,689,398	3,801,400	2,379,900	104,021,306
......	......	......	......	......	......	......	......	4,957,329
......	......	......	......	......	......	......	......	**3,920,799**
......	......	......	......	......	......	......	......	130,096,216
105,499	530,154	......	......	......	......	......	......	12,990,120
76,009	**736,814**	......	......	......	......	......	......	**14,625,428**
74,051,038	298,518,486	......	......	......	......	......	......	397,287,780
......	......	......	......	......	......	......	......	13,238,688
......	......	......	......	......	......	......	......	**16,598,706**
......	......	......	......	......	......	......	......	224,798,323
......	......	......	......	......	......	......	......	7,875,598
......	......	......	......	......	......	......	......	**8,813,046**
......	......	......	......	......	......	......	......	79,516,278
213	2,183	......	......	......	......	......	......	26,301
159	**1,717**	......	......	......	......	......	......	**1,894,492**
2,929,632	11,078,801	......	......	......	......	......	......	14,017,216
5,417	60,448	......	......	......	......	......	......	899,499
5,850	**64,024**	......	......	......	......	......	......	**454,307**
427,001	2,714,933	......	......	......	......	......	......	40,699,073
......	......	......	......	......	......	......	......	646,187
......	......	......	......	......	......	......	......	**480,583**
1,122	5,008	......	......	......	......	......	......	55,821,030
......	......	......	......	......	......	......	......	335,885
......	......	......	......	......	......	......	......	**35,999**
......	......	......	......	......	......	......	......	12,693,787
1,194	9,552	......	......	......	......	......	......	104,445
346	**2,774**	......	......	......	......	......	......	**76,007**
4,623,317	19,553,725	......	......	......	......	......	......	142,383,137
......	......	......	......	......	......	......	......	648,837
......	......	......	......	......	......	......	......	**528,242**
37	116	......	......	......	......	......	......	219,433,117
......	......	......	......	......	......	......	......	7,171,749
......	......	......	......	......	......	......	......	**6,199,663**
......	......	......	......	......	......	......	......	188,705,178
......	......	......	......	......	......	......	......	122,339
......	......	......	......	......	......	......	......	**202,429**
......	......	......	......	......	......	......	......	84,769,195
......	......	......	......	......	......	......	......	12,025,064
......	......	......	......	......	......	......	......	**9,289,525**
......	......	......	......	......	......	......	......	263,372,123
......	......	......	......	......	......	......	......	154,851
......	......	......	......	......	......	......	......	**46,423**
......	......	......	......	......	......	......	......	2,926,507
......	......	......	......	......	......	......	......	5,163,418
......	......	......	......	......	......	......	......	**4,969,118**
......	......	......	......	......	......	......	......	128,292,325
......	......	......	......	......	......	......	......	16,371,130
......	......	......	......	......	......	......	......	**15,360,726**
......	......	......	......	......	......	......	......	246,871,214
788,658	5,242,223	838,626	1,531,049	80,115,899	7,101,949	1,179,401	593,648	179,595,802
919,142	**6,247,594**	**997,260**	**1,900,401**	**95,967,110**	**8,818,891**	**1,287,672**	**892,892**	**181,079,785**
135,342,692	563,108,381	3,697,821	7,077,840	306,191,359	23,689,398	3,801,400	2,379,900	4,551,924,243

[3] Includes propane, butane, and natural gasoline.

[4] *Re* " not assigned," *see* footnotes under Tables VIIB and VIIC.

NOTE.—For individual metals, industrial minerals, and structural materials, *see* Tables VIIB, VIIC, VIID, and VIIE.

TABLE VIIB.—PRODUCTION, 1960 AND 1961, AND TOTAL TO DATE, BY MINING DIVISIONS—PRINCIPAL LODE METALS

Division	Period	Lode Gold		Silver		Copper		Lead		Zinc		Division Total
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
		Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
Alberni	1960	15	509	2	2							511
	1961	**139**	**4,929**	**98**	**91**			**690**	**75**			**5,095**
	To date	301,243	11,270,553	162,523	78,086	2,290,699	343,518	118,627	5,137			11,697,294
Atlin	1960	34	1,154	3	2							1,156
	1961											
	To date	344,197	12,126,732	3,375,333	2,893,942	24,777,661	8,160,266	23,765,211	3,437,907	91,067,749	10,864,497	37,483,344
Cariboo	1960	19,552	663,791	2,732	2,421							666,212
	1961	**20,243**	**717,817**	**3,213**	**3,010**							**720,827**
	To date	1,101,178	39,539,305	126,824	82,673	2,352	920	24,560	3,724	505	19	39,626,641
Clinton	1960											
	1961											
	To date	23,390	827,328	31,564	14,214	57,548	5,905	193	7			847,454
Fort Steele	1960	362	12,290	5,177,507	4,588,980			259,357,600	30,056,952	199,010,500	24,989,748	59,647,970
	1961	**367**	**13,014**	**5,199,531**	**4,871,753**			**281,169,600**	**30,959,585**	**173,592,100**	**20,301,596**	**56,145,948**
	To date	5,281	151,078	208,066,428	120,904,084	28,592	6,193	11,546,216,601	841,212,936	8,314,996,600	638,957,889	1,601,232,180
Golden	1960			194,659	172,532	147,739	42,822	9,054,501	1,049,326	14,600,369	1,833,368	3,098,048
	1961			**283,669**	**265,787**	**40,590**	**11,482**	**9,435,501**	**1,038 943**	**19,167,112**	**2,241,594**	**3,557,806**
	To date	169	4,844	3,468,025	2,635,908	1,094,088	342,943	223,095,645	21,182,385	248,754,975	20,635,668	44,801,748
Greenwood	1960	18,861	640,331	957,789	848,917	7,307,427	2,118,058	877,617	101,707	1,064,340	133,649	3,842,662
	1961	**17,207**	**610,160**	**943,009**	**883,562**	**6,744,419**	**1,907,861**	**782,690**	**86,182**	**897,363**	**104,947**	**3,592,712**
	To date	1,176,673	25,874,964	33,903,657	20,809,954	458,306,147	75,351,859	16,525,392	1,330,423	17,617,130	1,334,492	124,701,692
Kamloops	1960											
	1961											
	To date	47,868	1,608,328	304,512	181,984	6,411,583	1,179,668	538,097	45,030	438,023	29,826	3,044,836
Liard	1960											
	1961											
	To date	114	4,120	540	446	56	22	10,102	1,724			6,312
Lillooet	1960	141,087	4,789,903	28,907	25,621							4,815,524
	1961	**106,226**	**3,766,774**	**22,236**	**20,834**							**3,787,608**
	To date	3,619,739	126,135,458	880,704	555,982	400	41	62,513	2,548	15	2	126,694,031
Nanaimo	1960	1,517	51,502	31,522	27,939	1,879,473	544,765					624,206
	1961	**1,269**	**44,999**	**32,351**	**30,312**	**1,775,097**	**502,139**					**577,450**
	To date	89,128	2,095,459	669,619	425,315	28,198,826	5,275,473					7,796,247
Nelson	1960	274	9,302	122,762	108,808			20,227,114	2,344,120	79,281,898	9,957,302	12,419,532
	1961	**565**	**20,035**	**185,788**	**174,076**	**4,615**	**1,305**	**39,997,332**	**4,404,106**	**93,256,453**	**10,906,342**	**15,505,864**
	To date	1,329,986	41,593,017	8,224,085	5,021,897	14,802,985	1,683,575	325,627,292	38,765,342	760,915,513	93,219,457	180,283,288

		Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
New Westminster	1960					1,352,874	392,131					392,131
	1961			**49**	**46**	**1,474,646**	**417,148**					**417,194**
	To date	4,449	113,528	14,203	6,662	4,033,551	1,113,503	28,425	1,119	12,755	481	1,235,293
Nicola	1960			17	15	5,430	1,574					1,589
	1961	**16**	**567**	**8,063**	**7,555**	**6,528,767**	**1,846,858**	**3,696**	**407**	**3,052**	**357**	**1,855,744**
	To date	8,541	235,481	275,499	134,158	7,089,909	1,956,945	2,239,124	90,923	323,735	10,954	2,428,461
Omineca	1960	22	747	13,977	12,388			97,985	11,355	75,062	9,426	33,916
	1961	**15**	**532**	**11,352**	**10,636**			**111,115**	**12,235**	**90,632**	**10,599**	**34,002**
	To date	25,090	774,426	9,557,879	7,594,030	6,750,202	1,545,334	28,019,982	3,553,069	31,603,719	3,912,651	17,379,510
Osoyoos	1960	6,435	218,468	1,811	1,605	59,650	17,290	1,802	209	864	108	237,680
	1961	**3,332**	**118,153**	**1,233**	**1,155**			**1,227**	**135**	**1,003**	**117**	**119,560**
	To date	1,647,920	50,238,942	592,518	388,781	2,843,616	417,190	129,123	5,798	9,420	694	51,051,405
Revelstoke	1960	8	272	2,950	2,615			92,889	10,765	2,106,665	264,534	278,186
	1961											
	To date	37,300	1,069,260	4,107,618	2,766,476	153,686	51,037	36,343,774	3,853,894	27,194,200	3,313,250	11,053,917
Similkameen	1960	538	18,265	223	198	17,548	5,086					23,549
	1961											
	To date	184,012	6,327,260	4,219,439	2,582,266	601,187,921	111,134,861	382,544	13,304	72,275	3,964	120,061,655
Skeena	1960	7,548	256,255	199,498	176,821			112,695	13,060	171,494	21,535	467,671
	1961	**6,471**	**229,462**	**110,593**	**103,621**			**53,109**	**5,848**	**49,154**	**5,749**	**344,680**
	To date	2,407,874	60,739,375	68,677,739	43,937,433	689,106,270	98,025,648	59,912,896	5,426,103	17,028,222	2,516,489	210,645,048
Slocan	1960	123	4,176	521,900	462,576			26,303,094	3,048,266	27,038,893	3,395,274	6,910,292
	1961	**133**	**4,716**	**450,278**	**421,892**			**22,684,369**	**2,497,776**	**26,043,994**	**3,045,845**	**5,970,229**
	To date	15,788	455,724	70,341,972	45,174,307	229,696	43,512	876,282,964	71,825,379	693,060,075	67,220,963	184,719,885
Trail Creek	1960	395	13,410	1,020	904	143,095	41,476	57	7	51	6	55,803
	1961	**518**	**18,368**	**1,359**	**1,273**	**234,734**	**66,402**					**86,043**
	To date	2,950,615	62,617,907	3,624,266	2,069,217	121,577,851	18,158,785	135,754	11,004	119,621	14,365	82,871,278
Vancouver	1960	8,590	291,631	74,091	65,669	17,911,128	5,191,540	209,794	24,313	10,595,235	1,330,444	6,903,597
	1961	**3,213**	**113,933**	**53,718**	**50,332**	**13,466,438**	**3,809,386**	**59,194**	**6,518**	**5,596,531**	**654,514**	**4,634,683**
	To date	455,806	14,550,604	4,886,187	3,007,370	960,466,782	161,546,792	18,153,821	1,829,920	213,382,130	27,541,765	208,476,451
Vernon	1960	1	34									34
	1961											
	To date	5,224	176,082	12,823	8,084	654	100	24,913	2,933	10,816	1,146	188,345
Victoria	1960			14,062	12,464	2,622,243	760,056					772,520
	1961											
	To date	37,663	812,730	876,220	506,255	36,028,550	7,152,805	210,097	19,848	3,568,709	283,923	8,775,561
Not assigned[1]	1960	218	7,401	100,805	89,346	1,617,822	468,926	17,273,551	2,001,832	69,453,948	8,721,332	11,288,837
	1961	**107**	**3,794**	**67,028**	**62,803**	**1,423,106**	**402,568**	**29,986,001**	**3,301,759**	**69,253,796**	**8,099,231**	**11,870,155**
	To date	50,761	938,910	4,759,909	3,296,872	46,930,443	9,743,656	425,129,613	32,948,352	1,032,895,758	87,061,014	133,988,804
Totals	1960	205,580	6,979,441	7,446,237	6,599,823	33,064,429	9,583,724	333,608,699	38,661,912	403,399,319	50,656,726	112,481,626
	1961	**159,821**	**5,667,253**	**7,373,568**	**6,908,738**	**31,692,412**	**8,965,149**	**384,284,524**	**42,313,569**	**387,951,190**	**45,370,891**	**109,225,600**
	To date	15,870,009	460,281,415	431,160,086	265,076,396	3,012,370,068	503,240,551	13,582,977,263	1,025,568,809	11,453,071,945	956,923,509	3,211,090,680

[1] Gold, silver, copper, and some lead " not assigned " were recovered at the Tacoma smelter from dross shipped from the Trail smelter. The zinc and most of the lead were recovered at the Trail smelter by fuming current and reclaimed slag.

TABLE VIIC.—PRODUCTION, 1960 AND 1961, AND TOTAL TO DATE, BY MINING DIVISIONS—MISCELLANEOUS METALS

Division	Period	Antimony		Bismuth		Cadmium		Chromite		Iron Concentrates		Manganese		Mercury	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		Lb.	$	Lb.	$	Lb.	$	Tons	$	Tons	$	Tons	$	Lb.	$
Atlin	1960														
	1961														
	To date					319,212	561,762								
Cariboo	1960														
	1961														
	To date														
Clinton	1960														
	1961														
	To date							126	900						
Fort Steele	1960														
	1961									**51,171**	**110,000**				
	To date					1,837	3,823			51,171	110,000				
Golden	1960					30,409	43,181								
	1961					**37,212**	**59,539**								
	To date	40,062	14,906			310,455	511,741								
Greenwood	1960					5,861	8,323								
	1961					**5,514**	**8,822**								
	To date					39,241	65,841	670	31,395						
Kamloops	1960									4,058	35,968				
	1961														
	To date									21,167	95,851			10,987	5,795
Liard	1960														
	1961														
	To date														
Lillooet	1960														
	1961														
	To date	13,466	4,321											1,783	3,555
Nanaimo	1960									1,156,297	10,256,879				
	1961									**1,264,017**	**11,384,260**				
	To date									7,834,988	56,757,509				
Nelson	1960					501,833	712,603								
	1961					**568,156**	**909,050**								
	To date					4,446,178	7,510,233								
New Westminster	1960														
	1961														
	To date														
Omineca	1960					663	941								
	1961					**964**	**1,542**								
	To date	104,489	15,217			262,114	518,118							4,150,892	10,400,259
Osoyoos	1960														
	1961														
	To date											161			
Revelstoke	1960					8,499	12,069								
	1961														
	To date	9,394	3,455			103,612	176,102								

		Lb.	$	Lb.	$	Lb.	$	Tons	$	Tons	$	Tons	$	Lb.	$
Similkameen	1960														
	1961														
	To date														
Skeena	1960														
	1961														
	To date					141,890	316,764			1,200	6,000				
Slocan	1960					106,896	151,792								
	1961					**104,662**	**167,459**								
	To date	31,865	8,133			1,699,057	3,032,071					541	8,160		
Trail Creek	1960														
	1961														
	To date					115	210			550	1,925				
Vancouver	1960					33,065	46,952								
	1961														
	To date					473,365	968,758								
Vernon	1960														
	1961														
	To date														
Victoria	1960														
	1961														
	To date					7,000	10,929					1,167	24,508		
Not assigned[2 3 4]	1960	1,651,786	538,482	213,009	419,628	1,091,640	1,550,129								
	1961	**1,331,297**	**469,948**	**283,363**	**637,567**	**190,924**	**305,479**								
	To date	40,561,223	10,428,072	5,410,349	9,209,919	19,633,083	25,734,358								
Totals	1960	1,651,786	538,482	213,009	419,628	1,778,866	2,525,990			1,160,355	10,292,847				
	1961	**1,331,297**	**469,948**	**283,363**	**637,567**	**907,432**	**1,451,891**			**1,315,188**	**11,494,260**				
	To date	40,760,499	10,474,104	5,410,349	9,209,919	27,437,159	39,410,710	796	32,295	7,909,076	56,971,285	1,724	32,668	4,163,662	10,409,609

1 Estimated manganese content of about 40 tons of ore shipped for testing purposes by Olalla Mines Ltd. in 1956.

2 Antimony assigned to individual mining divisions is the reported content of concentrates exported to foreign smelters. Antimony "not assigned" is the antimony content of antimonial lead or of other antimony products at the Trail smelter.

3 Cadmium assigned to individual mining divisions is the reported content of custom shipments to the Trail smelter and to foreign smelters. Cadmium "not assigned" is the remainder of the reported estimated recovery at the Trail smelter from British Columbia concentrates.

4 Bismuth and indium recovered at the Trail smelter are not assigned to mining divisions and may include some metal from sources outside British Columbia.

Principal productive periods: Antimony, 1939–61; bismuth, 1929–61; cadmium, 1928–61; chromite, 1918 and 1929; indium, 1942–61; iron concentrates, 1951–61; manganese, 1918–20; mercury, 1940–44; molybdenite, 1914–18; nickel, 1958–61; palladium, 1928; platinum, 1887–1951; tin, 1941–61; tungsten, 1937–58.

TABLE VIIc.—PRODUCTION, 1960 AND 1961, AND TOTAL TO DATE, BY MINING DIVISIONS—MISCELLANEOUS METALS—*Continued*

Division	Period	Molybdenite (MoS_2)		Nickel		Palladium		Platinum		Tin		Tungsten (WO_3)		Other Value	Division Totals
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value		
		Lb.	$	Lb.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	$	$
Atlin	1960														
	1961														
	To date											292	360		562,122
Cariboo	1960														
	1961														
	To date							59	2,299			27,698	21,431		23,730
Clinton	1960														
	1961														
	To date														900
Fort Steele	1960									621,718	522,243				522,243
	1961									**1,119,350**	**727,578**				**837,578**
	To date									13,818,533	10,694,786			88,184[5]	10,896,793
Golden	1960														43,181
	1961														**59,539**
	To date														526,647
Greenwood	1960														8,323
	1961														**8,822**
	To date														97,236
Kamloops	1960														35,968
	1961														
	To date														101,646
Liard	1960														
	1961														
	To date							2	79						79
Lillooet	1960														
	1961														
	To date	2,448	2,440					3	113			32,353	37,921		48,350
Nanaimo	1960														10,256,879
	1961														**11,384,260**
	To date														56,757,509
Nelson	1960														712,603
	1961														**909,050**
	To date	25,058	18,378									13,739,939	33,900,311		41,428,922
New Westminster	1960			3,779,878	2,645,915										2,645,915
	1961			**4,180,677**	**3,194,037**										**3,194,037**
	To date			10,712,030	7,667,255										7,667,255
Omineca	1960														941
	1961														**1,542**
	To date	1,608	1,840					3	154			2,210,892	4,697,710	420[6]	15,633,718
Osoyoos	1960														
	1961														
	To date	1,020	1,020												1,020
Revelstoke	1960														12,060
	1961														
	To date											7,784	5,687		185,244

		Lb.	$	Lb.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	$	$
Similkameen	1960														
	1961														
	To date							1,280	128,661						128,661
Skeena	1960														
	1961														
	To date	13,022	18,020									360	331	1,889[7]	337,504
Slocan	1960														151,792
	1961														**167,459**
	To date														3,048,364
Trail Creek	1960														
	1961														
	To date					749	30,462	53	3,177						35,774
Vancouver	1960														46,952
	1961														
	To date														968,758
Vernon	1960	9,023	9,500												9,500
	1961														
	To date	9,023	9,500												9,500
Victoria	1960														
	1961														
	To date														35,437
Not assigned	1960													760,364	3,268,603
	1961													**676,327**	**2,089,321**
	To date													3,941,542	49,313,891
Totals	1960	9,023	9,500	3,779,878	2,645,915					621,718	522,243			760,364	17,714,969
	1961			**4,180,677**	**3,194,037**					**1,119,350**	**727,578**			**676,327**	**18,651,608**
	To date	52,171	46,198	10,712,030	7,667,255	749	30,462	1,400	134,483	13,818,533	10,694,786	16,019,324	38,663,751	4,031,535	187,809,060

5 Magnesium, 204,632 lb., 1941 and 1942.
6 Cobalt, 1,730 lb., 1928.
7 Selenium, 731 lb., 1931.

TABLE VIID.—PRODUCTION, 1960 AND 1961, AND TOTAL

Division	Period	Asbestos		Barite		Diatomite		Fluxes (Quartz and Limestone)		Granules (Quartz, Limestone, and Granite)	
		Quantity	Value[1]	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		Tons	$	Tons	$	Tons	$	Tons	$	Tons	$
Alberni	1960										
	1961										
	To date										
Atlin	1960										
	1961										
	To date										
Cariboo	1960					44	1,430				
	1961					**214**	**8,817**				
	To date					1,808	44,782			48	168
Clinton	1960										
	1961										
	To date										
Fort Steele	1960										
	1961										
	To date			8	80						
Golden	1960			28,573	279,716						
	1961			**17,722**	**178,316**						
	To date			189,852	2,363,806						
Greenwood	1960										
	1961										
	To date							1,790,502	1,540,319		
Kamloops	1960										
	1961										
	To date										
Liard	1960	40,748	11,724,077								
	1961	**45,113**	**11,129,704**								
	To date	230,800	64,863,967								
Lillooet	1960										
	1961										
	To date										
Nanaimo	1960							18,629	23,302		
	1961							**12,459**	**19,445**		
	To date							687,438	745,783		
Nelson	1960										
	1961										
	To date							7,601	8,174	2	51
New Westminster	1960									8,869	120,441
	1961									**6,004**	**114,437**
	To date									62,875	787,371
Nicola	1960										
	1961										
	To date										
Omineca	1960										
	1961										
	To date										
Osoyoos	1960							64,735	271,197	10,194	136,626
	1961							**40,869**	**170,995**	**9,459**	**138,578**
	To date							574,030	2,821,448	58,808	791,369
Similkameen	1960										
	1961										
	To date									250	1,700
Skeena	1960										
	1961										
	To date							601,019	1,050,722		
Vancouver	1960										
	1961										
	To date									29,692	418,606
Vernon	1960										
	1961										
	To date										
Victoria	1960							6	60		
	1961							**7**	**60**		
	To date							69	940	9,605	157,080
Not assigned	1960										
	1961										
	To date										
Totals	1960	40,748	11,724,077	28,573	279,716	44	1,430	83,370	294,559	19,063	257,067
	1961	**45,113**	**11,129,704**	**17,722**	**178,316**	**214**	**8,817**	**53,335**	**190,500**	**17,463**	**253,015**
	To date	230,800	64,863,967	189,860	2,363,886	1,808	44,782	3,660,654	5,987,886	161,030	2,154,640

[1] Does not include value of containers.
[2] Includes 51 tons of residue from Trail smelter and no value assigned.
[3] Arsenious oxide: Omineca, 1928, 16,997 lb., $340; Osoyoos, 1917–30 and 1942, 22,002,423 lb., $272,861.
[4] Bentonite: 1926–44, 791 tons.
[5] Fluorspar: Greenwood, 1918–29 and 1942, 35,309 tons, $783,578; Osoyoos, 1958, 32 tons, $1,386.
[6] Hydromagnesite: Atlin, 1915–16, 1,450 tons, $20,325; Clinton, 1921, 803 tons, $7,211.
[7] Iron oxide and ochre: Golden, 1927–39, 27 tons, $920; Nelson, 1948–50, 7,292 tons, $55,901; Vancouver, 1918–50, 10,669 tons, $97,389; Victoria, 1923, 120 tons, $840.
[8] Magnesium sulphate: Clinton, 1918–20, 1,923 tons, $39,085; Kamloops, 1918–42, 8,742 tons, $193,967; Osoyoos, 1915–19, 3,229 tons, $21,300.

to Date, by Mining Divisions—Industrial Minerals

Gypsum and Gypsite Quantity	Gypsum and Gypsite Value	Mica Quantity	Mica Value	Sulphur Quantity	Sulphur Value	Other Value	Division Totals	Period	Division
Tons	$	Lb.	$	Tons	$	$	$		
								1960	Alberni.
								1961	
						9,398[9]	9,398	To date	
								1960	Atlin.
								1961	
						20,325[6]	20,325	To date	
		122,000	3,186				4,616	1960	Cariboo.
		250,000	**8,025**				**16,842**	**1961**	
		10,013,800	143,012			300[14]	188,262	To date	
								1960	Clinton.
								1961	
873	6,236					156,191[6, 8, 12]	162,427	To date	
				40,577	643,145		643,145	1960	Fort Steele.
				40,730	**610,950**		**610,950**	**1961**	
112,878	298,824			288,605	5,226,799	16,894[11]	5,542,597	To date	
107,900[2]	337,200						616,916	1960	Golden.
131,000	**392,000**						**570,316**	**1961**	
761,046	2,147,814					1,276[7, 13]	4,512,896	To date	
								1960	Greenwood.
								1961	
						783,578[5]	2,323,897	To date	
								1960	Kamloops.
								1961	
1,246,918	6,323,178	424,700	2,075			203,055[8, 12]	6,528,308	To date	
				37,958	582,655		12,306,732	1960	Liard.
				52,681	**1,093,658**		**12,223,362**	**1961**	
				133,431	2,825,251		67,189,218	To date	
								1960	Lillooet.
								1961	
						5,129[13]	5,129	To date	
							23,302	1960	Nanaimo.
							19,445	**1961**	
							745,783	To date	
								1960	Nelson.
								1961	
						55,901[7]	64,126	To date	
							120,441	1960	New Westminster.
							114,437	**1961**	
							787,371	To date	
								1960	Nicola.
								1961	
2,407	10,050						10,050	To date	
								1960	Omineca.
								1961	
						11,460[3, 10]	11,460	To date	
							407,823	1960	Osoyoos.
							309,573	**1961**	
		1,588,800	25,938			295,547[3, 5, 8]	3,734,302	To date	
								1960	Similkameen.
								1961	
						16,858[4]	18,558	To date	
								1960	Skeena.
								1961	
		634,250	10,816	41,624	178,678		1,240,215	To date	
				4,801	56,206		56,206	1960	Vancouver.
				8,841	**101,426**		**101,426**	**1961**	
				627,397	5,855,705	97,389[7]	6,371,700	To date	
								1960	Vernon.
								1961	
		160,500	3,978				3,978	To date	
							60	1960	Victoria.
							60	**1961**	
						30,226[7, 13]	188,246	To date	
				181,369	1,813,690		1,813,690	1960	Not assigned.
				140,125	**1,401,250**		**1,401,250**	**1961**	
				3,427,726	34,127,565		34,127,565	To date	
107,900[2]	337,200	122,000	3,186	264,705	3,095,696		15,992,931	1960	Totals.
131,000	**392,000**	**250,000**	**8,025**	**242,377**	**3,207,284**		**15,367,661**	**1961**	
2,124,372	8,787,802	12,822,050	185,818	4,518,783	47,713,998	1,703,527	133,785,811	To date	

[9] Natro-alunite: 1912–27, 522 tons.
[10] Perlite: 1953, 1,112 tons, $11,120.
[11] Phosphate rock: 1927–33, 3,842 tons.
[12] Sodium carbonate: Clinton, 1921–49, 9,524 tons, $109,895; Kamloops, 1931–35, 968 tons, $9,088.
[13] Talc: Golden, 1927, 5 tons, $356; Lillooet, 1916–36, 296 tons, $5,129; Victoria, 1919–35, 1,504 tons, $29,386.
[14] Volcanic ash: Cariboo, 30 tons.

First production: Arsenious oxide, 1917; asbestos, 1952; barite, 1940; bentonite, 1926; diatomite, 1928; fluorspar, 1918; flux, 1911; granules, 1930; gypsum and gypsite, 1911; hydromagnesite, 1904; iron oxide and ochre, 1918; magnesium sulphate, 1915; mica, 1932; natro-alunite, 1912; perlite, 1953; phosphate rock, 1927; sodium carbonate, 1921; sulphur, 1916; talc, 1916.

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Table VIIe.—Production, 1960 and 1961, and Total to Date, by Mining Divisions—Structural Materials

Division	Period	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	Unclassified Material	Division Totals
		$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Alberni	1960				1,608	82,753										84,361
	1961				**830**	**84,746**										**85,576**
	To date				55,642	1,089,303										1,144,945
Atlin	1960				6,000	16,481										22,481
	1961					**16,050**										**16,050**
	To date		1,108		97,478	193,133										291,719
Cariboo	1960				253,232	531,903										785,135
	1961				**1,056**	**730,814**								**2,000**		**733,870**
	To date		7,500		959,899	4,505,892	1,193	184	4,651	15,807				11,242		5,506,368
Clinton	1960															
	1961															
	To date				1,606	109,322										110,928
Fort Steele	1960				62,948	178,875								8,118		249,941
	1961				**140,499**	**108,747**										**249,246**
	To date		5,350	71,941	1,173,949	3,641,456	7,800							8,118		4,908,614
Golden	1960				15,314	66,282										81,596
	1961				**8,149**	**94,683**								**12,154**		**114,986**
	To date		1,000	24,000	110,339	1,443,218								13,654		1,592,211
Greenwood	1960				2,546	34,339										36,885
	1961					**33,876**										**33,876**
	To date		102,442	30,500	168,319	416,776	114,361			6,922						839,320
Kamloops	1960				386,129	109,848										495,977
	1961				**250,291**	**387,360**										**637,651**
	To date		12,000	18,000	4,574,618	3,892,892	72,379									8,569,889
Liard	1960				3,100	200,045										203,145
	1961				**2,405**	**214,590**										**216,995**
	To date				32,665	1,722,747										1,755,412
Lillooet	1960				10,849	130,118										140,967
	1961				**9,276**	**122,979**										**132,255**
	To date		100	2,000	311,438	1,141,619										1,455,157
Nanaimo	1960		1,375,485	4,275	6,528	169,291										1,555,579
	1961		**1,601,464**	**10,450**	**97,580**	**197,965**										**1,907,459**
	To date		26,513,904	3,199,257	172,150	2,386,152	1,104,295	38,939		35,758						33,450,455
Nelson	1960				1,846	104,707										106,553
	1961				**60,728**	**122,947**										**183,675**
	To date		34,543	356,679	346,240	2,173,563	19,110	2,864								2,932,999
New Westminster	1960		162,318		183,448	2,553,613	183,936	122,800	583,103	22,671	83,842	559,809	48,825	212,439		4,716,804
	1961		**209,175**		**351,375**	**2,590,022**	**1,320**	**316,331**	**536,902**	**28,396**	**45,753**	**619,396**	**5,091**	**383,149**		**5,086,910**
	To date		1,359,390	9,310	8,606,089	25,968,438	1,612,599	4,816,407	11,463,096	850,452	2,810,730	10,834,903	329,390	921,941		69,582,745
Nicola	1960				10,660	11,869										22,529
	1961				**7,350**	**29,681**										**37,031**
	To date			8,000	115,716	371,424										495,140
Omineca	1960				1,745	297,451										299,196
	1961				**33,226**	**313,384**										**346,610**
	To date		3,077		593,715	2,954,726	5,274									3,556,792

		$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Osoyoos	1960					684										684
	1961					51,450										51,450
	To date		32,070	14,850	145,557	832,179										1,024,656
Revelstoke	1960				2,774	42,856										45,630
	1961				3,241	32,670										35,911
	To date		1,000	5,575	325,520	958,054										1,290,149
Similkameen	1960					71,260										71,260
	1961				175	73,000										73,175
	To date		11,571	24,000	511,219	1,772,182				1,363				11,992		2,332,327
Skeena	1960		50,725		44,476	85,965										181,166
	1961		39,954		38,484	105,124										183,562
	To date	10,500	1,433,635	144,000	1,230,104	4,273,177				4,925				8,324		7,104,665
Slocan	1960				24,250	85,415										109,665
	1961				6,814	55,161										61,975
	To date		1,000	115,143	101,078	710,311										927,532
Trail Creek	1960			5,584		60,890										66,474
	1961			8,500	500	107,386										116,386
	To date		28,000	75,734	212,542	1,521,607										1,837,883
Vancouver	1960	2,922,279		89,000	45,958	1,970,169		22,291	15,582							5,018,309
	1961	3,142,150		61,350		1,316,928	10,014	10,015	22,959							4,563,416
	To date	10,607,387	40,885	3,936,376	7,648,356	24,228,312	142,208	241,216	580,778	12,724			23,362	88,304		47,549,908
Vernon	1960				8,204	136,610										144,814
	1961				2,747	45,384										48,131
	To date		46,499	81,052	194,169	2,169,428	131,467	6,202	1,011	5	18,224	4,325		20		2,652,402
Victoria	1960	3,510,473	12,491		728	655,854	3,737		23,180			57,049		126,326		4,390,838
	1961	3,976,229	13,722		1,360	604,763	3,475		25,108			67,602	6,799	270,000		4,969,058
	To date	86,062,164	792,065		455,878	12,743,680	1,814,647	22,052	95,930	1,050	705,821	1,030,346	134,504	418,255		114,277,401
Not assigned	1960															
	1961															
	To date		315,498	505,018	282,455									3,150,828[1]	7,010,452[2]	11,264,251
Totals	1960	6,482,752	1,602,019	48,859	1,075,373	7,597,278	187,673	145,091	621,865	22,671	83,842	616,858	48,825	346,888		18,829,989
	1961	7,118,379	1,864,318	70,300	1,016,086	7,489,710	14,809	329,346	584,969	28,396	45,753	686,998	11,890	667,303		19,875,254
	To date	106,680,051	30,742,637	8,621,435	28,426,741	101,219,600	5,025,333	5,128,864	12,145,466	929,006	3,534,775	11,869,574	487,256	4,632,678	7,010,452	326,453,868

[1] Includes $3,150,828 of unclassified clay products, 1886–1910.
[2] Includes a value of $7,010,452 that cannot be allotted to a particular class of structural material.

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

Year	Tons (2,000 Lb.)	Value	Year	Tons (2,000 Lb.)	Value
1836–59	41,871	$149,548	1912	3,172,015	$10,786,812
1860	15,956	56,988	1913	2,642,637	9,197,460
1861	15,427	55,096	1914	2,285,964	7,745,847
1862	20,292	72,472	1915	2,064,173	7,114,178
1863	23,906	85,380	1916	2,542,524	8,900,675
1864	32,068	115,528	1917	2,429,818	8,484,343
1865	36,757	131,276	1918	2,666,896	12,833,994
1866	28,129	100,460	1919	2,397,172	11,975,671
1867	34,988	124,956	1920	2,852,535	13,450,169
1868	49,286	176,020	1921	2,670,314	12,836,013
1869	40,098	143,208	1922	2,726,793	12,880,060
1870	33,424	119,372	1923	2,636,740	12,678,548
1871	55,458[2]	164,612	1924	2,027,843	9,911,935
1872	55,458[2]	164,612	1925	2,541,212	12,168,905
1873	55,459[2]	164,612	1926	2,406,094	11,650,180
1874	91,334	244,641	1927	2,553,416	12,269,135
1875	123,362	330,435	1928	2,680,608	12,633,510
1876	155,895	417,576	1929	2,375,060	11,256,260
1877	172,540	462,156	1930	1,994,493	9,435,650
1878	191,348	522,538	1931	1,765,471	7,684,155
1879	270,257	723,903	1932	1,614,629	6,523,644
1880	299,708	802,785	1933	1,377,177	5,375,171
1881	255,760	685,171	1934	1,430,042	5,725,133
1882	315,997	846,417	1935	1,278,380	5,048,864
1883	238,895	639,897	1936	1,352,301	5,722,502
1884	441,358	1,182,210	1937	1,446,243	6,139,920
1885	409,468	1,096,788	1938	1,388,507	5,565,069
1886	365,832	979,908	1939	1,561,084	6,280,956
1887	462,964	1,240,080	1940	1,662,027	7,088,265
1888	548,017	1,467,903	1941	1,844,745	7,660,000
1889	649,411	1,739,490	1942	1,996,000	8,237,172
1890	759,518	2,034,420	1943	1,854,749	7,742,030
1891	1,152,590	3,087,291	1944	1,931,950	8,217,966
1892	925,495	2,479,005	1945	1,523,021	6,454,360
1893	1,095,690	2,934,882	1946	1,439,092	6,732,470
1894	1,134,509	3,038,859	1947	1,696,350	8,680,440
1895	1,052,412	2,824,687	1948	1,604,480	9,765,395
1896	1,002,268	2,693,961	1949	1,621,268	10,549,924
1897	999,372	2,734,522	1950	1,574,006	10,119,303
1898	1,263,272	3,582,595	1951	1,573,572	10,169,617
1899	1,435,314	4,126,803	1952	1,402,313	9,729,739
1900	1,781,000	4,744,530	1953	1,384,138	9,528,279
1901	1,894,544	5,016,398	1954	1,308,284	9,154,544
1902	1,838,621	4,832,257	1955	1,332,874	8,986,501
1903	1,624,742	4,332,297	1956	1,417,209	9,346,518
1904	1,887,981	4,953,024	1957	1,085,657	7,340,339
1905	2,044,931	5,511,861	1958	796,413	5,937,860
1906	2,126,965	5,548,044	1959	690,011	5,472,064
1907	2,485,961	7,637,713	1960	788,658	5,242,223
1908	2,362,514	7,356,866	1961	919,142	6,247,594
1909	2,688,672	8,574,884			
1910	3,389,476	11,108,335	Totals	135,342,692	$563,108,381
1911	2,540,022	8,071,747			

[1] Quantity from 1836 to 1909 is gross mine output and includes material lost in picking and washing. For 1910 and subsequent years the quantity is that sold and used.

[2] A combined total for 1871, 1872, and 1873 has previously been noted in Annual Reports and the above breakdown is estimated.

Table VIIIb.—Quantity[1] and Value of Coal Sold and Used[2], 1951–61

Year	District and Mining Division	Total Sales[2]	Used under Companies' Boilers[2]	Used in Making Coke[2]	Total Sold and Used[2]		District Totals, 1961	
		Tons	Tons	Tons	Tons	$	Tons	$
	Vancouver Island	....	....	....	....	....	**76,009**	**736,814**
1951	Nanaimo	391,687	3,425	....	395,112	3,486,615		
1952	,,	267,346	2,986	....	270,332	2,749,206		
1953	,,	204,931	1,798	....	206,729	2,059,828		
1954	,,	181,534	536	....	182,070	2,029,099		
1955	,,	173,861	465	....	174,326	1,769,682		
1956	,,	172,140	389	....	172,529	1,629,168		
1957	,,	163,574	439	....	164,013	1,849,306		
1958	,,	153,892	404	....	154,296	1,615,470		
1959	,,	136,879	361	....	137,240	1,415,971		
1960	,,	105,231	268	....	105,499	530,154		
1961	,,	**76,009**	....	....	**76,009**	**736,814**		
	Nicola-Princeton	....	....	....	....	....	**505**	**4,491**
1951	Nicola	899	....	....	899	8,640		
1952	,,	1,139	....	....	1,139	11,493		
1953	,,	1,040	....	....	1,040	10,400		
1954	,,	1,256	....	....	1,256	12,769		
1955	,,	1,259	....	....	1,259	12,904		
1956	,,	1,170	....	....	1,170	12,092		
1957	,,	1,081	....	....	1,081	11,615		
1958	,,	543	....	....	543	5,919		
1959	,,	416	....	....	416	3,710		
1960	,,	213	....	....	213	2,183		
1961	,,	**159**	....	....	**159**	**1,717**		
1951	Similkameen	3,941	....	....	3,941	28,094		
1952	,,	6,306	....	....	6,306	48,760		
1953	,,	7,047	....	....	7,047	51,012		
1954	,,	29,713	....	....	29,713	138,080		
1955	,,	73,475	....	....	73,475	379,511		
1956	,,	72,102	....	....	72,102	366,820		
1957	,,	17,696	....	....	17,696	92,748		
1958	,,	146	....	....	146	1,122		
1959	,,	1,161	....	....	1,161	8,527		
1960	,,	1,194	....	....	1,194	9,552		
1961	,,	**346**	....	....	**346**	**2,774**		
	Northern	....	....	....	....	....	**7,912**	**81,024**
1951	Liard	3,199	....	....	3,199	26,095		
1952	,,	3,854	....	....	3,854	42,606		
1953	,,	4,815	20	....	4,835	50,895		
1954	,,	4,359	....	....	4,359	33,079		
1955	,,	3,650	....	....	3,650	32,850		
1956	,,	4,642	....	....	4,642	38,211		
1957	,,	2,758	....	....	2,758	28,421		
1958	,,	3,194	....	....	3,194	28,738		
1959	,,	3,319	....	....	3,319	31,040		
1960	,,	2,293	....	....	2,293	21,526		
1961	,,	**2,062**	....	....	**2,062**	**17,000**		
1951	Omineca	27,904	....	....	27,904	206,799		
1952	,,	37,270	....	....	37,270	285,732		
1953	,,	42,079	....	....	42,079	324,986		
1954	,,	36,572	....	....	36,572	292,862		
1955	,,	30,015	....	....	30,015	227,010		
1956	,,	8,553	....	....	8,553	71,234		
1957	,,	4,991	....	....	4,991	47,414		
1958	,,	4,677	....	....	4,677	44,972		
1959	,,	5,453	....	....	5,453	55,318		
1960	,,	5,417	....	....	5,417	60,448		
1961	,,	**5,850**	....	....	**5,850**	**64,024**		
	East Kootenay	....	....	....	....	....	**834,716**	**5,425,265**
1951	Fort Steele	889,669	15,977	236,871	1,142,517	6,413,374		
1952	,,	822,071	15,813	245,528	1,083,412	6,591,942		
1953	,,	878,865	12,729	230,814	1,122,408	7,031,158		
1954	,,	820,081	15,310	218,923	1,054,314	6,648,655		
1955	,,	803,125	16,560	230,464	1,050,149	6,564,544		
1956	,,	890,100	19,518	248,595	1,158,213	7,228,993		
1957	,,	677,534	17,830	199,754	895,118	5,310,835		
1958	,,	401,875	7,274	224,408	633,557	4,241,619		
1959	,,	358,682	10,813	172,927	542,422	3,957,498		
1960	,,	472,782	13,800	187,460	674,042	4,618,360		
1961	,,	**619,828**	**14,698**	**200,190**	**834,716**	**5,425,265**		
1951	Provincial totals	1,317,299	19,402	236,871	1,573,572	10,169,617		
1952	,,	1,137,986	18,799	245,528	1,402,313	9,729,739		
1953	,,	1,138,777	14,547	230,814	1,384,138	9,528,279		
1954	,,	1,073,515	15,846	218,923	1,308,284	9,154,544		
1955	,,	1,085,385	17,025	230,464	1,332,874	8,986,501		
1956	,,	1,148,707	19,907	248,595	1,417,209	9,346,518		
1957	,,	867,634	18,269	199,754	1,085,657	7,340,339		
1958	,,	564,327	7,678	224,408	796,413	5,937,860		
1959	,,	505,910	11,174	172,927	690,011	5,472,064		
1960	,,	587,130	14,068	187,460	788,658	5,242,223		
1961	,,	**704,254**	**14,698**	**200,190**	**919,142**	**6,247,594**	**919,142**	**6,247,594**

[1] For differences between gross mine output and coal sold refer to table "Production and Distribution by Collieries and by Districts" in section headed "Coal" or "Coal-mining" in this and succeeding Annual Reports.

[2] The totals "sold and used" include:—
Sales to retail and wholesale dealers, industrial users, and company employees.
Coal used in company boilers, including steam locomotives.
Coal used in making coke.

TABLE IX.—COKE AND BY-PRODUCTS PRODUCTION FOR YEARS 1895 TO 1925 AND 1926 TO 1961

Year	Coal Used in Making Coke		Coke Made in Bee-hive Ovens		Coke Made in By-product Ovens		Coke Made in Gas Plants		Total Coke Made		Gas Sold and Used	Tar Produced	Other By-products[1]	Total Production Value of Coke Industry
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value				
	Tons	$	Tons	$	Tons	$	Tons	$	Tons	$	$	$	$	$
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	27,044	6,556,142
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
1952	323,922	1,972,918	35,110	440,756	142,156	1,729,924	64,906	525,384	242,172	2,696,064	4,625,747	252,070	25,639	7,599,520
1953	310,431	2,005,551			177,790	2,090,147	60,407	525,411	238,197	2,615,558	4,857,116	238,771	21,046	7,732,491
1954	302,052	2,052,641			168,982	2,032,902	67,108	566,660	236,090	2,599,562	5,113,334	226,824	20,586	7,960,306
1955	314,994	2,122,303			177,031	2,180,516	70,387	594,482	247,418	2,774,998	5,407,842	292,984	18,369	8,494,193
1956	328,805	2,277,402			180,263	2,270,167	78,185	738,292	258,448	3,008,459	5,145,851	287,437	20,961	8,462,708
1957	199,654	1,284,833			153,493	2,005,570			153,493	2,005,570	14,600	121,849		2,142,019
1958	224,158	1,420,328			173,920	2,253,102			173,920	2,253,102	14,600	97,803		2,365,505
1959	173,227	1,135,222			134,134	1,789,906			134,134	1,789,906	14,600	76,891		1,881,397
1960	186,960	1,124,760			139,040	1,948,370			139,040	1,948,370		108,360		2,056,730
1961	200,190	1,201,140			160,703	2,240,236			160,703	2,240,236		115,291		2,355,527
Totals	16,272,587	69,566,206	6,223,241	35,571,124	2,793,894	30,448,232	1,829,283	11,777,717	10,845,515	77,797,073	83,269,939	4,071,816	553,717	165,692,545

[1] "Other by-products" total 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, $344,682; pitch, $5,131; sulphuric acid, $6,658; tar-paint, $2,330; and miscellaneous, $10,827.

Table X.—Dividends Paid by Mining Companies, 1897–1961

Dividends Paid during 1960 and 1961

	1960	1961
Bralorne Pioneer Mines Ltd.	$638,940	$642,040
Cassiar Asbestos Corporation Ltd.	2,376,000	2,376,000
Consolidated Mining and Smelting Co. of Canada, Ltd.	16,380,344	16,380,368
Crow's Nest Pass Coal Co. Ltd.	372,708	489,326
Highland-Bell Ltd.	156,986	160,750
Reeves MacDonald Mines Ltd.	467,600	467,600
Sheep Creek Mines Ltd.	150,000	187,500
Others	53,365	16,655
Totals	$20,595,943	$20,720,239

Dividends Paid Yearly, 1917 to 1961, Inclusive

Year	Amount Paid	Year	Amount Paid
1917	$3,269,494	1941	$16,598,110
1918	2,704,469	1942	13,627,104
1919	2,494,283	1943	11,860,159
1920	1,870,296	1944	11,367,732
1921	736,629	1945	10,487,395
1922	3,174,756	1946	15,566,047
1923	2,983,570	1947	27,940,213
1924	2,977,276	1948	37,672,319
1925	5,853,419	1949	33,651,096
1926	8,011,137	1950	34,399,330
1927	8,816,681	1951	40,921,238
1928	9,572,536	1952	32,603,956
1929	11,263,118	1953	22,323,089
1930	10,543,500	1954	25,368,262
1931	4,650,857	1955	35,071,583
1932	2,786,958	1956	36,262,682
1933	2,471,735	1957	24,247,420
1934	4,745,905	1958	14,996,123
1935	7,386,070	1959	16,444,281
1936	10,513,705	1960	20,595,943
1937	15,085,293	1961	20,720,239
1938	12,068,875		
1939	11,865,698	Total	$663,166,111
1940	14,595,530		

TABLE X.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1961—*Continued*

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.[2]	Bridge River	Gold	17,759,500
Bralorne Pioneer Mines Ltd.[2]	Bridge River	Gold	1,884,885
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[3]
Goodenough (leasers)	Ymir	Gold	13,731
Hedley Mascot Gold Mines Ltd.	Hedley	Gold	1,290,553
Island Mountain Mines Ltd.	Wells	Gold	2,491,236[3]
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	780,000[4]
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.[2]	Bridge River	Gold	10,048,914
Poorman	Nelson	Gold	25,000
Premier Gold Mining Co. Ltd.	Premier	Gold	18,858,075[5]
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[3]
Reno Gold Mines Ltd.	Sheep Creek	Gold	1,433,640[3]
Sheep Creek Gold Mines Ltd.[7]	Sheep Creek	Gold	3,796,875[6]
Silbak Premier Mines Ltd.	Premier	Gold	2,425,000[5]
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[3]
Miscellaneous mines		Gold	108,623
Total, lode-gold mines			$79,986,755

[1] The gold-copper properties of Rossland are included in this table.

[2] *Early in 1959 Bralorne Mines Ltd. and Pioneer Gold Mines of B.C. Ltd. were merged under the name of* Bralorne Pioneer Mines Ltd., and dividend payments for 1959 and subsequent years are entered under the new company listing.

[3] Includes " return of capital " and " liquidating " payments.

[4] Former Kelowna Exploration Company Limited; changed in January, 1951.

[5] 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.

[6] In several years, preceding 1953, company revenue included profits from operations of the Lucky Jim zinc-lead mine.

[7] Since March, 1956, company name is Sheep Creek Mines Ltd.

TABLE X.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1961—*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
Canadian Exploration Ltd.	Salmo	Silver-lead-zinc	11,175,400
Capella	New Denver	Silver-lead-zinc	5,500
Consolidated Mining and Smelting Co. of Canada, Ltd.	Trail	Silver-lead-zinc	514,661,351[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
Giant Mascot Mines Ltd.	Spillimacheen	Silver-lead-zinc	179,263
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	1,950,640
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	142,238[3]
Queen Bess	Alamo	Silver-lead-zinc	25,000
Rambler-Cariboo	Rambler	Silver-lead-zinc	467,250
Reeves MacDonald Mines Ltd.	Remac	Silver-lead-zinc	3,565,450
Reco	Cody	Silver-lead-zinc	334,992
Ruth Mines Ltd.	Sandon	Silver-lead-zinc	125,490
St. Eugene	Moyie	Silver-lead-zinc	566,000
Sheep Creek Mines Ltd.	Invermere	Silver-lead-zinc	243,750
Silversmith and Slocan Star[4]	Sandon	Silver-lead-zinc	1,267,600
Silver Standard Mines Ltd.	Hazelton	Silver-lead-zinc	1,715,333
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
Sunshine Lardeau Mines Ltd.	Beaton	Silver-lead-zinc	164,000
Torbrit Silver Mines Ltd.	Alice Arm	Silver-lead-zinc	390,000
Utica	Kaslo	Silver-lead-zinc	64,000
Violamac Mines (B.C.) Ltd.	New Denver	Silver-lead-zinc	850,000
Wallace Mines Ltd. (Sally)	Beaverdell	Silver-lead-zinc	135,000
Washington	Rambler Station	Silver-lead-zinc	20,000
Western Exploration Co. Ltd.	Silverton	Silver-lead-zinc	30,867
Whitewater	Retallack	Silver-lead-zinc	592,515
Yale Lead and Zinc Mines Ltd.	Ainsworth	Silver-lead-zinc	278,620
Miscellaneous mines			70,239
Total, silver-lead-zinc mines			$546,403,998

[1] Includes $466,143 " return of capital " distribution prior to 1949.
[2] Earnings of several company mines, and custom 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 X.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1961—*Continued*

Copper Mines

Company or Mine	Locality	Class	Amount Paid
Britannia M. & S. Co.[1]	Britannia Beach	Copper	$18,803,772
Canada Copper Corporation	Greenwood	Copper	615,399
Cornell	Texada Island	Copper	8,500
Granby Cons. M.S. & P. Co.[2]	Copper Mountain	Copper	29,873,226
Marble Bay	Texada Island	Copper	175,000
Hall Mines	Nelson	Copper	233,280
Miscellaneous mines		Copper	261,470
Total, copper mines			$49,970,647

[1] The Britannia Mining and Smelting Co. Limited, a wholly owned subsidiary of the Howe Sound Company (Maine), paid the dividends shown to its parent company. On June 30, 1958, consolidation between the Howe Sound Company (Maine) and Haile Mines Inc. became effective, bringing into existence Howe Sound Company (Delaware). The Britannia mine became a division of the new Howe Sound Company, and in August Britannia Mining and Smelting Co. was liquidated voluntarily.

[2] The Granby Consolidated Mining Smelting and Power Company dividends commenced in 1904 and cover all company activities in British Columbia to date. The figure includes all dividends, capital distributions, and interim liquidating payments, the latter being $4,500,000, paid, in 1936, prior to reorganization.

Coal Mines

Company or Mine	Locality	Class	Amount Paid
Wellington Collieries Ltd.	Nanaimo	Coal	$16,000,000
Bulkley Valley Collieries Ltd.	Telkwa	Coal	24,000
Crow's Nest Pass Coal Co. Ltd.	Fernie	Coal	17,953,940
Canadian Collieries Resources Ltd.	Nanaimo	Coal	828,271
Total, coal mines			$34,806,211

Aggregate of All Classes

Lode-gold mining	$79,986,755
Silver-lead-zinc mining and smelting	546,403,998
Copper-mining	49,970,647
Coal-mining	34,806,211
Miscellaneous, structural, and placer gold	14,437,188
Total	$725,604,799

NOTE.—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.

Table XI.—Principal Items of Expenditure, Reported for Operations of All Classes

Class	Salaries and Wages	Fuel and Electricity	Process Supplies
Lode-mining	$33,257,369	$4,694,429	$11,998,998
Placer-mining	74,233	21,411	3,385
Fuel—coal, coke and gas plant	3,437,044	290,184	642,731
,, petroleum and natural gas	3,230,025[1]	361,718[1]	1,518,716[1]
Miscellaneous metals and industrial minerals	6,840,946	1,422,080	1,916,014
Structural materials industry	4,047,658	2,117,212	1,707,283
Totals, 1961	**$50,887,275**	**$8,907,034**	**$17,787,127**
Totals, 1960	52,694,818	7,834,728	21,496,912
1959	49,961,996	7,677,321	17,371,638
1958	48,933,560	8,080,989	15,053,036
1957	56,409,056	8,937,567	24,257,177
1956	57,266,026	9,762,777	22,036,839
1955	51,890,246	9,144,034	21,131,572
1954	48,702,746	7,128,669	19,654,724
1953	55,543,490	8,668,099	20,979,411
1952	62,256,631	8,557,845	27,024,500
1951	52,607,171	7,283,051	24,724,101
1950	42,738,035	6,775,998	17,500,663
1949	41,023,786	7,206,637	17,884,408
1948	38,813,506	6,139,470	11,532,121
1947	32,160,338	5,319,470	13,068,948
1946	26,190,200	5,427,458	8,367,705
1945	22,620,975	7,239,726	5,756,628
1944	23,131,874	5,788,671	6,138,084
1943	26,051,467	7,432,585	6,572,317
1942	26,913,160	7,066,109	6,863,398
1941	26,050,491	3,776,747	7,260,441
1940	23,391,330	3,474,721	6,962,162
1939	22,357,035	3,266,000	6,714,347
1938	22,765,711	3,396,106	6,544,500
1937	21,349,690	3,066,311	6,845,330
1936	17,887,619	2,724,144	4,434,501
1935	16,753,367	2,619,639	4,552,730
Grand totals, 1935–61	$1,017,351,599	$172,701,604	$368,515,320

[1] These figures for the petroleum and natural-gas industry are from returns made on Dominion Bureau of Statistics forms by thirty-one operators. The sum of the expenditures reported for salaries and wages, fuel and electricity, and process supplies is $5,110,459. The Canadian Petroleum Association supplied figures indicating expenditures by fifty-two companies in British Columbia in 1961, amounting to $59,400,000, which includes $5,592,000 for salaries and wages; expenditures for fuel and electricity and process supplies are not reported by the Canadian Petroleum Association. The items reported are given in the last paragraph of the Review on page A 13.

Note.—" Process Supplies " include explosives, chemicals, drill-steel, lubricants, etc.

TABLE XII.—AVERAGE NUMBER EMPLOYED IN THE MINING INDUSTRY,[1] 1901–61

Year	Placer-mining	Lode-mining			In Concentrators	In Smelters	Coal-mining			Structural Materials		Industrial and Miscellaneous	Total[2]
		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	....	2,358	1,680	4,038	....	....	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	824	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
1952	230	4,171	3,923	8,094	1,516	4,120	1,280	401	1,681	1,530	557	529	18,257
1953	132	3,145	2,589	5,734	1,371	3,901	1,154	396	1,550	1,909	559	634	15,790
1954	199	2,644	2,520	5,164	1,129	3,119	1,076	358	1,434	1,861	638	584	14,128
1955	103	2,564	2,553	5,117	1,091	3,304	1,100	378	1,478	1,646	641	722	14,102
1956	105	2,637	2,827	5,464	1,048	3,339	968	398	1,366	1,598	770	854	14,539
1957	67	2,393	2,447	4,840	838	3,328	1,020	360	1,380	1,705	625	474	13,257
1958	75	1,919	1,809	3,728	625	3,081	826	260	1,086	1,483	677	446	11,201
1959	99	1,937	1,761	3,698	618	3,008	765	291	1,056	1,357	484	459	10,779
1960	86	1,782	1,959	3,741	648	3,034	894	288	1,182	1,704	557	589	11,541
1961	**74**	**1,785**	**1,582**	**3,367**	**626**	**3,118**	**705**	**237**	**942**	**1,828**	**508**	**571**	**11,034**

[1] Mining industry includes all branches of the mineral industry except petroleum and natural gas.

[2] 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 XIII.—LODE-METAL MINES—TONNAGE, NUMBER OF MINES, NET AND GROSS VALUE,[4] 1901–61

Year	Tonnage[1]	Number of Shipping Mines	Number of Mines Shipping over 100 Tons	Gross Value as Reported by Shipper[2]	Freight and Treatment[3]	Net Value to Shipper[3]	Gross Value of Lode Metals Produced[4]
1901	926,162	119	78	......	......	......	$13,287,947
1902	1,009,016	124	75	......	......	......	11,136,162
1903	1,288,466	125	74	......	......	......	11,579,382
1904	1,461,609	142	76	......	......	......	12,309,035
1905	1,706,679	146	79	......	......	......	15,180,164
1906	1,963,872	154	77	......	......	......	17,484,102
1907	1,805,614	147	72	......	......	......	16,222,097
1908	2,083,606	108	59	......	......	......	14,477,411
1909	2,057,713	89	52	......	......	......	14,191,141
1910	2,216,428	83	50	......	......	......	13,228,731
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	2,720,669	132	59	......	......	......	19,992,149
1916	3,229,942	169	81	......	......	......	31,483,014
1917	2,797,368	193	87	......	......	......	26,788,474
1918	2,912,516	175	80	......	......	......	27,595,278
1919	2,146,920	144	74	......	......	......	19,756,648
1920	2,215,445	121	60	......	......	......	19,461,725
1921	1,586,428	80	35	......	......	......	12,925,448
1922	1,592,163	98	33	......	......	......	19,228,257
1923	2,447,672	77	28	......	......	......	25,348,399
1924	3,413,912	86	37	......	......	......	35,538,247
1925	3,849,269	102	40	......	......	......	46,200,135
1926	4,775,327	138	55	......	......	$38,558,613	51,508,031
1927	5,416,411	182	52	......	......	27,750,364	44,977,082
1928	6,241,672	110	49	......	......	29,070,075	48,281,825
1929	6,977,903	106	48	......	......	34,713,887	51,720,436
1930	6,804,276	68	32	......	......	21,977,688	41,292,980
1931	5,549,622	44	22	......	......	10,518,931	22,900,229
1932	4,354,904	75	29	......	......	7,075,393	19,705,043
1933	4,063,775	109	47	......	......	13,976,358	25,057,007
1934	5,141,744	145	69	......	......	20,243,278	34,071,955
1935	4,927,204	177	72	......	......	25,407,914	40,662,633
1936	4,381,173	168	70	......	......	30,051,207	43,813,898
1937	6,145,244	185	118	$48,617,920	$4,663,843	43,954,077	62,950,536
1938	7,377,117	211	92	40,222,237	4,943,754	35,278,483	53,878,093
1939	7,212,171	217	99	45,133,788	4,416,919	40,716,869	53,554,092
1940	7,949,736	216	92	50,004,909	6,334,611	43,670,298	61,735,604
1941	8,007,937	200	96	52,354,870	5,673,048	46,681,822	62,607,882
1942	6,894,844	126	76	50,494,041	5,294,637	45,199,404	59,694,192
1943	5,786,864	48	32	37,234,070	3,940,367	33,293,703	52,651,868
1944	4,879,851	51	31	29,327,114	2,877,706	26,449,408	39,369,738
1945	4,377,722	36	27	34,154,917	2,771,292	31,383,625	48,724,001
1946	3,705,594	50	32	48,920,971	2,904,130	46,016,841	56,653,485
1947	5,011,271	75	33	81,033,098	4,722,010	76,311,087	93,124,847
1948	5,762,321	97	51	118,713,859	18,585,183	100,128,727	121,696,891
1949	6,125,460	118	54	99,426,678	19,613,185	79,814,604	107,775,413
1950	6,802,482	112	58	108,864,792	22,113,431	86,751,361	118,464,619
1951	6,972,400	119	64	142,590,427	25,096,743	117,493,684	147,646,989
1952	9,174,617	95	58	140,070,389	30,444,575	106,601,451	144,151,515
1953	9,660,281	80	48	94,555,069	27,815,152	66,739,892	123,619,837
1954	8,513,865	63	40	106,223,833	29,135,673	77,088,160	120,829,789
1955	9,126,902	53	34	119,039,285	30,696,044	88,343,241	138,145,095
1956	8,827,037	70	40	125,043,590	31,933,681	93,110,262	143,546,586
1957	7,282,436	59	40	95,644,930	30,273,900	65,370,185	119,409,764
1958	6,402,198	57	28	83,023,111	28,068,396	54,955,069	100,591,049
1959	6,990,985	60	44	92,287,277	27,079,911	65,208,728	100,549,519
1960	8,242,703	67	31	114,852,061	29,505,158	85,346,903	125,674,531
1961	**8,392,161**	**59**	**39**	**112,488,918**	**30,304,050**	**82,184,868**	**123,913,897**

[1] Includes ores of iron, mercury, nickel, tungsten, and 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 calculated by valuing gold, silver, copper, lead, zinc, mercury (1938–44, 1955), and nickel (1936–37, 1958–60) at yearly average prices, and iron (1901–03, 1907, 1918–23, 1928, 1948–60) and tungsten (1939–45, 1947–58) at values given by operators.

Table XIV.—Lode-metal Production in 1961

Property or Operator	Location of Mine	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Contents: Gold	Silver	Copper	Lead	Zinc	Cadmium
			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
NORTHERN BRITISH COLUMBIA										
Atlin Mining Division										
Nil										
Liard Mining Division										
Nil										
CENTRAL BRITISH COLUMBIA										
Cariboo Mining Division										
Cariboo Gold Quartz and Aurum	Wells	The Cariboo Gold Quartz Min. Co. Ltd., Vancouver	37,944	Bullion	20,243	3,213				
Clinton Mining Division										
Nil										
Omineca Mining Division										
Cronin Babine	Smithers	P. Kindrat, Smithers, lessee from New Cronin Babine Mines Ltd., Vancouver	1,212[1]	Lead concentrates, 80 tons; zinc concentrates, 93 tons	14	11,572		116,673	106,542	1,377
		S. Piskulski, Terrace	2	Crude ore	1	11		291	83	
COAST AND ISLANDS										
Alberni Mining Division										
Musketeer	Tofino	Copper Town Mines, Vancouver	339	Concentrates, 14 tons	139	103	98	1,380		
Nanaimo Mining Division										
Copper Road	Quadra Island	R. I. Bennett, Heriot Bay	87	Crude ore		87	13,433			
Merry Widow and Kingfisher	Benson Lake	Empire Development Co. Ltd., Vancouver	535,833	Iron concentrates, 364,772 tons						

			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Mount Washington	Courtenay	Mt. Washington Copper Co. Ltd., Courtenay	5,305	Crude ore	77	8,050	230,276			
Nimpkish	Beaver Cove	Nimpkish Iron Mines Ltd., Vancouver	666,361	Iron concentrates, 423,826 tons						
Prescott, Paxton, Yellow Kid, Yellow Jacket	Texada Island	Texada Mines Ltd., Vancouver	893,892	Iron concentrates, 475,419 tons; copper concentrates, 7,352 tons	1,192	25,726	1,622,896			
New Westminster Mining Division										
Pride of Emory	Choate	Giant Mascot Mines Ltd., Vancouver	260,583	Nickel concentrates, 21,293 tons			1,734,123			
Valley View and Blue Bell	Agassiz	Steve Romaniuk and Mike Romaniuk, Harrison Hot Springs, lessees from George Dietrich, Agassiz	50	Crude ore		50	1,141			
Skeena Mining Division										
Silbak Premier	Premier	Silbak Premier Mines Ltd., Vancouver	831	Crude ore, 831 tons; tailings, 22 tons	6,471	112,850		55,993	57,828	
Vancouver Mining Division										
Britannia	Britannia Beach	Howe Sound Co. (Britannia Division), Britannia Beach	461,601	Copper concentrates and precipitates, 22,064 tons; zinc concentrates, 5,352 tons; tailings, 7,876 tons	3,211	55,397	13,637,206	118,388	6,452,851	
Cambrian Chieftain	Pender Harbour	Colonial Mines, Vancouver	389	Crude ore	2	1,130	53,764			
Victoria Mining Division										
Nil										
SOUTH CENTRAL BRITISH COLUMBIA										
Greenwood Mining Division										
Bounty Fraction	Beaverdell	Sheritt Lee Mines Ltd., Vancouver	13	Crude ore		1,543		1,404	2,657	
Cariboo-Amelia	Rock Creek	McKinney Gold Mines Ltd., Vancouver	5,086	Siliceous ore	5,432	6,024		11,307	81,297	
Highland-Bell	Beaverdell	Mastodon-Highland Bell Mines Ltd., Vancouver	18,954	Lead concentrates, 1,641 tons; zinc concentrates, 827 tons; jig concentrates, 250 tons	590	892,153		754,375	971,485	7,877
Mother Lode	Greenwood	Consolidated Woodgreen Mines Ltd., Vancouver	201,123	Copper concentrates, 4,163 tons	3,811	15,049	1,890,000			
Phoenix	Greenwood	Phoenix Copper Co. Ltd., Grand Forks	420,372	Copper concentrates, 9,909 tons	7,371	48,009	4,995,139			
Providence	Greenwood	S. J. Kleman, Greenwood	5	Crude ore	3	729		294	284	

Table XIV.—Lode-metal Production in 1961—*Continued*

Property or Operator	Location of Mine	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Contents					
					Gold	Silver	Copper	Lead	Zinc	Cad-mium
South Central British Columbia—*Continued*			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Kamloops Mining Division										
Nil										
Lillooet Mining Division										
Bralorne	Bridge River	Bralorne Pioneer Mines Ltd., Vancouver	154,040	Bullion; gold concentrates, 2,336 tons	105,510	22,578				
Pioneer	Bridge River	Bralorne Pioneer Mines Ltd., Vancouver		Mill residue, 61 tons	716					
Nicola Mining Division										
Craigmont	Merritt	Craigmont Mines Ltd., Vancouver	484,073	Copper concentrates, 11,672 tons (13,184 tons stockpiled)		7,797	6,645,487			
Stump Lake	Nicola	D. C. McWilliams and H. Riesterer, Vancouver	37	Clean-up	16	670		3,890	3,591	
Osoyoos Mining Division										
Fairview	Oliver	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	15,038	Silica flux						
French	Hedley	French Mines Ltd., Vancouver	5,366	Bullion; slag, 6 tons	1,927	313				
Nickel Plate	Hedley	Hedley Syndicate, c/o Wright Bros. & Associates Ltd., Vancouver		Mill clean-up; bullion; gold concentrates, 23 tons	785	57				
Norex	Oliver	Norex Mines Ltd., Oliver	590	Crude ore	620	886		1,292	1,180	
Similkameen Mining Division										
Nil										
Vernon Mining Division										
Nil										

			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Fort Steele Mining Division										
Sullivan	Kimberley	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	2,461,695	Lead concentrates, 206,966 tons; zinc concentrates, 199,177 tons; tin concentrates, 607 tons	367	5,305,644	824,200	295,968,000	204,226,000	......
Golden Mining Division										
Lucky Jim	Law Creek	R. J. Coffey, San Antonio, Texas	5	Crude ore	......	223	......	5,130	160	......
Mineral King	Toby Creek	Sheep Creek Mines Ltd., Nelson	211,010	Lead concentrates, 7,227 tons; zinc concentrates, 19,247 tons	......	289,236	47,753	9,926,976	22,246,496	53,160
Nelson Mining Division										
Gold Belt	Salmo	A. Endersby, Fruitvale	117	Crude ore	43	32	......	346	470	......
H.B.	Salmo	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	472,731	Lead concentrates, 4,857 tons; zinc concentrates, 39,494 tons	......	72,651	......	7,306,800	44,177,400	372,075
Jersey	Salmo	Canadian Exploration Ltd., Vancouver	374,032	Lead concentrates, 13,325 tons; zinc concentrates, 26,755 tons	......	61,672	......	21,187,155	31,852,526	247,238
Kenville (White Lease)	Nelson	D. H. Norcross, Nelson	74	Crude ore	64	28	......	148	148	......
Kootenay Belle	Salmo	K-Belle Enterprise Co., Linden, Alta.	7,703	Crude ore	317	808	......	15,669	16,204	......
Lucky Strike	Nelson	L. C. de Kock, Nelson	1	Crude ore	2	23	......	49	8	......
New Arlington	Erie	G. D. Fox, Trail	161	Crude ore	114	320	......	6,110	6,194	......
Queen	Salmo	A. Endersby, Fruitvale	50	Crude ore	19	16	......	157	257	......
Queen Victoria	Beasley	Swift Copper Mines Ltd., Vancouver	60	Crude ore	......	80	5,215	......	......	......
Reeves MacDonald	Remac	Reeves MacDonald Mines Ltd., Vancouver	420,508	Lead concentrates, 12,043 tons; zinc concentrates, 30,380 tons	......	53,875	......	13,584,522	33,490,749	192,340
Waterbed	Ymir	M. M. Arishenkoff, Shoreacres	9	Crude ore	6	79	......	1,497	1,077	......
Revelstoke Mining Division										
Nil	......	......	......	......	......	......	......	......	......	......
Slocan Mining Division										
Bess	Silverton	M. Tarnowski, Silverton	4	Crude ore	......	629	......	5,656	98	......
Black Fox	Kaslo	New Ainsworth Base Metals Ltd., Vancouver	78[1]	Lead concentrates, 2 tons; zinc concentrates, 14 tons	......	288	......	2,623	11,281	90
Bluebell	Riondel	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	252,821	Lead concentrates, 15,057 tons; zinc concentrates, 28,687 tons	......	318,159	320,600	22,428,228	29,146,290	140,270
Caledonia	New Denver	Northwest Mining Partnership, Kellogg, Idaho	1,079	Lead concentrates, 112 tons; zinc concentrates, 172 tons	15	11,259	......	153,779	209,384	777
Galena Farm	Silverton	F. Mills, Silverton	394[2]	Lead concentrates, 12 tons; zinc concentrates, 79 tons	1	1,911	......	16,186	94,341	685

[1] Estimated. [2] Includes 350 tons stockpiled since 1959.

TABLE XIV.—LODE-METAL PRODUCTION IN 1961—*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
SOUTH CENTRAL BRITISH COLUMBIA—*Continued*										
Slocan Mining Division—Continued			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Giant Western	Slocan	Giant Western Mines Ltd., Slocan	7	Crude ore		32		13	13	
Hewitt	New Denver	F. Pho and J. Heichert, New Denver	282	Lead concentrates, 24 tons; zinc concentrates, 40 tons	1	9,123		27,853	48,861	341
Highlander	Ainsworth	T. G. Laughton, lessee from Yale Lead & Zinc Mines Ltd., Toronto	510	Lead concentrates, 47 tons; zinc concentrates, 16 tons		1,021		66,031	20,091	91
Lone Bachelor	Sandon	E. Perepolkin, Hills	182	Lead concentrates, 34 tons; zinc concentrates, 34 tons; crude ore, 36 tons	2	8,213		96,370	50,301	260
Mammoth	Silverton	Loma Minerals Ltd., Calgary, lessee from Western Exploration Co. Ltd., Silverton	3,401	Lead concentrates, 208 tons; zinc concentrates, 310 tons	6	23,167		291,768	355,685	2,506
Ottawa	Slocan	Ottawa Silver Mines Ltd., Spokane, Wash.	90	Crude ore	1	10,905		698	333	
Richmond-Eureka	Sandon	Perepolkin, Fried, and De Rosa, c/o E. Perepolkin, Hills	575	Lead concentrates, 42 tons; zinc concentrates, 78 tons	3	6,645		49,613	90,088	557
Slocan Prince	Slocan	J. K. Pearson, Calgary	2	Crude ore		22		20	70	
Utica	Kaslo	Standard Beryllium Corporation, Kaslo	900	Lead concentrates, 14 tons; zinc concentrates, 33 tons	2	6,008		10,919	35,059	218
Victor	Sandon	Violamac Mines Ltd., New Denver	3,174	Lead concentrates, 413 tons; zinc concentrates, 422 tons	101	60,219		613,485	504,252	3,361
Yale	Ainsworth	Yale Lead & Zinc Mines Ltd., Ainsworth	809[1]	Mill clean-up; lead concentrates, 83 tons; zinc concentrates, 64 tons	1	1,865		115,042	73,835	359
Trail Creek Mining Division										
Velvet	Rossland	Mid-West Copper & Uranium Mines Ltd., Vancouver; Velvet Leasers, Rossland, lessees	8,153	Concentrates, 457 tons	518	1,431	239,313			

TABLE XV.—LODE-METAL MINES EMPLOYING AN AVERAGE OF TEN OR MORE PERSONS DURING 1961[1]

Name of Mine or Operator	Days Operating		Tons		Average Number Employed	
	Mine	Mill	Mined	Milled	Mine	Mill
Shipping Mines						
Bluebell (Cons. M. & S. Co. of Canada Ltd.)	254	354	252,821	252,821	272	19
Bralorne Pioneer Mines Ltd. (Bralorne Division)	365	365	154,040	154,040	336	20
Cariboo Gold Quartz Mining Co. Ltd.	280	365	37,944	37,944	97	9
Craigmont Mines Ltd.	365	107	484,073	484,073	218	11
Empire Development Co. Ltd. and Mannix Co. Ltd. (Iron Production Division)	170	140	535,833	535,833	80	8
Giant Mascot Mines Ltd.	365	365	260,583	260,583	143	22
H.B. (Cons. M. & S. Co. of Canada Ltd.)	365	365	472,731	472,731	105	12
Howe Sound Co. (Britannia Division)	280	279	461,601	461,601	310	27
Jersey (Canadian Exploration Ltd.)	365	365	374,032	374,032	152	11
Mastodon-Highland Bell Mines Ltd.	242	272	18,954	18,954	33	6
McKinney Gold Mines Ltd.	266	......	5,086	......	19	......
Mineral King (Sheep Creek Mines Ltd.)	306	359	211,010	211,010	85	11
Mother Lode (Consolidated Woodgreen Mines Ltd.)	357	357	201,123	201,123	16	19
Nimpkish Iron Mines Ltd.	306	306	666,361	666,361	39	35
Phoenix Copper Co. Ltd.	260	365	420,372	420,372	48	19
Reeves MacDonald Mines Ltd.	252	349	420,508	420,508	87	22
Sullivan (Cons. M. & S. Co. of Canada Ltd.)	247	247	2,461,695	2,461,695	888	320
Texada Mines Ltd.	300	355	894,621	893,892	159	38
Velvet Leasers	252	276	8,153	8,153	19	1
Victor (Violamac Mines Ltd.)	254	......	3,174	......	13	......
Non-shipping Mines						
Canam Copper Co. Ltd.	......	......	......	......	22	......
Coast Copper (Cons. M. & S. Co. of Canada Ltd.)	......	......	......	......	21	......
Newmont Mining Corporation of Canada Ltd.	......	......	......	......	26	......

[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.

Departmental Work

ADMINISTRATION BRANCH

The Administration Branch is responsible for the administration of the Provincial laws regarding the acquisition of rights to mineral and to coal, petroleum and natural gas, 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 a mineral claim as required by the *Mineral Act* and upon a placer claim or a placer-mining lease as required by the *Placer-mining Act* must be made at the office of the Mining Recorder for the mining division in which the claim or lease is located. Information concerning claims and leases and concerning the ownership and standing of claims and leases in any mining division may be obtained from the Mining Recorder for the mining division in which the property is situated or from the Department's offices at Victoria, and Room 101, 739 West Hastings Street, Vancouver. Officials in the offices of the Gold Commissioner at Victoria and the Gold Commissioner at Vancouver act as Sub-Mining Recorders for all mining divisions. 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 page A 53.

CENTRAL RECORDS OFFICES (VICTORIA AND VANCOUVER)

Transcripts of all recordings 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 surveyed 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, Room 101, 739 West Hastings Street. The maps conform in geographical detail, size, and number to the reference and mineral reference maps issued by the Legal Surveys Branch of the Department of Lands and Forests, 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. The charge for these maps is $1 plus 5 per cent tax for each sheet.

List of Gold Commissioners and Mining Recorders in the Province

Mining Division	Location of Office	Gold Commissioner	Mining Recorder
Alberni	Alberni	T. G. O'Neill	T. G. O'Neill.
Atlin	Atlin	T. R. McKinnon	T. R. McKinnon.
Cariboo	Quesnel	F. E. P. Hughes	F. E. P. Hughes.
Clinton	Clinton	R. H. Archibald	R. H. Archibald.
Fort Steele	Cranbrook	E. L. Hedley	E. L. Hedley.
Golden	Golden	R. E. Manson	R. E. Manson.
Greenwood	Grand Forks	R. Macgregor	R. Macgregor.
Kamloops	Kamloops	D. Dalgleish	D. Dalgleish.
Liard	Victoria	R. H. McCrimmon.	
Lillooet	Lillooet	E. B. Offin	E. B. Offin.
Nanaimo	Nanaimo	W. H. Cochrane	W. H. Cochrane.
Nelson	Nelson	K. D. McRae	K. D. McRae.
New Westminster	New Westminster	J. F. McDonald	G. C. Kimberley.
Nicola	Merritt	T. S. Dobson	T. S. Dobson.
Omineca	Smithers	G. H. Beley	G. H. Beley.
Osoyoos	Penticton	T. S. Dalby	T. S. Dalby.
Revelstoke	Revelstoke	W. T. McGruder	W. T. McGruder.
Similkameen	Princeton	B. Kennelly	B. Kennelly.
Skeena	Prince Rupert	T. H. W. Harding	T. H. W. Harding.
Slocan	Kaslo	W. E. McLean	W. E. McLean.
Trail Creek	Rossland	W. L. Draper	W. L. Draper.
Vancouver	Vancouver	J. Egdell	Miss S. Hyham (Deputy).
Vernon	Vernon	G. F. Forbes	G. F. Forbes.
Victoria	Victoria	R. H. McCrimmon	E. J. Bowles.

Gold Commissioners' and Mining Recorders' Office Statistics, 1961

Mining Division	Free Miners' Certificates		Lode-mining						Placer-mining					Revenue		
	Individual	Company	Mineral Claims Recorded	Certificates of Work	Cash in Lieu	Certificates of Improvements	Bills of Sale, etc.	Mineral Leases	Placer Claims Recorded	Placer Leases Granted	Certificates of Work	Cash in Lieu	Bills of Sale, etc.	Free Miners' Certificates	Mining Receipts	Total
Alberni	132	1	1,202	959	$4,400.00	......	94	7	2	......	4	......	......	$756.00	$11,675.25	$12,431.25
Atlin	127	2	616	181	900.00	......	38	1	8	23	82	$3,850.00	13	835.00	11,812.00	12,647.00
Cariboo	1,068	12	2,171	319	1,300.00	......	60	6	11	147	358	1,250.00	152	6,816.00	31,463.00	38,279.00
Clinton	38	......	214	210	1,200.00	......	4	......	......	16	6	......	7	190.00	2,935.00	3,125.00
Fort Steele	205	2	305	525	2,300.00	......	32	8	......	22	35	500.00	11	1,225.00	7,885.37	9,110.37
Golden	111	2	131	279	1,600.00	......	24	5	......	4	4	250.00	26	740.00	3,716.00	4,456.00
Greenwood	114	2	379	591	2,100.00	......	50	14	......	5	7	......	......	776.00	7,621.25	8,397.25
Kamloops	401	5	3,690	2,032	2,900.00	......	244	4	......	8	4	......	5	2,455.00	19,323.50	21,778.50
Liard	269	1	1,549	1,269	4,700.00	......	76	......	......	12	21	1,250.00	......	1,550.00	15,317.25	16,867.25
Lillooet	223	3	483	725	400.00	......	67	3	......	26	34	250.00	25	1,415.00	7,743.75	9,158.75
Nanaimo	130	1	310	992	6,840.00	......	61	1	1	1	8	......	15	700.00	10,870.50	11,570.50
Nelson	341	9	360	478	1,200.00	......	54	6	......	5	11	......	......	2,406.00	4,972.00	7,378.00
New Westminster	417	6	459	518	6,600.00	......	159	3	4	21	12	250.00	......	2,516.00	11,602.50	14,118.50
Nicola	103	......	3,042	2,655	900.00	......	176	......	......	......	......	......	......	515.00	18,511.00	19,026.00
Omineca	303	1	1,018	461	2,000.00	......	58	......	3	41	57	250.00	84	1,607.00	13,637.36	15,244.36
Osoyoos	191	5	282	191	600.00	......	25	14	......	......	......	......	......	1,255.00	2,968.20	4,223.20
Revelstoke	88	3	128	173	2,700.00	......	16	1	......	12	28	1,000.00	25	740.00	7,511.50	8,251.50
Similkameen	132	1	532	518	1,700.00	......	33	5	6	25	59	......	18	711.00	6,813.75	7,524.75
Skeena	209	3	734	2,279	3,900.00	......	164	2	......	2	3	......	......	1,295.00	12,047.25	13,342.25
Slocan	139	3	316	795	1,200.00	......	53	16	......	......	......	......	......	995.00	5,850.75	6,845.75
Trail Creek	82	1	71	31	......	......	3	7	......	......	......	500.00	......	510.00	1,215.50	1,725.50
Vancouver	1,852	206	592	230	4,500.00	......	31	3	......	......	1	......	......	27,801.00	9,604.25	37,405.25
Vernon	189	......	209	84	200.00	......	10	4	1	7	8	......	1	945.00	1,985.25	2,930.25
Victoria	316	39	271	170	500.00	......	12	......	......	2	25	......	......	5,727.00	4,045.70	9,772.70
Totals for Province, 1961	7,180	308	19,064	16,665	$54,640.00	......	1,544	110	36	379	767	$9,350.00	382	$64,481.00	$231,127.88	$295,608.88
Totals for Province, 1960	6,181	273	11,748	13,157	$47,540.00	39	1,364	100	30	248	811	$6,250.00	189	$55,410.50	$182,196.20	$237,606.70

Coal, Petroleum, and Natural Gas

The Administration Branch is responsible for the administration of the *Petroleum and Natural Gas Act* and for the *Coal Act*. Information concerning applications for permits and leases issued under the *Petroleum and Natural Gas Act* and concerning the ownership and standing of them may be obtained upon application to the office of the Chief Commissioner, Department of Mines and Petroleum Resources, Victoria, B.C. Similar information may be obtained respecting licences and leases issued under the *Coal Act*. Maps showing the locations of permits and leases under the *Petroleum and Natural Gas Act* are available, and copies may be obtained upon application to the office of the Department of Mines and Petroleum Resources, Victoria, B.C. Monthly reports listing additions and revisions to permit-location maps and listing changes in title to permits, licences, and leases and related matters are available from the office of the Chief Commissioner upon application and payment of the required fee.

Coal Revenue, 1961

Licences—		
Fees	$575.00	
Rental	9,417.95	
		$9,992.95
Leases—		
Fees	$100.00	
Rental	286.95	
Cash in lieu	100.00	
		486.95
		$10,479.90

At the end of 1961, 33,925,009 acres, or approximately 53,000 square miles, of Crown petroleum and natural-gas rights, issued pursuant to the *Petroleum and Natural Gas Act*, were held in good standing. This acreage, held by operators ranging from small independent companies to major international ones, was comprised of:—

	Acres
424 permits	25,898,913
5 natural-gas licences	159,027
32 drilling reservations	546,699
2,006 leases	7,320,370
	33,925,009

Petroleum and Natural-gas Revenue, 1961

Rentals and fees—		
Permits	$2,856,551	
Drilling reservations	59,989	
Natural-gas licences	12,638	
Petroleum, natural-gas, and petroleum and natural-gas leases	3,616,123	
Total rentals		$6,545,301

Sale of Crown reserves—		
Permits	$1,493,679	
Drilling reservations	3,082,821	
Leases	3,065,391	
Total Crown reserve sales		$7,641,891
Royalties—		
Gas	$1,152,396	
Oil	207,392	
Processed products	119,405	
Total royalties		1,479,193
Miscellaneous fees		23,817
Total petroleum and natural-gas revenues		$15,690,202

ANALYTICAL AND ASSAY BRANCH

By S. W. Metcalfe, Chief Analyst and Assayer

Rock Samples

During 1961 the chemical laboratory in Victoria issued reports on 1,927 samples from prospectors* and Departmental engineers. A laboratory examination of a prospector's sample generally consists of the following: (1) A spectrographic analysis to determine if any base metals are present in interesting percentages; (2) assays for precious metals and for base metals shown by the spectrographic analysis to be present in interesting percentages. The degree of radioactivity is measured on all samples submitted by prospectors and Departmental engineers; these radiometric assays are not listed in the table below.

The laboratory reports were distributed in the following manner among prospectors who were not grantees, prospectors who were grantees under the *Prospectors' Grub-stake Act,* and Departmental engineers:—

	Samples	Spectrographic Analyses	Assays
Prospectors (not grantees)	1,308	1,285	3,066
Prospectors (grantees)	311	307	748
Departmental engineers	308	164	742
Totals	1,927	1,756	4,556

Samples submitted to the laboratory for identification are examined by the Mineralogical Branch of the Department. During the year such samples numbered 140.

Petroleum and Natural-gas Samples

Reports were issued on forty-six samples. Of this number, nineteen were samples of formation waters from wells being drilled for gas and oil in the Province; five were supposedly waters from the same source but actually were drilling-muds, and therefore no analyses were performed on them; eight were samples tested for oil seeps; seven were condensates; one was a tank-bottom sample in which the

* 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.

amount of water was determined; one was a sample of petroleum; four were samples submitted by engineers of the Petroleum and Natural Gas Branch; and one was a natural gas. Nineteen spectrographic analyses were reported on samples in this category.

Coal Samples

Reports were issued on forty-six samples of coal submitted by the Purchasing Commission for proximate analysis and calorific value.

Miscellaneous Samples

Reports were issued on eighty-seven samples of a miscellaneous nature.

For the Minister of Mines and Petroleum Resources, four samples of rock were spectrographed and assayed for both precious and base metals. One sample from the Deputy Minister of the same Department was treated similarly.

For the Petroleum and Natural Gas Branch of the Department, spectrographic analyses were performed on two glass vials made by different manufacturers. Three types of commercial gels used in oil drilling operations were examined to determine the nature of the thickening agent used, and in addition two samples from stockpiles of gel in the Peace River area were investigated for the same reason. A sample of bran from the same area was examined for chemicals which may be poisonous to cattle.

For the British Columbia Research Council, spectrograpic analyses were performed on five samples.

For the Purchasing Commission, five samples of anti-freeze were compared, and in addition two cements.

For the Department of Agriculture, five samples were spectrographed and four of these were analysed for their content of the oxides of calcium and magnesium. Nineteen quantitative spectrographic determinations were performed on each of twenty-six samples of soil and plant ash. A white powder on holly leaves was identified as calcium carbonate. A sample of gypsum also was examined.

For the Department of Lands and Forests (Forest Research), ten samples of soil were spectrographed and ninety chemical analyses were performed on the same samples.

For the Department of Highways (Materials Testing Branch), spectrographic analyses were performed on two copper tubes. One water sample was examined for its lead content and another for the presence of sulphur compounds. A white layer on a piece of concrete was examined and found to be calcium carbonate. The oil content of two samples of gasoline was determined, and a spectrographic analysis was performed on a sample of soil.

For the British Columbia Hydro, the nature of a sediment plugging plastic tubes at a dam-site was determined by spectrographic means.

For the Dominion Astrophysical Observatory, a metal plating was spectrographed.

For the Victoria City Water Works, two water samples were analysed for comparison purposes.

For citizens of the Province, the following materials were examined: A sample of pozzolan was spectrographed for the presence of rare metals; a fatty material found on a beach was examined; the chloride content of two waters was determined, and an analysis was performed on another water sample; a spectrographic analysis was performed on a rock sample, which was also assayed for precious and base metals. A sample of clay was submitted by a citizen who had obtained it in Denmark and wished to determine whether such a clay occurred in the Province; the X-ray diffraction pattern indicated that the clay mineral was illite.

X-ray Powder Diffraction Analyses

One hundred and five analyses of this type were performed for identification purposes.

Examination for Assayers

A Provincial Government examination for certificates of competency and licence to practise assaying in British Columbia was held at Victoria and Trail in December. Two candidates passed the examination, four were granted supplementals, and one failed.

INSPECTION BRANCH

Organization and Staff

Inspectors and Resident Engineers

J. W. Peck, Chief Inspector	Victoria
Robert B. Bonar, Deputy Chief Inspector of Mines	Victoria
L. Wardman, Senior Electrical Inspector of Mines	Victoria
E. R. Hughes, Senior Inspector of Mines	Victoria
J. E. Merrett, Inspector and Resident Engineer	Vancouver
A. R. C. James, Inspector and Resident Engineer	Vancouver
J. D. McDonald, Inspector and Resident Engineer	Nelson
D. R. Morgan, Inspector and Resident Engineer	Fernie
David Smith, Inspector and Resident Engineer	Kamloops
W. C. Robinson, Inspector and Resident Engineer	Prince Rupert

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

E. R. Hughes supervised the Department's roads and trails programme and prospectors' grub-stakes.

Instructors, Mine-rescue Stations

Arthur Williams	Fernie Station
W. H. Childress	Nelson Station
T. H. Robertson	Kamloops Station
W. High (part time)	Cumberland Station

Board of Examiners for Coal-mine Officials

Robert B. Bonar, Chairman and Secretary	Victoria
A. R. C. James, Member	Vancouver
D. R. Morgan, Member	Fernie

R. B. Bonar, A. R. C. James, D. R. Morgan, and the mine-rescue instructors for the district in which an examination is being held form the Board for granting certificates of competency to coal-miners.

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

Board of Examiners for Shiftbosses (Metalliferous Mines)

Robert B. Bonar, Chairman	Victoria
A. R. C. James, Member	Vancouver
J. E. Merrett, Member	Vancouver

The Board conducts written examinations in various mining centres for applicants for underground shiftboss certificates. The Board is also empowered to grant provisional certificates without examination under such conditions as the Board considers necessary.

MINERALOGICAL BRANCH

Field work by officers of the Mineralogical Branch includes geological mapping and examination of mineral deposits, and studies related to ground-water and engineering geology. The results are published partly in the Annual Report of the Minister of Mines and Petroleum Resources 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 directly by prospectors and others, or through the Analytical Branch.

Professional Staff

On December 31, 1961, the professional staff included the following engineers classified as geologists or mineral engineers: H. Sargent, Chief of the Mineralogical Branch; M. S. Hedley, S. S. Holland, J. W. McCammon, N. D. McKechnie, G. E. P. Eastwood, J. T. Fyles, A. Sutherland Brown, J. M. Carr, W. G. Jeffery, W. C. Jones, A. F. Shepherd, and J. E. Hughes. In November Dr. Jeffery went on leave for a year in order to go to Ghana on a Canadian external aid mission.

Technical editing of the Annual Report of the Minister of Mines and Petroleum Resources and of other publications was directed by M. S. Hedley. Copy for printing was prepared by and under the direction of the editor for English, Mrs. Rosalyn J. Moir. Messrs. Hedley and Holland assisted in directing and supervising field work. Most of the other members of the professional staff are assigned to mapping the geology of selected areas and of mineral deposits. Mr. McCammon is responsible for studies of industrial minerals and structural materials, and Mr. Shepherd for records and library.

Field Work

A. Sutherland Brown with one assistant nearly completed the areal mapping of the Queen Charlotte Islands. A large part of Graham Island underlain by Tertiary volcanic rocks was mapped rapidly, using a helicopter after a previous photogeological study. The northern part of Moresby and eastern part of Graham Islands were mapped, using a land rover and inflatable speedboat.

J. M. Carr visited and examined many copper deposits in southern, central, and northwestern British Columbia, including the Princeton, Merritt, Poison Mountain, Taseko Lake, Granduc-Unuk, and Stikine River areas.

G. E. P. Eastwood with one assistant made petrographic and structural studies at several magnetite occurrences on Vancouver Island. The studies were concentrated mainly at Kennedy Lake and at the Merry Widow property (Mannix mine). At the latter the study was made in collaboration with W. G. Jeffery, who was carrying on 1-mile mapping in the area.

J. T. Fyles with three assistants continued mapping in the North Kootenay Lake-Duncan Lake area. The work included mapping at 500 feet to the inch and 1,000 feet to the inch in two localities near Ainsworth, and mapping at 2,000 feet to the inch in the vicinity of Duncan Lake. The work also included a reconnaissance west of Meadow Mountain.

Visits were paid to six mines or prospects in the Kootenay Lake-Salmo area and at the Wigwam property south of Revelstoke and a property on Ruddoch Creek, 60 miles northwest of Revelstoke.

S. S. Holland made studies regarding alluvial jade on the Fraser and Yalakom Rivers in the Lillooet area and on Wheaton Creek at the head of Turnagain River, visited placer ground in the Bridge River, Horsefly, Likely-Keithley Creek, and Manson Creek areas, and placer operations in the Wells-Barkerville area, and examined operations at Squaw Creek and McConnell Creek. He visited lode-metal properties in the Telkwa, Hazelton, Wedeene River, and Stewart areas, and an appraisal was made of the possibility of structural mapping on Bear Ridge in the Stewart area.

J. E. Hughes began a study of Devonian strata in the northern Rocky Mountains and in cores from drill-holes. The surface study was in the Stone Range and along Racing River, Alaska Highway, mileage 392 to 428. Cores examined were from holes in the Fort Nelson-Clarke Lake area.

W. G. Jeffery with four assistants continued mapping in an area in northern Vancouver Island, including Alice and Kathleen Lakes, and extending to Neroutsos Arm and Rupert Inlet. A preliminary geological map of the area has been prepared for publication at 1 mile to 1 inch.

W. C. Jones made studies regarding damsites involving geological mapping and evaluation of test-drill results, test-pit data, and seismic data for damsites on McGregor River, Clearwater River (Clearwater-Azure site), and Cariboo River (Cariboo Falls site), and mapped geologically the Hobson Lake-Summit Lake and Grand Canyon (Fraser River) sites.

J. W. McCammon examined industrial mineral and structural material occurrences or operations in many parts of the Province, completed a study of limestone deposits in the Vernon area, and examined molybdenite deposits at Towloon Lake, Sands Creek, and Takomkane (Boss) Mountain, and lead-zinc showings at Agate Bay on Adams Lake and at East Barriere Lake.

N. D. McKechnie examined and mapped lode-metal mines and prospects at Jordan River, Shawnigan Lake, Tranquil Inlet, and Mount Washington, on Vancouver Island, at Hedley, Olalla, Greenwood, Martel, and selected properties in the Merritt area.

The Department participated with the Geological Survey of Canada in an aeromagnetic survey that covered much of the area of moderate relief in central British Columbia. The area is of irregular outline and lies between 52 degrees 15 minutes and 56 degrees 00 minutes north latitude and mainly between 121 degrees 30 minutes and 125 degrees 00 minutes west longitude.

PETROLEUM AND NATURAL GAS BRANCH

The Petroleum and Natural Gas Branch is responsible for the administration of the " Regulation Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas," made pursuant to the *Petroleum and Natural Gas Act*. The regulation provides for the use of efficient and safe practices in the drilling, completion, and abandonment of wells; for the orderly development of fields discovered within the Province; and for the conservation and prevention of waste of oil and natural gas within the reservoir and during production operations.

Investigations are made of complaints of property damage resulting from geophysical and test-hole drilling programmes. The " Geophysical Regulations " are administered by the Chief Petroleum and Natural Gas Commissioner.

Staff

J. D. Lineham, Chief of the Branch	Victoria
R. R. McLeod, Senior Petroleum Engineer and member of the Board of Arbitration	Victoria
A. N. Lucie-Smith, Senior Petroleum Engineer and Chairman of the Conservation Committee	Victoria
W. L. Ingram, Petroleum Engineer	Victoria
K. C. Gilbart, Petroleum Engineer	Victoria
E. V. Rehwald, Petroleum Engineer	Victoria
T. A. Mackenzie, Statistician	Victoria
S. S. Cosburn, Geologist	Victoria
D. L. Griffin, Geologist	Victoria
D. M. Callan, Assistant Geologist	Victoria
P. K. Huus, Engineering Assistant	Victoria
M. B. Hamersley, Engineering Assistant	Victoria
G. E. Blue, District Engineer	Charlie Lake
H. B. Fulton, Field Geologist	Charlie Lake
D. L. Johnson, Field Engineer	Charlie Lake
H. A. Sharp, Engineering Assistant	Charlie Lake
M. A. Churchill, Engineering Assistant	Charlie Lake

The total Branch staff numbered twenty-five at the end of the year, including the above-named personnel, of whom seventeen were employed at headquarters and eight in the field office at Charlie Lake.

Staff Changes

There were no resignations from the professional or technical staff.

D. L. Johnson, a 1961 graduate in chemical engineering from the University of Alberta, joined the field staff as a petroleum engineer on July 3rd.

D. M. Callan returned from educational leave of absence on July 7th. Mr. Callan, who was awarded a diploma in petroleum reservoir engineering by the Imperial College of Science and Technology, London, England, resumed work with the Geology Section.

G. V. Rehwald was transferred on August 8th from the field office to Victoria to assume duties in the Reserves and Evaluation Section.

An additional man was employed on a permanent basis for sample-washing and core-handling duties at the field office.

Administration

The Petroleum and Natural Gas Branch is subdivided for administrative purposes into five sections, each of which is headed by a supervisor who is responsible for a specific phase of Branch work. There is a field office, including sample-washing and core-storage facilities, at Charlie Lake. The sections and respective section heads are as follows: Reservoir Engineering, R. R. McLeod; Reserves and Evaluation, A. N. Lucie-Smith; Development Engineering, W. L. Ingram; Geology, S. S. Cosburn; Statistics and Well Records, T. A. Mackenzie; and Field Office, G. E. Blue.

Board of Arbitration

Chairman: A. W. Hobbs, solicitor, Department of the Attorney-General. Members: R. R. McLeod, engineer, Department of Mines and Petroleum Resources; S. G. Preston, agrologist, Department of Agriculture.

The Board of Arbitration, responsible to the Minister of Mines and Petroleum Resources, held one hearing in 1961 at Fort St. John.

Eleven applications concerning right of entry came before the Board. Of these, one was settled by an award order of the Board, five were pending at the end of the year, three were concluded by agreement between parties subsequent to Board order, and two were settled by agreement between parties while a hearing was pending.

Conservation Committee

Chairman: A. N. Lucie-Smith, petroleum engineer. Members: N. D. McKechnie, geologist; M. H. A. Glover, economist.

An application by Sun Oil Company to the Minister of Mines and Petroleum Resources for a Pool MPR (Maximum Permissible Rate) for its Blueberry Mississippian Oil Field was referred to the Conservation Committee. The application was made to enable the company to meet a temporary refinery commitment in excess of the sum of the individual MPR's of the four potential producers in the field at that time.

The decision reached by the Committee was that a Pool MPR was only justified after a field had been fully delimited by drilling and was about to enter into a unitized operation for the purpose of pressure maintenance or secondary recovery and therefore, in this particular instance, there was no justification for changing for the temporary benefit of one operator the existing policy of individual well MPR's.

The Minister did not approve the application of Sun Oil Company but agreed to consider overproduction on a temporary basis, provided the equity of other operators in the Province was not thereby affected.

GRUB-STAKING PROSPECTORS

Under authority of the *Prospectors' Grub-stake Act* the Department has provided grub-stakes each year since 1943 to a limited number of applicants able to qualify. The normal maximum grub-stake is $300, with an additional amount up to $200 for travelling expenses. A limited number of experienced prospectors of proven ability may be granted top priority grub-stakes of as much as $400, plus a maximum of $300 for travelling expenses, where prospecting is to be done in approved areas where air transportation is necessary.

To qualify at the present time, the Department requires that the applicant shall be a bona fide prospector holding a free miner's certificate. He must be a British subject, between the ages of 18 and 70 years, and must have resided in British Columbia during the year preceding the date of application. He must be able to identify common rocks and minerals. The grub-staked prospector is provided with maps, a current list of prices of metals and ores, and the latest Departmental information circulars on prospecting and related matters.

It is required that in order to obtain the maximum grub-stake he agree to spend at least sixty days actually prospecting in the area of his choice in British Columbia considered favourably by officers of the Department. If he prospects a lesser time, the grant will be reduced proportionately. The grant is usually made in two payments: the first at the beginning of the season and the second after he has completed sixty days in the field and has submitted a diary. In the past, rebates have been recovered from grantees to whom payments have exceeded the proper amount for the time and effort devoted to prospecting. A field engineer is employed who contacts as many prospectors as he is able during the field season and gives advice and direction to those who need it. Grantees are permitted a reasonable number of free assays.

The grub-stakes are granted with the object of maintaining the search for mineral occurrences with mine-making possibilities. Any discoveries made, staked, and recorded are exclusively the grantee's own property. The grants are not intended for the purpose of exploring and developing occurrences already found, but one year is allowed to prospect ground that has been staked by a grantee while on a grub-stake. The grantee must not accept pay from other sources for services rendered during the period credited to the grub-stake.

It is recognized that competent and experienced prospectors are capable of looking after themselves in wilderness areas. Nevertheless, experience has shown that less hazard may result when prospecting is done by two or three men in a team. A man working alone may be injured or be taken seriously ill and, if alone, he may have to endure extreme hardship and pain.

Grub-stake grantees are not working for the Government but are self-employed and are not covered under the provisions of the *Workmen's Compensation Act*. Therefore, it is recommended that prospectors make their own arrangements concerning insurance coverage to provide for medical and other expenditures that may be incurred in the event of an accident.

Statistical information covering the grub-stake programme since its inception is given in the following table:—

GRUB-STAKE 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
1952	19,083	50	251	95
1953	17,850	41	201	141
1954	19,989	48	336	123
1955	21,169	47	288	183
1956	20,270	47	163	217
1957	22,000	46	174	101
1958	24,850	47	287	211
1959	21,575	38	195	202
1960	28,115	50	358	241
1961	29,175	47	309	325

Samples and specimens received from grub-staked prospectors are spectrographed, assayed, and tested for radioactivity. Mineralogical identifications are made on request.

One hundred and seventeen applications were received in 1961, and forty-eight grub-stakes were authorized. One of the grantees was unable to go out, and he returned his initial payment. Six other grantees were unable to complete the terms and conditions of the grant and received only partial payment. Fourteen prospectors were given grants for the first time, and three proved unsatisfactory. A few grantees used aircraft for transportation to their prospecting areas. Two grantees were affected by injury or sudden illness, but each man was accompanied by a partner who took care of him.

D. H. Rae again gave able service in interviewing applicants and supervising grantees in the field. He was able to contact thirty grantees in the field, of whom twenty-one were contacted at the actual scene of prospecting. The following notes have been largely compiled from Mr. Rae's observations while in the field and from information provided in the diaries of the grantees.

Alberni Mining Division.—Three miles from the head of Kennedy Lake a granodiorite contact was prospected; on Canoe Creek small limonite deposits were investigated. Near Taylor Arm on Sproat Lake, narrow quartz veins containing minor amounts of chalcopyrite were prospected.

The southwest portion of Tzartus Island (Barkley Sound) was prospected, and small outcrops of magnetite were investigated. Also in this area, along a granite-limestone contact, massive pyrrhotite containing minor amounts of chalcopyrite was given some attention. Some work was also done near Marble Cove, and in the Sarita River valley where considerable pyrrhotite was found. Sampling showed nothing of economic importance. Similar showings were found near Moyeha Bay. At Effingham Inlet a granite-limestone contact was investigated. A similar contact zone was found near Kildonan Lake and at Hecate Mountain.

Atlin Mining Division. — In the Sittakanay River valley considerable trail-cutting was done, several small gossans were prospected, and minor amounts of pyrrhotite and chalcopyrite were observed. Some work was done on King Solomon River, in the King Solomon Mountain area, at Mount Manville, and in the nearby Taku River valley. One mineralized zone showed low values in manganese. A shear zone 350 feet long and up to 20 feet wide returned disappointing assays. In the Kwashona Creek valley, field work indicated some small gossans, sparse chalcopyrite mineralization, and some pyrrhotite lenses, but nothing economic was reported.

Considerable work was done from a base camp off Windy Arm, covering part of Nakina River valley and the area adjacent to Yeth Creek and Katina Creek. In the vicinity of Chikoida Mountain, narrow stringers of asbestos fibre in serpentine were investigated, but the occurrence proved to extend over an area too small to be of importance. Some work was also done in the Tatshenshini River valley and on some of its tributaries. Nothing of commercial importance was reported, although numerous narrow quartz stringers containing minor amounts of galena and chalcopyrite were found. One wide, sparsely mineralized zone and a 10-foot-wide quartz vein were located high above the valley.

Cariboo Mining Division.—Some inconclusive work was done in the Goat River-Killam Creek-Isaac Lake areas. One narrow vein containing minor amounts of galena, sphalerite, and chalcopyrite was reported.

Near Davie Lake in the Chuchinka Creek valley, many rock samples were taken and brought in for identification, and some pyritic zones were sampled and assayed. Near Likely a pyritized zone (shear) was uncovered, but the assays of samples taken were too low to be of interest. Near Giscome a large area underlain by serpentine was prospected, but no asbestos was found. Some work was done in the Sinkut River area and in the valley of the Chilako River.

Clinton Mining Division.—Some work was done in the Churn Creek valley and in the Deep Creek and Potato Range areas. No useful information was reported.

A wide silicified zone containing appreciable amounts of arsenopyrite was prospected close to Kleena Kleene. Gold values in samples taken were sufficiently high to be of interest.

Fort Steele Mining Division.—Mount Anstey and parts of St. Mary River valley were given some attention; on Redding Creek an old tunnel on a mineralized zone showing disseminated molybdenite was cleaned out and sampled, but values were low.

Golden Mining Division.—In the Copper Creek valley an extensive outcrop of schist and faulted and broken argillite showed several small and unimportant gossans and numerous narrow quartz veins—sampling indicated values were too low. Brewer Creek valley, close to Dutch Creek, and the headwaters of Ben Abel Creek were also prospected.

Greenwood Mining Division.—Some work was done near Arlington Lakes, and pyritic quartz veins in pyroxenite were sampled. Some work was also done near Norwegian Creek and in the Granby River valley.

Kamloops Mining Division.—Placer possibilities at several locations on the North Thompson River south of Clearwater were investigated.

A great deal of work was done in the Criss Creek area, east of Deadman River. A series of siliceous dykes was found to contain low values in silver, molybdenum, and tungsten.

South of Walhachin, on the Thompson River, what appears to be a large body of magnetite containing low values in copper was prospected and staked.

Areas close to Notch Hill, near Walker Lake, and west of Stump Lake were investigated. Nothing of importance was reported. Some work was done near Skwaam Bay on Adams Lake. Work was also done near the old Vidette mine. Eight miles southwest of Kamloops a great deal of work was done on and adjoining the old Last Chance property. Results were encouraging and more work is to be done in this area.

The Forge Creek-Guichon Creek sector received some attention, with fairly encouraging results. A discovery was made on the north side of Kamloops Lake near Copper Creek, but details are not yet available.

Liard Mining Division.—In the vicinity of Ealue Lake considerable work was done on a wide mineralized zone in altered limestone showing some disseminated chalcopyrite and much pyrite. Sample assays were encouraging.

The area of the Racing River, and many of its tributaries, about 40 miles south of the Alaska Highway, received some attention. Many narrow quartz veins containing scattered amounts of chalcopyrite were observed.

Lillooet Mining Division.—Field work was carried on in several sectors, including La Rochelle Creek, Holbrook Creek, Marshall Creek, the headwaters of Blue Creek, and near the headwaters of Yalakom River. Molybdenite occurrences at the headwaters of Texas Creek were prospected. The Anderson Lake area near Gold Creek was given some attention, also parts of the Shulaps Range where serpentine containing small stringers of short fibre asbestos was reported.

Nanaimo Mining Division.—On Quadra Island, 6 miles north of Heriot Bay, serpentine containing very short fibre asbestos was investigated; minor amounts of malachite and chalcopyrite were also found in these outcrops. Some work was done near Hyacinthe Bay.

Nelson Mining Division.—A full season's work was carried out from a base camp on Summit Creek, between Bayonne and Blazed Creeks. The valleys of several creeks in this area were prospected.

New Westminster Mining Division.—Some work was done on the west side of Pitt Lake, close to the south end, where quartz veins mineralized with pyrite and minor amounts of chalcopyrite were uncovered.

Extensive serpentine outcrops were investigated in the Sowaqua Creek valley. Near Coquihalla Lakes a 20-foot-wide zone well mineralized with pyrite, galena, sphalerite, and rhodonite was thoroughly prospected. This zone has possibilities.

Nicola Mining Division.—In the Pete Hope-Plateau Lakes area, dyke rocks containing disseminated sulphides were investigated, as well as a narrow quartz vein well mineralized with chalcopyrite and galena.

Omineca Mining Division.—Field work was continued in the Manson Creek area. On Jackfish Creek a narrow silver-bearing vein was discovered, and on Boulder Creek scheelite float was found.

Considerable work was done on the north side of the Nation River commencing about 5 miles east of the Fort St. James–Manson Creek road. Narrow quartz stringers and sheets of coarse to fine mica were found in pinkish granite. Some work was also done near Twenty Mile Creek and up the east fork of Twin Creek; nothing of interest was reported.

About 10 miles west of Uslika Lake an interesting discovery was reported, and a 15-foot-wide zone mineralized with hematite and chalcopyrite was traced for about 2,000 feet. Assays of samples taken were very encouraging.

An extensive area adjacent to the Rottacker Creek valley was prospected, and several quartz veins from 3 to 8 feet wide were found in granodiorite. These were well mineralized with hematite and contained minor amounts of chalcopyrite.

Some prospecting was done at the northern end of the Nechako Valley, where quartz veins in limestone were investigated, and a large deposit of pure limestone was sampled.

A large area was prospected near the west end of Eutsuk Lake. On Chikamin Mountain, at 5,000 feet elevation on the south slope, a zone 30 feet wide showing minor chalcopyrite mineralization was uncovered. Two other vein outcrops, one 2 feet wide and one 9 feet wide, were found; both were sparsely mineralized but showed a wide range of sulphide minerals. At the southwest corner of St. Thomas Bay a large exposure of highly oxidized andesite was reported; argillaceous rocks here were heavily pyritized and in places showed minor amounts of galena.

In the Toodoggone Lake area, float well mineralized with chalcopyrite was found.

Osoyoos Mining Division.—Some prospecting was done around Mount Kobau, and a new vein was uncovered east of the old Smuggler mine southwest of Oliver. On the west side of Okanagan Lake close to Summerland considerable work was done on a wide pyritized shear zone. Several high assays in gold were reported but were not verified. Some work was done near Richter Pass and in the Apex Mountain area.

Revelstoke Mining Division.—Prospecting was done near Albert Canyon, lower Goldstream River, Frisby Creek, Ferguson, and the west side of Trout Lake. Nothing conclusive was reported.

A short time was spent prospecting in the vicinity of Moloch Creek, on the Tangier River where a granite-porphyry contact was investigated, and on Fang Creek where argillaceous schist containing large amounts of coarse cube pyrite was sampled.

Similkameen Mining Division.—In the Trout Creek area a zone 60 feet wide, mineralized with hematite and magnetite, was prospected. No further details are available. Several mineralized quartz veins were found on Siwash Creek, and a considerable amount of work was done on them. Near Teepee Lakes a mineralized shear zone was found.

Prospecting was done at a number of other places—in the Missezula Lake-Aspen Grove area, Lawless Creek, Mount Rabbitt, Mount Kennedy, Newton Creek, and along the Otter Lake fault.

Skeena Mining Division.—South of Stuart Anchorage on the east side of Pitt Island considerable work was done in endeavouring to prove further continuity of a small deposit of magnetite. At Baker Inlet on Grenville Channel, claims were staked and considerable work done on a deposit of sericite mica. An extensive limestone deposit on the shoreline in Kumealon Inlet was prospected and sampled. At Refuge Bay on Porcher Island a wide pyritized quartz vein was prospected and sampled.

Some work was done in the Marmot River valley near Stewart, where narrow quartz veins showing considerable galena and pyrite were prospected.

A short time was spent at the headwaters of Kwinitsa Creek close to a granite-gneiss contact, where pyritized quartz veins proved to be too low grade to be of interest; narrow pegmatite dykes were also investigated in this area. Up the Khyex River, barren-looking quartz veins were found close to a granite-sedimentary contact. Bornite float found near Rainbow Lake stimulated interest in the immediate area, but nothing was found in place.

At Horetzky Creek (Kemano area) altered limestone along a granodiorite contact showed minor amounts of pyrite, pyrrhotite, and traces of chalcopyrite. Some work was done near Suquash Landing, at Alarm Cove on Denny Island, and on Dowager Island on Mathieson Channel; nothing of importance was reported from any of this work. Near Lagoon Bay (on Fisher Channel) a small deposit of volcanic glass was discovered.

A base camp was established close to the highway bridge on the Bella Coola–Anahim road at Kahylskt Creek (Burnt Bridge River) crossing. Much copper-bearing float was found on the steep mountainside and was finally traced to its source. The showing appears small, but the area warrants further intensive prospecting. From here work was also done up Nusatsum River and up the Talchako River.

Some prospecting was done on the Queen Charlotte Islands—near Ironside Mountain, west of Steel Creek, up the Coates River, Yakoun Lake, Shields Bay, and Harrison Island.

Vancouver Mining Division.—Near Cascade Point on Knight Inlet, quartz veins found in granite showed minor amounts of molybdenite.

Halfway up Jervis Inlet, on the west side, iron-stained rocks containing narrow quartz stringers were prospected without success. Near McCannel Lake an unsuccessful attempt was made to trace the source of molybdenite float.

Vernon Mining Division.—Prospecting was done east of Enderby and near Bessette Creek. Northing of importance was reported.

MINING ROADS AND TRAILS

Provision is made in the *Department of Mines and Petroleum Resources Act* whereby the Minister may, with the approval of the Lieutenant-Governor in Council, authorize the expenditure of public funds for the construction or repair of roads and trails into mining areas. Assistance on a half-cost basis may also be provided on roads and trails to individual properties.

Requests for road and trail assistance must be made to the Department before the commencement of work. The type of access upon which assistance may be given depends upon the value of the property, the stage of development, and the amount of work to be done. A trail is sometimes sufficient for initial exploration, and a tractor-road may be adequate for preliminary work. Subsequent development might warrant assistance on the construction of a truck-road. A carefully drawn sketch or plan of the location of the road is required to be submitted and, where warranted by the amount of assistance requested, a report on the property by a professional geological or mining engineer may be required. An engineer from the Department may be required to report on the property before a grant is made and to inspect the road after the work has been done.

Total mileages and disbursements under " Grants in Aid of Mining Roads and Trails " during the fiscal year ended March 31, 1961, were as follows:—

Mining-roads	Miles	Cost
Construction	64.6	$80,600.00
Maintenance	233.0	25,615.15
Photo interpretation and terrain analysis	80.0	2,000.00
Bridge-site survey		11,834.45
Total		$120,049.60

In addition to the above, work was continued on the Cassiar–Stewart road. This road is being constructed under the " Roads to Resources " agreement between Canada and British Columbia. The construction is being supervised by the Department of Highways on behalf of the Department of Mines and Petroleum Resources. At the north end of the road, construction of the 30.5-mile section from Sawmill Point on Dease Lake to Tanzilla River was completed. The Tanzilla River to Stikine River section, 26.6 miles long, was 98 per cent completed at the end of 1961, and the Stikine River to Eddontenajon Lake section of 24.7 miles was 75 per cent completed. In December a contract was awarded on the 40.1-mile section from Eddontenajon Lake to Burrage River. At the south end of the road the Bear Pass section was 85 per cent completed, and the Strohn Creek to the lower Bell-Irving section of 31.87 miles was 13 per cent completed.

The Fort Nelson River bridge, about 1 mile upstream from the confluence of the Muskwa River, which was damaged when the ice went out on April 25th, was repaired and again put into service. The approach access, 4 miles long, from the Alaska Highway at Mile 298.7 to the west end of the bridge was reconstructed to an all-weather standard.

MUSEUMS

The Department has a large exhibit of mineral and rock specimens in the Douglas Building, Victoria; collections are also displayed in the joint office in Vancouver and in the offices of the Inspectors of Mines in Nelson and Prince Rupert.

Specimens from the collection in Victoria, accumulated in a period of more than sixty years, are displayed in cases on the fourth floor of the Douglas Building. 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 includes specimens collected by officers of the Department of Mines and Petroleum Resources and specimens donated by property-owners. The collection also includes type specimens purchased from distributors. Other valued specimens or groups of specimens have been donated or loaned to the museum.

ROCK AND MINERAL SPECIMENS

Information regarding collections of specimens of rocks and minerals available to prospectors and schools in British Columbia may be obtained from the Chief of the Mineralogical Branch.

PUBLICATIONS

Annual Reports of the Minister of Mines and Petroleum Resources, bulletins, and other publications of the Department, with prices charged for them, are listed in the Department of Mines and Petroleum Resources List of Publications available from the Chief of the Mineralogical Branch.

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.

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 and Petroleum Resources in Victoria and in Vancouver. Copies of these maps may be obtained on request. The boundaries of surveyed claims and leases are shown on the reference maps and other maps of the British Columbia Department of Lands, Forests, and Water Resources.

JOINT OFFICES OF THE BRITISH COLUMBIA DEPARTMENT OF MINES AND PETROLEUM RESOURCES 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 available to the public in the one suite of offices at 739 West Hastings Street, Vancouver 1.

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.

Topographic Mapping and Air Photography

The four divisions comprising the Surveys and Mapping Branch—namely, the Legal Surveys, Topographic, Geographic, and Air Divisions—continued to supply basic data relating to Provincial surveys and cartography during 1961.

Field-notes were received by Legal Surveys Division for the survey of 631 lots, thirty of which were completed under authority of the *Mineral Act* and the remainder under the *Land Act*. The Departmental reference-map series showing the current status of Crown land alienation was also maintained, and four sheets covering the lower Fraser Valley west of Hope are being redrawn at a larger scale.

Subdivision surveys undertaken by Legal Surveys Division in 1961 included twenty-five lots at Bear Lake north of Prince George and forty-two lots in the Willow River area. As the result of burgeoning mining activity in the vicinity of Merritt, thirty-two new subdivision lots were surveyed near that village. In the Chief Lake and Chilako River areas, sixty-six old section and district lot corners were restored, while reposting on a smaller scale also took place at Nanoose, Clinton, Fort Fraser, South Hazelton, and Kaleden. Five widely separated highway surveys covered a total of 69.19 miles.

Accomplishments of the Topographic Division during 1961 included establishing field control for 29½ standard National Topographic map-sheets in the vicinity of Banks Island, Bella Bella, and Stuart Lake. Large-scale surveys were also completed in the McGregor River, Prince George, Quesnel, Hobson Lake, Clearwater River, Fraser River, Kamloops, Nanaimo, Port Hardy, and Nitinat areas.

Order in Council No. 2033/61, dated August 14th, set out new regulations governing well-site surveys under the *Petroleum and Natural Gas Act*. The responsibility for checking and examining well-site plans to see that they conform to the accuracy stated in the regulations was delegated to the Geographic Division.

Geographic Division also introduced a new system of road classification for use on Provincial maps at scales of 1 inch to 2 miles and 1:250,000. The system should be particularly helpful to persons who frequently travel off the network of main roads. New Provincial maps reproduced and printed during 1961 included three editions of regional map 1D (Northeastern British Columbia); two sheets at 1:250,000 scale, Nootka Sound (92E) and Taseko Lakes (92O); and two maps at 1-inch-to-2-miles scale, namely, Kaslo (82 F/NE) and Nakusp (82 K/SW). In addition, Merritt (92 I/SE) was completely revised. Ottawa mapping agencies supplied stocks of fourteen National Topographic map-sheets at 1:50,000 scale covering widely separated parts of the Province.

During 1961 the prices of reprints and enlargements of air photographs were increased. The rates now charged by the Air Division are similar to those of the National Air Photo Library at Ottawa. Aerial photographic operations accomplished 13,817 square miles and 2,807 lineal miles of new coverage, while 184,286 photo reprints were sold or loaned to various public and private agencies.

Indexes showing available published maps, reference maps, manuscripts, and aerial photographs may be found in the envelope attached to the back cover of the 1961 Lands Service Annual Report. Further details concerning Provincial maps, aerial photographs, and surveys are available from the Director, Surveys and Mapping Branch, Department of Lands, Forests, and Water Resources, Victoria, B.C.

Department of Mines and Technical Surveys

The Canadian Government Department of Mines and Technical Surveys performs many functions related to mining and the mineral industry in general. 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 mineral industry. Brief reference to the work of the Surveys and Mapping Branch in British Columbia is made in the preceding note headed "Topographic Mapping and Air Photography." 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. J. E. Armstrong is in charge of this office at 739 West Hastings Street, Vancouver 1.

Field Work by Geological Survey of Canada in British Columbia, 1961

R. B. Campbell commenced field work in the Quesnel Lake East Half (93 A, E. ½) map-area.

D. B. Craig completed very detailed mapping of a well-exposed area in 82 L/16 map-area near Revelstoke.

D. C. Findlay completed detailed mapping and sampling of the Tulameen ultrabasic complex.

P. E. Fox commenced and completed a study of the Adamant batholith west of the upper Columbia River as part of the "Granites in Canada" investigation.

W. L. Fry made collections of plant remains from Mio-Pliocene rocks in the Kamloops-Quesnel area.

R. J. Fulton continued the study and mapping of the surficial deposits of the Nicola (92 I, E. ½) map-area.

H. Gabrielse completed the mapping of the Kechika (94 L) and Rabbit River (94 M) map-areas and also brought up to standard the work done by Operation Stikine in the Cry Lake (104 I) and Dease Lake East Half (104 J, E. ½) map-areas.

E. C. Halstead commenced the study and mapping of the surficial geology of the Nanaimo-Duncan-Gulf Islands map-areas (92 F/1, E. ½, G/4, C/16, B/13, B/14) together with A. Treichel, who studied the geohydrology of the same area.

R. L. Herr, B. S. Norford, and D. L. Scott carried out stratigraphic studies in southern British Columbia and Alberta.

D. W. Hyndman commenced detailed mapping in an area near Nakusp (82 K/4).

E. J. W. Irish continued field work in the Halfway River (94 B) map-area.

S. Leaming began a study of the sand and gravel deposits of the Strait of Georgia area.

G. B. Leech examined known mineral deposits in Fernie West Half (82 G, W. ½) map-area.

H. W. Little commenced 1-mile mapping of the Rossland-Trail (82 F/4) map-area.

E. W. Mountjoy completed the mapping of Mount Robson (83 E, S.E. ¼) map-area, part of which lies in British Columbia.

J. E. Muller completed the mapping of the Pine Pass (93 O) map-area and mapped one-half of the McLeod Lake (93 J) map-area in co-operation with H. W. Tipper.

K. H. Owens, F. Essex, J. Houlihan, J. Lee, and J. W. Kempt conducted an aeromagnetic survey of part of central British Columbia roughly between 121 degrees 30 minutes and 125 degrees west longitude and 52 degrees 15 minutes and 56 degrees north latitude. The cost of this survey was shared by the Department of Mines and Technical Surveys and the Department of Mines and Petroleum Resources.

B. R. Pelletier continued his stratigraphic studies of the Triassic formations in the Foothills and Rocky Mountains of northeastern British Columbia.

R. A. Price commenced a field and laboratory investigation of selected folds in the Foothills and Front Ranges, mainly in 82 G, East Half map-area.

J. E. Reesor continued his studies of granite and metamorphic complexes in the Valhalla Mountains.

D. F. Sangster began a study of contact metamorphic magnetite deposits on Vancouver and Texada Islands.

J. G. Souther completed the mapping of Chutine (104 F) and Tulsequah (104 K) map-areas and brought up to standard past work in Iskut (104 B), Telegraph Creek (104 G), and west half of Dease Lake (104 J) map-areas.

D. F. Stott completed the stratigraphic study of the Upper Cretaceous Smoky group, Lower Cretaceous Fort St. John group, upper part of the Lower Cretaceous Bullhead group, and equivalent strata in the foothills between Smoky River and Peace River.

G. C. Taylor continued the mapping of MacDonald Creek (94 K/10) map-area.

H. W. Tipper, with J. E. Muller, completed the mapping of McLeod Lake (93 J) map-area.

J. O. Wheeler completed the mapping of Rogers Pass (82 N, W. ½) map-area.

Publications of the Geological Survey

A total of nineteen publications of the Geological Survey of Canada relating to British Columbia was received by the British Columbia Department of Mines and Petroleum Resources in 1961.

MINES BRANCH

The Mines Branch has branches dealing with mineral resources, mineral dressing and process metallurgy, physical metallurgy, radioactivity, and fuels and explosives. A total of seventeen publications of the Mines Branch pertaining to British Columbia was received in 1961 by the British Columbia Department of Mines and Petroleum Resources. They included tabular pamphlets dealing with coal mines, gold mines, stone quarries, petroleum refineries, and milling plants in Canada.

MINERAL RESOURCES DIVISION

The Mineral Resources Division, which was a division of the Mines Branch, has now been transferred from the Mines Branch to the office of the Deputy Minister of Mines and Technical Surveys.

The Mineral Resources Division publishes studies on mineral resources, mineral economics, mineral legislation, mineral taxation, mining technology, and other miscellaneous mineral-industry subjects. A total of seven publications published by this Division was received by the library.

Lode Metals

CONTENTS

GENERAL REVIEW

Compared to 1960 the average Canadian prices paid in 1961 for gold and silver were up, and those for copper, lead, and zinc were down. The change in parity between the Canadian and United States dollar, brought about in the middle of the year, created a premium on the United States metal prices for the first time in ten years. The 1961 Canadian average price for gold consequently increased—$1.50 per ounce above that of 1960. The Canadian price for silver remained close to the fixed New York price of 91.375 cents per ounce until the end of 1961, when the price increased to $1.09, a price not equalled since 1919. The Canadian average prices for copper, lead, and zinc fell a substantial fraction of a cent each, compared to 1960, resulting in the lowest average price for lead since 1946. The decreases in base-metal prices would have been greater had it not been for the revaluation of the dollar.

Gold, silver, copper, lead, and zinc produced at British Columbia lode mines in 1961 had a value of $109,325,484. Miscellaneous metals, including iron ore, nickel, tin, and minor metals recovered at the Trail smelter, had a value of $18,651,608. The total quantity of ore mined at all lode mines amounted to 8,392,161 tons and came from fifty-nine mines, of which thirty-nine produced 100 tons or more. The average number employed in the lode-mining industry in 1961, including mines, concentrators, and smelters, was 7,111.

In 1961 twenty-three mills were operated—fifteen of them throughout the year. Of the other eight mills, that at the Empire mine was a seasonal operation, five operated intermittently, one closed, and one operated for the first time. The Craigmont mill opened September 15th with a production capacity of 4,000 tons per day, a capacity that has subsequently been increased. Five small mills operated intermittently, and the French mill closed after a life of five years. Three small mills accepted custom ore, as did one large one, the Britannia mill. Five mills were being built at the end of the year—three for iron ore and two for copper ore.

The Trail smelter recorded custom receipts of 13,957 tons of ore from eighteen properties, of which 98 per cent was from seven properties shipping siliceous ore. The smelter also recorded custom receipts of 2,799 tons of lead concentrates and 47,138 tons of zinc concentrates. Totals of approximately 32,691 tons of lead concentrates and approximately 31,364 tons of zinc concentrates were shipped out of the Province for smelting. Copper concentrates were shipped to the Tacoma smelter, except for part of the Craigmont production, the copper concentrates recovered by Texada Mines Ltd., and the copper contained in bulk nickel concentrates from Giant Nickel Mines Limited, all of which went to Japan. All iron-ore concentrates, amounting to 1,264,017 tons, were shipped to Japan.

Lode-gold production was down about 22 per cent from 1960 and was at the lowest figure in fifteen years. This was due in large part to closure of the Pioneer mine in 1960 and of the French mine in 1961, but it was also due to a minor drop in production from Bralorne and a drop in the 1961 gold production from Britannia and the copper mines at Greenwood. A new 600-ton cyanide mill was built at Bralorne to replace the combined gravity and flotation mill that had been in operation for many years. Closure of the Fairview mine at Oliver, long a source of silica flux at the Trail smelter, encouraged the shipment of siliceous gold ores, but smelter requirements of silica in excess of custom ore shipments was met by recovery of the dumps of the Queen mine at Sheep Creek.

The French mine at Hedley closed on May 21st, due to depletion of the ore-bodies. In its first period of operation from 1950 to 1955 the mine produced 32,463 tons containing 25,284 ounces gold; in its second period, with a mill, from 1957 to 1961 it produced 53,085 tons containing 26,429 ounces gold. The ore is gold-bearing skarn.

There was no change in the production of silver; the change in price came too late in the year to affect output or development to any marked extent. Except for very minor quantities of ore, the Highland-Bell continued to be the only operating silver mine in the Province.

The position of copper improved greatly with the coming into production of the Craigmont mine. Opened officially on September 15th, the mill by the end of 1961 was operating at more than its rated capacity of 4,000 tons of ore daily. This is the first major mine in British Columbia that was found solely as a result of geochemical and geophysical investigation of ground that was very largely covered by overburden and also by a younger formation. The Britannia mine, after going through a critical period in 1957–58, has reaffirmed its position as a mine and not merely a salvage operation. Effort is being made to revise the geological maps and to investigate the ore possibilities of many parts of the mine. With excess mill capacity, Britannia has accepted custom ore, a fact of advantage in the development of some copper deposits in the general region.

The active exploration for copper in southern British Columbia has begun to pay off. Serious investigation of the Bethlehem property started in 1955 and at once led to surface activity that spread far and wide. The Craigmont ore zone first became known in 1957 and focused attention on the general Promontory Hills area. In 1961 Bethlehem began to prepare its open pit for production to start about a year later than Craigmont. In seven years a great deal of money has been spent, and it has been demonstrated that exploration for hidden ore zones can be an expensive business. Much ground has been gone over by surveys of one sort or another more than once, and it is plain that better geological knowledge of ore occurrence is sorely needed.

Activity continued on the Granduc property, as well as on new and relatively new showings in the general Unuk River area, and more work is planned for 1962. East of the Stikine River, attention was attracted to Galore Creek, where extensive surface investigations were carried out on copper showings and diamond drilling was started. A great many claims are held in the general Unuk-Stikine area, and it is evident that copper mineralization, of types associated with porphyry and with skarn, is quite widely distributed.

Lead production was at the highest level since 1943, at a time when the price was the lowest in fifteen years. Zinc production was down, being 9 per cent below the average of the past five years. In August the United States Government contracted to purchase from The Consolidated Mining and Smelting Company of Canada, Limited, 55,000 tons of lead, using funds generated from disposal of surplus agricultural products. About half this amount was shipped in 1961.

The Reeves MacDonald mine established a new low level at an elevation of 420 feet. The main lead-zinc orebody has been demonstrated to have had, before faulting, a plunge length of more than 5,000 feet.

Exploration for lead and zinc continued along the general course of the Kootenay arc, and a discovery was made west of the Columbia River near Gordon Horne Peak.

For the second successive year the export of magnetic iron concentrates to Japan passed the million-ton mark, from three producing mines. Iron ore is already fourth in value of production of metallic products, with three more magnetic concentrators under construction and diamond drilling being done on at least two other deposits. What appeared for some years to be a relatively minor commodity has become one of the most important products of the mining industry.

Of the less common metals, molybdenum continued to attract attention. Work was done on showings at Alice Arm, Smithers, and Boss Mountain. The Boss Mountain property was acquired by Noranda Mines Limited, and major development was begun.

Prospecting was active in many quarters. In 1961, 19,064 mineral claims were recorded, the most for any year with the exception of 1956, when 26,170 claims were recorded.

Sensitized ammonium nitrate—AN/FO—was used underground in quantity for the first time. Pneumatic loaders were designed to permit the loading of any hole, and in the latter part of 1961 several mines had changed over to this new explosive. Activated raise platforms continued in use, a 600-foot raise being driven at 70 degrees at the Jedway mine. At the Jersey mine a raise platform was used in pillar recovery (*see* photographs, p. 70). A mill with a rated capacity of about 750 tons per day was built underground at the Sunloch mine. This is the first underground mill since a 750-ton mill was completed at the Big Missouri mine in 1938.

NOTES ON METAL MINES

TOOTSEE RIVER*

Lead-Silver

Silver Tip Group (Pegasus Explorations Limited)

(59° 130° N.E.) Registered office, 212, 678 Howe Street, Vancouver 1. E. P. Chapman, Jr., president and engineer in charge of property. This property of thirty-five recorded claims is about 4 miles northeast of Tootsee Lake and 17 miles by road south of Mile 701 on the Alaska Highway. Work done between June 15th and September 30th consisted initially of a geophysical survey. It has been reported that subsequently 17 miles of winter road was reconstructed and made suitable for summer travel with four-wheel-drive vehicles. Two vertical holes, totalling 795 feet, were diamond drilled on anomalous areas. The work was done by an average crew of fourteen men. The property was not visited.

CASSIAR*

Molybdenum

Lamb Mountain (Fort Reliance Minerals Limited)

(59° 129° S.W.) Company office, 3100, 25 King Street West, Toronto 1. J. A. Harquail, president; A. D. Wilmot, exploration manager. The property is about 7 miles north of Cassiar, and consists of twelve claims held by option and five claims held by record. It is reported that the mineralization consists of disseminated molybdenite occurring in altered granite and limestone along the contact between these rocks. The contact is obscured by overburden, but the presence of float indicates a mineralized zone extending over a considerable distance.

During July, 1961, some trenching and stripping was done by three men with the aid of a bulldozer. An access road was constructed between the property and the Cassiar mine road. Between September 30th and October 12th a crew of nine men was employed. Two EX holes, totalling 639 feet, were diamond drilled. All equipment was left on the property. The property was not visited.

Gold

Hanna Gold Mines Ltd.

(59° 129° S.W.) Head office, 401, 470 Granville Street, Vancouver 2; mine office, Cassiar. J. A. Hanna, president; C. Hood, Jr., managing director. The property, which was originally known as the Cornucopia group, consists of seventy-seven claims held by record. The claims lie on the east slope of Quartzrock Creek valley and 2 to 3 miles north of McDame Lake. The showings have been described in the 1947 Annual Report.

Work in 1961, which was carried out by a crew of five men, commenced on May 15th and was suspended on November 15th. Development work comprised 228 feet of drifting and 35 feet of crosscutting. Some surface stripping and sampling was also done. A camp, consisting of two bunk-houses, compressor-house, store-house, and several other buildings, was constructed. Access to the property is by one-quarter of a mile of road from the Cassiar–Stewart road.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1946, p. 61; 1947, pp. 70–72.]

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* By W. C. Robinson.

Copper

Lang Creek

(59° 129° S.W.) The Bass Nos. 1 to 10 recorded claims are held by The Consolidated Mining and Smelting Company of Canada, Limited. The Copper Nos. 1 to 32 recorded claims were held by the company under option from W. Storie and Associates, of Cassiar. The property is about 5 miles south-southeast of Cassiar at the juncture of Lang and McDame Valleys. Access is by 2 miles of jeep-road from the Cassiar–Stewart highway. Mineralization is reported to consist of a bedded deposit containing pyrrhotite, pyrite, chalcopyrite, and sphalerite in argillite interbedded in volcanics.

Work on the property commenced in May and was completed on August 27th. An average crew of seven men was employed under the direction of R. G. Gifford. Twelve holes were diamond drilled, totalling 2,202 feet. A Ronka EM geophysisal survey was made and plane-table mapping was done. It is reported that the option has been dropped. The property was not visited.

Lark

(59° 129° S.W.) Twenty recorded mineral claims were held under option by The Consolidated Mining and Smelting Company of Canada, Limited, from W. Storie and Associates, of Cassiar. The claims adjoin the Lang Creek group. Work on the property, which was done in conjunction with the work done on the Lang Creek group, included geophysical surveying, mapping, and the diamond drilling of three holes totalling 500 feet. It is reported that the option has been dropped. The property was not visited.

STIKINE*

Copper

Galore Creek (Kennco Explorations (Western) Limited)

(57° 131° S.E.) Company office, 1111, 1030 West Georgia Street, Vancouver 5. C. J. Sullivan, president, Toronto; J. A. Gower, manager, Vancouver. This company holds 162 claims by record and sixteen claims by option from Hudson Bay Exploration and Development Company Limited, all in the headwaters of Galore Creek, about 20 miles southeast of the junction of the Stikine and Scud Rivers. This property, which was partly located and explored in 1960, is to some extent a relocation of the HAB and BUY groups, on which trenching and diamond drilling was done by the Hudson Bay company in 1956 (Ann. Rept., 1956, p. 14). Its east boundary is close to the Copper Canyon property of Southwest Potash Corporation, on which some work was done in 1957 (Ann. Rept., 1957, p. 5). Work in 1961 included geological mapping and sampling, an air-borne magnetometer survey, ground geophysical and geochemical surveys, and surface diamond drilling of six holes totalling 1,239 feet. An average crew of twenty men was employed from May to September under the supervision of D. A. Barr. The property is accessible only by helicopter and was supplied in 1961 from the Stikine River, on which a river-boat was operated by Ritchie Transportation Company, of Wrangell.

Chalcopyrite-bornite mineralization is exposed in several zones at elevations ranging between 2,500 and 5,000 feet within an area of about 8 square miles. The area is largely underlain by syenite together with dykes and irregularly shaped intrusions of trachyte porphyry.

* By J. M. Carr.

HAB (The Consolidated Mining and Smelting Company of Canada, Limited)

(57° 131° S.E.) Company office, Trail. This company holds, under option from W. Buchholtz, four claims and one fractional claim of the HAB group which are surrounded by the Galore Creek property of Kennco Explorations (Western) Limited. The claims straddle the west fork of Galore Creek at about 2,600 feet elevation and were the site of some of the exploratory work done by the Hudson Bay company in 1956. Work in 1961 included making six hand trenches together with sampling and geological mapping. An average crew of four men was employed for about two weeks in July under the supervision of G. M. Gibson.

The exposed mineralization resembles that seen elsewhere in the Galore Creek area and is in altered porphyry. On the east side of the west fork, porphyries are exposed in contact with greywacke strata.

ISKUT RIVER*

Copper-Iron

Lake, Don, and Ken (Newmont Mining Corporation of Canada Limited)

(56° 130° N.E.) Head office, 906, 211 Portage Avenue, Winnipeg 2. J. Drybrough, president; G. W. H. Norman, geologist, Vancouver. This company holds 192 claims near the head of Forrest Kerr Creek, about 75 miles northwest of Stewart. The property includes the Lake, Don, and Ken groups and is reported to contain showings of skarn with magnetite and copper minerals. Work in 1961 was done by a small prospecting crew and continued from June to September. It included magnetometer surveying together with trenching by means of a Pionjar drill. The property is accessible only by helicopter.

UNUK RIVER*

Copper and Copper-Iron

Granduc Mines, Limited

(56° 130° S.E.) Company office, 604, 744 West Hastings Street, Vancouver 1. J. Drybrough, president; J. S. Moore, mine superintendent; G. W. H. Norman, geologist. This company owns the Granduc property, at the head of the Leduc River 25 miles north-northwest of Stewart, and holds large groups of claims farther north in the Unuk River district. In 1961 detailed property examinations were continued together with regional prospecting, and diamond drilling was done at Granduc and two other properties, as noted below. Base camps were re-established in April at the Granduc mine and at the junction of the Unuk and South Unuk Rivers, and an airstrip for two-engined aircraft was built near each. At Granduc 5 miles of road was constructed between the airstrip and the camp, and sixteen prefabricated buildings 12 by 16 feet in size were flown in and erected. As many as five aircraft, including helicopters, were used by the company to supply and maintain these widespread operations, which employed up to fifty men between May and September. At the end of the season the Unuk River camp was closed and work continued at Granduc with about fifteen men engaged.

(*a*) *Granduc.*—This property comprises sixty-four Crown-granted and 259 recorded claims. Work in 1961 was done mainly to explore possible north and south extensions of the Granduc orebody. An adit was driven southwestward for 500 feet from a portal at 3,400 feet elevation, more or less directly across the south fork of the Leduc glacier, from the existing adits. From this new adit six holes,

* By J. M. Carr.

totalling 5,734 feet, were drilled, partly southeastward under a mineralized showing (identified as No. 1A on Fig. 3, Ann. Rept., 1953) that is exposed high up in inaccessible cliffs, and partly northeastward under the glacier. Eleven other holes totalling 12,537 feet were drilled from surface at moderate to high elevations on Granduc Mountain, to explore possible mineralization lying north of the mine workings. Later in the year, seismic surveys and additional drilling, amounting to several thousand feet, were done to determine ice thicknesses in the south fork of the Leduc glacier.

(*b*) *Max.*—This group of 211 claims extends northward on McQuillan Ridge and the east side of Harrymel Creek. Work in 1961 included geological mapping and 2,550 feet of surface diamond drilling on the north side of McQuillan Ridge in a skarn zone containing iron sulphides, magnetite, and chalcopyrite. Including two holes drilled in 1960, a total of twelve holes has been drilled in this zone.

(*c*) *Ted Ray.*—This group comprises fifty-eight claims on the north side of Sulphuret glacier. Work in 1961 included geological mapping and 700 feet of packsack diamond drilling, which was done in an area of chalcopyrite and pyrite mineralization near an east-northeasterly shear zone. The area was referred to in 1935 as the Big Showing group (Ann. Rept., 1935, p. B 12), and is underlain by a body of porphyritic syenite which is emplaced in tuffaceous and limy sedimentary strata.

PORTLAND CANAL

SALMON RIVER (56° 130° S.E.)*

Gold-Silver-Lead-Zinc

Silbak Premier Mines Limited

Company office, 844 West Hastings Street, Vancouver 1. A. E. Bryant, president; H. Hill & L. Starck & Associates Ltd., consulting engineers. In May this company resumed mining and exploration of the high-grade oreshoot in the south wall of the Premier glory-hole. A truck-road was built into the glory-hole from the north side, and diamond drilling was done which located an extension of the oreshoot downward for about 50 feet, to the elevation of the old No. 1 level of the mine. An east drift on this level had been started in 1960, using a new portal constructed in the glory-hole. This drift was extended and the ore mined by raising, a pillar being left at the top. The oreshoot was then found by diamond drilling to persist downward to a depth of about 57 feet below No. 1 level. A new adit was driven to connect with the No. 110 sublevel, which is about 100 feet below No. 1 level, and from the old workings a crosscut and raise were driven to the ore. Altogether in 1961, 330 feet of drifting and crosscutting and 20 feet of raising were done, together with 2,030 feet of diamond drilling from surface and underground. A small shop was built at the 110 level. An average crew of fifteen men was employed, and 831 tons of high-grade ore was mined and shipped. The operation was closed in December because of washouts on the road to Stewart.

Examination of rock exposures on surface eastward from the mine camp shows the existence of steep, parallel sheets, which at least partly conform to the bedding of tuffaceous rocks. At the glory-hole the sheets strike east-northeast and possess steep northerly dips and are parallel both to the adjacent part of the main Premier vein, now stoped out, and to the oreshoot now being mined. The oreshoot is apparently localized near a cross-fracture of westerly dip, and it plunges steeply to the west. Existing plans and sections show that many of the mined-out orebodies

* By J. M. Carr and W. C. Robinson.

in the main vein also had this attitude, which suggests that ore in this part of the mine was mainly localized by the sheeting and cross-fractures.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1947, pp. 74–82; 1956, pp. 17–18; 1960, p. 8; *Geol. Surv., Canada,* Mem. 175, pp. 161–166.]

ALICE ARM*

Silver

Dolly Varden Mines Ltd.

(55° 129° N.W.) Company office, 837 West Hastings Street, Vancouver 1. F. C. Buckland, president; A. C. Skerl, consulting engineer. The company holds, by option agreement, the Dolly Varden group of seven Crown-granted claims, the Torbrit group of fifteen Crown-granted claims, and the Wolf group of four Crown-granted claims. The Dolly Varden property is on the west slope of Kitsault Valley and on the top of Dolly Varden Mountain, between 1,000 and 2,200 feet altitude. The Wolf property is on the east slope and bottom of Kitsault Valley about one-quarter of a mile south of Trout Creek. The 1951 Annual Report describes the geology and mineral occurrences of the upper Kitsault Valley.

Work in 1961 commenced in June and was suspended in October. Old workings were cleaned out and re-examinations were made of the properties. Geological mapping was also done. A crew of three men was employed under the direction of David Yorston. Transportation to the Torbrit camp was by truck from Alice Arm.

Molybdenum

Alice (Kennco Explorations (Western) Limited)

(55° 129° S.E.) Head office, 25 King Street West, Toronto 1. C. J. Sullivan, president. The property is on the east fork of Lime Creek, about 5 miles southeast of Alice Arm. It consists of sixty-three claims held by location. Work during 1961 commenced May 23rd and was suspended on November 15th. Nine BX holes, totalling 8,267 feet, were drilled. An average crew of eighteen men was employed under the direction of B. A. Bradshaw.

The camp was supplied mainly by helicopter. Some air-dropping was also employed from Beaver aircraft operating out of Terrace. A foot-trail from a point on tidewater opposite Alice Arm was used by personnel.

OBSERVATORY INLET*

Copper

Anyox (The Consolidated Mining and Smelting Company of Canada, Limited)

(55° 129° S.W.) D. C. Jackson, engineer in charge. The property is on the east side of Observatory Inlet and comprises seventy-three Crown-granted claims and thirteen recorded claims. In the period May 25th to October 17th two deep holes, with an aggregate length of 4,913 feet, were diamond drilled from the surface. The work, which was done by an average crew of eight men, included the construction of approximately 1,000 feet of road. The property was serviced by aircraft based at Prince Rupert and, in part, by helicopter.

* By W. C. Robinson.

QUEEN CHARLOTTE ISLANDS

Moresby Island

Iron-Copper

Tassoo (Wesfrob Mines Limited)* (52° 132° N.E.) Executive office, 25 King Street West, Toronto 1. G. T. Woodrooffe, president; G. K. Polk, engineer in charge. Wesfrob Mines Limited is a subsidiary of Ventures Limited (now Falconbridge Nickel Mines Limited). The property is on Tasu Sound near the mouth of Fairfax Inlet and consists of twenty-one Crown-granted and eleven recorded claims. Originally explored in 1907–09, production in 1914–17 was of the southernmost orebody (No. 3 zone) for chalcopyrite contained in magnetite. Recorded production is 5,180 tons, containing: Gold, 94 ounces; silver, 1,408 ounces; copper, 165,566 pounds. The property was acquired in 1956 by Frobisher Limited, and a subsidiary, Wesfrob Mines Limited, was formed to explore and develop the property, primarily as a source of iron ore. Some 22,000 feet of diamond drilling, much of it by packsack drill, was completed in 1956–57, and no further work was done until April, 1961. Seventy holes, totalling 16,308 feet, were drilled, and geological and magnetometer surveys were carried out during 1961. A thirty-man camp was completed in December, and work on the property is continuing.

The geology of the area surrounding the property is shown on Figure 1. The oldest rocks are pillow lavas, greenstones, and amphibolites of the Vancouver group that are correlatives of the Karmutsen formation of northern Vancouver Island. These volcanic rocks are overlain conformably by a thick massive limestone succeeded by thin-bedded dark limestones and argillites, which together form the Kunga formation. The limestone is of early Upper Triassic (Karnian) age, and the overlying thin-bedded limestones and argillites are of Upper Triassic (Karnian, Norian) to Early Jurassic (Sinemurian) age. Fragmental andesites of the Yakoun formation (Middle Jurassic) overlie the Kunga formation, and related dykes and sills are very numerous in the older rocks, especially along the shore of Lomgon Bay. Feldspar porphyry intrusive bodies occur at the property and in the central part of Lomgon Bay that are younger than the Kunga formation, unlike the Yakoun rocks, and older than granitic rocks of the northern termination of the San Cristoval batholith, the largest pluton of the islands. The San Cristoval batholith is composed primarily of foliated hornblende diorite. Its age is not known, except that it is younger than Middle Jurassic and older than post-tectonic intrusives that intrude early Upper Cretaceous rocks. Cobbles similar to San Cristoval diorite occur in the Honna formation of early Late Cretaceous age. Abundant dykes of undeformed, unmetamorphosed basalt of probable Tertiary age intrude all other rocks in the area.

Metamorphism has changed greenstones into amphibolites, limestone into marble, and argillite into hornfels. The hornfelsic argillites are very difficult to identify in the field as sedimentary rocks. The metamorphism is general in the rocks adjacent to the San Cristoval batholith. Metasomatism is more local and has formed the magnetite and skarn deposits. In spite of the intensity of alteration, remnants of the fossil pelecypods *Monotis* and *Halobia* may be found at a number of localities in the vicinity of the property.

The structure of the pre-diorite rocks on the south shore of Tasu Sound consists of a main northwesterly plunging syncline with secondary anticlines on each limb (*see* Fig. 1). Many northerly and northwesterly steep faults are known that are not shown on the figure, and others are suspected.

* By A. Sutherland Brown.

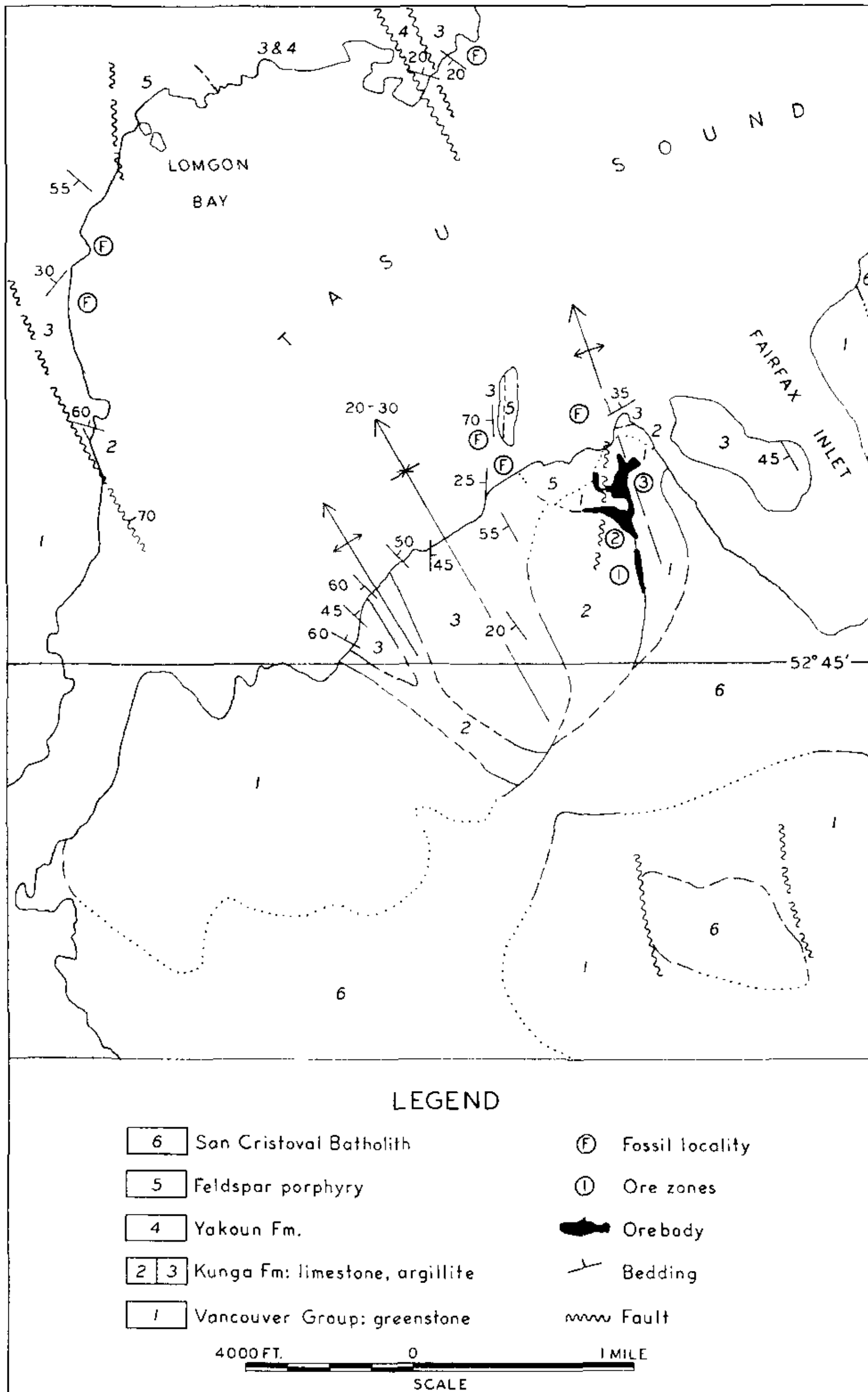


Figure 1. Geology of part of Tasu Sound, Moresby Island.

The orebodies are not yet fully explored. They occur along a northerly trending belt that is roughly coincident with the axial zone of the eastern subsidiary anticline. The southern and central orebodies (No. 3 and No. 2 zones) occur at the contact of the greenstone and the limestone, and the southern (No. 3) appears to be largely replacing limestone. The northern zone is contained entirely in greenstone. Prior to the current work, the company had announced ore reserves of 5,000,000 tons, averaging: Iron, 58.7 per cent; sulphur, 2.69 per cent. Sulphur varied from about 2 to 3 per cent throughout, present to a large extent as chalcopyrite in No. 3 zone, and to a lesser extent in No. 2 zone; in No. 1 zone it was largely present as pyrite.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1913, pp. 96–97; 1956, pp. 125–127; *Western Miner,* Oct. 1959, pp. 38–44.]

Iron

Harriet Harbour (Jedway Iron Ore Limited)*

(52° 131° S.E.) Head office, 1111 West Georgia Street, Vancouver 5; mine office, Jedway. L. T. Postle, president; J. M. Stitt, manager. Harriet Harbour is on Skincuttle Inlet, on the southeastern coast of Moresby Island, and is 70 miles south of Sandspit. The properties on Harriet Harbour consist of two Crown-granted claims, sixty-four recorded claims, and one optioned claim. The company is a subsidiary of The Granby Mining Company Limited and was formed in April, 1961, to take over and mine the Harriet Harbour property of Silver Standard Mines Limited. An option to purchase had previously been announced in January, 1961. Jedway Iron Ore Limited has a contract with Sumitomo Shoji Kaisha Ltd., of Tokyo, to supply 2,000,000 long tons of iron-ore concentrates over five years.

The geological setting of the Jessie orebody and other magnetite bodies at Harriet Harbour is shown on Figure 2. The oldest rocks exposed are greenstones and fine-grained amphibolites of the older volcanic rocks of the Vancouver group—co-relatives of the Karmutsen formation of northern Vancouver Island. These volcanic rocks are overlain conformably by limestone of the Kunga formation of early Upper Triassic age (Karnian). This limestone is thinner than normal in the vicinity of the Jessie orebody, where it is 50 to 100 feet thick. Stratigraphically above the massive limestone are thin-bedded dark limestones, followed by calcareous and siliceous argillites, all of the Kunga formation. These rocks have a total thickness of about 2,000 feet and are of early Upper Triassic (Karnian) to early Lower Jurassic age (Sinemurian). The volcanic and sedimentary rocks are cut by several groups of dykes and sills, a large number of which are amygdaloidal andesite similar to rocks of the Yakoun formation (Middle Jurassic age). In addition, feldspar porphyries occur that are older than the Jedway stock and the metamorphism.

The stratified rocks are folded into a broad domal anticline that trends approximately north 70 degrees west. This fold is truncated by northwesterly structures, both folds and faults, in the vicinity of Harriet Harbour. Part of the junction of these structures shows on Figure 2. All the aforementioned rocks are intruded by the Jedway stock, a small pluton with a surface area of about 1½ square miles. The stock is dominantly composed of medium-grained hornblende diorite. It is one of five small stocks on southeastern Moresby and Burnaby Islands that seem to be interrelated. These bodies are younger than early Cretaceous (Barremian) and may be late Cretaceous or early Tertiary. The plutonic rocks are cut by undeformed basalt and rhyolite dykes of presumed late Tertiary age.

* By A. Sutherland Brown and W. C. Robinson.

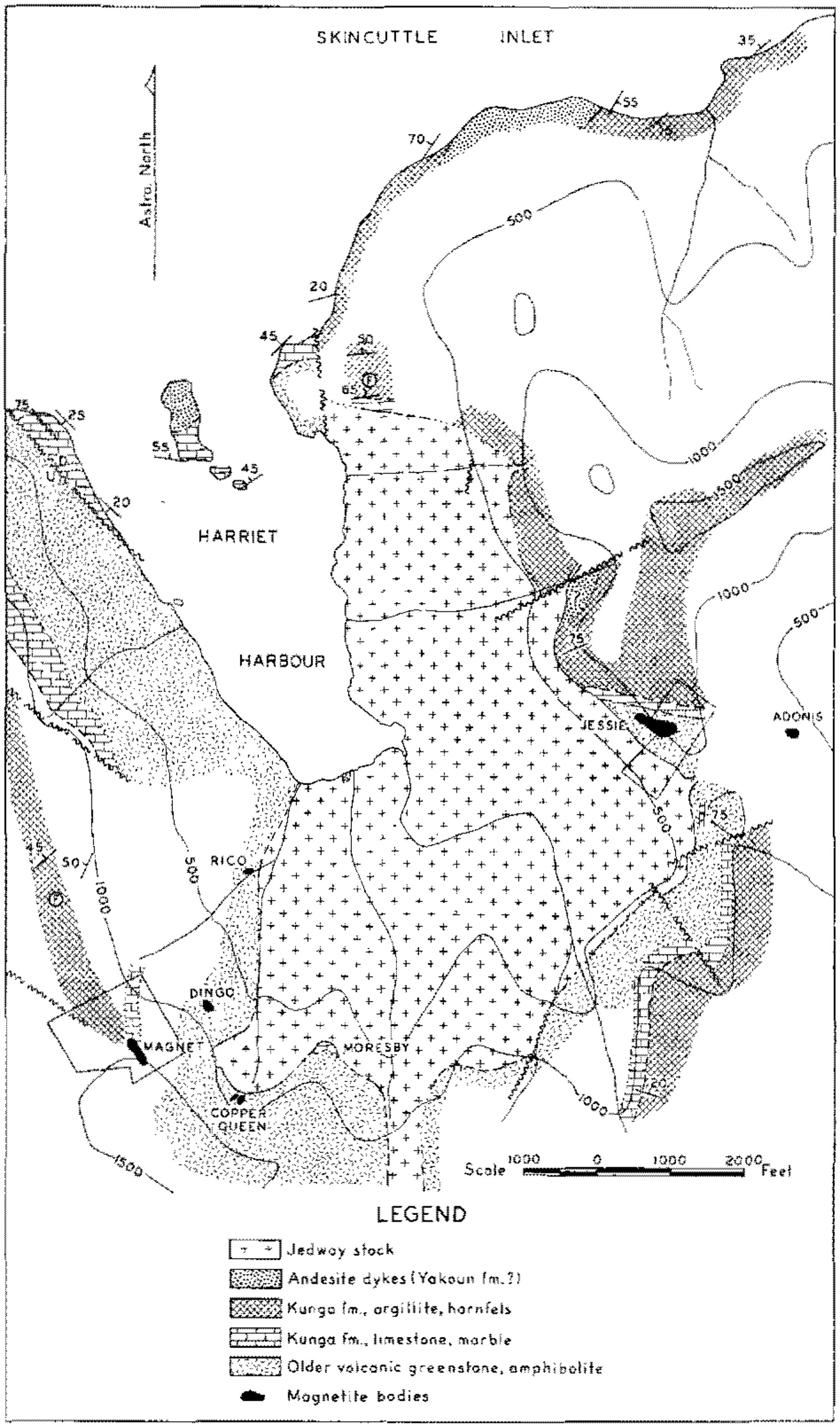


Figure 2. Geology of Harriet Harbour, Moresby Island.

Metamorphism has affected all the pre-diorite rocks to some degree. The older volcanic rocks show no trace of the pillow structures that are ubiquitous in them where they are undeformed and little altered. Close to the Jedway stock these rocks are now fine-grained amphibolites. The limestone is recrystallized, in some places to a sugary white marble. The argillites are white hornfels with no trace of bedding; with successively less metamorphism they range through varicoloured, banded, flinty rocks to dark-green thinly bedded rocks not much different from the original. Metasomatism has affected local areas around the periphery of the stock. In these places, greenstones and amphibolites have been converted to lime garnet-actinolite-epidote-chlorite skarn with magnetite and pyrite and chalcopyrite. The limestone has likewise been changed to garnetite in a few localities. The thin-bedded rocks of the Kunga formation were not seen to be greatly metasomatized. The feldspar porphyries appear to be affected by the metasomatism only slightly.

The Jessie orebody occurs in greenstone on the northern flank of the domal anticline adjacent to the Jedway stock. The orebody consists of a complicated series of digitate lenses of magnetite-rich skarn in a general zone of skarn and intense chloritic alteration. The ore lenses and the skarn zone are subparallel to the overlying base of the Kunga limestone. The limestone, the skarn zone, and the ore lenses all strike about north 60 degrees west and dip about 40 degrees northeastward. The skarn and chloritic zone is quite continuous. The top is 50 to 150 feet below the limestone, and the bottom, so far as is known, is 350 to 400 feet below the limestone. Some ore lenses are quite continuous, others irregular or discontinuous. Some discontinuities may be explained by steep minor faults striking parallel to the rock units. The orebody has not been fully outlined by diamond drilling, but three deep holes show its existence 800 feet down dip from the outcrop area. Near the surface the ore zone is nearly 1,000 feet long. Within the skarn zone the greatest thickness of ore is about 90 feet. Ore reserves have been stated to be 4,700,000 tons, which will produce 2,570,000 tons of concentrate. About 2,000,000 tons of ore will be mined by open pit.

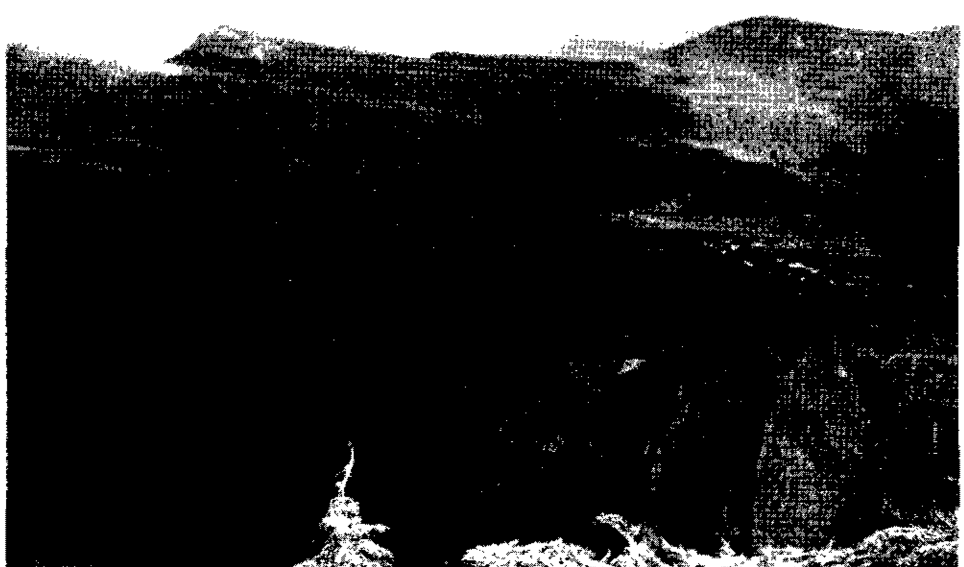
Most of the information on the orebodies was obtained by diamond drilling and magnetometer surveying prior to 1961. While the property was under option in the period January 28 to March 3, 1961, four diamond-drill holes, totalling 2,230 feet, were drilled from the surface.

In May, clearing of the property was started and work continued on construction and development of the open pit throughout the remainder of 1961. Mining contractors, R. F. Fry and Associates (Western) Ltd., drove 1,518 feet of adit and 552 feet of raise. Surface development work included the construction of 3.9 miles of road and the removal of 45,860 tons of waste from the open pit. Construction by the end of the year included the erection of a cook-house, two bunk-houses, a dry, store, school, office, staff-house, and ten residences.

At the end of 1961 the number of men employed on the property was eighty-seven. The camp is supplied by Northlands Navigation freighter as well as by barge. Transportation of personnel is by charter aircraft based at Sandspit.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1959, pp. 11–14; 1960, pp. 11–12; *B.C. Dept. of Mines*, Prel. Geol. Map, Southern Queen Charlotte Islands, 1960.]

Kano Inlet, west coast of Graham Island.



View northwest from head of Tartu Inlet, west coast of Graham Island. Basalt and trachyte flows of the Masset formation dipping northeast.

LOUISE ISLAND*

Iron

Iron Duke (52° 131° N.W.) This property consists of ten Crown-granted and two recorded claims. Ownership of the claims is diverse, but Campbell M. Robertson, of New Westminster, one of the owners, has an agreement with the others that enables him to explore the property or negotiate regarding it.

The property is on the slope north of Waste Creek, about 2½ miles west of Girard Point on the northeast coast of Louise Island. It is reached by a trail that leaves the beach nearly a mile west of Girard Point. During 1961, exploration initiated by Campbell Robertson included a geological examination and an attempt to build a road to the property from the shore near Mathers Creek. In the autumn the property was optioned by Magnum Consolidated Mining Co. Ltd., who made a magnetometer survey of the property and a geological map of the vicinity. Two diamond drills were moved to the Iron Duke late in 1961, and in January and February, 1962, fifteen AX holes were drilled totalling 3,054 feet. The exploration was maintained by helicopter. The option was dropped in March, 1962.

Bedrock is poorly exposed in the vicinity of the showings, except in some old cuts and a 70-foot adit. Young and Uglow (1926, p. 28) illustrate and describe the surface exposures of magnetite. Limestone occurs in a small outcrop at the northwest of the showings and granitic rocks for some distance just east of the showings. A zone of magnetic anomalies extends approximately 800 feet northeast up the hill from just below the adit, which is at about 1,100 feet elevation. A somewhat detached anomaly occurs southeast of the adit. Both anomalies are characterized by isolated distinct peaks. Most of the anomalous zone is on the Iron Duke No. 2 claim, Lot 2333, but extends onto the southwest corner of the Iron Duke No. 1, Lot 2332. The drill-holes were collared at the sites of magnetic peaks. The core seems to indicate that intercalated limestone, skarn, and magnetite with interfingering sills of granitic rocks all dip gently westward.

[Reference: Young and Uglow, 1926, Iron Ores of Canada, Vol. I, *Geol. Surv., Canada,* pp. 27–30.]

KITIMAT†

Iron

Wedeene Iron (54° 128° S.W.) Quebec Metallurgical Industries Ltd., 2200, 25 King Street West, Toronto, holds four Crown-granted and nine recorded mineral claims on magnetite showings on the south side of Iron Mountain. Iron Mountain rises to a height of 2,300 feet between the Wedeene and Kitimat Rivers about 8 miles north of Kitimat and 30 miles south of Terrace. In 1961 a camp was established at the railway bridge crossing Wedeene River at Mile 30.7 from Terrace. A drill camp was established at an elevation of about 1,800 feet on the mountain about 1½ miles by trail from the lower camp.

The claims cover showings of magnetite containing small amounts of pyrite and chalcopyrite, located more than fifty years ago for their copper content, and on which four short adits had been driven.

Geological mapping shows (*Geol. Surv., Canada,* Map 11-1956) that the summit and western slope of Iron Mountain are underlain by grey diorite, which is intrusive into an assemblage of green andesitic flows and fragmental rocks cut by dykes of much the same composition. On the eastern side of the Iron Mountain intrusions, irregular areas of skarn are exposed along both sides of a south flowing

* By A. Sutherland Brown.
† By Stuart S. Holland.

creek, which seems to flow along a structurally controlled lineament that can be seen on aerial photographs. The skarn is composed essentially of brown garnet and green epidote and appears to occur along the line of the creek and along lines of fracturing at a small oblique angle to it. The eastern contact of the Iron Mountain intrusion appears to be not less than 500 feet to the west of the creek lineament, and it is considered that the localization of skarn is related more to the fracturing than to the position of the intrusive contact. There is no indication that the skarn represents a replacement of limy beds in what is an essentially volcanic assemblage.

Within the skarn there are irregular disseminations and bodies of more or less massive magnetite. The magnetite occurs in three zones: A lower zone at the foot of the hill on the west side of the creek, an upper zone at an elevation of about 1,600 to 1,800 feet on the east side of the creek, and a zone at intermediate elevations in and along the creek. The lower zone was explored in 1960 by drilling with packsack and EX machines and in 1961 by further packsack drilling. The ore zone is about 600 feet long, along a northeasterly direction, and about 400 feet wide.

In 1961 the upper zone was being explored by diamond drill recovering EX core with drill-holes fanned downward along lines of section about north 60 degrees west and 100 feet apart. The upper zone has a length of about 1,000 feet in a northeasterly direction and a maximum width of about 300 feet.

No work has been done on the intermediate occurrences. Diamond drilling indicates that within the skarn zones the occurrence of disseminated and massive magnetite is most irregular. It is difficult with the present knowledge of mineral control to correlate from one diamond-drill hole to another in the same line of section and also from one line of section to the next adjacent.

In 1961, work was under the supervision of H. S. Lazenby. There were six men and a cook at the main camp at Wedeene bridge and four diamond drillers at the mountain camp. Diamond drilling comprised fifty-five holes totalling 11,489 feet. In addition, a magnetometer survey was made of the property.

SMITHERS*

Copper

Stock (54° 127° N.E.) The Stock group of fifteen claims held by Carl Glover, of Smithers, is at an elevation of about 5,000 feet at the head of Winfield Creek. The claims are reached by road up the Telkwa River, thence by about 10 miles of trail which climbs to the ridge north of Cumming Creek. The claims cover an old copper showing known as the Copper Queen, which from 1917 to 1919 shipped 12 tons of ore containing 1 ounce of gold, 91 ounces of silver, and 6,465 pounds of copper.

The rocks at the headwaters of Winfield Creek comprise intercalated reddish and brownish weathering dacitic and andesitic flows and breccias which strike north 35 degrees east and dip 20 degrees southeast. These rocks on the southeast side of the creek are cut by a southeasterly striking fracture which is mineralized with chalcocite. The old work, consisting of a large open cut with an adit and crosscut beneath, is caved and provides no information. It would appear that the mineralization developed preferentially in certain of the layered rocks, and that a pale biscuit-coloured dacite flow outcropping near the adit and open cut may have maintained a more open fracture than did the coarse agglomerates lying above it.

The main fracture, a break of small displacement, at one point contained a chalcocite vein as much as 12 inches wide, but elsewhere appears to be only sparsely mineralized. Wallrock alteration is absent in the vicinity of the old workings and along the extension of the fracture to the southeast.

* By Stuart S. Holland.

In the autumn of 1960 three X-ray drill-holes were put down beneath newly discovered showings of disseminated chalcocite lying to the southeast of the old workings. The results were not sufficiently good to encourage more work as the copper content was low and the width narrow.

Molybdenum

Glacier Gulch (Southwest Potash Corporation)*

(54° 127° N.E.) Executive office, 1270 Avenue of the Americas, New York 20. F. Coolbaugh, president; J. W. Bryant, engineer in charge. A total of sixty-one claims are held under option from W. Yorke-Hardy and partners. The property is in the cirque at the head of Glacier Gulch on Hudson Bay Mountain. Molybdenite mineralization occurs in volcanic rocks over a large area at the toe of the glacier.

Work on the property commenced June 1st and was suspended on November 4, 1961. Six holes, totalling 10,354 feet, were diamond drilled. The average crew consisted of fourteen men. The camp was supplied by pack-horses and the intermittent use of a helicopter. The helicopter simplified the problem of moving the drill and equipment to various sites on the rough terrain near the toe of the glacier.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1958, pp. 10–11.]

Silver-Lead-Zinc

Cronin (New Cronin Babine Mines Limited)*

(54° 126° N.W.) Company office, 844 West Hastings Street, Vancouver 1. L. C. Creery, president; H. Hill & L. Starck & Associates Ltd., consulting mining engineers. The property is on the east slope of Cronin Mountain, about 30 miles by road from Smithers. A description of the property was given in the 1949 Annual Report. During part of 1961, P. Kindrat, lessee, again operated the mine and mill. Eighty tons of lead concentrate and 93 tons of zinc concentrate were produced and shipped to the Trail smelter.

ENDAKO*

Molybdenum

Stella

(54° 125° S.E.) This property is 5 miles southwest of Endako. Twenty-six recorded claims are held by C. Riley, of Vancouver. The showings consist of a number of quartz veins in Topley granite that contain molybdenite. Work on the property done between July 15th and August 20th consisted of channel and bulk sampling of rock trenches, which had been blasted. A crew of five men was employed under the direction of S. Weiss. Transportation was by truck.

[References: *B.C. Dept. of Mines,* Bull, No. 9; *Geol. Surv., Canada,* Mem. 252, pp. 192–193.]

CARIBOO

WELLS-BARKERVILLE (53° 121° S.W.)†

Gold

Aurum (The Cariboo Gold Quartz Mining Company Limited)

Company office, 1007 Royal Bank Building, Vancouver; mine office, Wells. Dr. W. B. Burnett, president; Marcel Guiget, general manager; J. J. Stone, mill superintendent. Capital: 2,000,000 shares, $1 par value. This company operates the Aurum mine on the east side of Island Mountain adjacent to the community of Wells, which is 51 miles by road from Quesnel.

* By W. C. Robinson.
† By A. R. C. James.

The mine has been in continuous production since 1934 and has been operated by the present company since 1954. It is developed from a main haulage adit at the 4,000-foot level. Eleven levels have been developed from the Aurum shaft, which is a three-compartment internal shaft 1,450 feet deep and collared at the 4000 level. With the exception of a large quartz stope on 3125 level, all the working-stopes are now northwest of the shaft.

The ore occurrences are of two kinds. Pyritized quartz veins are found in groups and clusters in the micaceous quartzites of the Snowshoe formation. Pyritic replacement bodies in limestone occur in the Baker limestone beds of the same formation at the contact with the micaceous quartzites, and these bodies are directly related to the amount of folding, being more numerous where major folding has taken place. Both types of ore occurrence appear to be related to major faulting in the area. The average grade of the quartz ores of the Aurum mine has usually been in the range of 0.35 ounce of gold per ton, while the replacement ore is usually of higher grade, an average being 0.75 ounce of gold per ton. The quartz orebodies are mined by a cut-and-fill method, while the replacement deposits are usually developed by inclined drifting and are mined by slashing the ore on a retreating system.

Until about three years ago all the workings were in the general area of the Aurum fault zone and associated zone of folding. In 1958 it was decided to drift northwest on the 3000 level to explore the Mosquito Creek property, also held by the company. At a point 2,300 feet northwest of the shaft the drift crossed a fault which was subsequently named the Burnett fault. As with other major faults in the Wells camp, the Burnett fault strikes northward and dips eastward. Exploration soon confirmed that this was favourable ground for ore deposition. The first replacement stope, the M1, was opened on the northwest side of the fault in 1959, and shortly afterwards another orebody, the 64, was found on the southeast side of the fault. A system of folds with a general northwesterly plunge appears in the vicinity of the fault. In 1960 it was decided to drive into the Burnett fault area on two levels (3125 and 2850) immediately above and below the 3000 level. The drift on the 3125 level was completed in November, 1960, and that on the 2850 in March, 1961. The 2850 drift was extended several hundred feet beyond the Burnett fault and cut another northerly striking fault believed to be the Mosquito Creek fault. Exploration from these drifts has resulted in the discovery of a number of replacement orebodies, especially in the Burnett " crumple " up-plunge toward the Aurum workings. Four stopes have been mined on the 3125 level, and two stopes were being developed on the 3250 level at the end of the year. Northwest of the Burnett fault, mining continued in the M1 stope below the 3000 level, while a new orebody adjacent to the Mosquito Creek fault, the M8, was developed during the year. Three orebodies, the 56 and the 38 and 39, were developed on the 3000 and 2850 levels respectively southeast of the Burnett fault, and further exploration was continuing in this area at the end of the year. It would appear that the decision to drive into the Mosquito Creek section of the property is being amply justified by the ore being found.

The following is a summary of development work done at the mine in 1961:—

	Ft.
Drifting—	
Deferred development	2,025
Current development	1,251
Crosscutting	1,403
Raising	637
Diamond drilling	15,322
Box-holes and subdrifts	427
Test-holes (jackleg and ribbon steel)	15,719

At the end of the year a crew of 124 men was employed, of which eighty were underground. The remarkable safety record established in 1960 was maintained in 1961, there being only one lost-time accident recorded, giving a rate of four accidents per million man-hours worked. This compares very favourably with a rate of 64.2 accidents per million man-hours for the average for the previous five years. A full-time safety director is employed, and regular safety meetings and inspections are carried out.

A total of 37,944 tons of ore was milled, yielding 20,243 ounces of gold and 3,213 ounces of silver. This is approximately a 7-per-cent increase in gold production and a 3-per-cent decrease in the amount of ore milled.

LAC LA HACHE

Takomkane Mountain (52° 120° S.W.)*

Molybdenum

Boss Mountain (Noranda Exploration Company, Limited)

British Columbia office, 202, 2256 West Twelfth Avenue, Vancouver 9. This company bought the Boss Mountain molybdenum property in 1961. It includes eleven Crown-granted claims, forty-two previously recorded claims, and twenty-two claims newly recorded in 1961. The property is at 5,500 feet elevation near the head of Molybdenite Creek on the east side of Takomkane Mountain, 50 miles due east of Williams Lake. Camp was serviced by 80 miles of road from Williams Lake via Horsefly, the final 9 miles being passable by jeep only. During the work season 8 miles of new road was built from the camp down the south side of Molybdenite Creek to connect with the Hendrix Creek forest access road from Canim Lake. This creates a new access route about 57 miles long from 100 Mile House to the property.

The presence of molybdenite at this locality has been known since 1917 and has attracted attention intermittently to date. Stevenson (*B.C. Dept. of Mines,* Bull. 9, 1940, pp. 34–47) and Sutherland Brown (Ann. Rept., 1957, pp. 18–22) have published the most recent descriptions of the property.

The molybdenite mineralization occurs in a quartz diorite breccia pipe and in a long narrow zone of small quartz veins in quartz diorite.

The breccia pipe is exposed in an irregular lens-shaped area more than 100 feet wide and 400 feet long, as shown on Figure 3. In the centre of the pipe, molybdenite forms an irregular orebody 20 to 30 feet wide and about 350 feet long. The orebody plunges to the northwest and appears to bottom at depths ranging from 200 to 500 feet below ground surface. Estimates of the orebody so far delimited range from 1½ million tons averaging 0.7 per cent molybdenum to 1 million tons averaging 0.95 per cent molybdenum.

In the quartz veins, molybdenite is present as thin isolated seams and in scattered flakes. The veins are a few inches to 2 feet wide. They have been uncovered in short sections by cuts as indicated in the diagram and by pits and small trenches in a narrow zone extending nearly 2,000 feet up the bank of the creek southeast from the trenches shown.

Current interest in the showings began in 1956, when Climax Molybdenum Company optioned the property and started a programme of diamond drilling which was continued in 1957. American Metal Climax, Inc., a union of American Metal Company and Climax Molybdenum Company, did further diamond drilling, geological mapping, and geophysical surveying in 1958. In 1959 Southwest Potash Corporation, a subsidiary of American Metal Climax, Inc., carried out a programme

* By J. W. McCammon and A. R. C. James.

involving trenching, mapping, and more diamond drilling. They relinquished their option in 1960. In 1961 Noranda Exploration Company, Limited, used a bulldozer to do the trenching shown on the accompanying figure, and by the middle of August had completed the five diamond-drill holes indicated.

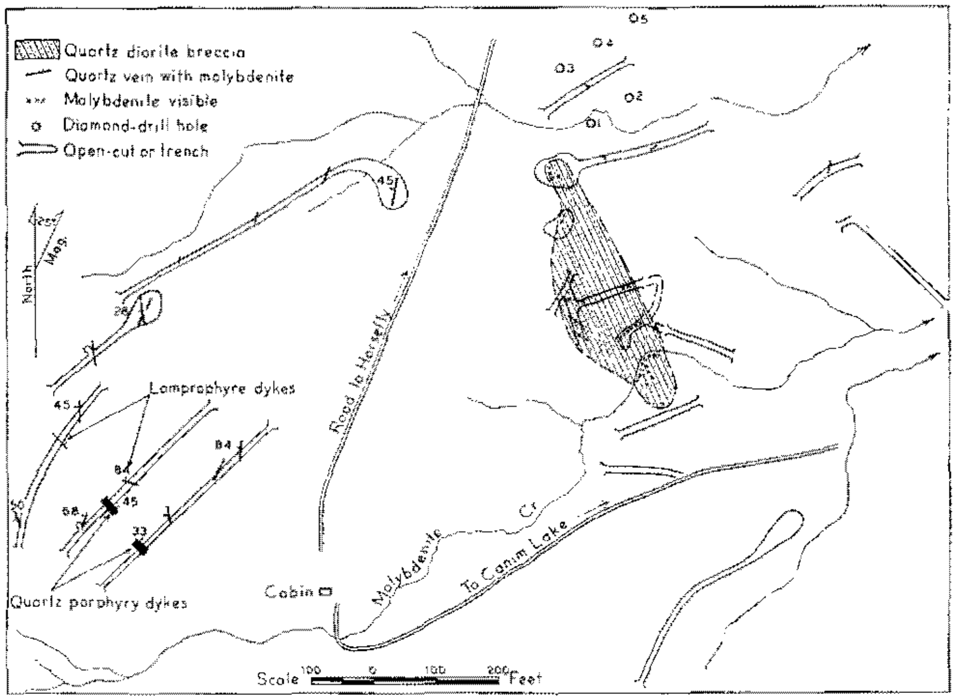


Figure 3. Boss Mountain molybdenite showings.

The trenches west of the road to Horsefly are shallow and barely expose bedrock. The rock uncovered is highly fractured quartz diorite. The quartz veins visible in the quartz diorite average 2 to 6 inches wide, with a single vein in the east end of the most northerly trench 19 inches wide. Most veins are badly fractured and cut by small faults with offsets of a few inches to a few feet. Molybdenite is erratically distributed through the veins as hairline seams and patches of flakes. None was recognized in the quartz diorite host rock.

Where the breccia pipe was exposed in trenches, molybdenite mineralization was seen as indicated in the diagram. The trenches were only a foot or two deep when examined, but the main one, near the centre, was being deepened. The best mineralization was visible in the old workings on the creek bank.

Previous diamond drilling, which seems to have tested most of the favourable ground, apparently failed to disclose a concentration of mineralization of economic interest other than that in the breccia pipe. As a result, the present company was directing its efforts to a search for extensions of the orebody in the pipe. The work carried out included 6,423 feet of exploratory diamond drilling; trenching and stripping; geological mapping; electromagnetic surveying; sampling of pits, trenches, and cores; soil-sampling; and general surveying. A crew ranging up to twenty-five men was employed throughout the season under the supervision of A. D. K. Burton.

CLINTON

Poison Mountain (51° 122° S.W.)*

Copper

Copper Nos. 1 to 4

This property comprises about forty-eight claims and fractions which are currently held by Huestis and Associates, partly by record and partly on option from H. Reynolds, of Lillooet. It is mainly on the west side of Poison Mountain, about 40 miles northwest of Lillooet near the headwaters of Yalakom River and Churn Creek. The principal showings are between 5,600 and 6,000 feet elevation on the east side of Poison Mountain Creek, mainly north of its tributary, Copper Creek. Access is by jeep-road, either from Big Bar ferry on the Fraser River or from the Yalakom River road at Blue Creek. Work done in 1961 by American Smelting and Refining Company on behalf of Messrs. Huestis and Reynolds included improvement of the road from Blue Creek, cleaning out of trenches, and a reconnaissance geophysical survey by the induced polarization method. A maximum crew of eight men was employed for about four weeks under the supervision of D. M. Fletcher and Lloyd Hewitt.

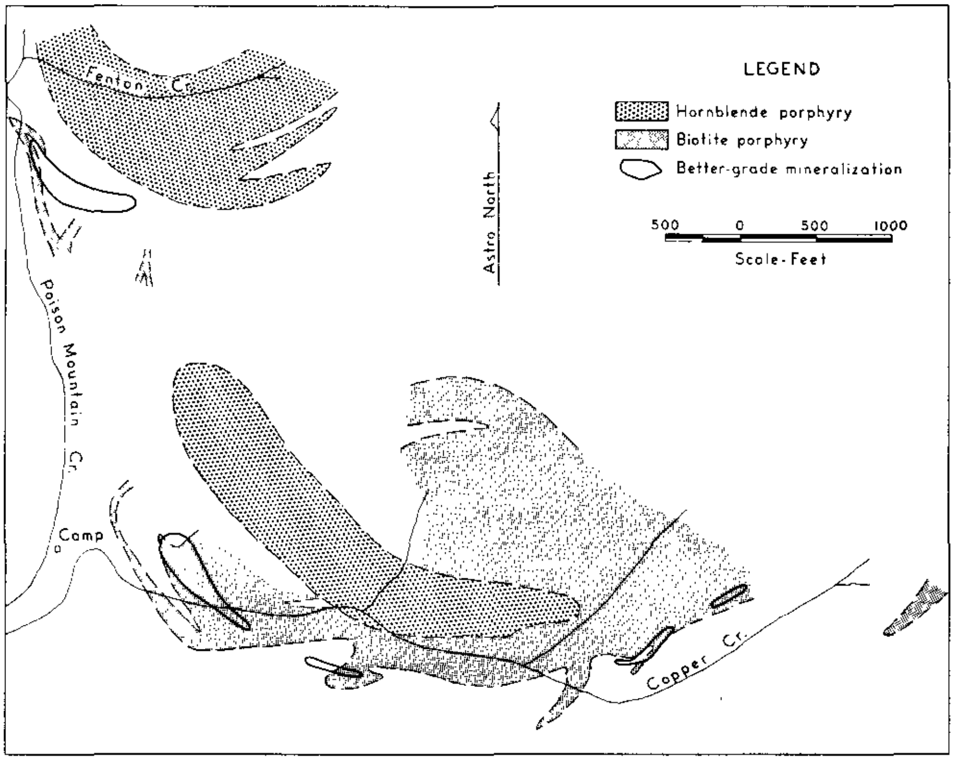


Figure 4. Copper group, Poison Mountain. Simplified geology.

Past work on this property has all been done in an area which measures about 1 square mile and is roughly bounded by Poison Mountain Creek to the west, Fenton Creek to the north, and Copper Creek to the south (*see* Fig. 4). Numerous trenches have been made and about 4,000 feet of diamond drilling done, in

* By J. M. Carr.

4

twenty-five holes of maximum length about 300 feet. The following description of the geology is based on a three-day examination of the showings and drill core, and on information kindly made available by the present and previous owners of the property.

In the explored area, two kinds of dacite porphyry have been successively intruded into interbedded argillite, greywacke, and conglomerate of presumed Lower Cretaceous age. The attitudes of the sedimentary rocks are seen only near Poison Mountain Creek, where the beds strike mainly north and northwest and possess moderate to steep easterly dips. The earlier porphyry is distinguished from the later one by the presence of rare but conspicuous books of biotite. The biotite porphyry forms an irregular, many-fingered body which extends for about 1 mile along Copper Creek and is roughly elliptical in plan. Dykes which may be offshoots of the main body occur farther north, near Poison Mountain Creek. The biotite porphyry grades in many places into breccia, which consists mostly of cataclastic porphyry but also of sedimentary rocks, and which resulted probably from explosion of this porphyry magma during its emplacement. The later hornblende porphyry forms two principal bodies of similar size and shape, each having a length of about half a mile and a maximum width of several hundred feet. The bodies are roughly crescent shaped in plan, being convex to the southwest, and are about 1,000 feet apart in a northerly direction. The southern one is emplaced mostly in biotite porphyry.

Alteration and mineralization affect all rock types, the hornblende porphyry being the least affected because it is the least fractured. Alteration includes biotitization, silicification, and, to a lesser extent, feldspathization. Mineralization is both disseminated and fracture-filling, and consists mostly of pyrite and chalcopyrite but also of bornite, molybdenite, and magnetite. Two zones of very low-grade copper mineralization occur, each containing one or more restricted areas of somewhat better-grade material. The northern zone follows roughly the southern margin of the northern body of hornblende porphyry. The southern zone is much larger and covers approximately the elliptical mass of biotite porphyry. It apparently grades outward to a halo of pyrite mineralization. In both zones, better-grade material occurs near the southwestern margin of the respective body of hornblende porphyry, and is either in or near biotite porphyry. Additional better-grade material occurs sparsely in the southern zone along the southern margin of the biotite porphyry.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1946, pp. 101–102; 1956, pp. 35–37; 1960, pp. 19–20.]

TASEKO LAKE*

Copper

Fish Lake (Phelps Dodge Corporation of Canada, Limited)

(51° 123° S.W.) Company office, 904, 1030 West Georgia Street, Vancouver 5. W. A. Hutchinson, Toronto, general manager; D. C. Malcolm, Vancouver, resident geologist. This company holds seventy-nine claims and fractions on both sides of the creek immediately northwest of Fish Lake, some 7 miles due north of Taseko Lake. The property was located in the fall of 1960 and partly covers the former Viccal group (Ann. Rept., 1935, pp. F 28–29). It occupies rolling country at about 5,000 feet elevation, and is a short distance east of a jeep-road which connects Fishem Lake in the Taseko Lake area with Hanceville.

* By J. M. Carr.

For several weeks in 1961, a small crew under the supervision of Lisle Dunn camped at Fish Lake and did work which included line-cutting, soil-sampling, magnetometer surveying, and the deepening of old hand trenches. These trenches contain the only bedrock seen on the property and are in two areas about 2,000 feet apart. In both areas, copper mineralization is disseminated in dacite porphyries. This and other properties held by the company in 1961 were supplied over distances of as much as 80 miles by helicopters and light aircraft which operated from newly constructed landing-strips situated at Pemberton Meadows, the head of Bridge River, and Fishem Lake respectively. During its summer operations in this region, the company employed about twenty-two men. Properties at Fish Lake and Tenquille Creek were visited by the writer.

LILLOOET

Bridge River (50° 122° N.W.)

Copper

B.R. (Phelps Dodge Corporation of Canada, Limited)*.—This company holds 125 claims forming the B.R. group near the head of Bridge River. In 1961 work was under the supervision of John Deleen and included rehabilitation and sampling of an old adit about 200 feet long, together with about 2,000 feet of diamond drilling.

Gold

Ace† The Ace Mining Company Ltd., 404, 510 West Hastings Street, Vancouver 2, holds forty-one recorded mineral claims covering a considerable area lying for the most part north of the Bridge River and extending for 4 miles west of the junction of Gun Creek. It includes the Wayside, Congress, and Minto mines. Work on this property was resumed, after an interval of twelve years, when Ernest Howard, now president of Ace Mining Company Ltd., discovered a new vein shear carrying gold values about 3,000 feet west of the old Congress mine. In December of that year an agreement with Bralorne Pioneer Mines Limited was reached whereby the latter optioned the property and carried out exploration work. Throughout much of 1960, exploration was concentrated on the new vein, and a drift was driven on it for 277 feet. Some geological examination and mapping was done on other parts of the property, and two diamond-drill holes were drilled in the Congress mine.

In 1961, work was continued from June 12th to the end of the year under the supervision of J. P. Weeks, chief geologist for Bralorne Pioneer Mines Limited; a crew averaging four men was employed. A considerable amount of stripping was done at various locations throughout the area of the property, and several mineralized shear zones were discovered. The most encouraging results were obtained from a showing called the Bluff vein, on the banks of Gun Creek 2,000 feet east of the Congress portal. This vein shear was traced for a length of 825 feet, and it is reported by the company that sampling indicated an average grade of: Gold, 0.13 ounce per ton; silver, 1.60 ounces per ton; antimony, 3.03 per cent; across an average width of 3.5 feet. The location and attitude of this vein suggests that it might be an extension of one of the veins developed in the Congress mine, in which case a very considerable strike length is indicated. Another vein, the Paul vein, was discovered too late in the season to permit its being traced along strike, but some encouraging assays are reported to have been obtained from the few exposures made.

* By J. M. Carr.
† By A. R. C. James.

Seven diamond-drill holes totalling 2,187 feet were drilled from underground sites in the Congress mine, mainly with the object of tracing and indicating the grade of the hangingwall vein. The work was still in progress at the end of the year and is said to be yielding some encouraging results. No surface diamond drilling was undertaken during 1961. Metallurgical test work continued to be carried out on mineral from the Congress mine.

In addition to the above-mentioned work by Bralorne Pioneer Mines Limited, Ernest Howard, president of Ace Mining Company Ltd., did some prospecting and bulldozer stripping on the west side of Gun Creek three-quarters of a mile north of the highway bridge across the creek. This work was started in July and continued until November. Mr. Howard also prospected on the Gold Belt group of sixteen claims, lying due north of the property under option to Bralorne Pioneer Mines Limited.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1948, pp. 106–112; 1960, pp. 20–21; Cairnes, C. E., *Geol. Surv., Canada,* Mem. 213, 1937, pp. 102–104.]

Bralorne Pioneer Mines Limited* Company office, 355 Burrard Street, Vancouver 1; mine office, Bralorne. F. R. Joubin, president; C. M. Campbell, Jr., resident manager; J. S. Thomson, mine superintendent; E. H. Hall, mill superintendent; A. J. Learmonth, plant superintendent. This company operates the Bralorne mine on Cadwallader Creek. It is reached by 51 miles of road from Shalalth or 75 miles from Lillooet, both stations on the Pacific Great Eastern Railway. The property was described in some detail in the 1958 Annual Report. The extensive workings are in a northwesterly trending vein system now being mined at depths between 3,600 and 4,700 feet below surface, with development work proceeding up to a depth of 5,200 feet below surface.

The workings are approached by a main haulage adit on No. 8 level. There are three internal shafts: the Crown shaft, approximately 2,600 feet deep from No. 8 to No. 26 level; the Empire shaft, approximately 3,280 feet deep from No. 3 to No. 26 level; the Queen shaft, 2,000 feet deep from No. 26 to a point just below No. 39 level. The major portion of present production is mined in cut-and-fill stopes between No. 28 and No. 35 levels, the 77 vein being the principal producing vein together with a small production from the 79 vein. The ore is hoisted in the Queen shaft to No. 26 level and is then hauled by battery locomotive to the Crown shaft, hoisted to No. 8 level, the main haulage level of the mine, and hauled by trolley locomotive to the mill. During the latter half of the year the new 600-ton cyanide mill was brought into full operation, replacing the old gravity and flotation mill. The old crushing plant was still in operation at the end of the year, but a start is to be made in 1962 on building a new plant. In 1961, 154,000 tons of ore was milled, yielding 105,510 ounces of gold.

A summary of development work done in 1961 is given below:—

	Advance (Ft.)	Additional Slashing (Cu. Ft.)
Drifting	2,476	14,050
Crosscutting	2,249	8,727
Raising	1,503	....
Transfer raises	489	570
Station excavation	....	21,370
Diamond drilling	10,893	....

* By A. R. C. James.

Following the completion of the shaft to No. 39 level in 1960, crosscuts were driven on No. 37 and No. 38 levels to the 77 and 79 veins. Seven hundred and ninety-one feet of development was done on the 77 vein on No. 38 level and 377 feet on the 79 vein. Three hundred and fifty-two feet of development work was done on the 77 vein on No. 37 level. At the end of the year the station had been cut and the crosscut was being driven on No. 36 level.

The sand fill system of stope-filling was completed in January, and, by the end of 1961, 70 per cent of the mine production was coming from hydraulic fill stopes. The sand and water mixture is pumped from the mill to a central reservoir on No. 8 level. From here it is passed downward to the lower workings through a 2⅜-inch diamond-drill hole.

An additional Jeffrey fan was installed on the surface at the top of the ventilation raise. The two fans in parallel now force approximately 120,000 cubic feet of air per minute down the raise to No. 25 level. From this point the air passes down into the Queen section by the developed part of the 79 vein and the Queen shaft. Auxiliary fans are located on Nos. 33, 34, 35, and 37 levels to direct the desired air flow on these levels. The exhaust air flows upward via stopes and manways and the Crown and Empire shafts to surface at Nos. 3 and 8 levels. Rock temperatures in the deeper workings reach 108 degrees, and an ample air flow is normally required to provide reasonable working conditions. In some development drifts and raises the air temperatures reach 90 degrees, but the average temperature of twelve stopes at the beginning of November was 75.6 degrees.

The number of men employed was 316, of whom 216 were employed underground. Although the year was marred by one fatal accident, it is pleasing to be able to report that last year's generally low accident rate has been maintained. The fatal accident occurred on the surface on December 23rd; a detailed description will be found elsewhere in this Report. A total of fifteen compensable accidents was reported during the year. This is a rate per million man-hours of twenty, which, although not quite as good as the 1960 record, compares favourably with rates of previous years. An active safety organization at the property receives the full backing of management, and regular safety meetings and inspections are held.

Bridge River United Mines Ltd.*

Company office, 404, 510 West Hastings Street, Vancouver 1. Raymond R. Taylor, president. Capital, 4,500,000 shares, no par value. This company controls twenty-one Crown-granted claims and fractions on the lower reaches of Hurley River, extending for a distance of 2 miles up the river from a point 1½ miles above Gold Bridge. The property includes the Ural, Forty Thieves, and Why Not claims, which were first located in 1897. Intermittent exploration work has been done for many years on these claims, which lie on the east side of the deep and rugged canyon of the Hurley River. The claims are underlain mainly by andesite of the Pioneer formation and diorite of the Bralorne intrusions, bounded on the west by an outcrop of serpentinized pyroxenite. Quartz-filled fractures occur in the andesites and diorites, some of which have been traced for over 900 feet. These veins in places contain gold values, but the vein matter has hitherto not generally been found to be of ore grade. A number of adits have been driven at various points at the foot of the canyon bluffs to explore the Forty Thieves, Why Not, Jewess, and other veins that outcrop either close to or on the canyon bluffs. Until the present company began work in 1959, the property had lain dormant since 1946.

In September, 1960, an agreement was made with Rayrock Mines Limited for the latter company to participate in the exploration of the property. In 1961, work

* By A. R. C. James.

was continued from the beginning of the year until the end of September. A total of 2,860 feet of diamond drilling was completed. Four thousand four hundred and forty feet of bulldozer trenching was done in June and July. The portal of the Ural No. 3 adit was retimbered and a detailed examination was made of the tunnel. Geological mapping was carried out on the property. A crew of eight men was employed in the early part of the year while diamond drilling was in progress. The work was under the supervision of Raymond R. Taylor.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1946, pp. 106–112; Cairnes, C. E., *Geol. Surv., Canada*, Mem. 213, 1937, pp. 88–91.]

ANDERSON LAKE*

Gold

Golden Contact (Cassiar Copperfields Limited)

(50° 122° N.E.) Company office, 928 West Pender Street, Vancouver 1. John A. McKelvie, president. Capital: 5,000,000 shares, $1 par value. This company holds under option the Golden Contact property on Gold Creek, north of McGillivray Creek, about 4 miles by jeep-road from Marne station on the Pacific Great Eastern Railway. The main showings are quartz veins, locally mineralized and containing gold values, within a schistose host rock. The showings were discovered in 1898, and a considerable amount of underground exploration has been carried out over three separate periods—1900–03, 1932–38, and 1947–53. There are six adit levels from No. 1 at 3,615 feet to the Pep adit at 2,938 feet elevation. The underground workings were inaccessible when the present company began work in 1960, but the workings on the Pep level and the Fortyniner adit level (3,187 feet elevation) have been reopened. The main workings on these two levels are in a strong quartz vein which strikes northward and dips west at 65 degrees. The vein is broken into segments by northwesterly striking faults. Development so far has been mainly in the "east segment" of the vein, lying north of the No. 1 fault.

A crew ranging from three to eighteen men was employed throughout most of the year under the supervision of John McKelvie. Underground work was mainly confined to the first four months of the year, when a raise was driven in the east segment of the vein from the Pep to the Fortyniner level. During the summer months the access road was improved and widened in places. The ground was cleared and levelled in front of the Pep adit portal. A sawmill and planer-mill were installed for cutting local timber. Two small bunk-houses were erected for personnel. Three 24- by 48-foot buildings were constructed as warehouse, machine-shop, and power-house respectively. The track was extended from the adit portal toward the crusher-site and 200 feet of snowshed was erected. An ore-bin building was completed, and a start made on a building to house a 100-ton mill. Work was still in progress at the end of the year. No compensable accidents were reported.

LILLOOET RIVER†

Copper

Salal (Phelps Dodge Corporation of Canada, Limited).—(50° 123° N.E.) This company holds forty-six claims near the head of Lillooet River on Salal Creek. Work in 1961 included geological mapping together with trenching and bulk sampling of a precipitous cliff face for a length of 1,500 feet.

* By A. R. C. James.
† By J. M. Carr.

Copper, etc.

Phelps Dodge Corporation of Canada, Limited

(50° 122° N.W.) This company holds eighty-four claims and fractions around Tenquille (Maud) Lake, which is about 15 miles north of the Pacific Great Eastern Railway at Pemberton and is reached by a good trail about 7 miles long from Pemberton Meadows. The property contains several prospects, including the Seneca, Gold King, Silver Bell, and Eva (Moffat and White's camp), whose locations were recorded by the Geological Survey in 1924. In about 1932, some drilling was done at the Gold King prospect. Mineralization seen on the property includes chalcopyrite that is partly in shear zones adjacent to dykes, and partly with magnetite in skarns. The host rocks include tuffaceous and volcanic strata together with limestone, and they show resemblances to rocks of the Nicola group. They are intruded nearby by granitic bodies. In 1961, work on this property included geological mapping and prospecting.

[References: *Geol. Surv., Canada,* Sum. Rept., 1924, Pt. A, pp. 91–99; *Minister of Mines, B.C.,* Ann. Rept., 1932, p. 211.]

SPENCES BRIDGE*

Copper

Dora Kay (Tombac Exploration Ltd.)

(50° 121° S.E.) Office, 700 Burrard Building, Vancouver 5. This property consists of sixty-five claims held by record. It includes the showings of the original Dora Kay group on the north side of Pimainus Creek, 7 miles northeast of Spences Bridge. Access is by a narrow road which leaves the Spences Bridge–Merritt highway just southeast of the Nicola River bridge and follows the east side of the Thompson River to Pimainus Creek, where a branch road follows the north bank of Pimainus Creek for some 2 miles and then climbs by a number of steep switchbacks to the Dora Kay. The road was badly gullied by run-off and impassable by automobile just east of the Pimainus Creek crossing.

The showings consist of stringers and thin veins of hematite, with minor chalcopyrite, erratically distributed in a strong shear zone in Guichon quartz diorite. The shear zone strikes north 15 degrees west and dips about sixty-five degrees east. Most of the hematite stringers strike a little south of west and dip, with few exceptions, between 40 and 85 degrees to the north.

The work done in 1961 included 1,000 feet of stripping, 482 feet of diamond drilling, and 6 miles of road construction. A crew of seven men was employed under the supervision of D. J. McDonald.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1926, p. 194; *Geol. Surv., Canada,* Mem. 262, Ashcroft Map-area, p. 105 (Toketic).]

HIGHLAND VALLEY

Copper

Royal Canadian Ventures Ltd.†

(50° 121° S.E.) Company office, 1011 Seventeenth Avenue West, Calgary, Alta. A. P. Newell, president; V. R. Chamberlain and H. W. Hunt, consulting engineers. This company holds about 100 claims in a block which extends from south of Calling Lake to north of the O.K. mine, in the southeastern part of the Highland Valley area. The property surrounds but does not include the O.K., Empire, and Kathleen mines, and it includes ground formerly held by Bethsaida Copper Mines Ltd. and Laco Mines Ltd. respectively.

* By N. D. McKechnie.
† By J. M. Carr.

Work in 1961 included geological mapping, magnetometer surveying, and about 650 feet of surface diamond drilling in seven holes. Some of the showings on the property are recent discoveries by Pat Gouthro, prospector, and are on either side of an irregular contact between younger quartz diorite and the later Bethsaida granodiorite porphyry stock. Bornite and chalcopyrite occur, mostly on silicified and sericitized joints but also as local disseminations in the adjacent rock.

Trojan Consolidated Mines Ltd.* (50° 120° N.W.) Company office, 809, 837 West Hastings Street, Vancouver 1. P. Cramond, president. This company holds eighty-two claims north and east of the south peak of Forge Mountain. Work in 1961 consisted of dewatering the Trojan mine and diamond drilling fourteen holes totalling 1,963 feet from the 150 level. An average crew of ten men was employed in May and June, the work continuing to July and being directed by H. Hill & L. Starck & Associates Ltd. Drilling was mainly from two stations about 90 feet apart in a northerly direction. Upward fans of holes explored the upper, least-known part of a mineralized zone on which exploration in the Trojan breccia area has been concentrated previously. Mineralization was encountered in many of the drill-holes but apparently not in commercial amounts.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1956, pp. 43–44; 1957, p. 24; 1959, p. 29.]

Bethlehem Copper Corporation Ltd.† (50° 120° S.W.) Company office, 814, 402 West Pender Street, Vancouver 3. Company office, Box 520, Ashcroft. H. H. Huestis, president; D. W. Pringle, manager; C. J. Coveney, geologist. Access to the property is by about 30 miles of road from Ashcroft. This company holds fifty-six Crown-granted and 106 recorded claims and fractions, immediately east of Quiltanton (Divide) Lake. The property is being prepared for production with a target date set for December, 1962. Initial site clearing and excavation for a mill have been carried out, several miles of road built, the surface of the pit cleared, and a start made on the stripping of overburden at the pit. Erection of a permanent assay office, machine-shop, and a combination office-warehouse building has been started. This work has all been contracted. The crew consists of seven men on staff and three on day rate. A camp has been rehabilitated at Divide Lake with a capacity of seventy-five men. About 10 miles of the road to Ashcroft has been rerouted and reconstructed with the aim of providing a first-class highway to the property. This work is being done by the Department of Highways.

Jericho Mines Limited† (50° 120° S.W.) Company office, 1531 Davis Street, Vancouver 5. H. B. Hatch, managing director; F. J. Hemsworth, consulting engineer. This company holds 156 claims south of Witches Brook, about 7 miles east of Quiltanton (Divide) Lake. Work done in 1961 consisted of soil-sampling and trenching by bulldozer in several areas. A crew of four men was employed.

* By J. M. Carr.
† By David Smith.

ABBOTT LAKE*

Copper

Viking (Kamloops Copper Company Ltd.)

(50° 120° S.W.) Company office, Seymour Street, Kamloops. R. W. Kennedy, president; H. Hill & L. Starck & Associates Ltd., Vancouver, consulting engineers. This company holds more than 100 claims in the Viking, K.C., and Rock groups near Abbott Lake, which is about 7 miles west-northwest of the Craigmont mine. Access is by a jeep-road from the Merritt–Spences Bridge highway near Dot. An average crew of eight men camped at Abbott Lake from May to July, and did work which included line-cutting, chain and compass surveying, and geological mapping.

The property is underlain by the Guichon batholith, in which most of the known copper showings are located near porphyry contacts. A collection of rock specimens taken systematically throughout the property was examined and found to contain a diversity of batholithic rocks and one specimen of Bethsaida granodiorite porphyry which was reported to have been collected at the northeast limit of the property, on the K.C. No. 18 claim.

MERRITT†

The Craigmont mine began production of copper concentrates and was officially opened in September, 1961. Numerous other properties in the Merritt area were actively explored in 1961, both near the mine at Promontory Hills and also south and east of Merritt. (The numbers of properties refer to their position on Fig. 6.) Several magnetic and electrical anomalies were drilled and others are still to be investigated. Whilst no commercial deposits except Craigmont have yet been found, their possible existence in this largely drift-covered area cannot be discounted. A feature of this year's exploration was the availability on contract of induced polarization survey equipment staffed by Hunting Survey Corporation Ltd., which worked on several properties at Promontory Hills.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1959, pp. 31–35; 1960, pp. 26–41, " Geology of the Promontory Hills."]

Copper-Iron

Craigmont Mines Limited‡

(50° 120° S.W.) Company office, 700, 1030 West Georgia Street, Vancouver 5; mine office, Box 399, Merritt. J. D. Simpson, president; R. G. Duthie, property superintendent. This company holds 112 mineral claims and fractions, of which eighteen are in five separate leases and four others have leases applied for. The Craigmont orebodies are on the Merrell Nos. 7 and 8 claims and McLeod Nos. 5 and 6 claims, and are between the forks of Birkett Creek at surface elevations between 3,800 and 4,200 feet. By a reorganization in January, 1961, the present company gained operating control of the property.

Until August, 1961, the property was being prepared for production. Milling began on August 29th at a rate of 2,400 tons per day, and the mine was opened officially on September 15, 1961. Production to the end of the year was mainly from the open pit and consisted of copper concentrates, the iron content of the ore being impounded in the tailings. Production in 1961 was as follows: Ore milled, 484,073 tons; grade of mill head, 1.63 per cent copper; concentrate shipped,

* By J. M. Carr.
† By J. M. Carr, except as noted.
‡ By J. M. Carr and David Smith.

11,672 tons. The concentrate was trucked to the railway at Coyle, a distance of about 5 miles, and from there shipped to Japan. In 1961, in the open pit, material moved by the contractors in advance of production measured 984,627 cubic yards, which included glacial till, waste rock, and stockpile ore. An additional 5,831,938 tons of this material was moved by the company, which also mined 512,549 tons of open-pit ore grading 1.50 per cent copper. Underground development was continued on two levels, and a study was begun of mining methods and ground control in a test stope. On the 2400 level the drift was extended 6,146 feet to a point 6,827 feet from the portal, and 440 feet of secondary development was done. Work on the 3000 level included 324 feet of crosscutting, 1,321 feet of raising, and 859 feet of subdrifting, from which 11,770 tons of ore grading 3.70 per cent copper was mined and milled. Diamond drilling was done on all adit levels, but mostly on the 3000 level.

Equipment purchased for the pit included three 4½-cubic-yard electric shovels, fourteen 27-ton diesel trucks, two track- and one rubber-mounted bulldozers, one 9-inch rotary electric drill, one 3-inch percussion drill, one explosives truck, one lubrication truck, and several service vehicles. The property is supplied with natural gas for heating and power, and with electricity, telephone, and teletype. In 1961 the crew employed was 304, of which seventy-four were salaried and the remainder on wages. No housing is provided on the property, and the crew lives mainly in Merritt.

The open pit is shaped like a horseshoe, open at the east end, and measures about 2,200 feet by 1,200 feet. The working-benches are 33 feet high, the berm widths are 30 feet, and the slope of the faces is 70 degrees. At the pit limits, two benches are consolidated to give a 66-foot bench. The final depth of the pit is expected to be 700 feet. The primary crusher is installed at the east end of the pit at 3,700 feet elevation, and a cable belt conveyor, 5,600 feet long, transports the stockpiled product of this crusher to the plant site at 2,400 feet elevation. The rated capacity of the mill is 4,000 tons per day. There are workings on three underground levels, at elevations of 2,400, 3,000, and 3,500 feet, respectively. The 2400 level adit is expected to be 8,600 feet in length when completed, and will be the main haulage level. The 3000 level adit is 6,293 feet long, and the 3500 level adit is 3,448 feet long, and these two levels are connected by a vertical ventilation raise 463 feet in length. Ore mined from the 3000 level is at present trucked to the primary crusher.

General Geology

The following notes supplement previous ones on the geology of the mine (Ann. Repts., 1959, pp. 31–34; 1960, pp. 35, 40) and are based mainly on examinations made over periods of several weeks in both 1959 and 1960. In the course of this work, the 3500 level was fully mapped and the 3000 level and surface exposures were partly examined. About 135,000 feet of drill core is available at the mine, of which about 30,000 feet was logged and some other sections were less closely examined. In addition, the mine staff provided much information, which is gratefully acknowledged. The photographs of the mine model (p. 36) are published through the courtesy of the company.

At the mine, metamorphosed Nicola rocks lie close to the south margin of the Guichon batholith and are intruded by andesite and by diorite or quartz diorite. The Nicola rocks are overlain to the south and west by younger volcanic rocks assigned to the Kingsvale group, and are thus isolated from the main outcrops of the Nicola group near Lookout Point.

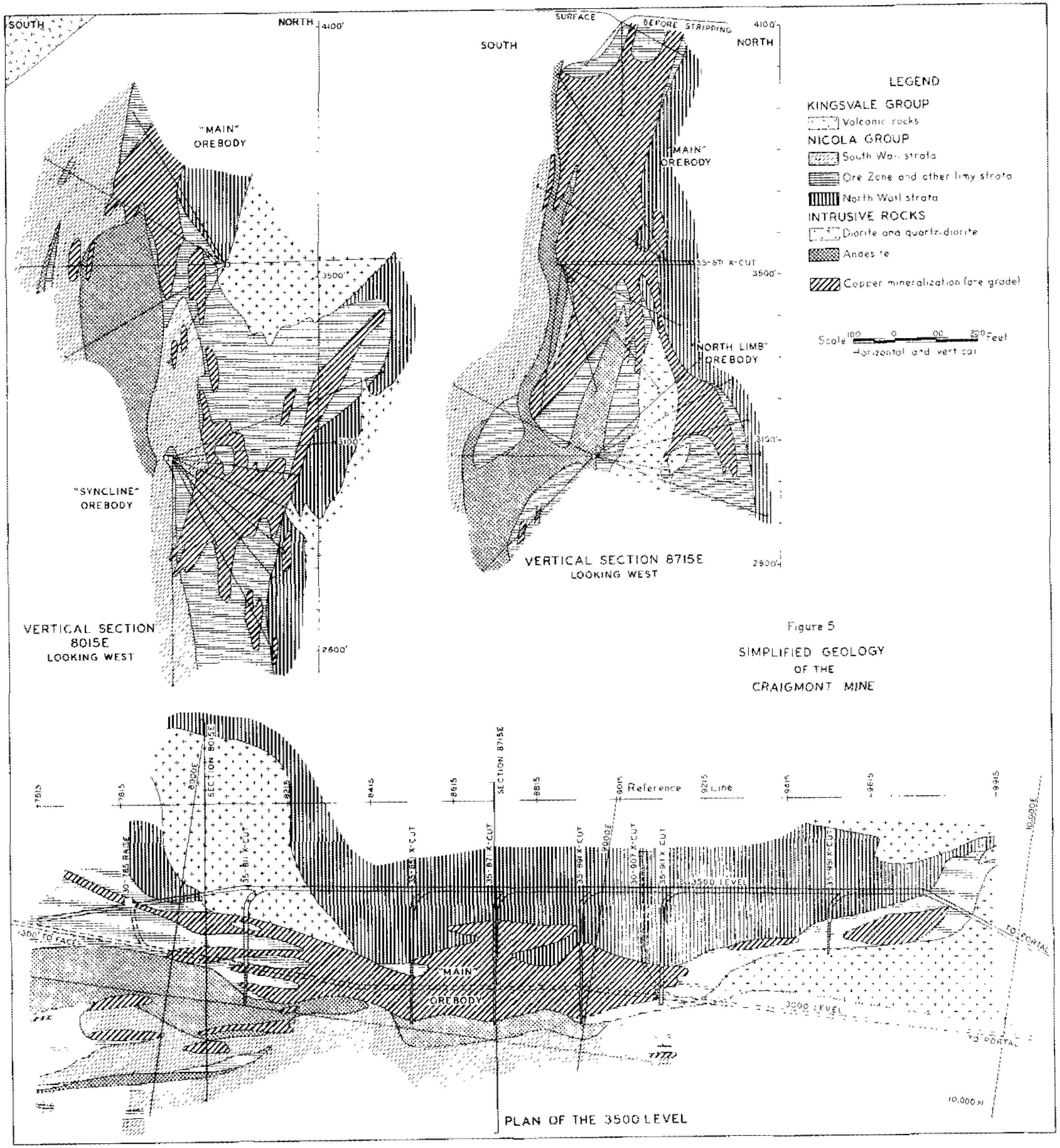


Figure 5

SIMPLIFIED GEOLOGY OF THE CRAIGMONT MINE

The Kingsvale rocks are exposed in the open pit and on the 2400 and 3000 levels, and consist mainly of flows and breccias of andesite together with some coaly tuffaceous sediments. They fill a basin whose northern side trends west-northwest, approximately parallel to Birkett Creek, and is moderately steep and probably structurally controlled. The rocks dip at low angles in widely varying southerly directions. In the open pit they overlie weathered, mineralized Nicola rocks and are themselves unmineralized. Biotite from a sample of an andesite flow about 50 feet above the Nicola surface was dated by radioactive methods by the Geological Survey of Canada. The determined age of the biotite is 80 million years, which the Survey suggests is a minimum age close to the actual time of deposition of the lava. On this evidence, the Kingsvale rocks are Upper Cretaceous in age and the Craigmont mineralization is earlier.

The Nicola strata form a steeply dipping sequence which strikes approximately east and which, together with the intrusive rocks, is partly altered and mineralized. With the exception of skarns and other intensely altered rocks, the strata include hornfelsed limy and non-limy greywackes, tuffaceous greywackes, tuffs, and recrystallized limestones. Textures range from very fine grained or aphanitic to medium grained or gritty, and many rocks have a porphyritic aspect due to the inclusion of grit-sized crystals or particles in a finer-grained matrix. Banding and foliation are generally more conspicuous than bedding, and may not be everywhere parallel to it. Except for their metamorphic features, the strata broadly resemble various Nicola rocks elsewhere on Promontory Hills. According to their location in the mine, the strata are divisible into the rocks of the ore zone and the north and south wallrocks, respectively. This division accords with broad lithological differences but is too imprecise to allow recognition of the detailed structure. Attempts to trace individual beds by means of their lithology have been only partly successful, and the results to date are of limited value. Accordingly, the accompanying illustrations show the geology in a general way only, without reference to the detailed structure.

Ore Zone

The ore zone ranges in width from less than 100 feet to more than 600 feet and has been explored for a length of 3,000 feet and to a depth of 1,600 feet. The zone contains most of the limy strata, the orebodies, other mineralized and strongly altered rocks, and some intrusive rocks. The limy strata are preserved mainly at the west end of the zone, and include limestones and interbedded non-limy beds which are scarcely distinguishable from some south wallrocks. The limestones are strongly banded, parallel to the bedding, which dips steeply and strikes in various directions but mostly eastward. The banding is of secondary origin and encloses occasional detached blocks of the adjacent non-limy beds. The beds thicken and thin rapidly and cannot be readily correlated even in neighbouring holes of a single fan of holes. The rest of the zone comprises intensely altered and more or less mineralized rocks. These include epidote, garnet, and actinolite skarns which partly contain calcite, quartz, and orthoclase. Some altered rocks are dark and limy, and consist chiefly of mosaic-textured quartz and orthoclase with finely disseminated calcite and chlorite. At least in the upper part of the mine, the copper and iron minerals mostly occur together, principally as iron skarn containing chalcopyrite. The iron skarn is largely a replacement of breccia and contains pink, grey, or white fragments of quartzofeldspathic hornfels which are enclosed in a skarn matrix consisting largely of magnetite and specular hematite. The fragments are mostly tabular and range in length from less than an inch to more than 1 foot. They are frequently bent, crumpled, and preserved in trains which clearly represent folded and brecciated beds. The fabric of the skarn closely resembles that of limestone at Lookout Point, which contains deformed and brecciated non-limy beds. As seen in crosscuts on the 3500 level, sections of iron skarn are separated by large bodies of hornfels whose banding is mainly steep and partly convolute. These bodies probably represent non-limy beds whose structural continuity is not established.

In the north wall the principal rock in the upper part of the mine is a rather distinctive hornfelsed greywacke without evident bedding but with a granular foliation which lies in various directions that are mainly oblique to the ore zone. The rock is traversed by sets of parallel joint planes, on which alteration has taken place. One set that is generally best developed is more or less parallel to the foliation. The foliation and joints are of uncertain origin and are probably secondary. In the 35-891 crosscut the joints form an arch which plunges at a moderate angle to the east-northeast and is asymmetrically steeper to the south. Ore is exposed in the floor beneath the crest of the arch, apparently in greywacke. In this crosscut and at several other places on the level, a well-banded hornfelsed greywacke siltstone is exposed at the contact of the greywacke and the ore zone, and is several feet thick. In this rock the strike of the banding conforms to the curved contact and the dip is nearly vertical, except at the east end, where it is fairly steep to the south. In the lower part of the mine the distinctive north wall greywacke is present in the 30-907 crosscut and in various drill-holes at least as far west as 7815 east, and is partly accompanied by the well-banded siltstone. In other holes the greywacke is missing and the north wallrocks cannot be clearly distinguished from rocks farther south.

The rocks immediately in the south wall are difficult to separate from those in the ore zone. The more distant rocks are partly distinctive, and some of them in the upper part of the mine can be recognized at places which are several hundred feet apart along the strike and dip, respectively. These rocks, which are grits and gritty tuffs, strike mostly eastward and dip fairly steeply to the south.

Intrusive Rocks

The relative age of the andesite and diorite intrusions, respectively, is uncertain. Andesite occurs principally as a steep irregular body which is more or less continuous throughout the length of the mine and is as much as 100 feet thick. The body appears to branch upward at progressively lower elevations to the east, and the main mass may reach the surface only in the extreme western part of the mine. The andesite is a non-vesicular, fine-grained rock possessing small, scattered, oriented phenocrysts of plagioclase. In places the original felted texture of the groundmass is replaced by a granular hornfelsic texture. In all specimens examined the rock consists principally of feldspar, actinolite, chlorite, and finely divided magnetite. In places the rock contains small patches of dioritic material, which possibly segregated from the rock during its cooling history. At its contacts with the limy rocks, the andesite frequently encloses numerous irregular masses of skarny limestone. These small inclusions are also seen within the main mass of the andesite, where they can partly be correlated in more or less extensive zones and may occupy the contacts of closely spaced branches of the andesite body.

Most of the dioritic bodies consist of a porphyritic rock which texturally resembles quartz diorite of the Guichon batholith, which forms extensive outcrops about 1,100 feet north of the mine. The batholithic margin is very irregular, as shown by a flat hole drilled northward on the 3500 level at 8015 east, which intersected alternating sections of the porphyritic rock and Nicola rocks, respectively, for at least 900 feet. The porphyritic rock is partly diorite and partly quartz diorite, and is characterized by hornblende crystals of a size larger than average. It forms all the bodies in the north wall together with a ragged dyke-like mass deep in the ore zone, and which is shown on section 8715 east. A second finer-grained type of quartz diorite forms one or more bodies which may also be related to the batholith. This rock, which contains more biotite than the porphyritic rock, occurs as a large, roughly concordant body which follows the south wall of the ore zone at the east end and becomes narrower westward. A possibly connected body of similar rock is exposed farther west in the open pit and strikes within and parallel to the ore zone. In places the dioritic rocks are massive and comparatively fresh, whereas elsewhere they contain skarn and are severely altered.

Alteration

Wallrock alteration of several kinds affects all the above-described rocks and is partly inseparable from skarn formation. It is intense near the orebodies and is locally conspicuous elsewhere near faults and places of mineral deposition. The following minerals are all products of rock alteration at various places in the mine: Epidote, calcite, actinolite, chlorite, orthoclase, quartz, biotite, tourmaline, sericite, kaolin, and zeolite. The list is doubtless incomplete. Orthoclase is widespread in and adjacent to the ore. It forms conspicuous zones of alteration in brecciated north wall greywacke, where it is accompanied by mineralized veins of chlorite and tourmaline or of quartz and calcite. It also permeates parts of the south wallrocks and selectively replaces some of the plagioclase phenocrysts of the gritty tuffs. Biotite has been noted as a major constituent in some of the south wall greywackes, and under the microscope is seen to be of secondary crystallization. Calcite veins are widespread, and are concentrated especially in the rocks overlying a buried portion of the uppermost orebody.

Orebodies

Three orebodies are separately recognized and are named the "main," "north limb," and "syncline" orebodies, respectively. The "main" orebody is an irregular tabular body as much as 220 feet wide and 2,200 feet long, and with a decided pitch to the east. It extends from the surface at 4,200 feet elevation to depths below the 3000 level. Except at the east end, the base of the orebody is furrowed longitudinally, and it divides downward roughly along a line parallel to the pitch. A northerly downward projection leads to the small "north limb" orebody, which is mainly above the 3000 level. In 1961 the part of this orebody between 8815 and 9065 east was being developed for mining in 30-901 test stope. The "syncline" orebody is west of the "north limb" orebody and mostly at lower elevations. It consists of a massive keel, with a width of as much as 300 feet, and a flange which projects upward to the north. This orebody is more or less separated from the others, although recent mine maps and sections show tenuous connections between it and the "main" and "north limb" orebodies, respectively. Within the orebodies and in places beyond them, chalcopyrite occurs as veins, lenses, streaks, blebs, and disseminations, and is generally accompanied by iron mineralization, which increases in magnetite toward the east end of the "main" orebody. Other copper minerals occur in very subordinate amounts, and pyrite, although present in parts of the ore, is mostly confined to weak disseminations in the wallrocks.

In 1961 the estimated reserves of ore were reported to be 22,575,000 tons, grading 2.08 per cent copper and 19.6 per cent iron.

Structure

The detailed structure at the mine remains obscure. The ore zone is apparently one of several limy belts in an upturned south-facing sequence of Nicola strata

Model of the Craigmont orebodies. Plan view.

Model of the Craigmont orebodies. View looking eastward.

adjacent to the batholith (Ann. Rept., 1960, p. 37). In the ore zone, as in some other limy belts, the strata were partly intensely deformed and brecciated, with minor dragfolding accompanied by flowage of limestone. In the rocks now comprising the orebodies, the dragfolds are largely unrecognizable. The only well-defined folds in the mine are a few small, steeply plunging dragfolds which occur in limestones at the west end of the ore zone. Should larger folds exist, their proper recognition will depend on an increased knowledge of the stratigraphy.

Faults are numerous at the mine, but the major ones are probably unidentified. There are many small pre-mineral faults exposed underground, and other, possibly larger ones are inferred in the drill-holes. A fault which may be important has recently been exposed in the open pit, and is an easterly fault of probable pre-mineral age which dips steeply to the south in the south wallrocks. It is parallel to strong sheeting in the rocks, which are better mineralized to the north of the fault. Oblique faults occur farther north, and they separate rocks whose sheeting differs somewhat in attitude across the faults.

The structure of the mine is so uncertain that the shape of the orebodies cannot adequately be explained. Their shape would appear partly to be controlled by that of the ore zone, which is irregular for reasons that are not yet understood. Folding, faulting, and dilation by igneous intrusions may all be factors controlling not only the shape of the ore zone, but also its internal structure. The easterly pitch of the " main " orebody and its bifurcation in depth may depend partly on the distribution and shape of the intrusions, whose emplacement was no doubt controlled to some extent by pre-existing structures. An important structural discontinuity approximately between 8200 and 8600 east shows the following features:—

(1) A vertical pinch in the "main" orebody.
(2) A possible gap between the "north limb" and "syncline" orebodies.
(3) A change in the attitude of secondary foliation and sheeting in the north wall greywacke in the 3500 level drift.
(4) A gap in the andesite on the 3500 level.
(5) A gap, in plan, between porphyritic diorite intrusions on the 3000 and 3500 levels, respectively.
(6) An easterly termination of a grit bed in the south wallrocks on the 3500 level.
(7) An offset, or divergence in strike, of a gritty tuff horizon to the south of the grit bed on the 3500 level.

A correct explanation of the discontinuity, whose nature is at present unknown, could help to solve many problems of ore control.

Exploration

On the Willy group of about thirteen claims and fractions, in the southwest part of the property, work in 1961 included about 20 miles of line-cutting, of which about half was done by bulldozer, together with a ground magnetometer survey and geological mapping, which was done by W. S. Pentland.

Copper

Peel Resources Limited (1)

(50° 120° S.W.) Company office, 408, 580 Granville Street, Vancouver 2. N. H. McDiarmid, president; F. L. C. Price, consulting engineer. This company holds forty-two claims in the Peel group which adjoin the north boundary of the Craigmont property and are largely a relocation of claims formerly in that property. The group lies entirely in the Guichon batholith. Work in 1961 was done by an average crew of five men under the supervision of D. R.

Morgan and included magnetometer, geochemical, and geological surveying. A road was built for the length of the property and joins the Craigmont mine road near Jackson Lake.

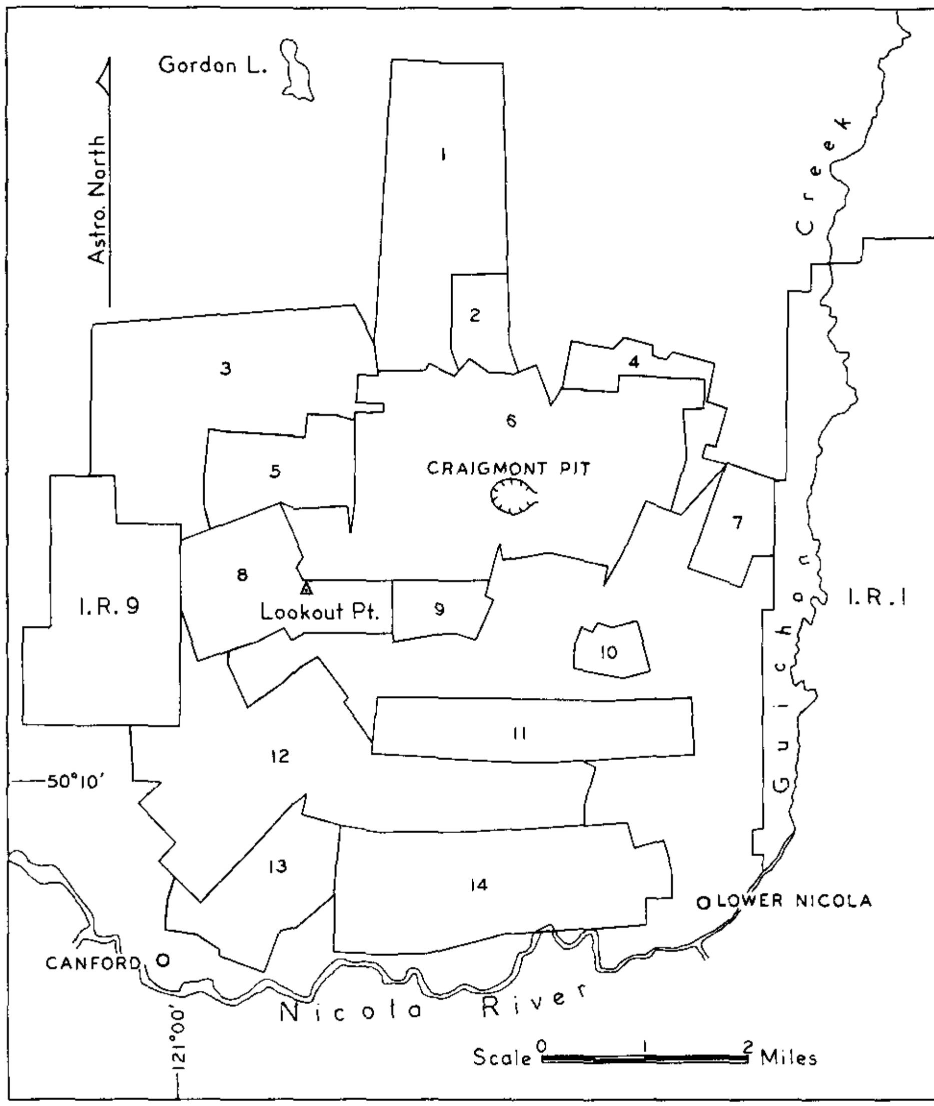


Figure 6. Properties at Promontory Hills, near Merritt.

Friday Mines Limited (2) (50° 120° S.W.) Company office, 408, 580 Granville Street, Vancouver 2. N. H. McDiarmid, president; F. L. C. Price, consulting engineer. This company holds eight claims in the Ron group which adjoin the north boundary of the Craigmont property and are a relocation of claims formerly in that property. Work done in 1961 was similar to that done on the adjoining Peel group and was performed by the same crew.

Torwest Resources (1962) Ltd. (3)

(50° 120° S.W.) Company office, 404, 409 Granville Street, Vancouver 2. W. E. Garnett, president; R. E. Falkins, secretary-treasurer; R. E. Renshaw, consulting engineer. This reconstituted company holds seventy claims which are in the Marb group west of the Craigmont property and are accessible by road from the Titan Queen (Paystin) showing on that property. The group lies mainly north of Shackelly (David) Creek at about 5,000 feet elevation, and covers ground that was partly the former C.J.S. group (Ann. Rept., 1958, p. 27). The group is underlain partly by batholithic rocks and partly by metamorphosed strata which occur within the Guichon batholith.

Work in 1961 included road construction, magnetometer surveying, trenching, and surface diamond drilling of nineteen holes totalling 8,166 feet. Prefabricated huts were used to build a camp at a small lake to the west of Jackson Lake, and an average crew of seven men, exclusive of drillers on contract, was employed from February to September.

Four localities on the property were chiefly explored. At the westernmost locality, which is north of Shackelly Creek near the eastern boundary of Indian Reserve No. 9, trenching exposed fractured, altered, and partly mineralized rocks including small bodies of limestone. Holes Nos. 3 and 7 were drilled eastward near this showing and failed to intersect significant mineralization. At a second locality, about 1 mile farther northeast, hole No. 1 was drilled vertically for 200 feet, mainly in batholithic rocks showing little or no mineralization. The third locality is 1 mile farther east, on or near the Marb No. 3 claim about 2 miles west-northwest of the Craigmont mine. At this locality in 1958 Northwestern Explorations, Limited (now Kennco Explorations (Western) Limited), mapped magnetic and geochemical anomalies in addition to mineralized outcrops. A magnetic anomaly was mapped for a length of as much as 700 feet in an east-northeasterly direction and a width of 150 feet. In 1961 the present company trenched the anomalous area and drilled holes Nos. 2 to 6 and 8 to 16. Rocks encountered were quartz diorite, diorite, and basaltic hornfels together with rare, short sections of dioritized tuffaceous rocks and limestone. Foliation, or layering, is moderately to steeply inclined. Finely disseminated magnetite is estimated to form as much as 10 per cent by volume of some of the hornfels. Rock alteration includes chloritization and epidotization. Sulphide mineralization is apparently greatest near strong, chloritic faults, and consists of chalcopyrite and pyrite, which occur either together or separately as fine disseminations and slender, rather widely spaced veins. In hole No. 2, which is one of the better mineralized holes, the core from a 30-foot intersection is estimated to contain about 0.65 per cent copper.

The fourth and easternmost locality is reported to be about 2,500 feet northeast of the third, on the site of a magnetic anomaly discovered in 1961 and measuring 600 feet long in a direction slightly north of east and 50 feet wide. Three holes were drilled and are reported to have intersected mineralization comparable to that at the previous locality.

Tormont Mines Limited* (4)

(50° 120° S.W.) Company office, 405, 25 Adelaide Street West, Toronto 1. A. Roberston, president. This newly formed company holds about thirty claims in the Laron group adjoining the northeast part of the Craigmont property. Work done included road construction together with geochemical, magnetometer, and induced polarization surveys. In addition, seismic surveying was done in order to determine depths to bedrock. Surface diamond drilling was

* By David Smith.

started, and one hole 590 feet in length was completed by the end of the year. Excluding a geophysical survey crew on contract, an average crew of eight men was employed from August under the direction of R. C. Coutts.

Highvale Copper Mines Limited (5)

(50° 120° S.W.) Company office, 1000, 355 Bay Street, Toronto 1. This newly formed company is controlled jointly by Rio Tinto Canadian Exploration Limited (Vancouver office, 1818, 736 Granville Street, Vancouver 2; L. B. Gatenby, manager), Mt. Washington Copper Co. Ltd., and Crown Silver Development Company Ltd. It holds about eighteen claims in the Lil group, which adjoins the western part of the Craigmont property and is part of the former K.L. group, on which the Rio Tinto company did geological, geochemical, magnetometer, and electromagnetic surveying in 1957 and 1958. In 1960 the same company did an induced polarization survey of part of the Lil group. In 1961 further work on this group was supervised by J. R. Lehto and included a small amount of trenching and road construction, together with surface diamond drilling of four holes totalling at least 2,593 feet. A camp on Shackelly (David) Creek was occupied from June to September.

The group occupies part of the southern contact of the Guichon batholith with rocks of the Nicola group, and is largely covered by overburden. Rocks encountered in the drill-holes and in a single trench included quartz diorite and diorite together with greywacke, quartz-poor tuffaceous greywacke, tuffs, and their dioritized equivalents. Hole No. 1 was drilled northward for a length of 648 feet near the extreme west limit of the adjoining Craigmont property. The other holes were drilled southeastward in a single vertical section, in the southeastern corner of the Lil group, about one-half mile farther east. Hole No. 3 is the most northerly and, like hole No. 1, partly intersected batholithic rocks. The middle hole, No. 4, penetrated strongly faulted and slightly mineralized Nicola strata, together with unmineralized light-coloured andesite of a type which occurs as post-mineral dykes elsewhere on Promontory Hills and at Highland Valley. The southern hole, No. 2, is close to an inferred contact between rocks of the Nicola group and later volcanic rocks of the Kingsvale group. It was drilled at minus 55 degrees for a length of 1,100 feet and intersected Nicola strata, which, in the lower half of the hole, contain a diabase dyke swarm. Numerous closely spaced dykes, intersected individually for lengths of as much as 40 feet, are partly sheared, chloritized, and mineralized with pyrite disseminations and veinlets. The adjacent Nicola rocks are similarly mineralized.

A trench made a short distance to the west of hole No. 1 exposed mainly tuffs which strike northeastward and dip steeply to the southeast. Assuming an approximate northeasterly strike for the Nicola strata in all the drill-holes, observations of the apparent dip of beds intersected in the cores suggest that the regional dip of the Nicola strata varies between steep and vertical.

Consolidated Standard Mines Limited* (7)

(50° 120° S.W.) Company office, 320, 355 Burrard Street, Vancouver 1. This company, which is controlled and managed by Bralorne Pioneer Mines Limited, controls twelve claims and fractions in the Shot group to the east of the Craigmont property. Access is by road a quarter of a mile north of the Craigmont mill. The group is largely covered by overburden, and work consisted mostly of geophysical surveying. A crew of five men was employed under the supervision of J. P. Weeks.

* By David Smith.

Betty Lou and Lou (Canex Aerial Exploration Ltd.)*

(50° 120° S.W.) Company office, 700, 1030 West Georgia Street, Vancouver 5. J. D. Simpson, president. This company holds about thirty claims in the Betty Lou and Lou groups at Lookout Point, adjoining the southwestern part of the Craigmont property. Work in 1961 consisted of geophysical surveying, which included completion of a magnetometer survey begun in 1960, an aerial photographic survey, and 602 feet of surface diamond drilling. A crew of six men was employed under the supervision of A. Allan.

Mid-West Copper & Uranium Mines Ltd. (9, 10, 11)

(50° 120° S.W.) Company office, 1002, 850 West Hastings Street, Vancouver 1. G. S. Shaw, president; F. J. Hemsworth, consulting engineer. This company holds thirty-seven claims in three separate groups to the south of the Craigmont property. The groups are the Har (9), Mid (10), and ARH (11), respectively, and in 1958 were part of the Merritt property held by Noranda Exploration Company, Limited. Work by the present company in 1961 included a geochemical survey of all the groups together with 1,000 feet of surface diamond drilling in two holes drilled from a single set-up near a mineralized showing immediately east of the road to Lookout Point, on the ARH No. 17 claim. One or more basalt flows were intersected together with other Nicola strata, none of which are strongly mineralized in the core. An average crew of three men was employed from April to August.

P.C.M., Cap, Domino, Hank, Freda (Britmont Mines Limited) (12).—(50° 120° S.W.) Company office, 402, 25 Adelaide Street West, Toronto 1. S. A. Perry, president; R. D. Bell, secretary-treasurer. This company holds about 100 claims on the south slope of Promontory Hills. Work in 1961 was directed by W. M. Sharp and included surveying and geological mapping together with trenching at several localities, mainly where geochemical anomalies had previously been found.

Wade (General Resources Ltd.) (13)

(50° 120° S.W.) Company office, 213, 678 Howe Street, Vancouver 1. E. M. Olts, president; Chapman, Wood and Griswold Ltd., consulting engineers. This company holds about thirty-eight claims, which are known as the Wade group and include the Wade, Tex, and Apache claims. The group is on the southern slopes of Promontory Hills at elevations mostly between 2,000 and 3,500 feet, and partly covers the former Lis group, on which magnetometer surveys were made in 1958 and 1959. Access is either from the Kinvig ranch or by a newly constructed road which joins the highway from the north side about 1 mile east of Canford railway station. Work by, or on behalf of, the present company in 1961 included surveying and line-cutting, geophysical and geological surveying, together with production of a topographic map from air photographs. It also included about 3 miles of road construction together with hand and bulldozer trenching whose total length exceeded 1 mile. A small crew was employed from March to December under the supervision of R. B. Stokes.

The principal showing is on a west-trending spur at about 2,700 feet elevation on or near Tex No. 4 fractional claim. Steep slopes immediately to the south are largely scree-covered, and the ground to the west and northwest is likewise poorly exposed. On the spur, several trenches and outcrops expose Nicola strata which dip northward at low to moderate angles and change strike progressively eastward, from

* By David Smith.

easterly to northeasterly. The strata, which are exposed intermittently along strike for a distance of as much as 1,000 feet, apparently comprise the following upward succession: pebbly dacitic quartz-tuff, vitric or lithic tuff, limy rocks (including limestone, limy tuff, and limy tuffaceous greywacke), andesite or basalt lava, and tuffaceous greywacke and siltstone. Although their true width is probably less than 75 feet, the limy rocks partly underlie a dip-slope and thus have an apparent width of as much as 150 feet. At the east end of the showing, steep dykes of quartz porphyry cut both the quartz tuff and more southerly beds, and probably extend west-southwestward under the scree. Granitic rocks were not seen and may be absent in this area, where they were previously mapped (Ann. Rept., 1960, Fig. 3). The exposed mineralization is of low grade and occurs mainly in the limy rocks. It consists of disseminations and veinlets of chalcopyrite and bornite which are either in the rocks themselves or in carbonate veins. The carbonate veins are mostly of calcite, but some are of siderite together with small amounts of quartz. The best mineralization was seen in limestone containing both siderite and calcite veins on either side of a mineralized fault of north-northeasterly strike and steep westerly dip. The fault encloses a narrow body of strongly sericitized, sheared, and mineralized quartz porphyry. In a gully at the extreme western end of the showing, a dyke of sheared, argillized, and unmineralized light-coloured biotite-andesite is exposed against somewhat mineralized and oxidized Nicola rocks, which are not limy. This post-mineral dyke is apparently emplaced in a major fault of uncertain trend.

Canford Explorations Limited

(50° 120° S.W.) Company office, 204, 569 Howe Street, Vancouver 1. R. A. Brossard, president. This company controls three properties in the Merritt area, on all of which work was done in 1961 by a small crew under the supervision of M. K. Lorimer.

(*a*) *P.L. Group (14)*.—This group consists of about sixty-five claims on the southern slopes of Promontory Hills at elevations between 2,000 and 3,000 feet. Parts of the group were formerly held by Georgia Leaseholds Limited, which in 1958 made a magnetometer survey and reportedly diamond drilled two holes on the site of an anomaly near P.L. No. 12 claim. In 1961 the present company diamond drilled a surface hole vertically for 449 feet in the same locality, which is about 3,000 feet north of the Merritt–Spences Bridge highway, measured from a point about 7,000 feet west of the Lookout Point road-junction. The hole is near outcrops of schistose metamorphic rocks, and it penetrated rock of this type containing disseminated magnetite in amounts of a few per cent, together with rare sections of pyrite as veinlets and disseminations. Immediately southeast of the drill-hole, a northeast-trending gully appears to follow a geological contact between the metamorphic rocks and medium-grained granite, which is exposed southeast of the gully.

(*b*) *Mint Group*.—This group of thirteen claims and fractions is owned by Marvin Scheuerman and adjoins the south bank of Nicola River, about 2 miles west of Merritt. It includes the Anaconda and Copper Belle prospects, described in Memoir No. 249 of the Geological Survey of Canada (pp. 125–126). Work in 1961 consisted of a magnetometer survey of six claims and a spontaneous polarization survey by S. F. Kelly of parts of the group.

(*c*) *H.J. Group*.—This group of one full and three fractional claims is north of Jesse Creek, about 4 miles north of Merritt, and was held for part of 1961 by option from W. D. Barr. Work consisted of a magnetometer survey, following which the option was dropped.

Skeena Silver Mines Ltd. (50° 121° S.E.) Company office, 301, 744 West Hastings Street, Vancouver 1. A. F. Lungley, president; C. Rutherford, consulting engineer. This company holds more than twenty claims adjoining the west side of Indian Reserve No. 9, about 1 mile north of the Merritt–Spences Bridge highway between Canford and Dot. The property is largely, if not completely, underlain by rocks of the Spences Bridge group. Work in 1961 included line-cutting and geophysical surveying.

Copper-Iron

Copper Soo Mining Company Limited (50° 120° S.W.) T. G. Wilson, managing director, Osoyoos; H. Hill & L. Starck & Associates Ltd., consulting engineers, Vancouver. This company, newly formed from the Copper Soo Mining Syndicate, holds forty-eight claims in the Soo, Bare, and Verna groups on the west slope of Sugarloaf Mountain, about 6 miles east and southeast of Merritt. The main showings are on Soo No. 11 claim, at about 3,300 feet elevation on the east side of the cut-off road, and were trenched in 1959. In 1960 a magnetometer survey was made of the Soo and Bare groups by H. H. Cohen. Work in 1961 consisted of additional magnetometer surveying, together with a self-potential survey near the main showings, geological surveying, and surface diamond drilling of nine holes, totalling 1,037 feet, on the Soo No. 11 claim.

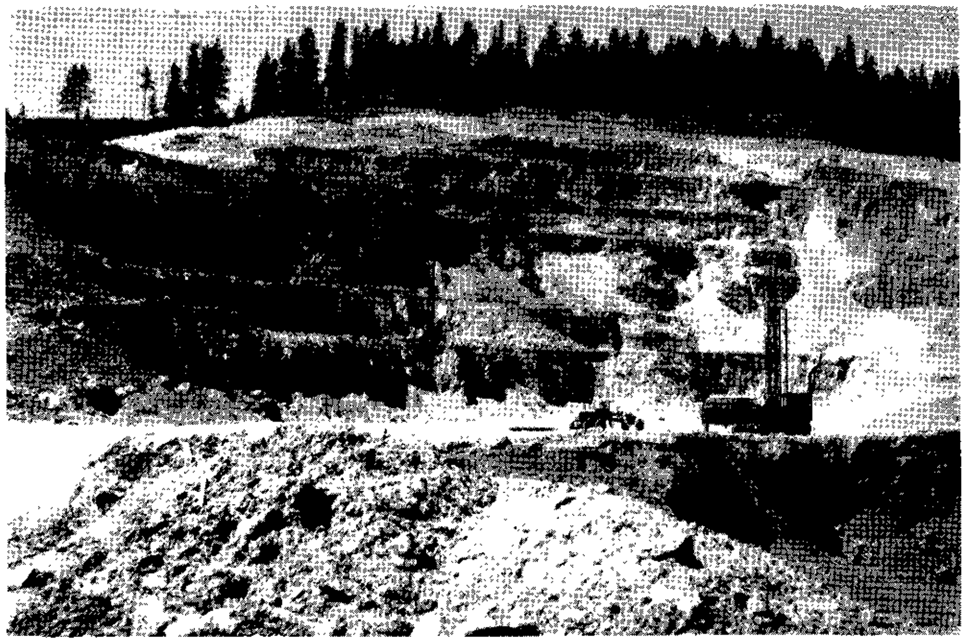
The main showings are exposed in trenches and outcrops at two localities about 1,000 feet apart in a northerly direction, and occur in Nicola strata which strike north or east of north and dip steeply. At the northern showing a 4-foot bed of limestone is almost entirely replaced by magnetite-epidote-garnet skarn for a distance of about 10 feet along its strike, and the skarn contains chalcopyrite in amounts estimated in places to equal 1 per cent copper. The limestone is sharply bounded on the west by bleached tuff or volcanic conglomerate which, although generally unmineralized, is at one place invaded by an offshoot of the skarn body. The offshoot pinches out within a few feet in a west-southwesterly direction, its only visible continuation being a series of steep fractures which cross the tuff bed in this direction. A second, thinner bed of limestone is exposed about 50 feet east of the first and is separated from it by massive tuff. Limestone can be traced for several hundred feet to the south of the showing.

At the southern showing, dark-green lava or poorly bedded tuff is fractured and contains patches and veins of altered rock consisting mainly of epidote and calcite together with magnetite and, locally, quartz and small amounts of chalcopyrite and malachite. The alteration and mineralization are chiefly associated with complex fracturing, which occurs at the south end of the showing. North-trending fractures continue northward for as much as 300 feet and contain only epidote, calcite, and magnetite. The upper parts of holes drilled from a set-up at the south end intersected unmineralized garnet-skarn and massive magnetite containing minor amounts of chalcopyrite and pyrite.

Copper

Judy Group* (50° 120° S.W.) This group of thirty-five claims, Judy 1 to 35, is on the southwest slope of Iron Mountain, 4½ miles south of Merritt. The claims are held by record by H. D. Merrell, K. I. Merrell, K. Moyes, and W. Hegan, all of Merritt. Access is by a road, passable to automobiles, which leaves the Merritt–Kingsvale highway about 3 miles from Merritt.

* By N. D. McKechnie.



Craigmont Mines Limited. Preparation of open pit, June, 1961.

Huestis Mining Corporation Limited. Bulldozer stripping at Skwaam Bay.

The ground was located in 1896 as the Victoria, Islander, and Charmer mineral claims. A shallow shaft, still in existence, was sunk on copper showings on the Charmer claim. There is no record of any subsequent work. The Charmer shaft, partially filled with water, measured 32 feet deep.

The rocks are tuffs and lapilli tuffs of the Nicola volcanic group showing in thin-section considerable secondary quartz and orthoclase and in some instances the barium feldspar celsian. In the latter connection it is interesting to note that barite is the principal gangue mineral in the Comstock of B.C. vein exposed in workings about a half mile northeast of the Charmer shaft. Near the shaft the rocks dip steeply east, and in trenches about 1,000 feet west they dip steeply west. One nearly east-west strike was noted about 400 feet west of the shaft. The tuffs show little or no bedding, and dips and strikes are obtainable only at formation contacts.

Chalcopyrite mineralization was seen only in the vicinity of the shaft, where it occurs in scattered stringers and blebs in a lapilli tuff and to a lesser degree in an overlying aphanitic grey siliceous tuff exposed for 250 feet on strike in a trench immediately west of the shaft. Hematite, which veins the chalcopyrite, occurs in fracture fillings and blebs and is widespread. It appears to bear no definite relationship to the copper mineralization.

At the time of the writer's visit in August, a series of bulldozed trenches had exposed the rocks over an east-west width of about 1,000 feet.

NICOLA

Copper

Copperado (Toluma Mining and Development Co. Ltd.)* (50° 120° S.W.) Head office, 1150 Denman Street, Vancouver 5; mine office, Merritt. A. M. Arnold, president; A. R. Allen, consulting engineer. The property, consisting of sixty-five claims held by record and one Crown-granted mineral claim, is owned by Guichon Mines Limited and operated under agreement by Toluma. It is 4½ miles by road from Nicola village and north of the lower end of Nicola Lake at an elevation between 3,500 and 4,500 feet.

The original showings, on the Turlight Crown-granted claim, were first opened in 1929 by an inclined shaft and further developed by underground workings between the years 1947 and 1952. A detailed description and maps of the Turlight occurrence are in the Annual Report for 1949, pages 115–120. A northwestward-striking shear zone in granodiorite contains lenses of quartz mineralized with chalcopyrite and bornite. The shear dips northeast at about 75 degrees.

Work in 1961 consisted of bulldozer trenching and diamond drilling on the P62, P64, P65, and B4 fractional mineral claims, about 1 mile northwest of the Turlight workings. The rock is granodiorite, similar to that at the Turlight, cut by aplite dykes. An east-west trending contact with Nicola volcanic rocks is exposed about 200 feet north of the south boundary of the P64 claim. Both granodiorite and aplite are cut by scattered stringers and narrow veins of quartz which is weakly mineralized by chalcopyrite and bornite.

The aplite occupies two sets of fractures, one striking a few degrees east of north, the other about northwest. The former dip eastward or westward at about 60 degrees, and the latter dip southwest at 25 to 35 degrees. The sulphide-bearing quartz stringers mostly strike north to north-northeast and dip flatly eastward at from 10 to 30 degrees. Two narrow veins dip northeast at less than 30 degrees. One barren quartz vein striking east and dipping 80 degrees north was the only steeply dipping quartz vein observed; its relationship to the mineralized quartz is not known.

* By N. D. McKechnie.

An unmineralized fault striking north 35 degrees west and dipping 65 degrees southwest has displaced the Nicola contact at least 600 feet to the southeast on its footwall side.

The showings displayed neither continuity nor correlation.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1929, p. 246; 1947, p. 136; 1948, p. 120; 1949, pp. 115–120; 1950, p. 112; 1951, p. 128; *Geol. Surv., Canada,* Mem. 249, p. 130.]

Quilchena (Guichon Mines Limited)* (50° 120° S.W.) Company office, 736 Granville Street, Vancouver 2. This property was operated under a share agreement with the owners by Quilchena Mining & Development Co. Ltd., 736 Granville Street, Vancouver. The property overlooks Nicola Lake and is about 1 mile south of Quilchena. Work in 1961 consisted of examination of the old workings, sampling, and some surface stripping. An average crew of five men was employed under the direction of S. F. Kelly.

ASPEN GROVE*

Copper

Wen Group (Skeena Silver Mines Ltd.) (49° 120° N.W.) Company office, 301, 744 West Hastings Street, Vancouver 1. The Wen group consists of thirty-two claims, the HN 1 to 18 and the Wen 1 to 14, which are southeast of Tommy Lake, 8 miles east of Aspen Grove. An electromagnetic survey was made by the Hunting Surveys Corporation. A crew of five men was employed under the direction of C. Rutherford. Subsequently an option was taken by Noranda Exploration on this group, and some 7,200 feet of stripping was done in 1961.

KAMLOOPS†

Copper

Makaoo Development Company Limited (50° 120° N.E.) Company office, 915, 736 Granville Street, Vancouver 2. L. G. Wood, president; W. I. Nelson, general manager. This company holds five Crown-granted and sixty-seven recorded claims in the vicinity of Coal Hill, about 3 miles southwest of Kamloops. Work in 1961 included eight surface diamond-drill holes totalling 3,126 feet, together with trenching and stripping amounting to 9,018 lineal feet and 6,290 square feet, respectively. About 2,000 feet of road was built. This work was done partly close to and northeast of the Noonday shaft and partly about 1,500 feet east of this shaft. Stripping in the latter area exposed disseminated, partly oxidized copper mineralization in porphyry and other fine-grained rocks.

Galaxy Minerals Ltd. (50° 120° N.E.) Company office, 1403, 1030 West Georgia Street, Vancouver 5. W. Fred Evans, president; W. I. Nelson, consulting engineer; P. C. Badgley, consulting geologist. This company holds six Crown-granted and forty-six recorded claims immediately west of the Makaoo property.

Work in 1961 continued from June to December and was done mainly on the Evening Star and Golden Star claims. It included nine surface diamond-drill holes totalling 4,263 feet together with 4,435 feet of trenching, 2,200 feet of road construction, and geochemical and geophysical surveys. One or more mineralized zones were intersected at intervals within a distance of several hundred feet measured in a west-northwesterly direction from the Star shaft.

* By David Smith.

† By J. M. Carr, except as noted.

Iron Mask (Kamloops Copper Company Ltd.) (50° 120° N.E.) Company office, 105 Seymour Street, Kamloops. R. W. Kennedy, president; H. Hill & L. Starck & Associates Ltd., Vancouver, consulting engineers. This company holds about thirty-nine claims, some of them Crown granted, in the vicinity of the Iron Mask mine, 7 miles west of Kamloops. The mine has been inaccessible since production ceased in 1928.

Work in 1961 included dewatering the mine by pumping from the Norma shaft, whose collar is about 410 feet above the lowest workings in the mine, which are on the 750 level. Other work included retimbering the Erin shaft down to the 300 level, setting up an assay office, underground sampling, and preparing for underground diamond drilling, which began after the year's end. A crew of about nine men was employed.

The parts of the mine which were accessible at the time of a visit in early February, 1962, included all the Norma workings, the Erin workings from the 300 level upward, and the 750 level as far west as the vicinity of the Iron Mask shaft station. Existing workings, which are not shown on published maps, occur as part of the 750 level east of the Iron Mask shaft and as the 50 and 80 levels, respectively, in the uppermost part of the Erin workings.

Mineralization seen in the Norma workings and in the Iron Mask and western Erin sections on the 750 level consisted principally of streaks and knots of chalcopyrite in veins of banded gypsum. These veins follow shears and persist in some cases for more than 100 feet, with widths in places of several feet. They mostly strike northeastward and dip fairly steeply to the southeast, and are then nearly parallel to the former Iron Mask and Erin orebodies. East of the Iron Mask shaft, however, some veins have irregular attitudes and others strike eastward. The Erin orebody, judging by a brief examination of the upper workings, was in a coarse breccia, consisting mainly of altered diorite, which grades at both ends into a banded gypsum vein. The length of the orebody in horizontal projection was about 600 feet, or roughly twice the length indicated on published maps, which fail to show the full southwestern extent of the orebody as indicated by large stopes above the 300 level. In plan the shape of the orebody is apparently somewhat concave to the southeast. Several porphyry intrusions occur near the Erin stopes, some being mineralized, whereas others are not. On the 100 level and elsewhere, an unmineralized dyke occurs parallel to the orebody immediately in the hangingwall, as though partly following the mineralized structure.

On the 300 level, broken, altered, and mineralized porphyry occurs well inside the footwall of the southwest part of the Erin structure, and may continue eastward into the Erin orebody. The mineralized porphyry is partly of a type formerly described as microdiorite or micromonzonite (Ann. Rept., 1956, p. 50) and is cut by easterly striking unmineralized porphyry dykes. Rock alteration is of several kinds and includes biotitization.

Faults and shears are numerous in the mine. An attempt was made in a previous report to explain the mineralized shears as due to the faulting of an inferred igneous contact lying farther west in the mine area (Ann. Rept., 1956, Fig. 6). The inferred contact is between picrite-basalt on the west and diorite on the east. Recent examination revealed this contact a hundred or more feet west of the Iron Mask shaft-station on the 750 level, where it coincides with a wide zone of brecciation and shearing, apparently devoid of mineralization. Between this point and the Erin workings on the 750 level, and on the 300 level at the southwest end of the Erin structure, faults of different character occur. They are tight, slickensided faults which strike north or northwestward and dip westward, and contain a thin seam of brown gouge and no visible mineralization. In both places the faults appear to interrupt or terminate mineralized gypsum veins. On the 300 level the Erin vein is exposed on the northeast side of one of these faults, which is itself offset farther southeast by a cross-fault. The cross-fault strikes northeast and contains a soft green breccia and a thin seam of brown gouge, which cause it to resemble post-mineral faults in the Python zone of the adjacent Makaoo property (Ann. Rept., 1956, p. 56). The south wall of the cross-fault contains an unmineralized porphyry dyke, whose attitude is similar to that of the fault.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1913, pp. 185–189; 1926, pp. 183–185; 1956, pp. 47–69.]

Ajax and Monte Carlo (The Consolidated Mining and Smelting Company of Canada, Limited)*.—(50° 120° N.E.) Company office, Trail. This company holds eight Crown-granted and five recorded claims. The property is situated immediately east of Jacko Lake, approximately 6 miles southwest of Kamloops. Surface work consisted of two diamond-drill holes totalling 1,004 feet in length. A crew of four men was employed, supervised by members of the company staff.

Rainbow (Huestis Mining Corporation Ltd.)*

(50° 120° N.E.) Company office, 1818 Marine Building, 355 Burrard Street, Vancouver 1. This property consists of twenty-three claims held by option and lies on Sugarloaf Mountain approximately 6 miles southwest of Kamloops. Surface work consisted of stripping by bulldozer and the drilling of four diamond-drill holes. A crew of four men was employed under the direction of Frank Cooke and C. Brown. The option was dropped.

NORTH THOMPSON

Barriere†

Lead-Zinc

Renning No. 1, LT, etc.

(51° 119° S.W.) A syndicate headed by K. Calder, of Vancouver, did a small amount of exploratory work on a lead-zinc showing on the south side of East Barriere Lake during 1961. The showing is about 3 miles east of the lake outlet, one-third of a mile southeast of the shoreline, and 450 feet above water-level. It can be reached by a rough 3-mile jeep-road from the sawmill at the end of the lake. The mill is 14 miles by road east of Barriere, a community on No. 5 highway 40 miles north of Kamloops.

The showing consists of a zinc-lead-copper replacement body in the crest of a small, recumbent, dragfolded anticline. It is exposed in the face of a low limestone bluff. By late August, 1961, a north and south oriented exposure 400 feet long with a maximum height of 36 feet had been created by blasting a few rounds off the bluff face and using a bulldozer to clear away debris and trench down a few feet along the base of the bluff.

A large fault, apparently of the thrust type, can be traced near the base of the exposed face from the south end to within 120 feet of the north end. It strikes north and dips 25 degrees east. Below the fault, only black siliceous and limy gouge and unconsolidated breccia can be seen. Between 160 and 190 feet from the north end of the trench the gouge contains several blocks, up to 4 feet in diameter, of

* By D. Smith.
† By J. W. McCammon.

highly siliceous rock material containing traces of sulphides. At the north end of the exposure the rock above the fault is relatively undisturbed, very thin-bedded, dark-grey platy limestone that strikes north 20 degrees west and dips 36 degrees east. In the central part of the cut the rock is poorly exposed and relationships are obscured, but there appears to be a narrow cherty or silicified thin-banded limestone zone immediately above the fault. This zone is, in turn, overlain conformably by limestone similar to and of the same attitude as that to the north. In the southern 150 feet of the exposure the rock above the fault is much disturbed. At least three other faults intersect the main fault at low angles, and the rock between the faults is shattered and silicified. Above the fault intersections, and forming the upper part of the bluff, is the nose of a recumbent anticline that contains the main mineralized showing. In the crest of the fold is a mass about 21 feet long and 21 feet high of siliceous, calcitic, and dolomitic gangue containing patches and streaks of sphalerite, galena, chalcopyrite, and pyrite. The rock stratigraphically above the mineralized zone is thin-bedded limestone similar to that to the north; the rock stratigraphically below the zone is thin-bedded siliceous material that is either chert or silicified limestone. The upper limb of the fold is almost horizontal, and the lower limb is cut off by the main fault.

A chip sample across the chord of the fold at the mineralized section, a distance of 21 feet, assayed: Gold, trace; silver, 2.1 ounces per ton; copper, 0.11 per cent; lead, 3.11 per cent; zinc, 5.9 per cent.

Little Fort

Gold

Windpass (Fort Reliance Minerals Limited)*

(51° 119° S.W.) Head office, 3100, 25 King Street West, Toronto. The property is east of Dunn Lake, about 8 miles north of Chu Chua, and east of Little Fort, about 60 miles north of Kamloops. This former gold producer, which closed in 1939, is held under three mineral leases covering the following former Crown-granted claims: North Dunn, Donegal, Brenda Fraction, Signe, Belfast, Gott, Elise, Jupiter, Maple Leaf, Premier, Sweet Home, and the Windpass Nos. 1 to 3. A small amount of stripping and a geophysical survey were carried out under the direction of A. D. Wilmot, engineer-in-charge; address, Hobson Road, R.R. 4, Kelowna.

Molybdenum

Tintlhohtan Lake (Calder Molybdenum Company Limited)†

(51° 120° N.E.) In the autumn of 1960 and in 1961 Calder Molybdenum Company Limited did some trenching and diamond drilling on an old molybdenum prospect near Tintlhohtan Lake. This lake is 12 miles northwest of Little Fort, a village on No. 5 highway 62 miles north of Kamloops. By July, 1961, the area had been blanketed by 140 mineral claims—four in the name of Thomas Loveway, four in the name of Gung Loy Jim, six in the name of Gordon Angus, nine in the name of Guy Gilman, and 117 in the name of Calder Molybdenum company. The showings were first investigated in 1938 and 1939, when the ground was known as the Anticlimax property.

Access is by 17 miles of road from Little Fort via Lemieux and Fourteen Mile Creeks. The last 8 miles of road are suitable for jeep vehicles.

At the showings, molybdenite occurs in small veinlets and lenses of pegmatite and quartz in a granite stock. The stock is at least three-quarters of a mile in

* By David Smith.
† By J. W. McCammon.

diameter. It is bordered on the north, east, and south by greenstone and is covered by overburden to the west. The bulk of the stock appears to be medium-grained alkali-granite consisting essentially of quartz, microperthite, and albite-oligoclase. A porphyritic finer-grained phase is exposed around the " B " workings, and a few small aplite masses occur at scattered points.

The original showings, at "A" and " B " on Figure 7, are at 4,500 feet elevation on the bare top and west slope of a small hill one-half to three-quarters of a mile northeast of the north end of Tintlhohtan Lake. A recent discovery is in the creek bed one-half mile southeast of the original showings.

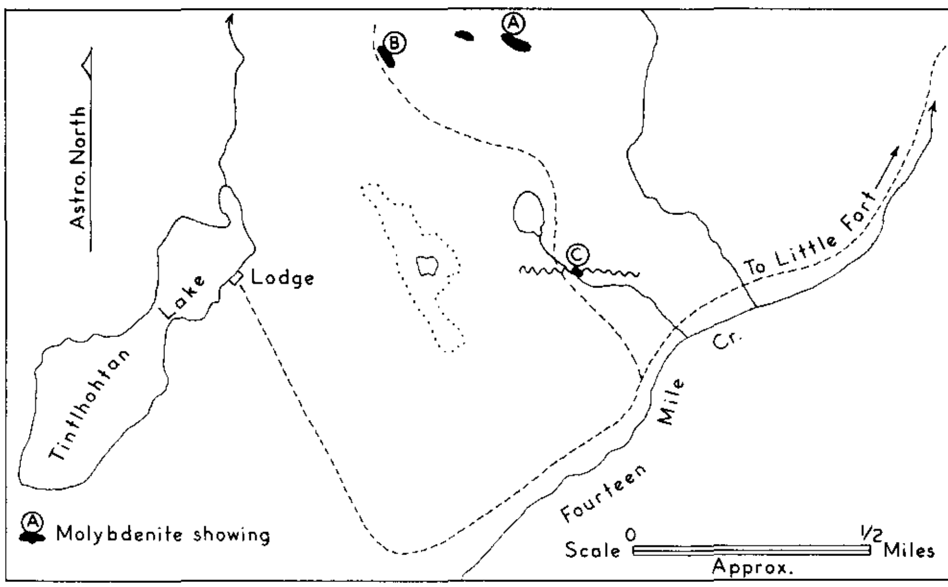


Figure 7. Tintlhohtan Lake molybdenite showings.

Stevenson* has described in detail the old workings at "A" and " B." At "A" he mentions six small pits, each with one or two short quartz veins, generally one-half to 1 inch wide but with one or two as much as 8 inches wide, that contain small scattered flakes of molybdenite. Recent work consisted of digging one new trench 100 feet long from east to west, another 12 feet long, and a third one 15 feet long on the bare hilltop. A few ¼- to ½-inch-wide quartz veinlets containing scattered flakes of molydenite were exposed by the trenches.

At " B " the old workings consisted of ten pits, of which only one showed mineralization. This pit appears to have exposed a single large pod of highly mineralized pegmatitic-aplitic material that contained as much as 10.8 per cent molybdenite in a 10-inch-thick specimen. No new diggings were found at " B," but two shallow bulldozer trenches roughly 200 feet long had been scraped in a north-westerly direction across a flat area between "A" and " B." The trenches did not reach bedrock.

During current exploration work a new discovery of molybdenite mineralization was made at " C " in the bed of a small creek. In the creek bed a contact between granite on the north and greenstone on the south is exposed along a shear zone. Much brecciation and bleaching and some pyritization has taken place along

* *B.C. Dept. of Mines*, Bull. 9, Molybdenum Deposits of British Columbia, 1940, pp. 20–28. (Scale on page 22 should read 200 feet instead of 40 feet.)

the zone. Considerable bulldozing had been done on the creek bank in preparation to set up two diamond drills about 150 feet upstream from the contact. This activity had covered much of the bedrock, and in the visible exposures no molybdenite was recognized. However, a diamond-drill core 191 feet long that was available for examination showed granitic rock containing molybdenite scattered in dark quartz veinlets and hairline seams at 1- to 12-foot intervals through much of its length.

CLEARWATER*

Molybdenum

Sands Creek (51° 120° N.E.) During 1960 and 1961 Calder Molybdenum Company Limited did some trenching and diamond drilling on an old molybdenite prospect near the mouth of Sands Creek. The showings and surrounding area were covered by seventy-seven mineral claims located in 1959 and 1960 by T. Wrixon, C. Fuller, and S. Pearson. Very brief notes on the prospect have been published by J. F. Walker (Ref. 1) and J. S. Stevenson (Ref. 2).

Sands Creek is a small stream that flows westward into the Clearwater River 2 miles north of Clearwater, a village on No. 5 highway 82 miles north of Kamloops. The Clearwater River road crosses Sands Creek 1½ miles north of the highway. The showings are in the creek banks a few hundred feet downstream from and west of the road. A rough road extends from the river road through a sawmill site 1 mile north of No. 5 highway to the workings.

In the surface showings, molybdenite occurs as scattered flakes in quartz veins and pegmatite dykes that intrude granodiorite near a contact with metamorphosed sediments. At two or three isolated spots in drill cores, some molybdenite was seen disseminated in granodiorite.

The oldest rocks on the property are thin-bedded micaceous quartzites and siliceous argillites. They are best exposed along the south bank of the creek but also show at two places on the north bank as indicated on Figure 8. They strike northwestward and dip vertically to steeply south.

The quartzites and argillites are intruded by a coarse-grained speckled pinkish granodiorite composed of approximately 30 per cent each of quartz, orthoclase, and oligoclase, with accessory biotite and minor apatite and sphene. Scattered phenocrysts as long as three-quarters of an inch give the rock a somewhat porphyritic appearance. The contact between the granodiorite and the argillites is not well exposed, and in most places the visible contact is faulted and irregular. It has a general east-west trend and appears to be nearly vertical but may dip steeply south.

The granodiorite is intruded by quartz veins, pegmatite dykes and lenses, and granophyre dykes. No veins nor dykes were seen in the metamorphic rocks, and in one or two instances veins in the granodiorite were seen to end at a faulted contact. The thickness of the quartz veins ranges from 2 to 18 inches, most often being 8 inches or less. The veins pinch and swell and are badly broken by faulting, usually being continuous for less than 10 feet along strike. The strike varies from north 30 degrees east to east, generally being between north 50 and 70 degrees east. Dips are steep south to vertical. A few small irregular masses and short faulted dykes of quartz-feldspar pegmatite are exposed in the workings. Granophyre dykes 2 inches to 1 foot thick are common. They consist of medium- to fine-grained, granular, light-coloured rock characterized by a micropegmatitic intergrowth of quartz and feldspar.

* By J. W. McCammon.

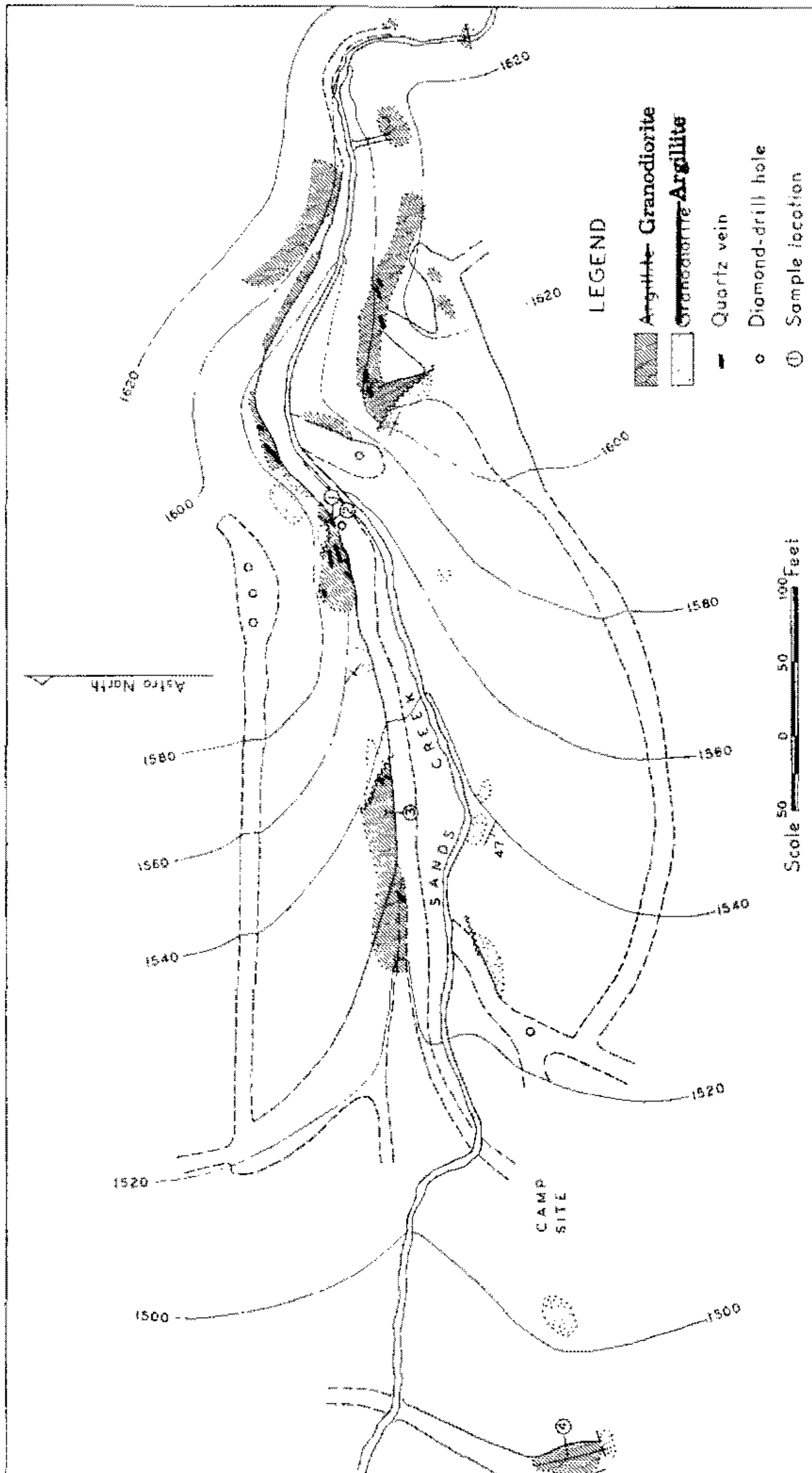


Figure 8. Sands Creek molybdenite showings.

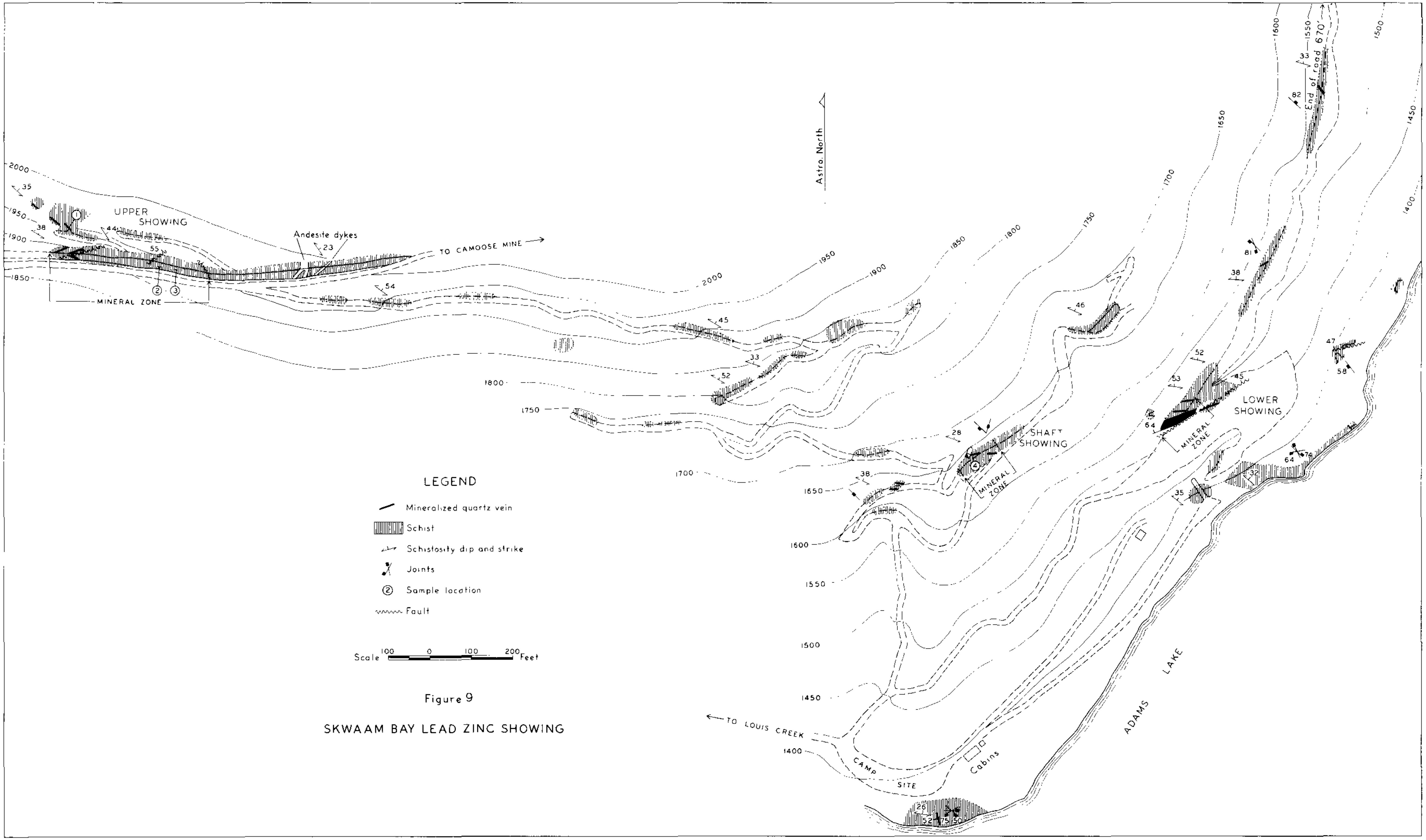


Figure 9

SKWAAM BAY LEAD ZINC SHOWING

There is apparently a strong east-west striking shear zone extending down Sands Creek at the molybdenite showing. This is indicated by the fragmented veins and the crushed, gougy, and sometimes brecciated nature of the rocks, particularly on the north bank of the creek. The granodiorite especially crumbles readily into coarse sand. In places it looks fresh and solid, but if it is struck with a pick it disintegrates into rubble. The bulk of the diamond-drill core examined was very crumbly and gougy or in short segments.

As previously mentioned, the only mineralization found on the surface was in quartz veins or pegmatite lenses. Molybdenite, pyrite, and occasionally small amounts of chalcopyrite occur erratically in patches and hairline seams in the gangue. Most of the vein segments contain some molybdenite, but a few are quite barren. None of the veins seen contained any appreciable concentrations of mineralization. The erratic nature of the distribution is well illustrated by the assays of samples 1 and 2, which were cut across the width of the same 8-inch-wide vein 1 foot from each other. Rusty patches several feet across were found in various places along the exposed granodiorite bank. Pyrite was the only sulphide mineral detected in these patches, but sample No. 3 was cut across the diameter of a 5-foot zone of this type to check for possible molybdenum mineralization. Sample No. 4 was cut across a series of small rusty patches of pegmatite and quartz in granodiorite exposed in the most westerly open cut. The results of assays for the molybdenite content of the four samples were: No. 1, 1.91 per cent; No. 2, 0.15 per cent; No. 3, trace; No. 4, trace. Sample No. 1 was taken at one of the best-mineralized sections seen on the property.

The key to a core shack containing cores of eleven diamond-drill holes was kindly made available by Mr. Calder. Unfortunately the cores were incomplete, and it was not possible to obtain a plan to correlate the cores with known drill sites. All core examined consisted essentially of crumbly or gougy granodiorite with widely scattered narrow quartz veins, pegmatite lenses, and thin granophyre dykes. One core, presumably from the most westerly drill site shown on Figure 8, started in dark argillite and changed to granodiorite at the 68-foot mark. Thinly disseminated molybdenite flakes in granodiorite were noted in four sections a few inches long in three cores. Apart from these instances, all the mineralization was confined to quartz veins or pegmatite. The metallic minerals noted were molybdenite, pyrite, magnetite, and scarce chalcopyrite. No extensive nor heavy mineralization was seen in any of the cores.

Development work done on the property consisted of bulldozer trenching and diamond drilling. The main trenches and what are thought to be the diamond-drill hole sites are shown on Figure 8. One to two hundred feet northeast of the creek and about 100 feet above the main trench a shallow bulldozer trench several hundred feet long had been dug along the hillside in a northwesterly direction. Nothing other than a few small barren exposures of granodiorite was seen in this trench.

[References: (1) *Geol. Surv., Canada,* Sum. Rept., 1930A, p. 153A; (2) *B.C. Dept. of Mines,* Bull. 9, 1940, pp. 33, 34, 83.]

SKWAAM (AGATE) BAY*

Lead-Zinc

Huestis Mining Corporation Ltd. (51° 119° S.W.) In mid-May, 1961, Huestis Mining Corporation Ltd. began exploration work on some lead-zinc showings on a group of 115 claims located by Ivan Bennett, Harold Jones, and Ken Calder at Skwaam (Agate) Bay on

* By J. W. McCammon, except as noted.

Adams Lake. The original showings were formerly known as the Try Me and Rankin group (Ann. Rept., 1924, p. B 157). After completing nearly 2 miles of bulldozer trenching and stripping and doing extensive prospecting in the claims area and adjoining countryside, the company abandoned the property in mid-August.

The showings are at the point on the west shore of Adams Lake where the north side of Agate Bay joins the lake. The workings are spread for three-fifths of a mile along the hillside from the shoreline for 600 feet up the hill. Access is by 24 miles of road east from Louis Creek, a small community on No. 5 highway 37 miles north of Kamloops.

On the property very low-grade lead-zinc-copper mineralization occurs in quartz veins in schists. The schists consist mainly of fine-grained quartz and sericite or fine-grained quartz and chlorite. One thin-section examined contained relatively large grains of orthoclase and another contained plagioclase. All rocks contain pyrite with at least a little carbonate, and several are limy enough to effervesce freely with dilute acid. Scattered small pods and lenses of limestone occur in a few places. The schists are normally some shade of green, but in irregular zones have been bleached to yellow and brownish light grey to white. These bleached zones range from a foot to 200 feet wide, most being exposed for less than 20 feet. As far as could be seen, the zones are not directly related to the mineralization and nothing of value was noticed in them. The strike of the schistosity ranges between south 80 degrees west and north 35 degrees west, averaging north 70 degrees west. It dips to the northeast at 22 to 54 degrees, averaging 38 degrees. A microscopic secondary cleavage inclined at about 45 degrees to the schistosity can be seen in many thin-sections. Lineations representing minute parallel and en échelon crenulations, secondary cleavage traces, and striations are abundant on planes of schistosity, sometimes striking in as many as three different directions on a single plane. The rocks are part of the Shuswap terrane, whose age is in doubt.

Two small dykes of fine-grained andesite exposed near the east end of the upper trench contain the only rock other than schist seen on the property.

Many faults with small apparent throws are exposed in the workings. Most strike northwestward or northeastward and dip rather steeply north. The majority appear to be thrust faults. Slickensides indicate that there has been considerable movement along the schist planes, and although no major locus of such movement was recognized, there may well be some large faults parallel to the schistosity.

Joints are prevalent in the rocks. They fit roughly into three sets: one strikes northwest; a second, east-west; and a third, northeast. All are nearly vertical or dip steeply, usually to the south.

Apart from pyrite, which is abundant everywhere, the only sulphides recognized occur in quartz and quartz-carbonate veins in the schists. Two types of veins are present. One type is characterized by the narrowness of individual members, widths ranging chiefly between one-quarter and 1 inch. These are in closely spaced swarms that form the main mineralized zones in the upper and shaft cuts. The veins are more or less parallel and lie partly conformable with the schistosity but frequently cross it at small angles. Few seem to persist for many feet along strike, but rather they tend to pinch out or are sheared off along schist planes. The other veins are larger, with widths ranging from 4 to 18 inches and in one exceptional case to 20 feet. The larger veins are widely scattered throughout the property. They strike slightly north or south of west and usually dip fairly steeply northward. All pinch and swell erratically and are cut off by faults, some being represented only by short scattered lenses and pods. The veins consist chiefly of quartz with variable amounts of calcite, dolomite, or ankerite and erratically distributed grains and patches of pyrite, galena, sphalerite, and chalcopyrite. Fine-grained dark grey-green tourmaline forms conspicuous patches in one or two veins visible in the adit near the lakeshore.

Exploration work was concentrated in three areas referred to herein for convenience as the upper, shaft, and lower showings. A rough road bulldozed out between the showings served to expose bedrock in intervening areas, and in some spots additional stripping was carried out. The layout of the work is shown on Figure 9.

The workings at the upper showing consist of the main trench, two shallow cuts above the main trench, and two or three small blast-holes in the bluffs to the north. The main trench is 1,000 feet long, 15 feet wide at the floor, and has a maximum face height of 50 feet on the north wall. A concentration of slightly mineralized quartz veins, most less than an inch thick, was uncovered in a 380-foot-wide zone as shown on the figure. The best mineralization is in the eastern 200 feet of this zone. The short cut immediately north of the main trench exposed a few scattered half-inch veins and one 1-foot-wide vein near the west end. Blast-holes exposed scattered mineralization in lensy 6- to 18-inch veins 50 and 100 feet northwest of this cut. The second cut to the north exposed only barren yellow-stained light-grey schist. Sample No. 1 was cut across 1 foot of well-mineralized vein exposed in the first cut as indicated, sample No. 2 was cut along 10 feet on the bottom of the main trench across numerous thin veins, and sample No. 3 was similar to No. 2 but 30 feet east of it.

At the shaft showing a trench 15 feet deep, 150 feet long, and up to 30 feet wide was excavated on a swarm of ½- to 1-inch-thick slightly mineralized veinlets and one or two thicker veins. On the bank at the northwest corner is an old inclined shaft 5 feet square sunk on a bearing of north 25 degrees east at a 45-degree angle down a lensy 6-inch to 1-foot-thick vein that contains scattered sulphides. Sample No. 4 was cut for 10 feet across the schistosity near the centre of the swarm of thin veinlets.

At the lower showing an area roughly 400 feet long by 200 feet wide was stripped off a large lens-like exposure of quartz-carbonate material containing sparse, patchy, but in spots quite spectacular, sulphide mineralization. The lens appears to terminate to the southeast at a fault in the floor of the cut and is covered by overburden to the northwest. Numerous small slightly mineralized veinlets are present in the exposure along each side of the main lens.

On the beach 100 feet south of the lower showing, an old adit extends for 56 feet into the hillside on a bearing of north 38 degrees west. Several small veins are exposed in the adit. One or two contain small amounts of sulphides, and some contain tourmaline, but nothing of apparent economic interest is visible.

Three small pits near the beach northeast of the adit show nothing of interest.

Assay results on the four samples that were collected are shown below.

During its exploration work the company took bulk samples from the upper showing. The samples were cut along consecutive 10-foot spacings across the 200-foot eastern section of the mineralized zone indicated on Figure 9. Each of the twenty samples weighed 400 pounds. The average of all of these samples is shown as sample No. 5 in the table.

Sample	Gold	Silver	Copper	Lead	Zinc
	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent	Per Cent
No. 1	Trace	0.8	0.14	5.16	1.70
No. 2	*Nil*	Trace	0.03	0.64	0.70
No. 3	*Nil*	Trace	0.01	0.20	0.14
No. 4	*Nil*	0.1	0.02	0.16	0.17
No. 5 average	Trace	0.1	0.025	0.21	0.38

Zinc

Rose Group* (51° 119° S.W.) This property consists of the following claims: Rose 1 to 20 and Rose 27 to 46, located by I. Bennett, R.R. 3, Salmon Arm, and held under option by Tombac Explorations Limited. The claims lie about 5 miles north of Agate Bay on the west shore of Adams Lake. The ore, a high-grade resinous sphalerite, lies against the southern contact of a very prominent limestone bed which strikes almost at right angles across Adams Lake at this point. A total of 1,575 feet of diamond drilling was done. A crew of six was employed under the direction of B. Backler. The option was dropped.

SIMILKAMEEN RIVER†

Copper

Deep Gulch (Copper Mountain Mines Ltd.) (49° 120° S.W.) Company office, 1500 Marine Building, 355 Burrard Street, Vancouver 1. R. Collishaw, president. This company holds forty-eight claims, on which the main showings are immediately east of the Hope–Princeton highway, to the south of Deep Gulch Creek, about 12 miles by road south of Princeton. In 1961 four surface diamond-drill holes were made, bringing the total number drilled on the property since 1958 to sixteen and the total footage drilled to 3,028 feet. An average crew of three men was employed between April and November. Some of the drilling was in the Copper Mountain gabbroic stock and some in the adjacent Nicola rocks.

[Reference: *Minister of Mines, B.C.,* Ann. Rept., 1959, pp. 53–54.]

Friday Creek Development Co. Ltd. (49° 120° S.W.) Company office, 1614 Burrard Building, 1030 West Georgia Street, Vancouver 5. D. F. Hamelin, president. This company holds twenty-six claims, of which all except four are on option from I. C. and R. L. Ashley, of Princeton. The property adjoins the southern part of the Deep Gulch property and lies mainly between the Hope–Princeton highway and the Similkameen River. Access by vehicle is either through the Deep Gulch property or from a point on the highway south of Friday Creek.

Work in 1961 included about 500 feet of trenching, 710 feet of diamond drilling, road construction, and a geophysical survey. Stripping to bedrock was done over a wide area on the south bank of Friday Creek, and one or more new trenches were made a few hundred feet south of the creek. About 12 tons of hand-picked material with bornite was stored for prospective shipment, and bulk samples were taken from the stripped area for assay and mill tests.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1960, pp. 56–67.]

HEDLEY

Gold

Good Hope and Nighthawk (Nighthawk Gold Mines Limited)‡ (49° 120° S.E.) Head office, 1500, 355 Burrard Street, Vancouver 1; W. R. Wheeler, president. The property includes ground formerly held by Hedley Mascot Gold Mines Limited and is 3 miles southeast of Hedley at an elevation of about 5,000 feet, between Cahill and Winters Creeks. There are fifty-four mineral claims, thirty of which are Crown granted. The geology in the vicinity of the workings is described and illustrated

* By David Smith.
† By J. M. Carr.
‡ By N. D. McKechnie.

in the Annual Report for 1947, pages 142 to 144. Drill cores mentioned in that account were not available to the present writer.

The principal showing (Fig. 10) lies on the boundary between Good Hope No. 1 and Good Hope No. 2 fractional Crown-granted mineral claims about 150 feet north of their south boundaries. This is a large open cut, or pit, from which some 4,500 tons was mined intermittently between 1944 and 1948. Bulldozer cuts are distributed over an area about 800 by 300 feet, extending from the main pit southwestward through the Good Hope No. 3 to the Nighthawk No. 7 Crown-granted mineral claims.

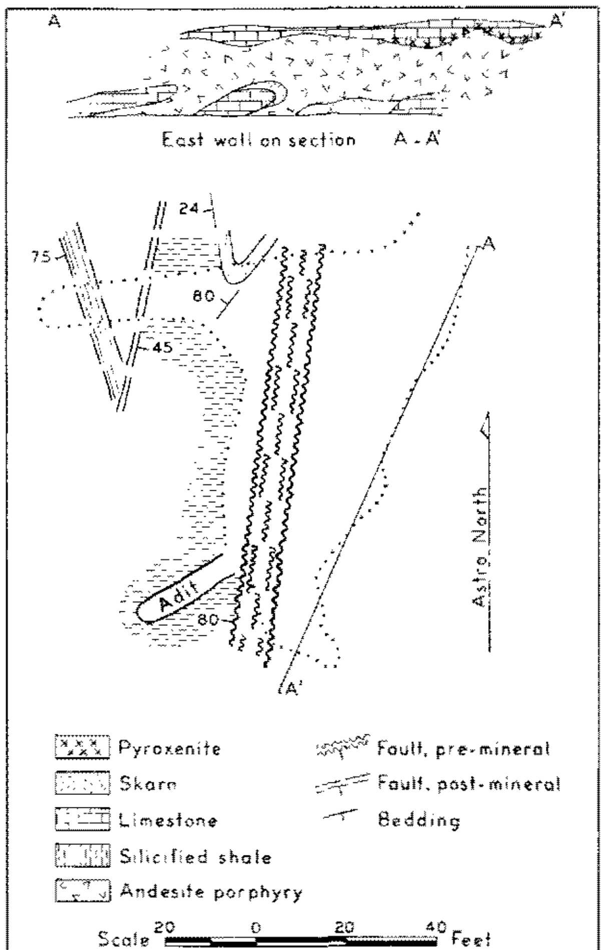


Figure 10. Nighthawk Gold Mines Ltd. Main pit.

The rocks in the vicinity are volcanic flows and fragmentals, with subordinate tuffs, argillite, and limestone, intruded by granodiorite and aplite. Epidote, garnet, and calcite are common metamorphic minerals; locally the rocks are altered to an epidote-pyroxene-garnet-quartz-calcite skarn and to garnetite. The limestones are recrystallized and locally may be strongly silicified. The argillites are metamorphosed to a cherty rock, in which bedding structures have been preserved; of these, the most striking are concretions up to a foot or more in diameter, the best exposures of which were in the south side of the main pit. On the north side of the main pit a zone of coarse green pyroxene crystals lies along the footwall of crystalline limestone in contact with mineralized skarn. A similar zone is exposed in a trench 300 feet south, where the pyroxene lies in limestone along its contact with silicified shale. At both places the pyroxene appears to be a local phenomenon.

Bedding dips flatly, up to 25 degrees except at local steepenings, in a general northerly direction. A section accompanying the 1947 Annual Report shows granitic sills, indicated by diamond drilling, dipping northward at some 15 to 20 degrees.

The principal showing (Fig. 10) consists of a mineralized fault about 10 feet wide striking north 10 degrees east and dipping 80 degrees westward. The rock on the footwall side on the north side of the pit consists of flat-lying limestone overlying altered andesite porphyry. The porphyry is epidotized and garnetized and locally forms skarn. There are three tongues of limestone, bordered in part by skarn, exposed in the lower half of the pit wall and dipping 20 to 60 degrees north to northeast. The footwall of the flat-lying limestone is bordered for an exposed length of some 25 feet by coarse pyroxene crystals. The pyroxene may bear some relationship to the fault because it disappears from the contact as the pit wall recedes eastward from the fault. The rock on the hangingwall side of the fault, exposed in the west side of the pit, is silicified argillite overlain by flat-lying limestone. There is no pyroxene exposed on this contact. At the north end of the pit there is a small fold marked by a thin skarn bed. If this fold is due to movement on the fault, then the hangingwall side moved up and southward at an angle of about 70 degrees to the horizontal. A limestone-pyroxene-silicified shale contact exposed 300 feet south of the main pit and on the footwall side of the projected fault shows a swing from southwest to south approaching the projected fault. This would agree with a southward movement of the hangingwall side. No marker beds were recognized, and the amount of movement on the fault is not known, but as the pit is about 15 feet deep the movement would need to be more than that figure since recognizable rocks are not exposed across the fault. It is possible, then, that the mineralized fault has appreciable lateral and vertical extensions beyond the present exposure.

The mineralization is sparse. It is described in the 1947 Annual Report as follows: "Metallic minerals sparingly present include arsenopyrite, pyrite, chalcopyrite, pyrrhotite, native bismuth, a lead-bismuth telluride 'hedleyite,' molybdenite, and native gold. The gold is erratically distributed and does not appear intimately associated with any particular mineral. Small grains of gold were seen in cleavage cracks in pyroxene and coarse calcite, and also in apparently close association with quartz, arsenopyrite, and native bismuth."

Two post-mineral faults are exposed west of the mineralized fault. One, striking north 20 degrees west and dipping 75 degrees southwestward, is truncated by the other, which strikes north 12 degrees east and dips 45 degrees southeastward. The later fault would cross the mineralized fault about 25 feet below the pit. The displacement on either fault is not known.

French (French Mines Ltd.)*

(49° 120° S.E.) Company office, 314, 718 Granville Street, Vancouver 2; mine office, Hedley. W. B. Burnett, president; J. S. Biggs, mine superintendent. The French mine is on the Oregon mineral claim, on the east side of Cahill Creek, a southwesterly flowing tributary of the Similkameen River about 5 miles east of Hedley. It is at an elevation of 3,900 feet and is reached by a branch from the Nickel Plate road about 3 miles from the highway.

* By David Smith.

A short history of the property is given in the Annual Report for 1957 and more detailed descriptions in the Reports for 1959 and 1960.

On May 21, 1961, management suspended mining and milling operations. Ore reserves had become depleted, and a continuous exploration programme was not encouraging.

The operation averaged 45 to 50 tons per day with a mine crew of nine men. The ore was trucked to the cyanide mill on the flat east of Hedley. Fencing and closure of mine openings has been carried out.

The mine is developed from three adit levels—the 3920 level (Kelowna), the 3835 level (Granby), and the 3785 level (Cariboo). In 1961 mining and development was carried out on an exploration basis. Previously and on clean-up, ore was mined by open stoping and transferred to raises by slusher. The following is a summary of work completed in 1961:—

Drifting	ft.	190
Raising	ft.	126
Crosscutting	ft.	95
Ore milled	tons	5,366
Gold recovered	oz.	1,927

A crew of twenty men was employed in all operations—nine underground and eleven on surface.

OLALLA

Manganese

Olalla Manganese (The Consolidated Mining and Smelting Company of Canada, Limited).*—(49° 119° S.W.) Company office, Trail. This property consists of twelve recorded claims, the Dief Nos. 1 to 12, approximately 6 miles northwest of Olalla. Access is by truck-road. Surface work in 1961 consisted of geological mapping. A crew of three men was employed under the supervision of J. Richardson.

Copper-Gold

Sunrise, Golconda, Copper King (Friday Mines Limited)†—(49° 119° S.W.) Head office, 408, 580 Granville Street, Vancouver 2; mine office, Box 45, Keremeos; N. H. McDiarmid, president; G. E. Leonard, project engineer. The property is at Olalla and consists of four Crown-granted and forty-three recorded mineral claims. It includes the assets of Hedley Monarch Gold Mines Ltd., absorbed by Friday Mines Limited, and the Golconda group, held by option from Keremeos Mines Ltd.

The showings have been known since 1899. They are known as the Sunrise showings, immediately west of the highway at Olalla; the Golconda, about 1½ miles west of Olalla at about 2,600 feet elevation; and the Copper King, about one-quarter of a mile southeast of the Golconda at an elevation of 3,400 feet. The Golconda is described in the 1960 Annual Report. All are described in various Annual Reports from 1899; the more detailed descriptions are: Copper King, 1917, page 206, 1922, page 163; Sunrise, 1937, page D 17, 1946, page 126, 1947, page 151, 1948, page 124. The geology of the region is shown on Geological Survey of Canada Maps 341A, Keremeos, and 628A, Olalla.

During 1961 bulldozer stripping was done in the Sunrise and Copper King areas, and 9,720 feet of diamond drilling was done in the area as a whole.

All the showings lie within a stock of pyroxenite which intrudes sedimentary and volcanic rocks of the Triassic(?) Shoemaker formation. The pyroxenite is

* By David Smith.
† By N. D. McKechnie.

intruded by diorite and by a still younger syenite. Dykes of andesite intrude pyroxenite and syenite.

The pyroxenite, originally chiefly augite, has undergone successive alterations, three of which are detectable in hand specimen and will be described in terms of the most evident secondary minerals. The earliest is marked by a development of biotite, in plates up to one-quarter inch in diameter, and is formed at and near syenite contacts. Locally, where narrow syenite dykes are abundant, the pyroxenite may become a fairly fine-grained highly biotitic rock not obviously related to its parent. The next successive alteration is a development of calcite which may be coarse enough to be visible and which in any event is made apparent by the application of acid. This alteration is strongest in the general vicinity of the working known as the Powder adit; some thin-sections were found to be so high in calcite as to resemble a silicified impure limestone. The cause of the alteration is not known. The third consists of the introduction of quartz and orthoclase. It varies widely in intensity from place to place but seems to occur more or less throughout the pyroxenite mass.

The syenite also is markedly affected by the introduction of quartz and orthoclase, yielding a rock type locally described as " silicified syenite." Calcite is present but is not prominent.

The andesite dykes are comparatively fresh and appear to be younger than the quartz-orthoclase alteration.

The mineralization can be divided into four main types:—

(1) Quartz, pyrite, chalcopyrite, galena, sphalerite, tetrahedrite, and gold.
(2) Quartz, pyrite, chalcopyrite, and molybdenite.
(3) Chalcopyrite and magnetite.
(4) Quartz with minor calcite and, locally, sparse pyrite.

The last appears to be younger than the first three, but the relative ages of the others are not known.

Sunrise Section.—The Sunrise workings consist of recent open cuts and a number of underground workings which have been known for years as the Sunrise shaft and the Sunrise, Shepherd, Powder, Pyroxenite, and Haulage adits (*see* Fig. 11).

The Sunrise showings consist of narrow quartz veins lying in and near apophyses of the principal syenite mass and to a minor extent in the pyroxenite. The principal showing is the Sweetener vein, which is exposed in the north side of the Shepherd adit and is the only example of type 1 mineralization found so far on the property. It is in a narrow shear in syenite striking east-west and dipping 80 degrees north. The quartz is about an inch wide and locally, with rock inclusions, up to about 4 inches wide. Erratic high assays have been obtained in several samplings; 255 tons shipped in 1948 assayed 0.537 ounce gold per ton and 0.5 ounce silver per ton. The remaining showings are barren quartz veins with calcite, of type 4. Their strikes and dips are indicated diagrammatically on Figure 11.

The Sweetener vein is cut off at the Shepherd adit face by a northward-striking andesite dyke. The Sunrise and Shepherd veins occupy parallel fractures, and the quartz of the Shepherd vein cuts an accompanying andesite dyke. The barren quartz and the andesite dykes are contemporary and are younger than the Sweetener vein. It appears that conjugate fractures may be occupied by both the barren quartz-calcite veins and the andesite dykes.

A ravine trending southwest from the vicinity of the Powder adit marks the trace of a fault striking about north-south, parallel to the main Keremeos Creek valley, and dipping 30 to 35 degrees east; this fault is exposed also in a road cut north of the ravine at an elevation of about 2,000 feet. The 1947 Annual Report

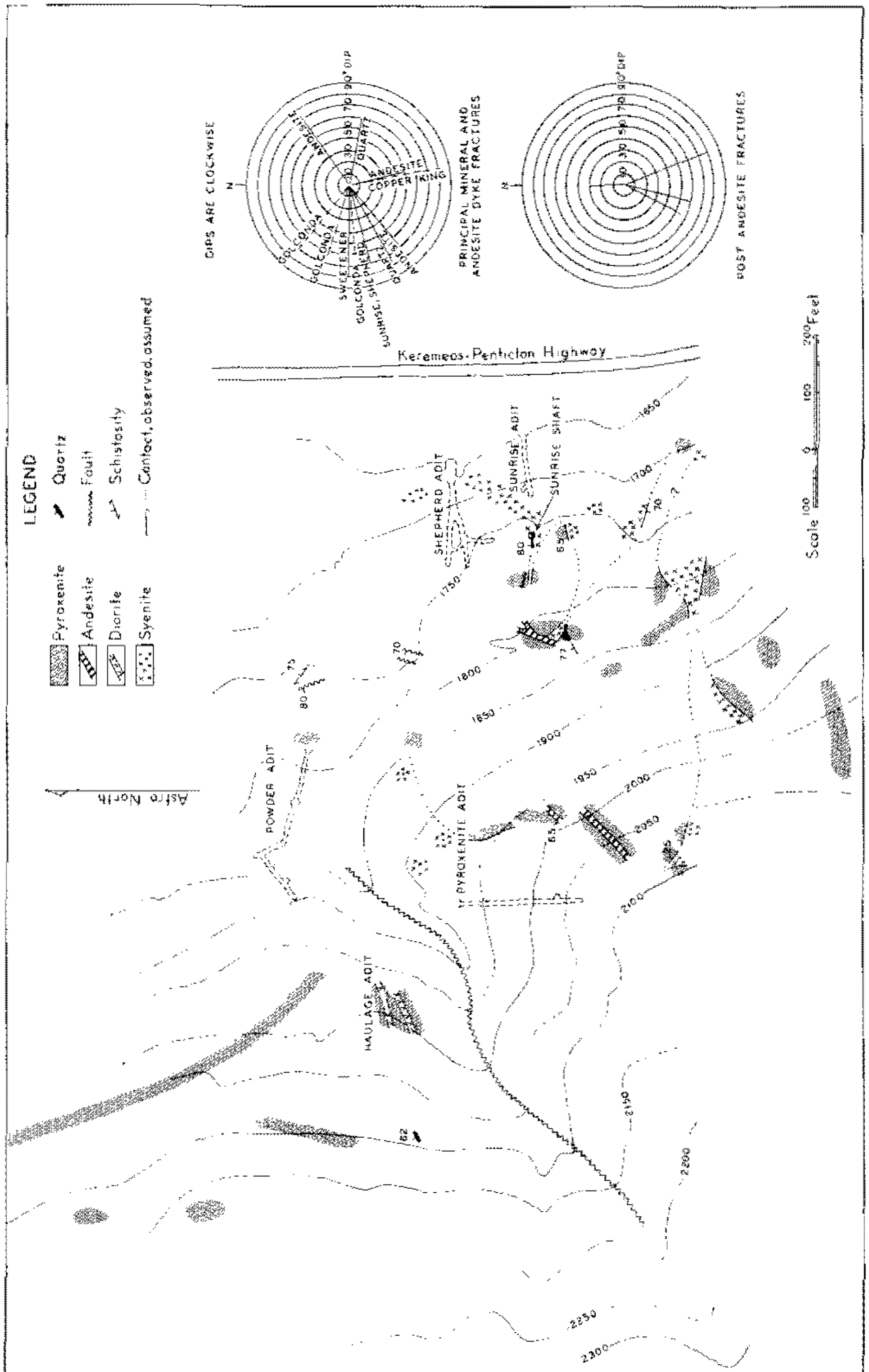


Figure 11. Friday Mines Ltd. Sunrise showings.

states that the last 100 feet of the Powder adit follows a southwesterly striking unmineralized shear in pyroxenite, but the working was not accessible at the time of the writer's visit.

Copper King Section.—This showing is on the west contact of the pyroxenite with Shoemaker quartzites and consists of a shear up to 6 inches wide mineralized with chalcopyrite and magnetite striking north 10 degrees west and dipping 80 degrees west. Some epidote-garnet skarn is present. The quartzites are intruded by diorite sills to which the vein shear is more or less parallel. The shear is exposed in a 35-foot shaft and, 200 feet northward on strike and 100 feet lower in elevation, it is exposed in a trench where it is in contact with a small body of limestone. An adit started in pyroxenite 25 feet northeast of it does not reach the shaft. There is no apparent relationship between this shear and the Golconda structure to the northwest.

FAIRVIEW CAMP*

Silica-Gold

Fairview (The Consolidated Mining and Smelting Company of Canada, Limited)

(49° 119° S.W.) Head office, Trail; mine office, P.O. Box 337, Oliver. G. S. Ogilvie, property superintendent. This property consists of thirty-six Crown-granted claims. The mine lies about 5 miles to the west of Oliver. Quartz is mined and shipped to Trail for use as flux. Production was continuous from January to July, and the mine was officially closed in September, 1961. All mine entrances and openings were closed, mining plant dismantled, and buildings removed. A total of 15,259 tons of quartz was shipped. Development work included 68 feet of raising and 912 feet of diamond drilling. One accident was reported. A crew of six men was employed.

Stemwinder (The Consolidated Mining and Smelting Company of Canada, Limited).—(49° 119° S.W.) Company office, Trail. This property consists of five Crown-granted claims held under a lease-royalty agreement. It adjoins the Fairview property and is situated 8 miles west of Oliver. Surface work consisted of six diamond-drill holes totalling 1,156 feet. A crew of four was employed under the supervision of G. S. Ogilvie.

Gold

Standard

(49° 119° S.W.) This property of nine recorded claims, the Standard Nos. 1 to 9, is 2 miles northwest of Oliver and is accessible by the Fairview road for 2½ miles and by road north for 2 miles. The property is held by Continental Consolidated Mines Limited, 535 Howe Street, Vancouver, having been acquired late in 1961 from Oliver interests. In the summer an adit 230 feet long was driven under old shallow workings on a quartz vein and a small stope was mined to surface. A total of 502 tons was shipped to the Trail smelter. A crew of three men was employed.

ANARCHIST MOUNTAIN*

Chromite

Anarchist Chrome

(49° 119° S.E.) Pacific Chrome Alloys Ltd.; company office, 213, 736 Granville Street, Vancouver 2. S. W. L. Kelly, manager; F. J. Hemsworth, consulting engineer. This property comprises the following twenty-eight claims: Three Sisters Nos. 1 to 8, Pacific Nos. 1 to 12, and RS Nos. 1 to 8. Access is by 1 mile of road north of the Anarch-

* By David Smith.

ist Summit on Highway No. 3. Work during 1961 consisted of magnetometer and geological surveys and the diamond drilling of five holes totalling 803 feet. A crew of four men was employed.

CAMP McKINNEY*

Gold

Cariboo-Amelia (McKinney Gold Mines Limited)

(49° 119° S.E.) Mine office, Rock Creek. H. Hill & L. Starck & Associates Ltd., consulting management engineers; A. G. Ditto, general superintendent. This property consists of the following Crown-granted claims held under option: Cariboo, Alice, Emma, Maple Leaf, Waterloo, Sawtooth, Okanagan, Wiarton, and Amelia. Early in 1961 the shaft was sunk 180 feet below No. 5 level, and No. 6 station was cut 140 feet below that level. On No. 6 level a crosscut was driven 400 feet in a southwesterly direction to the vein, and at the end of 1961, 800 feet of drifting had been done to the east. Two raises were driven to connect with No. 5 level. Between the two levels 250 feet of subdrifting was done. Ten diamond-drill holes totalling 1,900 feet were drilled.

Production in 1961 totalled 5,086 tons of ore, which was trucked 16 miles to Rock Creek and shipped to the Trail smelter. Gross content: Gold, 5,432 ounces; silver, 6,024 ounces; silica, 65 per cent. A crew of sixteen included twelve men underground and four on the surface.

BEAVERDELL*

Silver-Lead-Zinc

Highland-Bell (Mastodon-Highland Bell Mines Limited)

(49° 119° S.E.) Company office, 502, 1200 West Pender Street, Vancouver 1; mine office, Beaverdell. K. J. Springer, president; O. S. Perry, manager; A. Zelmer, mine superintendent; B. Goetting, mine engineer. The property consists of thirty-two Crown-granted claims and four recorded claims. Production for 1961 was obtained from the 2800, 2900, and 3000 levels, the main haulage being the 2900 adit. Development work continued, and ore has been opened up on the 2850 level. In 1961 the normal production of 75 tons per day was maintained. Further exploration work and diamond drilling was carried out on the Sally property.

The following is a summary of operations for 1961: Drifting, 752 feet; crosscutting, 596 feet; raising, 211 feet; diamond drilling, 9,697 feet; ore milled, 18,954 tons. An average crew of forty men was employed, of whom twenty-two worked underground.

MATT (Kennco Explorations (Western) Limited)

(49° 119° S.E.) Company office, 1030 West Georgia Street, Vancouver 5. The MATT group of seventy-five recorded claims is on the south side of Tuzo Creek, 5 miles southwest of Beaverdell. Work on the property in 1961 consisted of geochemical sampling, geological mapping, trenching, and prospecting. An access road 5 miles long was built into the area. A crew of six men was employed under the direction of J. M. Anderson.

* By David Smith.

GREENWOOD

Copper-Gold-Silver

Mother Lode (Consolidated Woodgreen Mines Limited)* (49° 118° S.W.) Company office, 204, 569 Howe Street; Vancouver 1; mine office, Greenwood. R. A. Brossard, president; C. W. S. Tremaine, manager; G. F. Groves, chief engineer. No development work was done at the Mother Lode-Sunset ore zones. A total of 201,123 tons of ore was milled, almost all of it from the Mother Lode pit. Milling was continuous throughout the year at nearly 650 tons per day. Thirty-four men were employed.

On the Morrison Crown-granted mineral claim an old crosscut adit and related workings, some 3,000 feet southwest of the Mother Lode pit, and 200 feet lower in elevation, were reopened. Most of the underground work was done during the years 1899 and 1900. The crosscut, bearing east of north and shown on a company map to be about 800 feet long, was inaccessible beyond 500 feet because of water dammed by caved ground. The 1899 Annual Report states that mineralization was found in the crosscut at distances from the portal of 90, 415, and 565 feet. No attempt was made to develop the showing at 90 feet, and limited and erratic workings illustrate the poor success achieved in attempts to explore the other two. Recent diamond drilling, about 1956, did not find important mineralization. Up to 1907, the last year of record, about 3,500 tons had been shipped; the principal assays were in gold, reported (1899) as $8 to $10 per ton.

The rocks on the west side of Deadwood Creek, opposite the Mother Lode pit, are grey Knob Hill cherts. On the hilltop, 200 feet higher in elevation than the Mother Lode mill, the Knob Hill is overlain by siliceous Brooklyn sharpstone conglomerate; the contact strikes north 45 degrees east and dips 30 degrees southeast. To the northwest along the hilltop, on a line passing near the northwest corner of the Gem Crown-granted mineral claim, Lot 297, the rocks are downfaulted twice across shallow northeastward-trending ravines. The sharpstone conglomerate disappears beneath Phoenix volcanics about 1,000 feet northwest of the corner post.

Presumably the Brooklyn limestone, with which most of the ore of the general district is associated, lies above conglomerate; Seraphim places it 2,000 feet above the Knob Hill formation (*see* list of references).

The Morrison adit is in limestone for 320 feet. The limestone then terminates against a northwest-striking fault, and on the west side of the adit it ends against a northeast-striking fault. From 320 feet to a strong east-west fault zone at 450 feet the adit is in tuffs and andesite. Sharpstone conglomerate is exposed in a working west of the adit. Limestone is exposed immediately north of the fault zone, but the adit was not accessible much beyond; the drill cores from this section are sharpstone conglomerates, tuffs, and andesites of the Brooklyn formation. There is some skarn in the cores, but it is not prominent. No Knob Hill rocks were recognized in the adit nor in the cores from the drill-holes.

The geological situation at the Morrison is not clear. The drilling shows a limited amount of limestone. Along the ridge the rocks appear to be higher in the succession to the northwest, and it is in this direction that a stronger occurrence of limestone might be sought.

[References: Geology and Copper Deposits of the Boundary District, B.C., Trans., *C.I.M.*, Vol. LIX, 1956, R. H. Seraphim; *Geol. Surv., Canada,* Mem. 21, 1912, Geology and Ore Deposits of Phoenix, Boundary District, B.C., O. E. LeRoy; Mem. 19, 1913, Mother Lode and Sunset Mines, Boundary District, B.C., O. E.

* By N. D. McKechnie.

LeRoy; Paper 45-20, 1945, Greenwood-Phoenix Area, B.C., D. A. McNaughton; Map 6-1957, Kettle River (East Half), H. W. Little.]

Ruby Mac*

(49° 118° S.W.) Rubymac Mines Ltd.; company office, 507, 475 Howe Street, Vancouver 1. Karl Wickstrom, president. This private company owns eighteen recorded claims and two mineral leases on the north side of McCarren Creek, 1 mile east of No. 3 highway. The property is 3½ miles by road south of Greenwood. Bralorne Pioneer Mines Limited held an option and stripped with a bulldozer and diamond drilled one hole 409 feet. A crew of four was under the direction of J. P. Weeks. The option was dropped.

PHOENIX*

Copper-Gold-Silver

Phoenix Copper Company Limited

(49° 118° S.W.) Company office, 1111 West Georgia Street, Vancouver 5; mine office, Phoenix. L. T. Postle, president; J. H. Parliament, manager. This property consists of seventy-seven claims as follows: Twenty-nine Crown-granted, thirty-eight recorded, and ten leased. The mine and concentrator were operated continuously during 1961.

In October, 1961, a decision was made to enlarge the capacity of the concentrator from 1,000 to 1,500 tons per day by the installation of additional grinding and flotation equipment. This work has been started. The average tonnage milled during the year was 1,076 tons per day.

Production of ore, for the most part, was from the Old Ironsides pit. A small amount was produced at the Idaho pit. Some ore was produced from the Rawhide claim on a royalty basis. No diamond drilling or underground mining was done. The geological mapping of the old underground workings was continued. A 2½-cubic-yard power-shovel and two 20-ton Euclid trucks were purchased in 1961 to replace equipment previously rented. During 1961, 890,652 tons of waste was removed and 420,372 tons of ore transferred to the mill. A total of 392,767 tons was milled.

A total crew of seventy-three men was employed, as follows: Surface, fourteen; open pit, twenty-seven; crusher and concentrator, eighteen; and staff, fourteen.

ROSSLAND†

Gold-Copper

Velvet (Velvet Mine Leasers)

(49° 117° S.W.) This property is leased from Mid-West Copper & Uranium Mines Ltd. by Velvet Mine Leasers—R. Lefevre, H. W. Lefevre, J. C. Urquhart, B. W. Price. Company office, P.O. Box 340, Rossland. J. Rozeck, mine manager. The property is on the western slope of Sophie Mountain, 11 miles from Rossland on the Rossland–Cascade highway.

Mining was done in stopes above No. 7 level. Development consisted of 335 feet of drifting and 490 feet of raising. The mill operated part time in milling 8,153 tons, producing 457 tons of concentrate, which was shipped to the Tacoma smelter. The average number of men employed was ten.

* By David Smith.
† By J. D. McDonald.

Rossland Mines (The Consolidated Mining and Smelting Company of Canada, Limited)

(49° 117° S.W.) Company office, Trail. The property consists of ninety-one Crown-granted claims and fractions wholly owned by The Consolidated Mining and Smelting Company of Canada, Limited. The Alberta and Charleston claims were leased from the Crown, and the Iron Colt claim was optioned. These were abandoned at the end of 1961. Under the supervision of D. W. Heddle, exploration geologist, one diamond-drill hole was drilled a total of 2,240 feet. The hole was collared on the Alberta claim. Drilling was done between the end of March and the middle of May. Four men were employed during drilling operations.

TRAIL*

Gold

W.D. (W.D. Mining Company Ltd.)

(49° 117° S.W.) This property is owned and operated by W.D. Mining Company Ltd. The company consists of five men with equal shares. F. Donelly, of Trail, president. Mine office, 1360 McLean Street, Trail. All work on the property is done on a part-time basis. The property is on the west side of the Columbia River, 5 miles south of the old Trail bridge along the Casino road. In 1961, 355 feet of diamond drilling was done.

NELSON

Copper

Queen Victoria (Swift Copper Mines Limited)†

(49° 117° S.E.) Company office, 206, 62 Richmond Street West, Toronto. H. W. Olch, president; E. Derrough, mine manager. This company owns three Crown-granted and a large number of recorded claims near Beasley. The main showings and old workings were originally on the Queen Victoria Crown-granted claim, which has lapsed, and the ground has since been held by recorded claims. A road 1½ miles long leads to the property from a point on the Nelson–Trail highway about 8 miles west of Nelson.

The Queen Victoria claim was Crown-granted in 1896, and shipments of copper ore were made mainly to the B.C. Copper Company smelter at Greenwood, between 1907 and 1917 and again in 1926 and 1927. Total production up to and including 1927 is recorded as: Ore shipped, 44,423 tons. Gross contents: Gold, 168 ounces; silver, 19,993 ounces; copper, 1,404,884 pounds. In 1956 the Finley Company of Reno, Nevada, optioned the property and shipped about 1,800 tons of ore to the Kenville mill.

Old workings on the property consist of open pits and an open stope. In 1961 the present company did extensive bulldozer stripping close to these workings and uncovered the portals of two old adits beneath the stope. An average crew of four was employed in this work for seven months. A trial shipment of 60 tons of ore, assaying 4.35 per cent copper, was shipped to the Tacoma smelter. The 150-ton Kenville mill at Taghum was optioned by Swift Copper Mines Limited, but no work was done on the mill.

The copper mineralization is in an easterly dipping lens of skarn in a series of beds whose trace runs diagonally westward and upward across the face of the hill. Blocky, very fine-grained green rocks are in the hangingwall, and relatively thin layers of dark-green amphibolite are exposed near the footwall. A blocky grey sill-like mass of feldspar porphyry also occurs along the footwall. The skarn consists of

* By J. D. McDonald.
† By James T. Fyles.

mixtures of a reddish-brown granular rock rich in garnet, a greenish rock rich in epidote and diopside, and a dark-green medium-grained amphibolite. Calcite is common in some of the skarn, and at one place a small lens of limestone is exposed.

The lens of skarn has an average dip of 20 to 30 degrees to the east, and its longest dimension exposed in the stripping is more or less parallel to the dip. The skarn rapidly increases in thickness from about 10 feet near the east end of the stripping to at least 100 feet near the centre of the stripping and decreases again to the west to no more than 10 feet at the west end of the stripping. The stripped zone is 400 to 500 feet long. Exposures of rocks beyond the stripping are poor, but a thin lens of skarn, possibly at the same horizon as that in the main stripping, has been exposed by bulldozers about 300 feet west of the upper end of the main stripping. Folds and broad warps of the hangingwall near the eastern end of the main stripping plunge about 10 degrees in a direction somewhat east of north. Probably the long axis of the main lens of skarn is parallel to this plunge.

Sulphide mineralization consists of disseminated grains and irregular clusters of chalcopyrite, pyrite, and minor bornite within the skarn. Fine-grained magnetite is present in minor amounts. Zones of chalcopyrite are irregular and do not have well-defined shapes or boundaries. Locally, spectacularly high-grade material is present, but considerable amounts of skarn contain no chalcopyrite. Ore that has been mined appears to have come from two poorly defined shoots in the thickest section of the skarn lens.

Gold-Silver

White*

(49° 117° S.E.) D. Norcross, of Nelson, has the White, Greenhorn Fraction, and My Emer Crown-granted claims under lease from Kenville Gold Mines Limited. They are adjacent to the upper adit of the old Granite mine. The vein is a faulted section of the Granite vein and has a limited tonnage of high-grade ore. The drift, serviced by a 50-foot winze inclined at 40 degrees, was extended 100 feet during 1961. Some stoping was done on the vein from the drift. Seventy-four tons of ore was shipped to the Trail smelter, with returns of 64 ounces of gold. All work was done by Mr. Norcross.

YMIR

Gold

Yankee Dundee (Cayzor Athabaska Mines Limited)*

(49° 117° S.E.) Company office, 3669 West Thirty–fifth Avenue, Vancouver 13. Mine office, Ymir. J. D. Lippmann, president. Capital: 3,500,000 shares, no par value. D. C. Smith, exploration superintendent; W. A. Hall, mine superintendent. In August, 1961, Cayzor Athabaska Mines Limited optioned the property from Yankee Dundee Mines Limited. Equipment was moved onto the property in September, and mining started September 23rd. A raise was started from a point 4,600 feet from the portal of the Wildhorse adit. The 5- by 12-foot two-compartment raise was driven to a point 142 feet above the track, following the dip of the vein at about 67 degrees. Operations were shut down temporarily on December 7th. It is proposed to continue the raise to break through in the old workings, a distance of about 400 feet from the Wildhorse tunnel. The average number of men employed was eight.

* By J. D. McDonald.

SALMO*

Erie Creek (49° 117° S.E.)

Gold

New Arlington This property was leased by G. D. Fox, 1396, 3307 Dahlia Crescent, Trail, from J. Russell, Borrega Springs, California. Other lessees are F. Singer and S. Hadler. The property is on Rest Creek, 7 miles by road from Salmo. During the year 161 tons of ore was shipped to the Trail smelter.

Sheep Creek (49° 117° S.E.)

Silica

Kootenay Belle K. Belle Enterprise Company Limited, Linden, Alta., has leased the waste dumps on the old Kootenay Belle mine from M. Arishenkoff, of Shoreacres. The dump material is shipped to the Trail smelter for flux, and the gold content is paid for in addition to silica. A front-end loader and one truck were used to load and haul the silica rock to Trail. Total shipped: 7,703 tons.

Queen F. R. Rotter, of Salmo, is shipping silica rock from the Queen waste dumps to the Trail smelter for flux, having leased the mine dumps on a royalty basis from Sheep Creek Mines Limited. A front-end loader and truck were used to load and haul the silica rock to Trail. Total shipped, 18,937 tons.

Gold

Nugget.—This mine, which was formerly part of the Reno holdings, is owned by A. Endersby, of Fruitvale. Some development work was done during the year by the owner.

Aspen Creek (49° 117° S.E.)

Lead-Zinc

H.B. (The Consolidated Mining and Smelting Company of Canada, Limited) Company office, Trail; mine office, Salmo. J. C. MacLean, property superintendent; J. M. B. Scarborough, mine superintendent; N. Doyle, mill superintendent. The H.B. mine is on the west side of Aspen Creek, with the main camp on the north side of Sheep Creek, 7 miles by road from Salmo. The ore occurs as lead-zinc replacement in dolomite. There are five zones, known as No. 1 or east orebody, No. 2 or west orebody, two flat-lying orebodies named X-1 and X-2, and No. 4 orebody, which lies between X-1 and X-2.

The main production comes from the No. 1 and No. 2 orebodies, in which the ore is mined by long-holing from sublevels on the hangingwall and footwall, and scraped to ore-passes from slusher drifts. In the long-holing the holes are drilled with 2⅛-inch tungsten carbide bits. Hoists in the slusher drifts are 50- and 60-horsepower electric. Production from these two stopes accounted for 69 per cent of the total production. The total long-hole footage for the year was 100,289 feet. In 1962 further pillar recovery is scheduled for No. 1 zone.

Production in the other ore zones accounted for 27 per cent of the total production. Mining is done by slashing and benching with jacklegs, using a panel system of pillars and stopes. Partial pillar recovery is done on a retreating basis. Development: Drifting and crosscutting, 1,239 feet; sublevels, 3,291 feet; raising, 2,356 feet; total, 6,886 feet.

* By J. D. McDonald.

Underground diamond drilling was 11,776 feet, and surface diamond drilling to check the extension of No. 1 ore zone was 3,245 feet.

The concentrator treated 472,731 tons of ore during 1961, an average of 39,394 tons per month. This was the highest in the West Kootenay area. The average number of men employed was 117, sixty of whom were employed underground.

The mine-rescue team trained regularly and competed in the West Kootenay competition. There were no lost-time accidents during 1961. This performance won for the mine the Dominion and Regional John T. Ryan Safety Trophies for 1961. This is the third time in the past four years that these awards have been won by the H.B. mine. This is an outstanding achievement in the mining industry.

Iron Mountain (49° 117° S.E.)

Lead-Zinc

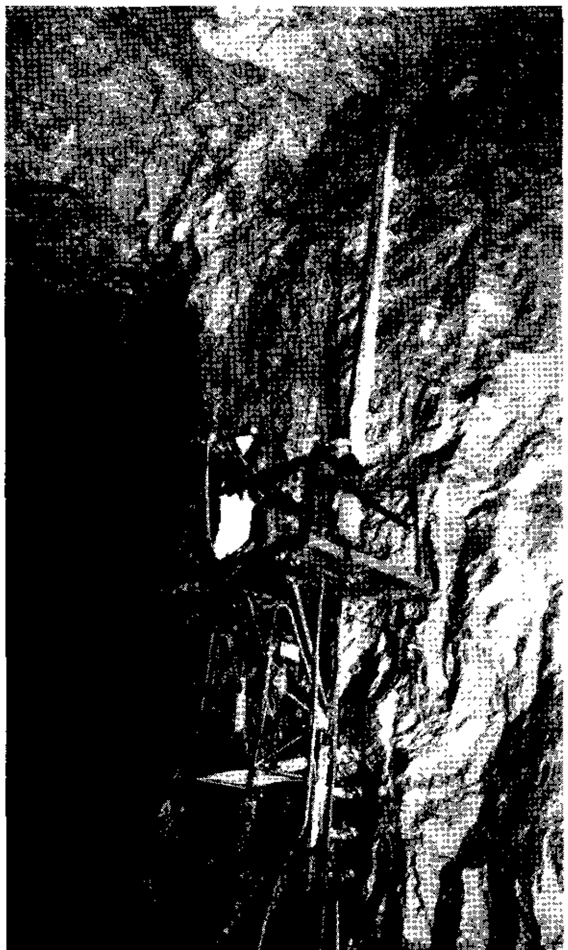
Jersey (Canadian Exploration Limited)

Head office, 700 Burrard Building, Vancouver; mine office, Salmo. G. A. Gordon, general manager; J. D. Little, assistant general manager; R. G. Weber, property superintendent; J. W. Robinson, mine superintendent; H. A. Steane, general mill superintendent; R. W. Gould, mill superintendent. This company is a wholly owned subsidiary of Placer Development Limited. The property is reached by two roads which leave the Nelson–Nelway highway 4 and 4½ miles, respectively, south of Salmo, the north road being the main access road. The lead-zinc concentrator is beside the Nelson–Nelway highway and is served by a conveyor system. The mine and camp are located on the summit between Sheep Creek and Lost Creek.

All production came from the Jersey lead-zinc mine. The ore occurs as lead-zinc replacement in dolomitized limestone along folds which plunge gently to the south. Trackless mining is being done in the A, D, E, F, and G zones and conventional track mining in A and B zones. Most of the ore being developed is in relatively thin steeply dipping beds, and is being mined by conventional open stoping with jacklegs and slushers. In the trackless mine the ore is hauled from chutes or loading points by 8-ton Dumptors; this is 65 per cent of the total production.

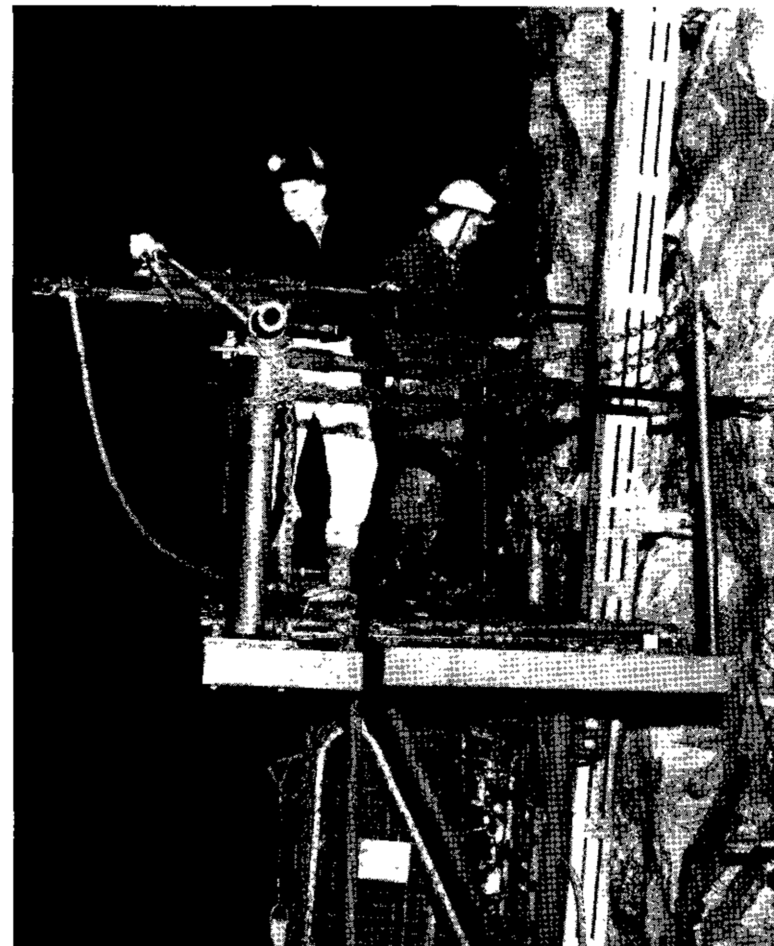
Pillar recovery was started during the year. Three pillars in the track mine were blasted, the drilling and loading being done from a staging. In A zone of the trackless mine the pillars range in plan size from 20 by 20 feet to 40 by 40 feet, and up to 60 feet in height. A raise machine was used in the A zone to drill off a 60-foot-high pillar (*see* illustration). The rail was rock bolted to the pillar wall, fillers being used for irregularities. A horizontal bar arrangement was mounted rigidly on the rear of the platform. A Leyner was mounted on the bar to swing horizontally, and 4-foot 1¼-inch round sectional steel was used with 2-inch tungsten carbide bits. The platform was made rigid by coupling the outer ends of the drill cross-bar to eyebolts set in the pillar. Horizontal rings were drilled at intervals from the top down. This pillar has not been blasted. A smaller pillar in the G zone was drilled and blasted, using the raise machine. Management is of the opinion that the raise machine provides a safe and economical method for drilling pillars where undercutting and removal through footwall haulage is not possible, where height makes scaffolding impractical, and where pillars are too small to economically warrant internal development.

Total development was 7,686 feet, consisting of 999 feet of 16- by 16-foot drifting, 6,227 feet of subdrifting, and 460 feet of raising.



(Courtesy Canadian Exploration Limited.)

Pillar recovery with a raise machine at the Jersey mine, Salmo. View of set-up.



(Courtesy Canadian Exploration Limited.)

Pillar recovery with a raise machine at the Jersey mine, Salmo. The drilling-platform.

In the fall of 1961 the use of AN/FO explosive was tried on an experimental basis. By the year end the mine was converting to the use of AN/FO in most of the workings.

The concentrator treated 374,032 tons of ore during 1961, an average of 31,169 tons per month. Lead concentrates were shipped to the Bunker Hill smelter at Kellogg, Idaho; zinc concentrates were shipped to the Trail smelter during the first six months of the year, and for the remainder of the year were shipped to Kellogg.

A mine-rescue team practises regularly in the mine, and competed in the West Kootenay Mine Rescue Competition at Nelson. The property continued to maintain its excellent safety record of the past three years, having only one lost-time accident over six days during 1961. The average number of men employed was 157, of whom seventy worked underground.

NELWAY*

Lead-Zinc

Reeves MacDonald Mines Limited (49° 117° S.E.) Company office, 410 Metropolitan Building, 837 West Hastings Street, Vancouver 1; mine office, Remac. L. M. Kinney, Metaline Falls, Wash., general manager; F. R. Thompson, manager; W. Pollock, mine superintendent; J. M. McDearmid, mill superintendent. Capital: 3,000,000 shares, $1 par value. This company owns the Reeves MacDonald mine on the Pend-d'Oreille River, on the Nelway–Waneta road 4 miles west of Nelway. Lead-zinc replacement orebodies in limestone have been developed from the 1900 main haulage level.

Four orebodies are being mined—the Reeves, B.L., O'Donnell, and No. 4—the major production coming from the Reeves. These four orebodies are faulted segments of a single ore zone.

Mining above the 1900 level in the Reeves has been completed, and the major development is between the 1100 and 1900 levels. This section is serviced by No. 2 and No. 3 shafts. The No. 2 shaft is used as a service shaft for hoisting men and supplies. It is located in the footwall of the Reeves orebody, inclined at 52 degrees, with the hoistroom on the 1900 level. The No. 3 shaft, which is inclined at 55 degrees, is the production shaft. During 1961 the No. 3 shaft was sunk from the 980 level to the equivalent of the 403 level, a distance of 694 feet. The sinking was contracted to R. F. Fry and Associates (Western) Limited. The sinking, including timbering and rails, was done during the period of June to November. Mucking was done with a Cryderman mucker mounted in the centre compartment with wood stringers along the top and bottom of the frame. The bottom level was established at the 420 level, with the scram level at the 660 level, and the loading-chute at the 480 level.

Mining is done with long-hole machines, drilling down-holes from horizontal slots. These slots are slashed to the ore outline and are at 50-foot intervals. Modifications to the horizontal slots are being made on the lower levels. The full slot is not being taken out, leaving pillars in the centre. A vertical slot is taken out along the main longitudinal pillar and 50-foot down-holes are drilled and blasted to the vertical slot. Drilling is done with 2⅛-inch (75,548 feet) and 3-inch (17,466 feet) tungsten carbide bits.

Total development was 5,390 feet, consisting of drifting, 2,783 feet; raising, 1,721 feet; sinking, 694 feet; stations, 192 feet.

* By J. D. McDonald.

The crushing unit had a 4-foot Symons short head cone crusher installed in September. This by-passes the secondary crushing unit used previously, which has been left in place for emergency work. In the mill new tanks for the flotation cells were installed.

The milling rate averaged 35,042 tons per month, with a total production of 420,508 tons. Zinc concentrates were shipped to the Trail smelter. Lead concentrates were shipped to the smelter at Kellogg, Idaho. The number of men employed, including staff, was 117, of whom fifty-two worked underground.

A mine-rescue team practises regularly, and competed in the West Kootenay Mine Rescue Competition.

Red Bird (The Consolidated Mining and Smelting Company of Canada, Limited)

(49° 117° S.E.) This property, comprising sixteen Crown-granted mineral claims and fractions, was optioned by the Hecla Mining Company, of Wallace, Idaho, to The Consolidated Mining and Smelting Company of Canada, Limited. Fourteen recorded claims, held by Consolidated adjacent to the Red Bird group, are included in the group. The property is on the south side of the Pend-d'Oreille River and west of claims belonging to Reeves MacDonald Mines Limited. It is accessible by 14 miles of road north from Metalline Falls, Wash., to the International Boundary (via the Gardner Cave–Frisco Standard road) and then approximately 2 miles to the No. 1 adit. A geological description of the property is contained in British Columbia Department of Mines Bulletin No. 41.

No. 1 adit was rehabilitated for a distance of 1,000 feet. Two hundred feet of drifting and timbering was required to by-pass a caved section of the old drift. This was completed at the end of August.

A diamond-drilling programme consisted of nine holes totalling 2,136 feet. These were drilled from underground in No. 1 adit. The exploration programme under the property supervision of R. W. Holditch was completed in the middle of October. A maximum of nine men was employed.

NORTH KOOTENAY LAKE*

RIONDEL (49° 116° N.W.)

Silver-Lead-Zinc

Bluebell (The Consolidated Mining and Smelting Company of Canada, Limited)

Company office, Trail; mine office, Riondel. D. S. Campbell, property superintendent; J. B. Donald, mine superintendent; T. F. Walton, mill superintendent. This property is at Riondel, on a small peninsula 1½ miles long, on the east shore of Kootenay Lake, 6 miles by road north from the southern trans-Provincial highway at Kootenay Bay ferry-landing. The ore occurs as lead-zinc replacement in a limestone bed 100 to 150 feet in stratigraphic thickness, striking north and dipping 35 to 38 degrees to the west, under Kootenay Lake. There are three zones conforming to three broad arches in the limestone—the Kootenay Chief at the south end, Bluebell in the centre, and Comfort to the north.

The mine is serviced by No. 1 shaft, inclined at 35 degrees. The levels are at intervals of 150 vertical feet, with No. 2 level and No. 5 level extending north to the Bluebell and Comfort zones.

* By J. D. McDonald.

Development was confined mainly to the Kootenay Chief zone, with some work above No. 5 level in the Comfort ore zone. On No. 8 level a ventilation raise was driven through to No. 6 level. Crosscutting on No. 9A level was slow, due to heavy ground, water, and carbon dioxide gas, and solid timbering was required. Development work in 1961: Drifting, 1,281 feet; subdrifting, 5,263 feet; raising, 4,205 feet; total, 10,749 feet; a total of 1,566 feet of raise and drift timbering. Diamond drilling consisted of 20,550 feet in exploratory holes.

Mining methods are open stoping and cut-and-fill stoping with deslimed tailings. Recovery of longitudinal pillars continued, and the mining of one sill pillar was started, using square sets and deslimed tailings. A total of 57,835 cubic yards of tailings was placed in cut-and-fill and open stopes for pillar recovery. Up to the end of 1961 a total of 224,078 cubic yards of deslimed tailings has been placed underground, using 4-inch-diameter polyethylene pipe. Wear has been slight, and no pipe has been replaced because of it.

Present pumping is at the rate of 4,200 imperial gallons per minute. Main pump stations are on No. 5, No. 8, and No. 9A levels. Discharge lines presently consist of two 12-inch-diameter pipe-lines extended up the manway of No. 1 shaft. Considerable success was made in solving the problem of scale deposits in the pumps and pipes from the precipitation of the dissolved carbonates in thermal water. A "threshold" treatment is being used, which consists of the addition of sodium-tri-poly-phosphate to the mine water in a concentration of 3 to 4 parts per million. This keeps the dissolved carbonates in the thermal water from precipitating out in the pumps and pipes. A hard deposit had been built up in the main 12-inch discharge lines that had cut down the capacity of pumping. The insides of the pipes were treated with a weak solution of muriatic acid by completely filling the pipes with the acid solution. This treatment was very successful.

In the main ventilation system, an additional 48-inch dual-duty aerofoil fan was installed in parallel with the other three similar units. Three units are operating at all times, and the fourth unit is a stand-by. Installed capacity is 200,000 cubic feet per minute exhausting from the mine. Three stand-by diesel units, two 375 kva. and one high-speed 187.5 kva., supply power to main fans, auxiliary fans on No. 8 and No. 9A levels, as well as for pumping in the event of power outages.

The thermal water and the carbon dioxide gas released by this water continue to be a serious problem. Cementation Company (Canada) Limited was contracted to carry out a programme to seal off the thermal water, the work starting in July under the supervision of A. York. On No. 8 level five 4-inch drainage holes were drilled into the thermal zone and the water was lowered to just above No. 8 level. The openings to the thermal water zone on No. 6 level were sealed with concrete bulkheads and the surrounding fractures were grouted. This sealed off the flow of water and gas at No. 6 level preparatory to grouting the entire zone above No. 8 level. Grouting was done on No. 9A level to tighten up the ground in drifting through the footwall argillites. The ground below the bottom of No. 1 shaft was grouted through long drill-holes. This has apparently grouted off the ground below shaft bottom.

Mine-rescue and first-aid classes were held. Two teams competed in the West Kootenay Mine Rescue Competition at Nelson. The team captained by B. Ramage won the West Kootenay competition and competed in the Provincial competition in Nanaimo. The average number of men employed was 265, of whom 178 were employed underground.

The concentrator treated 252,821 tons of ore, or 21,068 tons per month.

Tam O'Shanter (Prudential Petroleums Ltd.) Company office, 980 West Pender Street, Vancouver 1. L. R. Cranwall, president. This property was optioned by H. F. Kenward to Prudential Petroleums Ltd. The claims are about one-half mile north of the Bluebell mine and lie east of the Bluebell limestone, which is under Kootenay Lake in this area. The Tam O'Shanter is a narrow vein in argillites and pegmatites, just north of Indian Creek. There is very little mineralization showing on the surface. In 1918 and 1921 a total of 94 tons was shipped, with a gross content of 1,664 ounces of silver. Three men were employed and four holes were drilled during the month of October.

AINSWORTH (49° 116° N.W.)

Silver-Lead-Zinc

Highlander, etc. (Yale Lead & Zinc Mines Limited) Company office, 525 Seymour Street, Vancouver 2; mine office, Ainsworth. H. M. Turner, of Western Mines Limited, property manager. Capital: 5,000,000 shares, $1 par value. This company controls most of the mineral claims lying between Coffee and Cedar Creeks. The property was closed in December, 1958, and since then has been worked by lessees. T. G. Laughton and three partners continued leasing for the first three months of 1961. They were then employed by Yale Lead & Zinc Mines Limited in doing a small amount of development work on the 1900 level. The mill operated temporarily, milling lessees' ore. The mine and concentrator were completely closed in July. In November the mine office at Ainsworth was completely destroyed by fire.

The concentrator has been left in operational condition. This is the only mill in the area, and it is understood that the company would lease it to any mines in the district that start operating and require milling facilities.

WOODBURY CREEK*

Gold-Silver-Lead-Zinc

Scranton (Scranton Mines Limited) (49° 117° N.E.) Company office, 1519 Marine Building, 355 Burrard Street, Vancouver 1. R. H. Olcott, president; C. E. Lind, mine manager. Capital: 3,000,000 shares, $1 par value. This company owns the Scranton group of claims in Kokanee Glacier Park, astride Pontiac Creek, a tributary of Woodbury Creek. The mine camp is on Pontiac Creek, at an elevation of 5,600 feet, and is reached by 11½ miles of road from a point on the Nelson–Kaslo highway 8 miles south of Kaslo.

A crew of two men were employed from June 1st to September 29th. All work done was on the upper Pontiac vein. This consisted of surface stripping and 101 feet of timbered drift 50 feet below the old workings.

KASLO*

Silver-Lead-Zinc

Black Fox (New Ainsworth Base Metals Ltd.) (49° 117° N.E.) Company office, 623, 470 Granville Street, Vancouver 2; mine office, Kaslo. W. Inverarity, president and manager. Capital: 4,000,000 shares, no par value. This property is on Keene Creek, 10½ miles by road from Kaslo and one-half mile past the Cork Province mine. A crew of three men was employed for seven months. The main drift was extended north and south along the vein. The ore occurs in a 7- to 8-foot steeply dipping vein which

* By J. D. McDonald.

strikes roughly north-south. Good zinc ore was observed in the drift, ranging from 6 inches to the full width of the vein. Diamond drilling was done to test for parallel veins to the east. A geophysical survey was made on the property, and it was reported that some anomalies were recorded. Development ore was stockpiled at the mine.

Utica (Standard Beryllium Corporation of New York) (49° 117° N.E.) Company office, 1776 Broadway, New York 19, N.Y.; mine office, Kaslo. P. L. Brandon, president; W. W. Tyler, manager. This company has obtained controlling interest in Lajo Mines Limited. The mine is at the head of Twelve Mile Creek, about 15 miles from Kaslo. An extensive examination of the property was made by Mr. Tyler in the spring and early summer. A pilot run of 900 tons of dump and backfill material was put through the 50-ton mill on the property. The grade of the material was: Silver, 7.7 ounces per ton; lead, 0.65 per cent; zinc, 2.3 per cent.

In September, 1961, the camp was rehabilitated and a small development programme was started. On No. 5 level 98 feet of drifting was done on the east vein. On No. 7 level a 70-foot rope raise and dump pocket was completed, and 43 feet of winze was sunk below No. 7 level, following the ore. On the surface some stripping was done on the West and Sol veins. The property was shut down on December 10th due to winter conditions, and reopening is planned for May, 1962. An average of ten men was employed.

Lead-Zinc-Silver

Empire (49° 117° N.E.) This property consists of eight recorded claims owned by E. Muller, of Helix, Ore. Mine office, Kaslo. E. Augustine, mine manager. The road to the property leaves the Kaslo–New Denver highway at a point 12 miles west of Kaslo, and runs in a northerly direction to Mount Jardine, a distance of 7 miles. Two men worked for one month. Eleven feet of drifting was done. No ore was shipped.

RETALLACK-THREE FORKS*

Silver-Lead-Zinc

Caledonia (Northwest Mining Partnership) (50° 117° S.E.) Company office, 519 West Mission, Kellogg, Idaho; mine office, Retallack. This is a private company consisting of three partners, E. B. Olds, D. G. Lehn, and D. M. Russell, of Kellogg, Idaho. D. M. Russell is mine manager. The property is near Blaylock, adjacent to the Kaslo–New Denver highway. It consists of fourteen Crown-granted claims which were optioned in May, 1961, from Mrs. G. E. McCready, of Kaslo. Stoping in the old workings on No. 2 level started June 1st. A 200-foot raise to connect No. 3 to No. 2 level was started. The raise was driven 75 feet when the property shut down on December 15th due to winter conditions. An average of three men was employed. The ore was trucked to Sandon and milled at the Carnegie mill. Zinc concentrates were shipped to the Trail smelter and lead concentrates to the Bunker Hill smelter at Kellogg.

Production: Ore milled, 1,079 tons. Gross content: Silver, 11,259 ounces; lead, 153,779 pounds; zinc, 209,384 pounds.

* By J. D. McDonald.

Texas, Fourth of July (July Silver Mines Ltd.)

(50° 117° S.E.) Company office, Carbon, Alta., mine office, Kaslo. V. J. Dresser, president; L. N. Garland, manager. This company holds under option a group of Crown-granted mineral claims at the headwaters of Robb Creek, a tributary of Kaslo River. The property is reached by 6 miles of road which leaves the Kaslo–New Denver highway at a point 16 miles from Kaslo, and follows the west side of Robb Creek in a southerly direction. The road is well constructed and maintained. On the Texas vein, No. 2 tunnel was reopened and No. 3 tunnel was extended to pick up the downward extension of the vein from No. 2 tunnel. During the operational period from June to October 31st, three men were employed.

Silver-Lead

London-Panama (Vimy Explorations Limited)

(50° 117° S.E.) Company office, 837 West Hastings Street, Vancouver 1; mine office, New Denver. S. Garnett, president; J. Bell, manager. This company has under option the London-Panama group of claims on London Ridge, above Retallack, at an elevation of 6,000 feet. One and a half miles of old road was rehabilitated, and 3 miles of new road was constructed to the property. The road takes off from the New Denver–Kaslo highway at a point 10½ miles from New Denver. Sampling was done on the surface and in some of the old workings. The caved portal of the Panama was stripped to gain access to the old workings. An average of four men was employed for three months.

SANDON*

Silver-Lead-Zinc

Silversmith, Richmond-Eureka, etc. (Carnegie Mining Corporation Limited)

(49° 117° N.E.) Company office, 416, 25 Adelaide Street West, Toronto; mine office, New Denver. A. W. White, president; J. C. Black, manager. Capital: 5,000,000 shares, no par value. This company is controlled by Violamac Mines Limited. The property consists of forty-six Crown-granted and six recorded claims and fractions which include the Silversmith, Slocan Star, Richmond-Eureka, Ruth-Hope, and Slocan King mines on Sandon Creek, south of Sandon.

In the Richmond-Eureka mine, lessees E. Perepolkin, L. Fried, and E. DeRosa shipped 575 tons of ore to the Carnegie mill. The operational period was three months.

The concentrator operated on a one-shift part-time basis from May to December. Three men were employed. The total amount of ore treated was 5,010 tons, made up of ore from the Victor, 3,174 tons; Caledonia, 1,079 tons; Richmond-Eureka, 575 tons; Lone Bachelor, 182 tons.

Carnation, etc. (Silver Standard Mines Limited)

(49° 117° N.E.) Company office, 808, 602 West Hastings Street, Vancouver 1; mine office, New Denver. R. W. Wilson, president; A. E. Ritchie, general superintendent. This company has optioned a group of fifty-nine Crown-granted claims and fractions in the Sandon area, formerly held by Kelowna Exploration Limited. The option was obtained from Oil Participations Inc., who had acquired the claims when Kelowna Exploration Limited went into liquidation.

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* By J. D. McDonald.

This group of claims covers part of the Standard-Silversmith lode system, and includes such old properties as the Carnation, Wakefield, Mascot, and Minniehaha, and others. It is accessible by 4 miles of road which switchbacks up the mountain west of Sandon. The geology of the area and of the various showings is described in British Columbia Department of Mines Bulletin No. 29.

A diamond-drilling programme was completed between August and early October. A total of 2,573 feet was drilled—five surface holes with a total of 1,543 feet and four underground holes on the Carnation 5480 level, with a total of 1,030 feet. Eight men were employed for a period of two months.

Victor (Violamac Mines Limited) (49° 117° N.E.) Company office, 416, 25 Adelaide Street West, Toronto; mine office, New Denver. A. W. White, president; J. C. Black, mine manager. Capital: 1,000,000 shares, $1 par value. Violamac Mines Limited is controlled and operated by New Dickenson Mines Ltd. The Victor mine is 2½ miles by road northwest of Sandon, or 2½ miles by road southeast of Three Forks.

Salvage operations continued during 1961. Mining was done above No. 7 level and above and below No. 5 level. Total development was 261 feet, including 110 feet of drifts and crosscuts and 151 feet of raising. The mine produced 3,174 tons of ore, which was milled at the Carnegie concentrator. The concentrates were shipped to the Trail smelter. The number of men employed was thirteen. There were no lost-time accidents during the year. This is a continuation of the excellent safety record which Violamac operations have had over a number of years.

Lone Bachelor (Lone Bachelor Mines Limited).—(49° 117° N.E.) This company is controlled by Violamac Mines Limited, which owns the adjoining Victor property. The property was under lease to E. Perepolkin, L. Fried, and E. DeRosa, who worked the property until June, 1961. Production was 182 tons of mill feed, which was treated at the Carnegie concentrator.

Slocan Base Metals (Violamac Mines Limited).—(49° 117° N.E.) Violamac Mines Limited has optioned this group of claims adjacent to the Victor property. An adit was driven 1,100 feet on a vein which had not previously been explored. This adit is on the road to Sandon, above and south of No. 4 level of the Lone Bachelor. Two men were employed during 1961.

New Springfield.—(49° 117° N.E.) This Crown-granted claim, 1 mile west of Sandon, is owned and operated by E. H. Petersen, of Sandon. Some development work was done, but there was no production.

SLOCAN LAKE*

Silver-Lead-Zinc

Mammoth (Loma Minerals Limited) (49° 117° N.E.) Company office, 801 Fina Building, 736 Eighth Avenue Southwest, Calgary; mine office, Silverton. D. W. Hilland, president; R. T. Avison, mine manager; C. Towgood, mill superintendent. This company has a long-term lease on the holdings of Western Exploration Company Limited, in the Silverton area.

Development work started in February, and the main raise from No. 12 level was completed to No. 10 level. A drift was driven along the vein on No. 10 level,

* By J. D. McDonald.

and the raise was driven from No. 10 level to the old Mammoth workings on No. 9 level. This provides access and ventilation to the area below No. 9 level. The main stoping area was between No. 10 level and No. 9 level. Development consisted of 270 feet of drifting and 460 feet of raising. The concentrator, operating on a one-shift basis, treated 3,401 tons of ore during 1961. The average number of men was fourteen, three of whom were employed in the mill.

Hewitt (Kopan Developments Limited).—(49° 117° N.E.) Company office, 906, 11 Adelaide Street West, Toronto. W. W. Dennis, president. This property was leased to F. Pho and J. Hichert for two years. The lessees mined on No. 10 level, and the ore was hauled to the Western Exploration concentrator. The total ore treated was 282 tons.

Galena Farm.—(49° 117° N.E.) F. Mills, of Silverton, holds a lease on this mine, 2 miles by road south of Silverton. The ore was hauled to the Western Exploration concentrator. The total ore treated was 374 tons.

SPRINGER CREEK*

Silver

Anna (Silver King Mines Limited)

(49° 117° N.E.) This group of five claims is owned by Silver King Mines Limited; mine office, Silverton. B. Marasek, president and manager. The property is on the northern side of Springer Creek, adjoining the Ottawa mine on the east. It is accessible by 5 miles of good road from Slocan City.

Development continued on No. 4 level: Drift extension, 650 feet; crosscutting, 35 feet; raising, 205 feet. One raise was driven 170 feet on the dip to connect with No. 3 level, but was not completed. An average crew of four men was employed for six months. No ore was shipped.

Ottawa (Ottawa Silver Mines Limited)

(49° 117° N.E.) Company office, 19 North Bernard Street, Spokane, Wash.; mine office, Silverton. T. C. Hughes, president; C. Thickett, mine manager. The option on this property to Skylane Mines Limited was bought back by Ottawa Silver Mines Limited in the spring of 1961. In August the property was optioned to Silver Buckle Mining Company, of Wallace, Idaho. This option was dropped in November after geological examination.

The property is on the north side of Springer Creek, 5 miles by road from Slocan City. All work was done by Ottawa Silver Mines Limited. A small tonnage of ore mined on No. 8 level was shipped to the Trail smelter. A new drift was started, called No. 9 level, to be driven along the Ottawa shear to intersect the downward extension of the vein.

Arlington (Aumaque Gold Mines Limited)

(49° 117° N.E.) Company office, 1600, 100 Adelaide Street West, Toronto 1; mine office, Slocan City. A. W. Johnson, president; R. C. Phillips, manager. Capital: 10,000,000 shares, $1 par value. This property consists of five Crown-granted and ten recorded claims and is under option from B. I. Nesbitt, of Vancouver. The property is on the north side of Springer Creek, 6.7 miles by road from Slocan City.

* By J. D. McDonald.

The old "A" level of the Arlington mine was rehabilitated by stripping the first 80 feet, which was caved, and retimbering 238 feet of drift. The level was reopened for a length of 700 feet. The portal of " D " level was opened up, and some surface stripping was done. On "A" level eight diamond-drill holes were completed, with a total length of 600 feet. The holes were drilled along the drift at intervals to explore the shear from footwall to hangingwall. Work was completed and all equipment removed by the end of October.

NAKUSP*

Copper

Nadeco

(50° 117° N.W.) This group of six recorded claims is owned by R. Joy, P. Hurry, R. Jordan, F. Jordan, and H. Murphy, of Nakusp. The claims are 8 miles north of Nakusp, on the new Nakusp–Galena Bay road, 1,000 feet up the hill from the road at an elevation of 1,900 feet. Copper mineralization occurs in narrow shear zones in diorite. Three shears were observed, the widest being 4 feet. A short distance to the west, and down hill from the showings, a limestone bed outcrops and strikes parallel to the strike of the shear zones. Three diamond-drill holes were drilled to a total depth of 144 feet. It was noted that the diorite had pyrite sprinkled through it.

NORTH LARDEAU*

FERGUSON (50° 117° N.E.)

Copper

New Zone Copper Limited

Company office, 120 McKenzie Avenue, Revelstoke; mine office, Ferguson. A. E. Peterson, mine manager. Capital: 200,000 shares, no par value. This property is west of the Nettie L and is reached by the Nettie L road, 1½ miles from the road up the south fork of Lardeau Creek. The showing is in schistose siliceous rocks alongside the road at an elevation of about 4,000 feet. The zone appears to strike north 20 degrees west and to dip steeply to the southwest. The vein was sparsely mineralized with pyrite and some chalcopyrite. Two grab samples from surface assayed 0.29 per cent and 0.16 per cent copper, and 0.12 per cent and 0.13 per cent nickel.

A drift was started a short distance below the showing and was driven about 35 feet. The property was closed in November. Four men were employed for a three-month period.

SOUTH LARDEAU

Lead-Zinc

Duncan (The Consolidated Mining and Smelting Company of Canada, Limited)*

(50° 116° S.W.) Company office, Trail. This property consists of fifty-eight Crown-granted and recorded claims. No underground work was done in 1961. On the surface, geological mapping and diamond drilling were done. In an area south of the adit, and another area near the south end of the peninsula on which the mine is located, thirteen diamond-drill holes were completed with a total footage of 6,416 feet. From the end of April to the middle of August, ten men were employed under the supervision of T. W. Muraro, exploration geologist for the company.

* By J. D. McDonald.

Sal (The Consolidated Mining and Smelting Company of Canada, Limited)*

(50° 116° S.W.) This group of thirty-seven claims was located by A. B. Mawer, a prospector for The Consolidated Mining and Smelting Company of Canada, Limited, in 1960. The claims are on Mount Willet, a 9,000-foot peak east of the head of Kootenay Lake. They cover lead-zinc mineralization in dolomite on both limbs of the Duncan anticline that in prospecting was traced southward from the Duncan mine on Duncan Lake 15 miles to the north. On the Duncan anticline, quartzites of the Hamill group are in the core and calcareous rocks and dark-grey argillites of the overlying Badshot formation and Lardeau group are repeated on the flanks. The anticline is isoclinal; on Mount Willet the axis plunges about 10 degrees to the north and the axial plane strikes about north 20 degrees east and dips steeply to the west.

Mineralization consists of fine-grained pyrite, galena, and sphalerite in grey and dark-grey dolomite and siliceous dolomite. Three zones, known as the A, B, and C zones of mineralization were mapped and sampled. These three zones are between elevations of 7,500 and 8,000 feet and are on the eastern limb of the Duncan anticline. The A zone is in a basin facing southwest about 1½ miles southeast of the summit of Mount Willet, B zone is on a northwesterly facing cliff three-quarters of a mile southeast of the summit, and C zone is on a steep east-facing slope less than one-half mile north of the summit. The A and C zones were tested by packsack diamond-drill holes. Eleven holes totalling about 550 feet were drilled. Although several mineralized shoots are present in each zone, the grade is low and the mineralization not continuous enough to encourage continued exploration.

A helicopter was used for all transportation. The crew consisted of four men under the direction of T. W. Muraro.

CRESTON†

Liz B

(49° 116° S.E.) This property consists of eight recorded claims owned by Mrs. E. Barclay, of Nelson. It is at 3,100 feet elevation on Wildes Creek, 2 miles north of Wynndel and 1½ miles east of the Creston–Kootenay Bay highway.

The mineralization occurs as low-grade zinc in limestone, with footwall and hangingwall rocks varying from schist to limy schist. The property was optioned to Sheep Creek Mines Limited in October. At the end of 1961 one diamond-drill hole was completed at 365 feet. During a two-month period three men were employed.

KIMBERLEY‡

Silver-Lead-Zinc

Sullivan (The Consolidated Mining and Smelting Company of Canada, Limited)

(49° 115° N.W.) Company office, 215 St. James Street West, Montreal; western headquarters, Trail. W. S. Kirkpatrick, Montreal, president; R. D. Perry, Trail, vice-president and general manager. Sullivan mine office, Kimberley. J. R. Geigerich, general superintendent; R. M. Porter, mine superintendent; H. J. Chalmers, Chapman Camp, superintendent, Sullivan concentrator. The Sullivan mine is on Mark Creek, 2 miles north of Kimberley, and the concentrator is at Chapman Camp, 2 miles south of Kimberley. The holdings include 678 Crown-granted claims and fractions. The following report, prepared by the management, is a synopsis of the operations:—

* By James T. Fyles.
† By J. D. McDonald.
‡ By D. R. Morgan.

" During 1961 the mine produced and the concentrator treated about 2,462,000 tons of ore; seventy-one per cent of which was produced from the section above 3900 level and twenty-nine per cent from below 3900 level. Drawing of P-14 pillar, blasted in July, 1959, was completed after producing 1,500,000 tons.

"Approximately 16,000 tons of slag were loaded and shipped to Trail from the old smelter site at Marysville, B.C.

" The total development footage was 53,597 feet. This included drifting on the new 2600 and 2700 levels. Major development included the excavation of the new 2500-level crushing chamber, coarse ore and fine ore bins. Installation of the new crusher and 1,500-foot conveyor from the 2500 to the 2850 level will be completed in 1962. A new hoist-room was excavated on the 3900 level for No. 32 shaft. Installation of the new hoist for No. 32 shaft was nearly completed at the year-end.

" The total backfill placed was 710,079 cubic yards. This consisted of 378,668 cubic yards (53%) of planned cave, 186,050 cubic yards (26%) of gravel, 120,982 cubic yards (17%) of float rock (with five per cent iron sulphides added) placed in 5 stopes below 3900 level, and 24,379 cubic yards (4%) of development waste. The gravel filling program which started in 1935 has now been completed.

" The ventilation system supplied fresh air and exhausted 900,000 c.f.m. of contaminated air. A new exhaust ventilation shaft (No. 31) was near completion and will replace No. 14 shaft. An additional 90,000 c.f.m. will be added to the exhaust system when this is completed. Thirteen primary fans, requiring 1,425 horsepower, were in operation.

" Improvements and developments in 1961 included the noise control devices installed on vane type motors on blast-hole drills and on long-hole percussion drills. The use of Nitro-Carbo-Nitrate as a blasting agent was progressing favourably by the end of 1961.

" The Sullivan mine had 16 lost-time accidents in 1961, a reduction of 10 from the previous all-time low of 26 in 1959 and 1960. No lost-time accidents occurred at the Sullivan concentrator in 1961. Accident frequency rate at the mine was 10.1 accidents per million man-hours worked and severity was 950.5 days lost per million man-hours worked or a total time loss of 1,505 days. At the concentrator there were no accidents in 1961. A carry-over of 220 days lost time from former accidents gave a severity rate of 298.8 days lost per million worked. No. 1 shaft section, employing about 120 men, completed their second consecutive calendar year without a lost-time accident.

" Fourteen Sullivan mine and concentrator employees obtained or renewed their Industrial First Aid certificates. One hundred and twenty-eight employees passed St. John's First Aid examinations. A team from the Sullivan concentrator won the East Kootenay First Aid competition.

" Sixteen employees obtained their Mine Rescue certificates in 1961, making a total of 279 since 1930. A team from the Sullivan mine won first place in the B.C. Provincial Mine Rescue competition at Nanaimo. Refresher training was given to twenty-eight men in four rescue squads and to all underground supervisors.

" The concentrator operated 247 days during 1961 at an average of 9,966 tons of ore per day. Employees at the year-end totalled 807 at the mine and 379 at the concentrator."

Lead-Zinc

Western Exploration (Reeves MacDonald Mines Limited)

(49° 115° N.W.) Head office, 410, Metropolitan Building, 836 West Hastings Street, Vancouver 1; mine office, Remac. L. M. Kinney, Metalline Falls, Wash., general manager; F. R. Thompson, manager. This property is near the headwaters of the east branch of Mark Creek, 10 miles north of Kimberley. It can be reached by a rough road leading from the old open pit area at the Sullivan mine. The property comprises 110 Crown-granted claims, leased from the Western Exploration Company Limited, and six claims held by record at the north end of the group. Activities were directed to exploration.

A crew of men extended a jeep-road 3.3 miles from the existing road on Consolidated property, and soil-sampled an area of claims in the vicinity of Buhl Creek. Preparations were made for a number of drill sites on the Kent No. 5 and Bur No. 5 mineral claims, and a contract crew drilled two diamond-drill holes totalling 1,461 feet on the claims. M. H. McLeod was in charge of the work for the company.

ST. MARY RIVER*

Copper

Welcome and Enterprise (Newmont Mining Corporation of Canada Limited)

(49° 116° N.W.) Head office, 604, 744 West Hastings Street, Vancouver 1. John Drybrough, Winnipeg, president. This property is near the headwaters of the St. Mary River, 25 miles northwest of Kimberley. It is 2 miles east of the outlet of Sawyer Creek, and can be reached by about 34 miles of road from the highway at Marysville. In addition to the Welcome and Enterprise Crown-granted claims, the property consists of eighty-eight mineral claims which have been optioned by the company for exploration. The showings are quartz-carbonate lenses containing chalcopyrite and locally galena in a vertical, north 20 degrees east fault zone.

Exploration work during 1961 included surface stripping, mapping, and 1,590 feet of diamond drilling in five holes. A maximum of eight men was employed. The work commenced in mid-May and continued to August 1st under the direction of A. J. Stanley, geologist.

WINDERMERE*

Toby Creek (50° 116° S.E.)

Silver-Lead-Zinc

Mineral King (Sheep Creek Mines Limited)

Company office, 6, 490 Baker Street, Nelson; mine office, Toby Creek. J. R. Pyper, president; H. E. Doelle, managing director; J. B. Magee, resident manager. This mine is at Toby Creek, 28 miles southwest of Athalmer. It has been developed in a ridge between Jumbo and Toby Creeks, and is entered by three levels which have been driven from the mountainside north of the camp. No. 7, the lowest or main haulage level, is at an elevation of 4,775 feet, No. 3 level at 5,460 feet, and No. 2 level at 5,595 feet. Three intermediate levels have also been driven from an inclined shaft in the workings but do not extend to the surface. The mine is operated by the open-stope method, and the workings are in four orebodies known as the "A," "B," "C," and "D." The property comprises twenty-three Crown-granted claims and seventeen located claims. A description of the deposit is included in the 1959 Annual Report.

The mine produced 211,010 tons of lead-zinc ore in 1961, most of the ore coming from the stopes above No. 4 level. The ore was developed and mined from

* By D. R. Morgan.

all the levels between No. 2 and No. 7, and its extraction was extended across the "A," "C," and "D" zones. Total development included 4,274 feet of drifting and crosscutting, 1,397 feet of raising, and 23,769 feet of diamond drilling. New development included the extension of No. 7 level to the orebody on the north side of the workings, and the commencement of a new level to enter the limestone at an elevation of 300 feet below the present workings. This level is being driven from the Jumbo Creek side of the property and will be known as No. 9 level.

The production of barite during 1961 was 4,215 tons. Most of the barite was obtained from the "C" and "D" zones above No. 3 level. The reserves in that area are rapidly nearing depletion, and preparations are being made to mine barite from the lower levels. The barite is shipped in the crude state, and is trucked to Invermere for shipment by rail.

The mine was ventilated by both mechanical and natural means. Approximately 29,000 cubic feet of air per minute was exhausted from the workings, and of this quantity 18,000 cubic feet per minute was supplied by a 15-horsepower electrically driven fan which is located on the No. 2 intake airway. The remainder was by natural means. This quantity was found to be sufficient for the requirements of the workings.

The concentrator operated at 90 per cent capacity throughout the year and produced 19,247 tons of zinc concentrates, which averaged 57.5 per cent zinc, and 7,227 tons of lead concentrates, grading 68 per cent lead. The concentrates were trucked to Invermere for shipment by rail. Surface construction and alterations during 1961 included the addition of a 22- by 40-foot extension to the power-plant building and the installation of a 350-kva. diesel-operated a.c. generator. Other construction included the building of a duplex dwelling, one teacher's quarters, and an additional room to the school. The company logged and cut 180,000 board feet of timber for the mine.

The average number of men employed was ninety-nine, of whom fifty-five were engaged underground.

SPILLIMACHEEN*

Copper

St. Andrew Mining Co. Ltd. (50° 116° N.W.) Head office, 1501 Burrard Building, 1030 West Georgia Street, Vancouver 5. This company relinquished a large number of claims held in the Warren Creek area in 1960, and presently holds 101 mineral claims which are located between the headwaters of Warren Creek and Rocky Point Creek, 15 miles due west of Spillimacheen. The claims run in a north-south direction and form a block 5¼ miles long and 1¾ miles wide. The northern end, on Rocky Point Creek, can be reached by a 30-mile logging and mining road leading from Parson, and the southern end by a 20-mile logging-road from Brisco along Bugaboo Creek and a 5-mile pack-horse trail. The property is divided into two parts known as the Sykes and Copper Butte zones, and elevations range from 7,000 to 9,000 feet. A report on a previous prospect in the area is included in the 1920 Annual Report.

Geological and geophysical surveys were made in 1961, and eight holes were diamond drilled, totalling 1,200 feet. The work was under the direction of A. C. A. Howe, consulting engineer, and lasted from June 1st until the beginning of September. The crew consisted of six men.

* By D. R. Morgan.

RUDDOCK CREEK*

Lead-Zinc

IT and IN (Ventures Limited) (51° 118° N.W.) Head office, 25 King Street West, Toronto. H. V. Fraser, president; Alex. Smith, manager; E. D. Dodson, geologist in charge. More than 100 claims, known as the Ruddock Creek property, have been located on the boundary between the Revelstoke and Kamloops Mining Divisions about 60 miles northwest of Revelstoke. The claims are on Gordon Horne Peak, a 9,500-foot summit between the head of Ruddock Creek, which flows east into the Columbia River, and Oliver Creek, which flows north and west into Tumtum Lake.

The claims cover lead-zinc mineralization in a calcareous layer in schists and gneisses of the Shuswap terrain. The mineralization was discovered in late September, 1960, on the south slope of Gordon Horne Peak between elevations of 7,500 and 8,000 feet. Subsequently it was traced intermittently to the northwest onto the east slope of Oliver Creek.

The mineralized zones consist of relatively continuous layers a few feet to a few tens of feet thick containing dark-brown sphalerite, pyrrhotite, and galena closely associated with a layer of grey to white fetid marble. Sphalerite commonly is medium grained and occurs with quartz in a granular aggregate which superficially resembles a gneissic gabbro. Sulphides also occur as matrix in a breccia of rounded and streaked-out fragments of glassy quartz and siliceous rock. Locally very fine-grained sphalerite, pyrrhotite, and quartz form a thinly banded rock of cherty appearance, containing rounded and eye-shaped cherty fragments. All the cherty material seen in thin-section resembles mylonite. Fluorite, barite, epidote, and amphibole are found at places in the mineralized zones. Sill-like sheets and irregular masses of pegmatite which in general are not mineralized are present throughout the schists and gneisses.

On Gordon Horne Peak, where most work has been done, the schists and gneisses dip gently to the southwest more or less parallel to the slope of the hill. The mineralized layers are contorted by relatively small complex folds which appear to plunge gently to the northwest. The pegmatites and the folding produce a complicated distribution of the mineralized zones.

A Hiller 12E helicopter, based at Mile 64 north of Revelstoke on the Big Bend highway, was used for transportation. A tent camp was maintained near the showings, and during the summer detailed mapping and drilling of the showings on the south slope of Gordon Horne Peak were carried on.

REVELSTOKE*

Wigwam (The Consolidated Mining and Smelting Company of Canada, Limited) (51° 118° S.E.) Head office, Trail. This property consists of fourteen recorded claims on the north side of the Akolkolex River, a westerly flowing stream that joins the Columbia 14 miles south of Revelstoke. The property is accessible by rough road which leaves the Revelstoke–Arrowhead highway 10½ miles south of Revelstoke and follows a southeasterly direction for 5 miles to the Akolkolex River then turns northeastward up the river for about 4 miles. The road along the river was cleared by bulldozer during the summer, and a tent camp was used by the exploration crew of six men during September. Work consisted of plane-table geological mapping, trenching, sampling of the known showings, and prospecting of the surrounding country.

* By J. T. Fyles.

The Wigwam is a lead-zinc property, on which considerable work was done between 1924 and 1930 by the Wigwam Mining Company, of Tacoma, Wash. At that time a road was built to the property from the railway station of Wigwam, a camp was built at the end of the road below the showings, almost 6,000 feet of diamond drilling was done, and many trenches, pits, and a number of short adits were made. Very little work has been done on the property since 1930. The camp has since been destroyed by fire, and the present road makes use of logging-roads north of the Akolkolex River and the old mine road along the river.

The showings consist of replacements of limestone and siliceous limestone by pyrrhotite, pyrite, galena, and dark-brown sphalerite. The limestone forms a thick layer which strikes north 20 to 30 degrees west and dips 20 to 25 degrees to the east. The rocks adjacent to the limestone are somewhat metamorphosed dark-grey argillites and schists. The limestone is finely crystalline white or grey and white banded, and is fetid. It contains siliceous zones with layers of fine-grained grey or white cherty rock a few inches thick lying parallel to the banding in the limestone. These thin layers show repeated tight dragfolds which plunge at low angles to the north and are Z-shaped looking down plunge.

The sulphides are mainly in the siliceous parts of the limestone. They are mostly very fine grained and occur in layers parallel to the layering in the siliceous limestone. Some of the mineralization consists of scattered disseminated grains of sulphides; other mineralization is massive in layers a few feet thick which locally contain rounded fragments of siliceous rock resembling incompletely replaced breccia fragments. Locally fairly coarse-grained galena and minor light-brown sphalerite and pyrite occur as irregular lenses in crystalline limestone. Grades given in old reports in general are low in lead-zinc and silver (*see* Ann. Rept., 1929, p. 334).

The main siliceous zone extends to the northwest up the hill from the end of the road, a horizontal distance of almost a mile and a vertical distance of more than 2,000 feet. The zone is about 200 feet thick, gradually becoming thinner toward the northwest. Early exploration outlined three poorly defined mineralized lenses within the siliceous zone. Because of the low dip of the limestone, the dimension exposed by the slope of the hill is more nearly parallel to the dip than it is to the strike. Exploration has not gone far enough to determine the rake of the mineralized lenses.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1929, p. 334; Gunning, H. C. (1929), Lardeau Map-area, British Columbia, *Geol. Surv., Canada*, Mem. 161, pp. 101–103.]

SKAGIT RIVER

Copper

A.M. (Canam Copper Company, Ltd.)*

(49° 121° S.E.) Company office, c/o 609, 850 West Hastings Street, Vancouver 1. W. M. Sharp, resident engineer. This property, comprising eight Crown-granted and fifty recorded claims, is astride the divide on the west boundary of Manning Park, about 4 to 6 miles by road from the Hope–Princeton highway, 26 miles east of Hope. Detailed descriptions of this property have appeared in the Annual Reports for 1938, 1949, 1954, and 1959. The last-mentioned report indicates that the mine is in a steep fold close to a major fault.

Intermountain Construction Ltd., employing a crew of twenty-five men, extended the 8- by 8-foot No. 15 level or 4300 adit a total distance of 932 feet to the east face, now 6,400 feet from the portal. The final 220 feet of tunnel was driven

* By J. E. Merrett.

in the ore zone, and an additional 175 feet was driven in a southerly direction in brecciated beds. Near the east face a raise machine was used to complete 136 feet of 6- by 10-foot timbered raise. In driving the raise, 650 feet of long-hole drilling was done for perimeter blasting with Xactex explosives. In addition, 2,200 feet of exploratory diamond drilling was completed. All work was suspended at the end of August.

Copper-Lead-Zinc

Gold Coin (Earlcrest Resources Ltd.)*

(49° 121° S.E.) Company office, 213, 678 Howe Street, Vancouver 1. E. M. Olts, president; R. B. Stokes, engineer in charge. This company holds forty-seven claims and two mineral leases on the north side of Shawatum (Ten Mile) Creek, a tributary of Skagit River, 25 miles southeast of Hope. The property is reached by leaving the Trans-Canada highway a few miles west of Hope and following the Silver Creek-Skagit River road in a southeasterly direction for 28 miles. A short distance beyond the Skagit River bridge a jeep-road leads to the claims, a distance of 3 miles. The showings, consisting of numerous outcrops of sulphide mineralization in altered sedimentary and volcanic rocks of the Hozameen group, have been prospected over a number of years by minor surface workings. In 1950 a few hundred feet of diamond drilling was done on the Gold Coin No. 2 claim to explore the downward extension of a series of narrow veins that outcrop on bluffs to the north of Shawatum Creek and east of Star Group Creek. In 1958 Noranda Exploration Company, Limited, did some prospecting, mapping, and magnetometer surveying. The present company began similar work in 1960. In 1961 a crew averaging nine men was employed under the direction of R. B. Stokes between May and November. A magnetometer survey was carried out on the Gold Coin No. 4, a total of 205 feet of trenching was done on the Gil group, test pitting and stripping was carried out on the Gold Coin group, and eight diamond-drill holes totalling 1,377 feet were drilled. Over 4 miles of jeep-road was completed up to the camp. The company reports that the object of its work has been to investigate the possibility of establishing a large low-grade open-pit operation. The weighted average for thirteen cut samples taken over the mineralized zone is, according to figures published by the company, as follows: Gold, 0.049 ounce per ton across 22.5 feet; silver, 0.86 ounce per ton across 22.5 feet; copper, 0.10 per cent across 21.8 feet; lead, trace across 21.8 feet; zinc, 3 per cent across 22.8 feet.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1929, pp. 241, 242; 1938, pp. F 16–F 20.]

HOPE*

Nickel-Copper

Pride of Emory (Giant Mascot Mines Limited)

(49° 121° S.W.) Company office, 844 West Hastings Street, Vancouver 1; mine office, P.O. Box 820, Hope. W. Clarke Gibson, president; H. Hill & L. Starck & Associates Ltd., consulting management engineers; F. Holland, mine superintendent; C. Major, mill superintendent; O. C. Gilroy, surface superintendent. The property is at the head of Stulkawhits (Texas) Creek, which flows eastward into the Fraser River about 6 miles north of Hope. From a point on the Trans-Canada highway 10 miles north of Hope, a good gravel road 5.1 miles long leads up Stulkawhits Creek valley to the mill and surface buildings at the 2600 adit portal. A branch road from this point gives access to the 3550 adit portal. The adit numbers designate elevations above sea-level.

* By A. R. C. James.

The Pride of Emory showing was found in 1923 by Carl Zofka, and since that time development and production have been carried on by several different companies. A short summary of earlier development was given in the 1959 Annual Report. In 1959 Giant Mascot Mines Limited acquired Newmont Mining Corporation's interest in Western Nickel Mines Limited, and on May 26th joined with Pacific Nickel Mines Limited to form a new company, Giant Nickel Mines Limited. The mine was immediately prepared for production, which began on July 5, 1959. Apart from occasional temporary stoppages, production has been continuous since that time. Early in 1961 Pacific Nickel Mines Limited sold its interests to Giant Mascot Mines Limited, and the latter company took over the sole ownership of the property.

The ore occurs in a number of separate orebodies, the principal ones being the Pride of Emory, the Brunswick Nos. 1, 2, and 5, and the 2663, which was mined out in 1958. The orebodies are steeply plunging pipe-like deposits and occur in an irregular stock-like intrusion of ultrabasic rocks approximately 1½ square miles in area. They comprise disseminated and massive sulphides, of which pyrrhotite, pentlandite, and chalcopyrite are the most common. The mine is developed from two adit levels—the 3550 level, with portals on both west and east sides of the mine, and the 2600 level, which is the main haulage level. An ore-pass and an internal inclined shaft joins the two levels. Until this year most mining and development was in the section of the mine from the 3550 level to the outcrops of the orebodies at the 4,000- to 4,250-foot levels. This year two new levels were developed from the internal shaft at 3,400 and 3,250 feet elevation, respectively.

In 1961 most production was from the upper section of the Pride of Emory orebody. By the year-end this section was mined out, with the exception of some pillars, and broken ore was being drawn from the " B " zone of this orebody. In the Brunswick No. 1, an additional 10,000 tons of ore was broken at the surface, and this was being drawn at the year-end. Diamond drilling confirmed a substantial tonnage of ore in this orebody between the 3550 and 3710 levels, and this was being drilled for long-hole blasting at the end of 1961. In the Brunswick No. 5, diamond drilling indicated a considerable tonnage of ore above the back of the old stope at the 3,710-foot level up to 3,850 feet elevation. This was drilled, and blasting was nearly completed by the year-end. The ore was loaded into 6-ton-capacity Granby cars at two mucking-machine draw-points on the 3550 level and trammed to the main ore-pass.

The most important development work in 1961 has been in the section of the mine below the 3550 level. Early in the year a breakaway was made from the internal shaft at the 3400 level. A crosscut was driven 340 feet to a point midway between the Brunswick Nos. 1 and 5 orebodies. From here drifts were driven laterally to intersect the two orebodies and to provide drill sites for the exploration of the Brunswick Nos. 2 and 7 orebodies. Development and currently planned long-holing has been completed to the 3550 level in the Brunswick Nos. 1 and 5 orebodies. Blasting is in progress, and ore is being drawn from both stopes. Ore is extracted via scraper drifts and is dropped to the 3400 level, where a 100-horsepower slusher pulling tandem 60-inch hoes moves the ore to the main ore-pass.

Another level at 3,250 feet elevation has also been developed from the shaft. The main crosscut has been driven 9 by 9 feet in cross-section, and trolley locomotives with 6-ton Granby cars have been installed for haulage. This level is planned as a major access to the Brunswick orebodies to the south, the Pride of Emory to the north, and the 1600/1900 zone to the east. Emphasis has initially been given to exploring the Brunswick Nos. 5 and 7 zones, and development here between the 3250 and 3400 levels was virtually completed by the end of the year. It is planned to load from the Brunswick No. 5 by chute and bulldoze chambers and from the Brunswick No. 7 by two scraper draw-points direct into Granby cars. In the Brunswick No. 2 zone, diamond drilling has indicated a substantial tonnage of ore between the 2950 and 3550 levels, and a probable downward extension of this orebody to the 2600 level is also indicated.

The following is a summary of development work done in 1961:—

	Feet
Drifting and crosscutting	3,392
Raising	3,407
Diamond drilling	32,079
Long-hole (blast-hole) drilling	155,178

The mine and surface plant was shut down from November 26th to the end of the year to permit extensive alterations to the crushing plant and to permit removal to surface of waste from an intensified development programme. At the crushing plant a Nordberg vibrating grizzly was installed ahead of the primary crusher, a Symons rod deck screen replaced the existing screen, and a short head gyratory crusher replaced the standard secondary crusher. An addition was made to the crusher building to permit reinstallation of the standard gyratory crusher, which is being overhauled. The mill continued to produce a bulk nickel concentrate, which is supplied to Sumitomo Metal Mining Company Ltd. in fulfilment of a three-year contract. The concentrates are trucked from the property to Vancouver Wharves Ltd. bulk-loading plant at North Vancouver by two Mack truck-trailer units. In 1961 a total of 260,583 tons of ore was milled, a 4-per-cent increase from last year's production despite the five-week shut-down.

The crew in December comprised 139 men, of whom seventy-six were employed underground. The accident rate at Giant Mascot mine in 1961 showed some improvement on the 1960 record; there were thirty-one lost-time accidents, giving a rate per million man-hours of 89.0 as compared with 162.0 in 1960. However, this still compares unfavourably with the Provincial metal-mine rate, which was 21.0.

HARRISON LAKE

Copper

Valley View* (49° 121° S.W.) Owner, George Dietrich, Agassiz. This property is on the east slope of Mount Woodside, 4½ miles west of Agassiz. Steve and Mike Romaniuk, of Harrison Hot Springs, leased the property and in April trucked to the Britannia concentrator 50 tons of chalcopyrite-bearing quartz ore which had been removed by surface trenching. Production was suspended when it was found the grade of the ore was not sufficient to warrant this type of operation.

Copper-Zinc-Gold

Lucky Jim (Mac.-M. & H. Mining Co. Ltd.)* (49° 121° S.W.) J. N. McLeod, New Westminster, president. This property, comprising thirty-one recorded claims and fractions, is on the east side of Chehalis River approximately 8 miles by road north from the Mission–Agassiz highway at Harrison Mills. Between January and May a crew of five men erected a camp, constructed roads to the tunnel portal, and completed 470 feet of 6- by 7-foot drift on a vein occurrence of pyrite, chalcopyrite, and sphalerite in quartz.

* By J. E. Merrett.

HOWE SOUND*

Copper-Zinc

Britannia (Howe Sound Company (Britannia Division)) (49° 123° N.E.) Head office, 500 Fifth Avenue, New York, N.Y.; mine office, Britannia Beach. William M. Weaver, Jr., president; A. D. McCutcheon, manager; A. J. McDougall, general superintendent. Shrinkage, cut-and-fill, filled square-set, sublevel caving, and blast-hole mining methods were used to remove ore from the Victoria, No. 8, and Bluff ore zones.

Exploration development was done locally in many areas, the principal amounts being done on the extension of 41-234 drift in the Victoria mine and in extending the east and west headings of the 5700 level of No. 8 mine. During 1961, 8,567 feet of drifting and 1,580 feet of crosscutting were completed. Additional exploration was done by diamond drilling, of which 25,058 feet was completed. The concentrator milled 461,601 tons of Britannia mine ore and 4,800 tons shipped by various mining operations for custom milling. The milled ores produced 22,064 tons of copper concentrate, 5,352 tons of zinc concentrate, and pyrite which was stockpiled. The copper and zinc concentrates were shipped to the Tacoma and Anaconda smelters, respectively, and 19,790 tons of pyrite was also shipped for sale. Some metallic copper was recovered by precipitation, by passing mine drainage water over iron shavings. In addition, some mill tailing was sold to British Columbia Cement Company Limited, Lafarge Cement of North America Ltd., and Construction Aggregates Ltd.

During the year five employees were successful in passing a mine-rescue training course, forty-five men completed industrial or St. John Ambulance first-aid courses, and eight men completed shiftboss certification.

The average number of men employed was 336, of which 205 were employed underground.

SECHELT PENINSULA*

Copper

Cambrian Chieftain (49° 123° N.W.) Company office, 1505 West Third Avenue, Vancouver 9. Colonial Mines, a registered partnership, employing a crew of five men, optioned the Cambrian Chieftain property of twelve recorded mineral claims, located south of Mount Hallowell near the top of the steep western slope of the Caren Range on Sechelt Peninsula. Access to the showings, at a general elevation of 3,200 feet, is by way of 5½ miles of steep gravel road from Kleindale, a settlement on Pender Harbour.

Between May and September, 1961, 389 tons of ore was mined by open-pit methods. The ore was trucked to a newly constructed dock at Garden Bay, whence 214 tons was shipped to the Britannia concentrator and the balance to the Tacoma smelter. It was reported that the average grade of the ore was 7 per cent copper, 4 ounces silver, and 0.02 ounce gold per ton.

In addition, geophysical (magnetometer) and geological surveys were made of the property.

Gold

Skookum (French Mines Ltd.) (49° 123° N.W.) Company office, 1007 Royal Bank Building, Vancouver 2. This company optioned and examined the Skookum group of twelve claims, located in the area of Aero Bay, Agamemnon Channel in Jervis Inlet at the north end of

* By J. E. Merrett.

Sechelt Peninsula. It was reported that a crew of two men working during the months of July and September under the direction of John Biggs completed 16 feet of 4- by 4-foot shaft and 243 feet of diamond drilling in eight holes. The mineralization was reported to be pyrite in a granitic porphyry.

POWELL LAKE*

Copper-Iron

Copper King (Delhi Pacific Mines Limited)

(50° 124° S.W.) Company office, Room 405, 25 Adelaide Street West, Toronto. Andrew Robertson, manager. This company optioned from Norco Resources Ltd. five Crown-granted and 102 recorded claims south of Olsen Lake and in the vicinity of Theodosia River. A crew of twelve men and a helicopter were used to explore and diamond drill occurrences of magnetite and chalcopyrite in a northwesterly trending skarn zone along the southeast flank and across the summit of a ridge approximately 1 mile south of Olsen Lake. The option was dropped after 3,400 feet of diamond drilling had been completed in twelve holes.

BUTE INLET*

Copper

Colossus (Phelps Dodge Corporation of Canada, Limited)

(50° 125° N.E.) Company office, 904, 1030 West Georgia Street, Vancouver 5. W. A. Hutchison, Toronto, general manager; D. C. Malcolm, Vancouver, resident geologist. This company held under option from H. W. Gardner, Vancouver, four Crown-granted and forty recorded mineral claims and fractions in the vicinity of Buker Creek on the north side of Estero Basin of Frederick Arm, west of the south end of Bute Inlet.

A crew of four to six men, employed from February to June, rehabilitated three tunnels and completed 363 feet of diamond drilling in three underground drill-holes.

LOUGHBOROUGH INLET*

Gold

Loughborough Gold (Great West Mining Corporation Ltd.)

(50° 125° N.W.) Company office, 580 Hornby Street, Vancouver 1. L. Wolfin, president. This company optioned twelve claims in the area 1 mile south of Gray Creek on the east shore of Loughborough Inlet, 7 miles north of Chancellor Channel. This property was formerly known as the Golden Gate group and was described in the 1936 Annual Report. The mineral exposures and mine workings are at an approximate elevation of 500 feet and 4,000 feet from tidewater. It was reported that gold and silver mineralization occurs in northeasterly striking quartz veins and stringers within a 10- to 15-foot-wide band of altered and sheared andesitic rocks in typical coastal granodiorite. A crew of two men was employed for a month examining this property and completing 396 feet of diamond drilling in two holes.

TEXADA ISLAND*

Iron-Copper

Texada Mines Ltd.

(49° 124° N.W.) Registered office, 626 West Pender Street, Vancouver 2; mine office, Box 35, Vananda. A. D. Christensen, San Francisco, president; B. L. Alexander, general manager; J. Kenneth Halley, chief engineer; J. Yuill, mine superintendent; L. D. Smillie, mill superintendent. This property, comprising eight Crown-granted and twelve

* By J. E. Merrett.

recorded claims, is at Welcome Bay, 3 miles northwest of the mine camp at Gillies Bay on the southwest coast of Texada Island.

Open-pit mining methods were used to remove 770,804 cubic yards of waste rock and 894,621 tons of iron ore. The concentrator milled 893,892 tons of ore and produced 475,419 tons of iron concentrate and 7,352 tons of copper concentrate.

An exploration programme was undertaken to investigate the ore potential below the bottom limits of the open pits. In carrying out this work 108 diamond-drill holes totalling 34,261 feet were completed. A survey was also made of the possibility of mining the indicated ore.

At the mine plant a new 36- by 48-inch primary jaw crusher, a hydraulically activated feeder, and a new dumping pocket were installed to replace the older worn-out unit. Additions were made to the grinding and flotation sections of the recovery plant to improve and increase recovery. These additions included a 9- by 14-foot Dominion rod mill with its accessory conveyors, pumps, etc. A new three-drum wet magnetic separator was added to the coarse circuit, and a larger filtering unit was added to the fine circuit.

Other additions to the mine plant included a new assay office, an 80,000-gallon steel water-storage tank, new explosive and cap magazines, a new electrical transformer bank, and two substation buildings. A new carpenter-shop was added to the Gillies Bay camp plant. The average number of men employed was 180.

QUADRA ISLAND*

Copper

Copper Road (50° 125° S.E.) This property, comprising twelve recorded claims, is owned by Messrs J. and E. G. Adams, of Campbell River, and is under lease to Robert I. Bennett, of Seattle, Wash. The mineral occurrence is a narrow quartz-bornite vein having a generally northwest strike and steep dip. A crew of two men completed 110 feet of open cut and 30 feet of winze, from which 87 tons of ore was shipped to the Britannia concentrator. Work completed on the surface plant included the clearing and levelling of an operating yard, the construction of a water reservoir and the installation of a permanent water-line, the installation of truck-loading facilities, and the erection of a sinking A-frame.

VANCOUVER ISLAND

Sayward (50° 125° S.W.)†

Iron

Iron Mike Office, c/o Caldwell and Hartt, R.R. 1, Campbell River. The group consists of seventy claims, held by record, 4 miles southwest of Sayward and 3 miles west of the junction of the White and Salmon Rivers. The magnetite showings were found in 1959, and there is a brief description of them in the Annual Report for 1960.

Diamond drilling totalling 2,100 feet in twenty-four holes was done to the end of 1961 on the Iron Mike, Iron Dan, Iron John, and Iron Dick claims, and some stripping was done on the Iron Ken. The diamond-drill holes were grouped in four areas.

Six vertical holes explored for the continuation of magnetite exposed in outcrops on the Iron Dan mineral claim over a strike length of 300 feet. In two holes appreciable core lengths of clean magnetite were obtained, 14 feet in one and 6 feet

* By J. E. Merrett.

† By N. D. McKechnie.

in the other. The 14-foot section appears to correlate with a zone of thin magnetite, or magnetite stringers in skarn, encountered in the other five holes; the 6-foot section in hole 6 does not appear to be represented in the other holes.

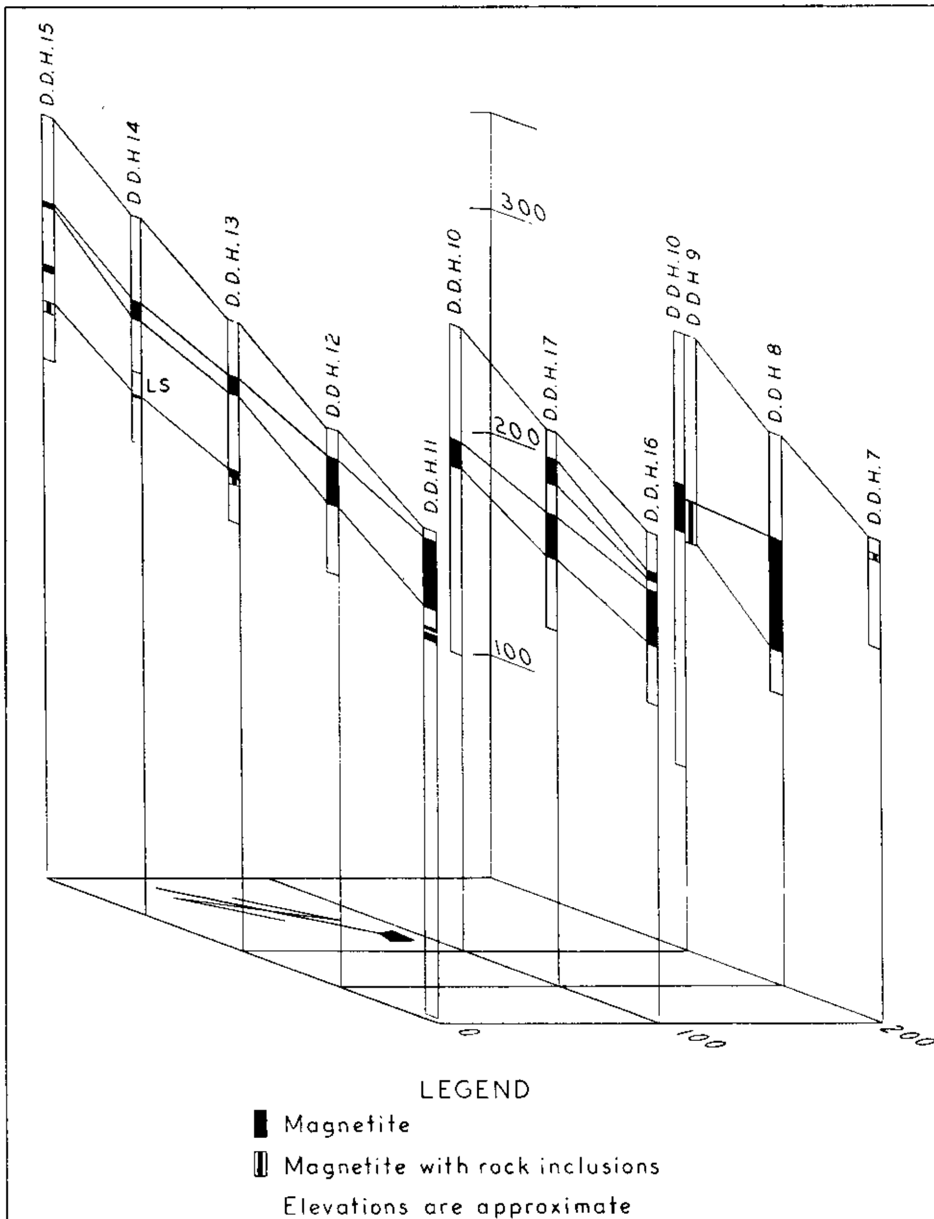


Figure 12. Diamond-drill intersections on the Iron Mike property.

Holes 7 to 18 (Fig. 12) tested an area 200 feet square on the Iron Mike mineral claim. These were the strongest and most persistent indications of magnetite found. The longest core length of clean magnetite was 39 feet in hole No. 8. The better intersections in the other holes were of the order of 20 feet, but the vein pinches quite rapidly southward.

Three vertical holes were drilled on the Iron John mineral claim at 100-foot intervals, away from an exposure of magnetite. One, nearest the outcrop, cut 15.5 feet of magnetite with numerous skarn inclusions; the second hole cut 10 feet of magnetite from surface, beneath 5 feet of overburden, and an additional 35 feet of core containing clean magnetite in lengths of 8, 3, and 5 feet and 4.5 feet of magnetite and skarn; the third hole cut 8.5 feet of magnetite with skarn inclusions.

Three holes were drilled near magnetite outcrops on the Iron Dick mineral claim over a length of 200 feet. The core of only one was seen by the writer; it contained magnetite with garnetite inclusions in the first 5 feet from surface.

Limestone was cut in only three of the holes—two on the Iron John mineral claim and one, No. 14, on the Iron Mike. There was no apparent continuity of limestone between the Iron John holes, 100 feet apart, nor did limestone show in holes 13 and 15, 50 feet on either side of hole 14. It is possible that if more continuous limestone beds could be found in the vicinity, magnetite associated with them might be in larger bodies.

NIMPKISH LAKE (50° 126° S.W.)*

Iron

Nimpkish, Klaanch (Nimpkish Iron Mines Ltd.) Company office, 419, 409 Granville Street, Vancouver 2; mine office, Camp A, Beaver Cove. S. V. Wines, project manager; D. Burns, mine superintendent; R. Bick, mill superintendent. A crew of sixty-five mined 666,361 tons of ore, from which 423,826 tons of concentrate was produced and shipped by Canadian Forest Products Limited railway to the loading-dock at Beaver Cove. In addition, 183,435 cubic yards of waste rock was removed from the ore zone. Sixteen diamond-drill holes totalling 2,595 feet were completed on an extension of the ore zone on the south side of the pit. In addition, several holes were diamond drilled to test a magnetic anomaly about 1,000 feet northwest of the pit.

The camp is on Anutz Lake, immediately south of Nimpkish Lake, and the pit is 5 miles farther south, on the southwest bank of the Nimpkish River. The crushers are immediately southeast of the pit, and the mill is across the river. The access road for the entire operation passes across the pit headwall.

The regional geology is described in Geological Survey of Canada Memoir 272 and illustrated in Map 1029A. Near the pit the Nimpkish River more or less follows a contact zone between Quatsino limestone on the southwest and a large intrusion of quartz diorite and related rocks on the northeast. The rock of the contact zone is mostly fine grained and medium to dark green, and was assigned by Hoadley to the Karmutsen group. In the pit, however, it appears to intrude the limestone and is locally medium grained. It may be an instrusion associated with the Bonanza group or a chilled marginal phase of the quartz diorite. It is called greenstone in this report.

The local geology is described in the Annual Report for 1960 and is illustrated by Figure 13 herewith. Relations are complex in detail, but in general diorite underlies the east part of the pit, limestone the west part, and greenstone occurs between these rocks in the north, near the river. Four magnetite orebodies lie athwart the limestone-diorite contact; from north to south they are called the River, Road, South, and East orebodies. The Road and South orebodies are incompletely separated by a wedge of diorite. The East orebody is small, and mining from it has been incidental to pit preparation.

* By G. E. P. Eastwood and J. E. Merrett.

Skarn and sulphide minerals are abundant only in the River orebody, where the host rock is largely greenstone. In the other orbodies the magnetite is generally massive and contains only sparse pyrite and pyrrhotite. Some garnet, epidote, and pink microcline have formed in diorite adjacent to magnetite, but limestone is generally merely recrystallized. Considerable ankerite is developed in sheared limestone west of the South orebody, but it is not known whether it is related to magnetite deposition. In the River orebody the principal minerals associated with the magnetite are garnet, epidote, calcite, and pyrite, with less amphibole, pyrrhotite, and chalcopyrite.

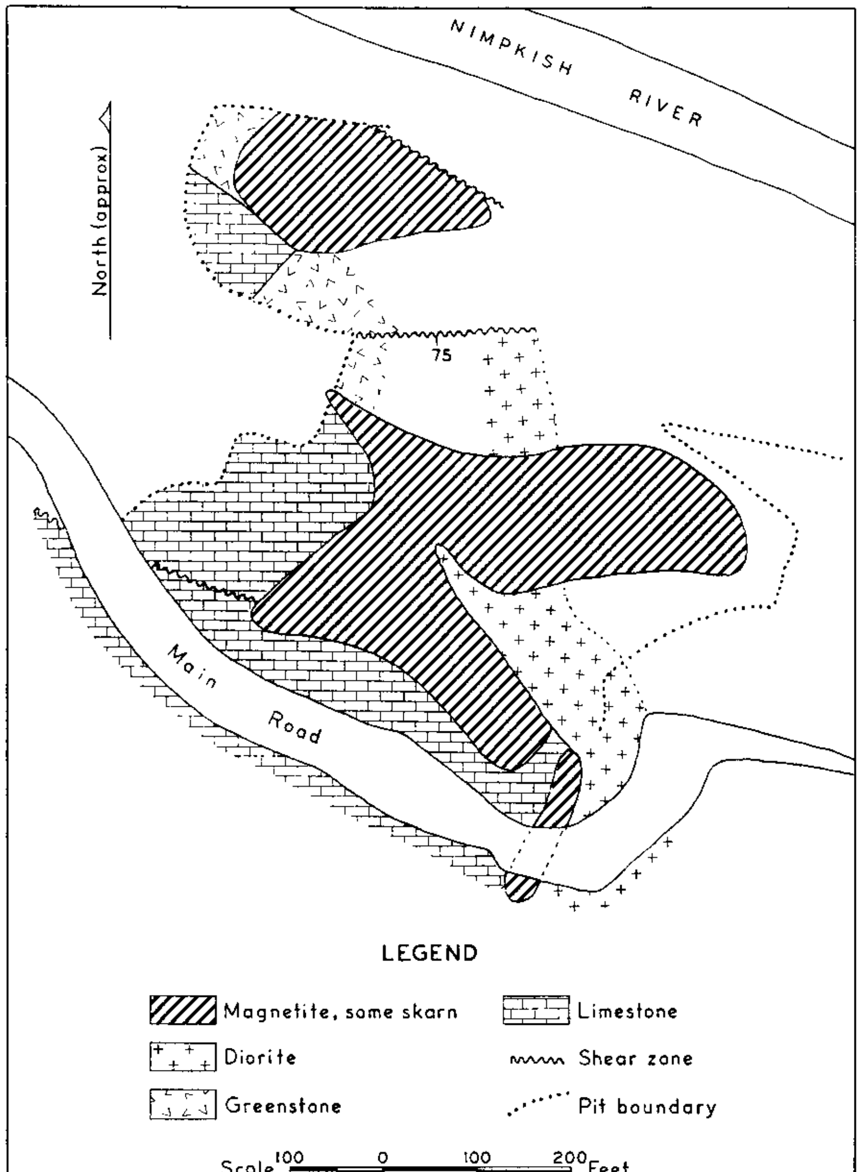


Figure 13. Nimpkish Iron Mines Ltd. Simplified geology of pit.

Benson River (50° 127° S.E.)*

Iron

Empire Development Company Limited

Company office, 1012, 736 Granville Street, Vancouver 2; mine office, Port McNeill. E. C. Oates, general manager; P. W. Billwiller, mine engineer; J. Lamb, geologist. The mine is operated by Mannix Co. Ltd. (company office, 737 Eighth Avenue Southwest, Calgary, Alta.). In October, P. M. Stiles succeeded A. Ostgard as project manager. Empire Development is owned 40 per cent by Quatsino Copper-Gold Mines Limited, 33 per cent by Mannix, and 27 per cent by various interests.

The property includes a large block of Crown-granted claims and several recorded claims on the northeast slope of Merry Widow Mountain, adjoining the Coast Copper property on the south and west; it is conveniently referred to as the Empire property. A reciprocal agreement exists involving exploration rights to iron mineralization by Empire Development on the Coast Copper property and to copper mineralization by The Consolidated Mining and Smelting Company of Canada, Limited, on the Empire property.

The camp and mill are in the Benson River valley at 800 feet elevation, and are reached by 25 miles of road from Port McNeill on the east coast of Vancouver Island. From the camp, 4 miles of tote-road leads to the crusher and open pit at about 2,500 feet elevation. Crushed ore is brought down to the mill by surface tram-line. The heavy snowfall at pit elevation precludes open-pit mining during the winter, and the operation is shut down from Christmas to about the beginning of May.

In 1961 the Merry Widow was the only open pit in production. The Kingfisher pipes had been mined down to the economic limit for open-pit operation in 1960, and the small Raven orebody had been mined out. At the end of May it was discovered that a large section of the Merry Widow headwall was very slowly settling into the pit. Mining was halted, then cautiously resumed. The headwall was drilled off with a wagon drill, and blasted on August 6th to a stable slope. The average number of men employed during the eight-month operating period was 120. During this period 772,800 tons of waste and 535,833 tons of ore were mined from the open pit and 364,772 tons of concentrate was produced and shipped. Increased sulphides were encountered in the deeper mining, resulting in a higher sulphur content in the concentrates.

An adit was collared at about 1,800 feet elevation and driven 920 feet to pass beneath the Kingfisher pits. In order to remove the ore remaining in the Kingfisher deposit, 110 feet of additional crosscut and 1,450 feet of raising were driven. Drilling has shown that the Kingfisher deposit is shaped like a sling-shot; the remaining ore is in the lower part of the forks and in a short stem which pinches downward, above the adit level. A portable crushing plant was erected at the portal for crushing the ore to be trucked to the mill.

The regional and local geology are described in the Annual Report for 1960 and illustrated by Figure 9 therein. The magnetite occurs in Quatsino limestone and in an overlying thin wedge of Bonanza pyroclastics, near the contact with a diorite stock. The contact of the stock is gently cuspate in plan and dips east or northeast at 55 to 70 degrees. The layered rocks generally dip west or southwest at low to moderate angles, that is toward the diorite. The Kingfisher and Merry Widow orebodies are in one of the embayments in the diorite contact, the Kingfisher entirely in limestone, the Merry Widow partly in limestone but mostly in pyroclastics. The headwall of the Merry Widow pit has been cut back into diorite.

* By G. E. P. Eastwood and J. E. Merrett.

Early in the exploration and development it was apparent that the layered rocks have an anomalous northeast strike, with northwest dip, adjacent to the orebodies, and that they have been broken by a northeast-striking fault, known as the Kingfisher fault, but there were only obscure hints of additional structural complexity. Bedding in the Kingfisher pit and remnants of bedding in the upper part of the Merry Widow dipped uniformly northwest. Deeper mining in the Merry Widow has, however, disclosed one relatively large fold in the upper contact of the limestone; from a gentle northwest dip it turns abruptly down to a steep southeast dip. Deep drilling indicates that it changes back to a northwest dip at greater depth and is probably involved in several smaller and relatively tight folds. During mineralogical studies of tuff and skarn in the pit, several high-calcite bands were outlined, above probable anticlinal bands of limestone intersected in deep drilling. It seems likely that the tuffs have also been folded to some extent. Several small, tight folds in the limestone contact are exposed in the south wall of an extension of the main pit, known as the South pit, but limestone is not exposed on strike with them in the main pit, and therefore they were assumed to be very local structures. It now seems more probable that they plunge steeply northeast, passing beneath the present floor of the main pit. In the Kingfisher adit, limestone beds are markedly warped and twisted, though not in any regular fold pattern, contrasting sharply with the uniform beds in the Kingfisher pits above. It is concluded that rocks adjacent to the orebodies have been considerably stressed, even where the structure appears simple, and it is suggested that the stressed condition of the rock may have been just as effective as were individual structures in localizing the deposition of magnetite.

The Merry Widow deposit contains a variable amount of sulphides, and these in turn contain a certain amount of gold and silver. The sulphides include pyrrhotite, pyrite, chalcopyrite, and minor arsenopyrite and sphalerite. They occur sparingly through most of the upper part of the deposit, but are more abundant in the northeast and in the lower part. They are present as grains disseminated through magnetite and skarn and as irregular masses intimately associated with the magnetite. Seven grab samples were taken from sulphide masses in the course of mineralogical studies in the pit, and were assayed for gold, silver, copper, and sulphur. A pyrrhotite sample, No. 1239, was also assayed for platinum, but none was found. The other results are shown in the left-hand columns of the table below. Only one sample was pure sulphide, and the various sulphide contents in the other samples were calculated from the sulphur and copper assays and from visual estimates of the relative proportions of pyrite and pyrrhotite. The gold and silver assays were then recalculated as content in total sulphides; these recalculated values are shown in the two right-hand columns of the table.

Sample No.	Gold	Silver	Copper	Sulphur	Chalcopyrite	Pyrite	Pyrrhotite	Arsenopyrite	Total Sulphides in Sample	Gold, Total Sulphides	Silver, Total Sulphides
	Oz. per Ton	Oz. per Ton	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Oz. per Ton	Oz. per Ton
1185	0.50	6.8	18.67	27.67	54	16	....	....	71	0.71	9.6
1242	1.01	10.8	20.72	31.50	60	20	....	....	80	1.27	13.6
1237	0.34	9.3	19.81	35.36	58	....	38	....	96	0.35	9.7
1238	1.16	1.6	2.76	23.09	8	....	1	91	100	1.16	1.6
1239	0.74	1.3	1.66	33.30	5	....	80	....	85	0.87	1.5
1240	0.08	5.1	13.53	17.96	39	8	....	....	47	0.17	10.8
1241	0.08	0.2	0.15	27.55	0.4	51	....	....	52	0.15	0.4

The silver is obviously concentrated preferentially in chalcopyrite. The gold content appears to be related not so much to chalcopyrite as to the total sulphide content of the ore. Samples Nos. 1240 and 1241 were taken from an extension of the pit that is known as the South pit, where sulphides are scarce. The other samples are from the northeast part of the pit, where the sulphide content is relatively high. However, the relationship is not a regular one. Samples Nos. 1185 and 1242 were taken a few feet apart, from the same chalcopyrite mass.

Empire Development continued exploration on the Ajax and Shamrock prospects, both on Coast Copper ground, and conducted a dip-needle survey on the Snowbird prospect on Empire ground, 2½ miles northwest of the Merry Widow. Diamond drilling on the Shamrock amounted to about 800 feet in eight holes. The magnetite here occurs as relatively massive lenses a few feet thick and as larger stockworks and breccia zones in which the magnetite is crowded with blocks of skarn. The various occurrences are too small or too low in over-all grade to make ore at this time. Dip-needle surveying was continued on the Ajax. The magnetite here forms thin west-dipping sheets in Bonanza tuffs and in underlying limestone adjacent to a small northeast-striking fault. An orebody was not indicated.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1928–31, 1950–52, 1956–60.]

Copper

Old Sport (Coast Copper Company, Limited)

Company office, Tadanac; mine office, Port McNeill. The Consolidated Mining and Smelting Company of Canada, Limited, is principal shareholder and manages the operation. H. G. Barker, property manager; R. M. Mattson, mine superintendent; A. B. deVoogd, mine geologist. The property, also known as the Benson Lake property, comprises forty-eight Crown-granted claims southward from Benson Lake on the west side of Benson River, and adjoins the Empire property on the north and east. Access is by way of a 26-mile gravel road from Port McNeill, where twenty employee residences were under construction.

In 1960 a road was built from the Empire camp to Benson Lake. In 1961 a permanent camp suitable for 200 men was constructed at a site one-half mile south of the lake. A crew of eighty-two men completed the construction of four bunkhouses, a cafeteria, a general office, a laundry, and a 50,000-gallon water-storage tank, and the erection of power-line poles from the power plant to the mine site. At the end of the year the crushing plant, 750-tons-per-day concentrator, changehouse, recreation hall, and shop buildings were under construction. A new adit crosscut was driven from the new camp to intersect the 5500 level (formerly No. 8 level) drift near the south end, and the drift was enlarged to serve as a main haulageway. Raises were driven in ore in preparation for mining. A crew of fourteen men completed 1,262 feet of crosscutting, 1,031 feet of drifting, and 1,200 feet of raising. Exploratory diamond drilling was continued from underground stations. A water-storage dam for power development on Raging River above the falls between Benson and Maynard Lakes was 70 per cent completed. Approximately 160 acres of land were cleared in the area to be flooded. An adit and penstocks were driven beside the river. Work commenced on the preparation of the power-house foundations, where it is intended to install generating equipment of 2,400-horsepower (2,200 kva.) capacity. It was hoped the annual rainfall (134.9 inches in 1960 and 129.7 inches in 1961) would be sufficient to maintain the plant's operation throughout most of the year, but in case of water shortage it is intended to install a diesel-driven stand-by plant.

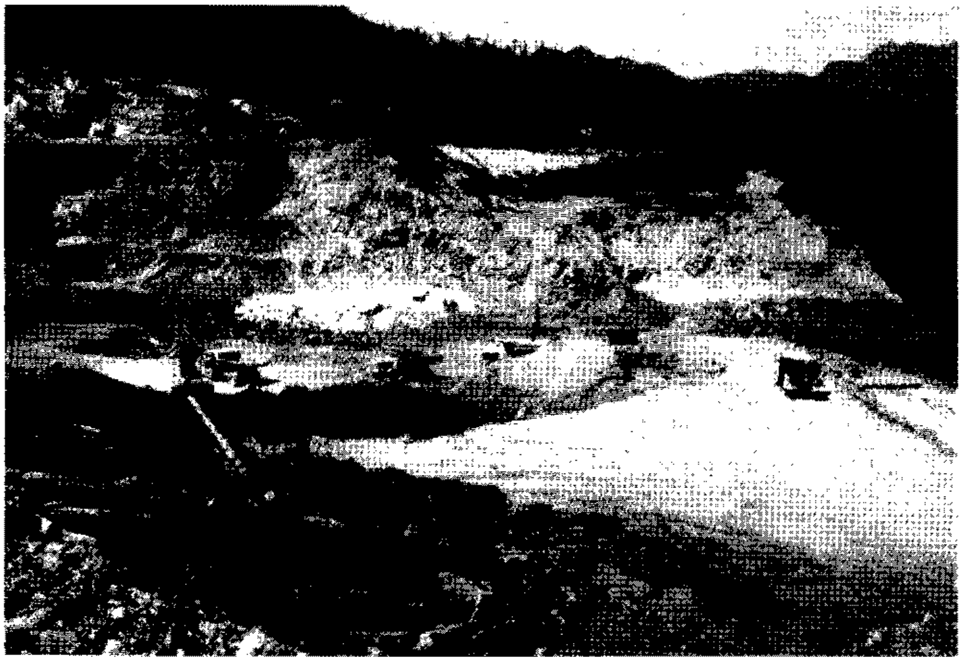
The mineralization occurs along the contact of the Karmutsen volcanics with the overlying Quatsino limestone. This contact dips 37 degrees southwest at the mine. In detail the mine sequence is, in descending order:—

Quatsino limestone.
Upper flow.
" Old Sport Horizon."
Karmutsen volcanics.

The Karmutsen volcanics in the mine are massive, fine grained to dense, and dark green to greenish-black. Scattered amygdules suggest that most of the rock is flow lava. The " Old Sport Horizon " is a concordant zone, about 15 feet thick, of skarn and magnetite containing many dykes and sills. It is host to a large part of the copper ore and is described in some detail below. The upper flow, where fresh, is dense and dark-green to greenish-black volcanic rock. It was considered to be a sill and was long known as the " included diorite," but recent drilling has disclosed amygdules in it, convincing company geologists that it is a flow and that similar appearing dykes cutting the limestone also cut the flow. Its average thickness on 5500 level is about 40 feet. The lower and upper few feet of the flow are partly replaced by skarn and magnetite. The Quatsino limestone is medium to coarse grained and commonly is white to light grey and massive; in part it is banded light and dark grey. It is intruded by many small, dense, greenish-black dykes, commonly from 6 inches to 2 feet wide. A larger body occurs in the limestone in a long crosscut southwest from the central part of the 5500 level drift; in colour and texture it closely resembles both the dykes and the upper flow.

The " Old Sport Horizon " was studied in some detail in the southern 800 feet of the 5500 level drift, and more generally in the remainder of this drift and in the old No. 5 level drift. It is a thin zone of skarn, magnetite, and one or more sill-like bodies, lying between the Karmutsen volcanics and the upper flow, and is transected by many narrow dykes. The sill-like bodies are light green, massive, fine to medium grained, and were called felsite by Gunning. One of them locally rests on the Karmutsen group and sends apophyses into it; it also sends similar apophyses into massive skarn and magnetite. The sill-like bodies, and some of the dykes, have, however, been partly replaced by skarn; it is concluded that they were intruded not into skarn, but into a pre-existing rock, and that such pre-existing rock has been completely replaced by skarn and magnetite, whereas dykes and sills have been replaced only partially. What this other rock may have been is not evident in the mine. Scattered skarn in small, local shear zones in the underlying Karmutsen might suggest that the " Old Sport Horizon " may have been sheared Karmutsen volcanic rock. However, surface exposures on Craft Creek 1 mile northwest of the mine and diamond drilling through the Quatsino-Karmutsen contact zone half a mile south of the mine disclose that the Karmutsen is overlain successively by a thin limestone member, an amygdaloidal flow, and the Quatsino limestone. It thus appears probable, although not entirely certain, that the " Old Sport Horizon " originally was a thin limestone member. If it was limestone, its thorough replacement by skarn and magnetite contrasts sharply with other deposits of this type in the Benson River area, in which dykes and volcanic rocks are preferentially replaced by skarn, and limestone is but little altered.

Fractures include several bedded shear zones and many cross-faults. Some bedded shear zones, a few inches wide, occur in the upper part of the Karmutsen volcanics and displace some of the dykes a few inches. The hangingwall part of the " Old Sport Horizon " is also more or less sheared. A few narrow shear zones wind through skarn and sills. In the southeast part of the mine the cross-faults



Nimpkish Iron Mines Ltd. Open-pit operation, August, 1961.

Noranda Mines Limited, Kennedy Lake Division. Open-pit preparation, September, 1961.

strike northeast and are vertical or dip steeply northwest. They range from tight fractures to shear zones a foot wide. Most of them displace horizontal traces of contacts to the right, commonly from 5 to 15 feet. In the northwest part of the mine the cross-faults are more variable in direction, are commonly marked by broader shear zones, and generally displace horizontal traces greater distances, both left and right.

The magnetite throughout the zone is not considered ore at this time, as the cost of mining it alone would be prohibitive at present prices. However, some magnetite may be recovered as a by-product of the mining and milling of copper ore.

The ore minerals are chalcopyrite and less bornite. Only the Bornite shoot contains significant bornite. Other sulphides include widely distributed pyrite and local pyrrhotite. The ore minerals occur as veinlets and disseminated grains in sills, skarn, and magnetite. A little vein quartz is commonly associated. The ore minerals form four shoots in the " Old Sport Horizon " and in the hangingwall of the upper flow. The shoots are short and deep, and are separated by several hundred feet of essentially barren ground. Generally they rake northwest, but the upper part of the Central shoot plunges directly down-dip. From northwest to southeast they are named the North, Central, Bornite, and South shoots. The North and Bornite shoots lie entirely in the " Old Sport Horizon," the South in the hangingwall of the upper flow, but the Central shoot lies partly in each zone. The upper and lower sections of the Central shoot are in the " Old Sport Horizon," the middle section in the hangingwall of the flow. In the shoots in the " Old Sport Horizon " the copper mineralization generally does not extend across the full width of the horizon, but is commonly restricted to the middle or footwall portion. Copper mineralization in the hangingwall of the upper flow is exposed in few places; in the Central shoot on 5500 level it occurs across a total thickness of 9 feet. The controls of the shoots are not evident.

[References: Gunning, H. C., *Geol. Surv., Canada,* Sum. Rept., 1929, Pt. A; *Minister of Mines, B.C.,* Ann. Repts., 1911–31, 1956, 1960.]

KYUQUOT (50° 127° S.E.)*

Iron

Little Lake Group This group of eighteen recorded mineral claims is in the Alberni Mining Division about 2½ miles north of Power Lake at the head of Ououkinsh Inlet. The property, held by H. Benjamin and H. Clement, of Zeballos, was optioned to Rio Tinto Canadian Exploration Limited. A crew of four men employed from mid-April to the end of June completed magnetic and geological surveys, stripped some outcrops, and did a total of 262 feet of diamond drilling in four holes.

ZEBALLOS (50° 126° S.W.)*

Gold-Copper

Privateer (New Privateer Mine Limited) Company office, c/o H. Hill & L. Starck & Associates Ltd., 844 West Hastings Street, Vancouver 1. New Privateer Mine Limited, under the option and control of National Explorations Limited, holds the former Privateer mine property and, by option, four claims located by George Uebel, 1,500 feet northwest of the Privateer concentrator. The Privateer shaft and 1300 level workings were dewatered, and a crew of six men completed seven diamond-

* By J. E. Merrett.

drill holes totalling 1,186 feet of drilling from that level to investigate No. 3 vein below the level and Nos. 4 and 5 veins to the north. The workings were allowed to flood after the drilling was completed.

In addition, the crew completed 5,732 feet of diamond drilling in twenty-four surface holes in exploring two copper-bearing ore zones on the Uebel claims.

Iron

F.L. (Zeballos Iron Mines Limited) Company office, 504, 850 West Hastings Street, Vancouver 1; mine office, Zeballos. R. M. Belliveau, project manager; R. Kirwan, general superintendent. This company is a subsidiary of International Iron Mines Ltd., which latter company has been acquired by National Bulk Carriers Incorporated of New York, N.Y. Thirteen Crown-granted and seven recorded claims are under lease from Ventures Limited, and eighteen recorded claims are under lease from various owners. The mine is on Blacksand Creek, 4 miles north of Zeballos.

In 1961 the number of men employed varied between twenty and 225, depending upon the amount of construction work being done. The construction of the crushing plant, surface tram-line, beneficiating plant, tailings disposal, and ship-loading facilities was 80 per cent completed at the end of the year. The designed daily capacity of the plant is 3,600 tons of mill feed.

Surface stripping of the planned pit area began in December, and 23,000 cubic yards of overburden was drilled and blasted during that month.

HESQUIAT HARBOUR (49° 126° S.E.)*

Iron-Copper

Hesquiat (Sun-West Minerals, Limited) Company office, Tofino. Lorne Hansen, president. A crew of five men was employed surface stripping and completing 1,500 feet of diamond drilling in eight holes on an occurrence of magnetite and chalcopyrite near the mid-point of the east shore of Hesquiat Lake. The property was optioned in October to Paco Resources Ltd. and Fort St. John Petroleum Limited.

HERBERT INLET (49° 125° S.W.)*

Gold

Berton Gold Mines Limited Company office, 42, 610 Jervis Street, Vancouver 5; mine office, Herbert Inlet via Tofino. B. L. Clayton, president; J. C. Jackson, manager. This company owns twenty-one Crown-granted and two recorded mineral claims on the south slope of Abco Mountain at the head of Herbert Inlet. A crew of three men extended the 1,000-foot level adit to a total length of 915 feet, at which point it was reported the drift intercepted a 12-foot dyke. The drift face is now approximately 500 feet south of and 800 feet vertically below the lowest exposed vein outcrop.

Copper

Catface (Ventures Limited) British Columbia office, Suite 401–4, 402 West Pender Street, Vancouver 3. Alex. Smith, exploration manager. This company owns forty-four recorded claims on Catface Mountain at the west end of the peninsula between Herbert Inlet and Bedwell Sound. A crew of five men was employed for one month completing 677 feet of diamond drilling in seven drill-holes.

* By J. E. Merrett.

BEDWELL RIVER (49° 125° S.W.)*

Gold

Musketeer (Copper Town Mines Limited)

Registered office, c/o Curry & Co., 202, 717 West Pender Street, Vancouver 1; mine office, Tofino. John Luttin, president; S. Craig, manager. This company optioned seven Crown-granted and five recorded mineral claims covering the former Musketeer and Buccaneer mines, on the south side of Bedwell River, approximately 7½ miles from the river mouth. In October the Musketeer mine and mill were reopened. Ore was removed by underhand stoping methods. A crew of thirteen men, five of whom were employed underground, mined 1,100 tons of ore, of which 339 tons was milled to produce 14 tons of concentrate. Three diamond-drill holes totalling 1,200 feet were drilled to investigate the Robillard vein to the east of the Trail vein. The operation closed December 19th.

TSOLUM RIVER (49° 125° N.W.)*

Copper-Silver

Domineer (Qualicum Mines Limited)

Operating companies, January to October—Noranda Exploration Company, Limited, Room 202, 2256 West Twelfth Avenue, Vancouver 9; October to December—Mt. Washington Copper Co. Ltd., Suite 404, 1111 West Georgia Street, Vancouver 5; mine office, Courtenay. S. J. O. McClay succeeded O. W. Nichols as property manager at the time of the change in operating companies. This property, comprising four Crown-granted and eighty-five recorded claims is near the summit on the northeast slope of Mount Washington, 15 miles northwest of Courtenay. Access is by public motor-road to Comox Logging Company gate near the southwest end of Wolf Lake. From there logging-roads and a short connecting road lead to the showings at about 4,500 feet elevation. The claims lie within the land grant of the Esquimalt and Nanaimo Railway Company, Limited, the owners of the base-metal occurrences and with whom an operating agreement has been made for the removal of the ore.

While under the direction of Noranda Exploration, the work was confined to the Murex Creek area. A long trench was made across an electromagnetic anomaly discovered in the fall of 1960. Bedrock was exposed in a series of ridges of silicified volcanics. A rusty zone some 50 feet wide in the volcanics was noted to be mineralized with pyrite, pyrrhotite, and chalcopyrite, which in some sections was reported to assay as much as 1 per cent copper. Two diamond-drill holes totalling 745 feet were put down on this zone, and the copper mineralization disclosed assayed less than 0.5 per cent copper.

Under the direction of Mt. Washington Copper Co. Ltd., a crew of eight men did 925 feet of diamond drilling in eight holes, built 1 mile of road, and removed 10,000 cubic yards of overburden to prepare the Domineer ore zone, described in the 1960 Annual Report, for the mining and shipping of ore. The crew was increased to twenty-five, and 4,449 tons of low-grade ore was mined, trucked to the Comox dock, and shipped by scow to the Britannia concentrator. In addition, 856 tons of higher-grade ore was shipped by scow to the Tacoma smelter. At the end of 1961, when snow conditions made ore removal too difficult, 70 feet of 6- by 8-foot tunnel was completed.

* By J. E. Merrett.

BUTTLE LAKE (49° 125° N.W.)*

Gold-Silver-Copper-Lead-Zinc

Lynx, Paramount, Price (Western Mines Limited) Company office, 1500 Marine Building, 355 Burrard Street, Vancouver 1. J. A. C. Ross, managing director. In May this company optioned from P. M. Reynolds and Associates the Lynx, Paramount, and Price groups of mineral claims in the vicinity of Myra and Price Creeks at the south end of Buttle Lake. The property comprises twenty-three Crown-granted and forty-two recorded mineral claims, covering an area approximately 6,000 feet wide and 21,000 feet long. The Lynx showings are at several locations between elevations of 1,200 and 1,700 feet on the north side of Myra Creek approximately 2½ miles west of the south end of Buttle Lake. The Paramount showings, at an elevation of 1,500 feet, are south of the Lynx and on the south side of Myra Creek. The Price showings are on the east slope of Myra Mountain at several locations between elevations of 900 and 1,900 feet, and are one-half to 1½ miles southwest of the south end of Buttle Lake.

Information contained in earlier Annual Reports indicates that the mineral occurrence is in a generally northwesterly trending zone of sericite schists formed by shearing in volcanic rocks of the Vancouver group. Contained in the schists are silicified zones and innumerable narrow quartz stringers. The silica gangue is accompanied by calcite and barite. Pyrite, chalcopyrite, tetrahedrite, galena, and sphalerite occur mainly in the siliceous lenses, either disseminated or in small veinlets. Small fractions of an ounce of gold and variable amounts of silver occur with the sulphide minerals.

Work done in 1961 was directed to the development of the Lynx and Paramount areas and, to provide access to these workings, 5 miles of trails and 2½ miles of jeep and tractor road were built from the lake. In addition to the road and trail construction, the crew of eleven men completed 60 feet of trench and four diamond-drill holes totalling 689 feet of drilling on the Paramount zone, fourteen diamond-drill holes totalling 6,544 feet of drilling on the Lynx zone, and a detailed geological map embracing the three mineralized areas.

GREAT CENTRAL LAKE (49° 125° S.E.)*

Gold

Apex, Morning (Sileurian Chieftain Mining Company Limited) Company office, c/o Claude E. Hamilton, secretary-treasurer, 833 Rogers Building, Vancouver. Walter Eilers, president. The property comprises six Crown-granted and eleven recorded claims, including the former Apex and Morning groups, north of Doran Lake, between Sproat and Great Central Lakes, 26 miles north of Alberni. Commencing in August, a crew of three men completed 1,694 feet of diamond drilling in nine drill-holes.

TRANQUIL INLET (49° 125° S.W.)*

Gold

Tofino Mines Limited This property, 2½ miles north of the head of Tranquil Inlet is owned by Moneta Porcupine Mines, Limited, and is under option to W. E. McArthur, of Greenwood. In order to improve access to the property, the crew of four men reopened and in places rerouted the existing 3 miles of road from the base camp, 1 mile upstream from the mouth of Tranquil Creek, to the lower tram terminal below the

* By J. E. Merrett.

mine. At the mine it was reported that construction included a new approach to the ore-bin, a new roof on the mill building, two bunk-houses, and an assay office, and the assay office was fully equipped. Underground it was necessary to replace the ladders between the 1500 and 1700 levels and to rebuild some chutes. On the 1500 level 30 feet of drift was completed and a raise was started. On the 1700 level 50 tons of ore was mined for a mill test.

Iron-Copper-Gold

Tofino Inlet (Sun-West Minerals, Limited)

Company office, Tofino. Lorne Hansen, president. This company holds sixty-five recorded mineral claims encompassing the area around Deer Bay at the head of Tofino Inlet. A crew of five men using a TD-20 bulldozer was employed surface stripping five mineral showings of magnetite, bornite, and chalcopyrite. It was reported that the chalcopyrite, when accompanied by quartz, contained high values in gold and silver.

Kennedy Lake (49° 125° S.E.)*

Iron

Kennedy Lake (Noranda Mines, Limited (Kennedy Lake Division))

British Columbia office, 601, 1587 West Eighth Avenue, Vancouver 9; mine office, Ucluelet. F. E. Patton, property manager; J. Sadler, mine engineer. The operation of the property was turned over to the Kennedy Lake Division of Noranda Mines, Limited, by Noranda Exploration Company, Limited, on April 1st. The company owns or controls a large block of recorded mineral claims in the Draw Creek drainage basin between Maggie and Kennedy Lakes, 7 miles east of Ucluelet on the west coast of Vancouver Island. Access to the open pit is by 2½ miles of MacMillan, Bloedel and Powell River Limited logging-road from the shore of Kennedy Lake on the Alberni–Tofino road (Kennedy Highway), 14 miles from the Tofino–Ucluelet road.

A strong magnetic anomaly on Draw Creek (then known as Magnetic Creek) was reported by the Provincial Mineralogist in 1902 and by Einar Lindeman in 1908, but magnetite was not found. Recently E. Chase found a strong anomaly on Draw Creek by dip-needle, and in January, 1960, located nine covering claims. Western Ferric Ores Ltd. diamond drilled 1,184 feet in six holes and ran additional dip-needle traverses, then sold its interest in the property to Noranda Exploration Company, Limited, on May 15th. Diamond drilling was continued through 1961.

During 1961 Deeg & Yarrow Diamond Drilling Co. Ltd., diamond-drilling contractors, completed thirty-four AX holes totalling 20,220 feet of drilling. Kie Mine Co. Ltd., a wholly owned subsidiary of Peter Kiewit Sons Company of Canada Ltd., obtained the contract to prepare an open pit for mining of the iron ore, and removed 673,000 cubic yards of overburden, 1,478,000 cubic yards of bedrock, and stockpiled 40,000 tons of ore. The open pit was mined by conventional benching methods. A. Hill was project manager.

Draw Creek was diverted from the eastern part of the orebody. The timber-owners had in 1960 logged off the bottom and lower slopes of Draw Creek valley, including the pit site. Belliveau Enterprises Ltd. constructed 7½ miles of two-lane truck-road from the crushing plant at the quarry to the concentrator at the mouth of Toquart River on Toquart Bay. John Laing and Son, contractors, were erecting the crushing plant and the concentrator. The concentrator is designed to produce 700,000 long tons of iron concentrates per year. It has been located on tidewater to avoid pollution of Draw Creek and Maggie Lake. Adjacent to the concentrator,

* By G. E. P. Eastwood and J. E. Merrett.

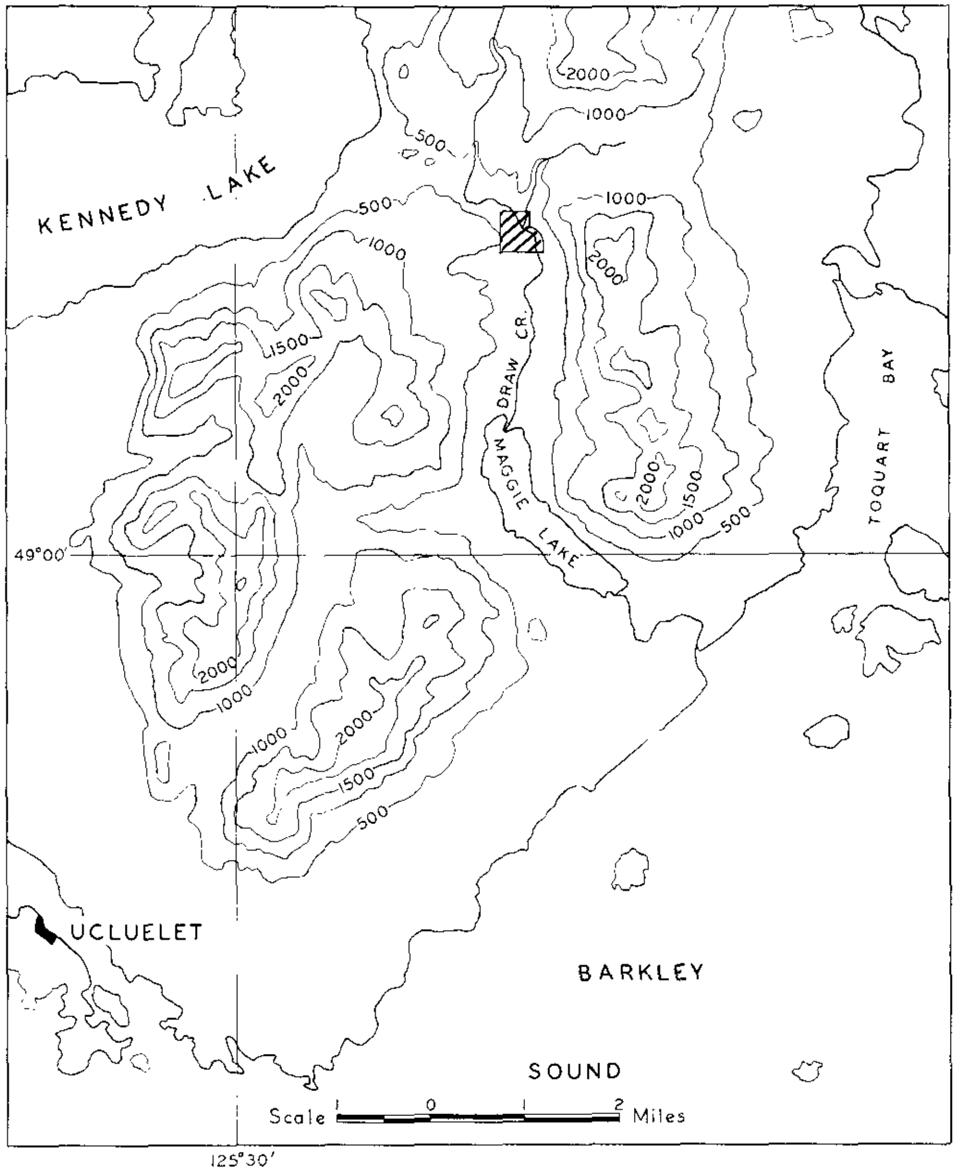


Figure 14. Index map of Kennedy Lake-Toquart Bay area. Showing location of Figure 15.

on Toquart Bay, Pacific Piledriving Co. Ltd. was constructing the dock and loading facilities. These facilities will make it possible to accommodate vessels of 45,000 tons capacity. The Noranda staff of fifteen was accommodated in a small trailer camp south of the pit and east of Draw Creek. Rock fill was laid nearby as foundation for a permanent office building. The Kie Mine staff and crew of 140 were housed in a trailer camp on the south shore of Kennedy Lake, about 5 miles from the pit. Belliveau and Laing established temporary camps farther west along Kennedy Lake. A permanent bunk-house and a cook-house for twenty-five men have been built on a Crown lease near the shore of Kennedy Lake. The company purchased twenty lots in the village of Ucluelet to provide sites for employee houses.

The area has a high rainfall, and vegetation is correspondingly lush. Between October 1, 1960, and September 30, 1961, the Noranda staff recorded over 300 inches of rain, even though the summer of 1961 was unusually dry. Snow is uncommon. Timber is generally large and underbrush tall and very thick.

The principal streams are Draw Creek, which flows southeast and south to Maggie Lake, and Redford Creek, which flows south to join Draw Creek opposite the north end of the pit. Draw Creek follows a relatively broad valley that has a low gradient southward from the pit. Creek elevation at the pit is between 250 and 275 feet, and the elevation of Maggie Lake is about 120 feet.

The topography varies from rolling to mountainous. East of Draw Creek a ridge rises steeply to 2,000 feet, locally to 2,600 feet, and 2 miles southwest of the pit another hill rises steeply to 2,300 feet. Within the first mile north, west, and southwest of the pit, however, the relief is relatively low and in detail is highly irregular. A thick deposit of gravel, sand, and less clay has been laid on the floor and lower walls of Draw Creek valley. Only on the steep slope of the ridge to the east are rock exposures abundant. The pit lies between two prongs of a low, east-trending bedrock ridge. One prong crosses Draw Creek just north of the pit, producing a short section of continuous outcrop, and passes beneath a gravel terrace on the east bank. The other prong plunges southeast beneath overburden at the crusher site. Relationships are such that the pit wall will be highest at the south end, against the south prong. Bedrock is sporadically exposed along the ridge, whereas to the north, east, and south it is about 99 per cent covered.

General Geology

The regional geology has not been mapped. Reconnaissances by Noranda Exploration and the Department of Mines and Petroleum Resources have merely indicated the principal rock types. In general, a large area southeast of the pit appears to be underlain mostly by quartz diorite and related rocks. Kennedy Lake appears to be underlain largely by massive, dark greyish-green volcanic rocks. Between these areas is a complex belt of volcanic rocks, limestone, minor argillite, and abundant but relatively small dioritic intrusions. The local structural trend is northeast, an anomalous direction for Vancouver Island.

Exposures in the pit in late August and early September, 1961, together with nearby outcrops, were mapped at 100 feet to the inch. They were not sufficient, however, even when supplemented by logging of core from twenty-seven drill-holes, to fully determine the relationships of the rocks or outline the structure. Figure 15 is a generalized plan of the rocks as then exposed, and serves as a reference in describing what is known of their distribution.

The rocks in the pit belong to a narrow belt that trends northeast between the large quartz diorite mass on the southeast and a smaller diorite body on the northwest. They include limestone, dark greyish-green andesite, light-coloured rocks thought to be largely tuffs, minor argillite, and numerous dykes that are probably apophyses of the quartz diorite. Drilling has shown that most of the area between the pit boundary and Draw Creek is underlain by variable thicknesses of magnetite at greater or lesser depth, but when the pit was mapped only small areas of this magnetite had been exposed.

Limestone

The limestone forms a relatively large mass, beginning about the middle of the pit and extending northeast far beyond the area of Figure 15. It is bounded on the northwest, southwest, southeast, and below by the light-coloured rocks, and is

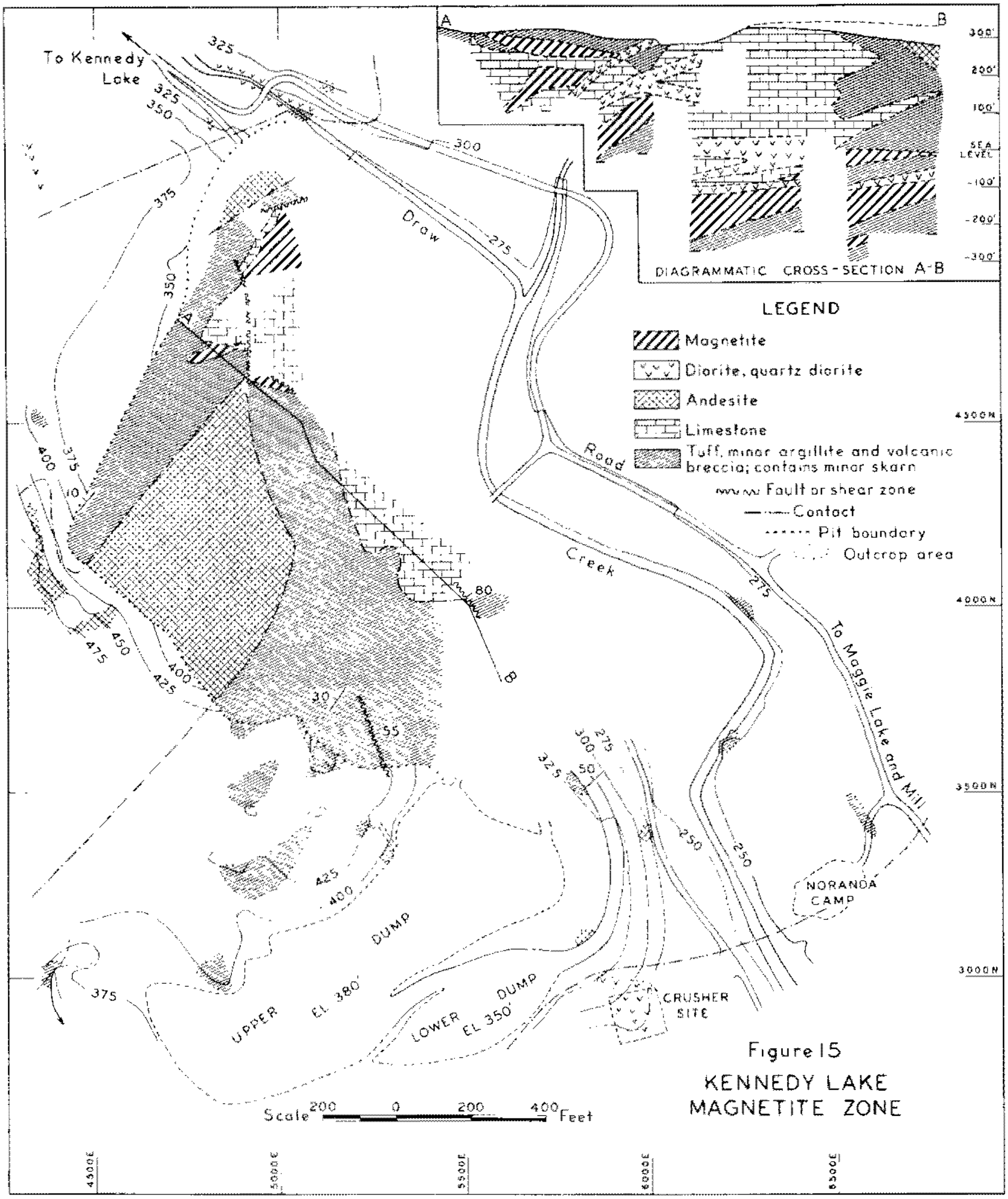


Figure 15

KENNEDY LAKE MAGNETITE ZONE

intruded by many dykes. Limited exposures of the limestone when the pit was mapped were largely of massive white rock, fine to medium grained, normally little altered but locally dolomitized, silicified, or serpentinized. This alteration is found principally along sheared zones; it is rare against dykes and magnetite. Locally on surface and more commonly in drill cores, the limestone is light to dark grey and banded. The occurrences of banding were too scattered to indicate the internal structure of the limestone. Relations between limestone and the light-coloured rocks are complex in detail, as indicated on Figure 15, and the over-all structure is not clear. In general the limestone has the form of a large irregular lens with tongues extending out into the enclosing rocks. It is believed to have undergone intense plastic deformation.

Tuffs

Light-coloured rocks lie beneath the limestone and on three sides of it. They are exposed in two general bands in the west part of the pit and extend southwest beyond the area of Figure 15. Drilling has shown that they also underlie andesite between the bands at depths generally less than 100 feet. Additional outcrops of these rocks occur north and southeast of the pit. They are mostly massive looking, but locally are markedly banded. In colour they range from white to light pink, to light and medium green or greenish-grey, and to vaguely mottled white, green, and red; more rarely they are light brown. The banded rocks are mostly white, pink, and pale green. The white and pale-coloured rocks, both banded and massive, are hard and brittle and resemble cherts. In thin-section, however, they are seen to consist dominantly of feldspar, with less amphibole and epidote, occasionally some pyroxene, and variable amounts of clinozoisite, sericite, and chlorite. Quartz forms veinlets with clinozoisite but is rare as a rock constituent. Light- and medium-green rocks contain proportionately more ferromagnesian minerals. Pink bands differ from the white only in having reddish-brown allophane dust disseminated through the feldspar. The rocks are fine grained to dense, the paler varieties being generally the finer grained. All show granular rather than interlocking texture. In addition, much of the white or cream-coloured rock, both banded and massive, contains angular and sub-rounded medium-sized grains of feldspar in the dense matrix, accentuating the detrital appearance of the rock. It is concluded that the paler varieties are feldspathic tuffs, and that much of the light- and medium-green rocks may be more mafic tuffs. The mottled rocks are sparingly scattered through the tuffs and do not appear to represent a definite horizon. They consist of angular but vaguely defined bodies, an inch or two across, of white and red rock in a medium-green matrix, and are thought to be modified volcanic breccias.

Alteration of the tuffs is not commonly apparent in outcrop or hand specimen, but is revealed in thin-section as a variable replacement of feldspar and amphibole by sericite, clinozoisite, chlorite, and serpentine. All stages in this alteration can be seen, from almost fresh tuff with only incipient sericite on the feldspar, through altered rock with remnants of the original minerals and relics of the original texture, to masses of sericite and clinozoisite. The distribution of alteration was not determined.

Small patches of dark-grey tuffaceous argillite are scattered along the southeast tuff band, both in the pit and to the southwest. Exposed boundaries of these patches are vague. The centre of one patch is calcareous, and another patch contains angular limestone fragments.

The internal structure of the tuffs is obscure. The only evidence is provided by three areas of banded tuff, indicated by symbols of attitude on Figure 15. In the northwesterly area about 20 feet of banded tuff is exposed above massive tuff.

Extensions were covered at the time of mapping. In the middle area, banded tuff occurs over a strike length and a width across strike of 250 feet and a vertical range of 80 feet. Extensions along strike were covered. Both up-dip and down-dip, the banded tuff appears to grade to massive tuff by fading of the colour differences between bands. The southeast area is exposed merely as a small rock cut along the haulage road. In each area the banding dips northwest, but the areas are too small and too isolated from each other to outline a significant segment of the structure; in view of the intense deformation that the limestone appears to have undergone, the structure in the tuffs is probably also complex.

Andesite

Massive dark greyish-green andesite occurs in the western part of the pit between the main tuff bands, and extends to the southwest. Additional exposures of massive andesite were found in the north part of the pit and southeast of the pit. Diamond drilling has disclosed short sections of this rock in limestone. In thin-section it is a confused, interlocking aggregate of andesine feldspar, amphibole, and minor quartz, epidote, and chlorite. The feldspar crystals tend to be large and lath-like, and the rock is sub-porphyritic. The groundmass is fine grained, but notably coarser than the tuffs. Some indistinct angular reddish patches, an inch or two across, were found along the margins of the main mass in the west part of the pit, but fragmental structures are generally absent. Andesite in limestone is almost certainly intrusive. Andesite in small exposures southeast of the pit may also be intrusive. But the andesite in the north and west parts of the pit is probably flow lava. Contacts with the tuffs, both on surface and in drill core, are gradational rather than sharply defined. The drilling has shown that tuffs underlie the andesite in the west part of the pit at depths generally less than 100 feet, and that the contact is nearly flat. When this flatness is considered in conjunction with the relatively great thickness of andesite revealed on the steep hillside west of the pit, an andesite intrusion appears improbable. Finally, the andesite is uniformly fine grained, a fact compatible with flow lava, but not with an intrusion the size of the main body, that should show some increase in grain size toward the centre.

Intrusive Rocks

A large stock or batholith lies southeast of the pit, and one outcrop of it is shown on Figure 15 at the crusher site. A smaller stock is exposed just northwest of the pit. Numerous dykes cut the rocks in the pit, but none was large enough to show on Figure 15. All of the bodies are massive. The southeasterly mass is coarse grained and mottled light grey and greenish-black to black; it has a broad chilled margin that is greenish-grey and non-porphyritic. The northwesterly stock is mostly medium grained and medium grey to greyish-green, but locally is porphyritic, light grey, and siliceous looking. The thicker dykes have coarse-grained cores, that closely resemble the southeast mass, and broad marginal zones of light-brown porphyry. Thinner dykes are entirely porphyritic or have brown aphanitic margins. The thinnest dykes, 1 to 5 feet thick, are entirely aphanitic. They are distinguished from the fine-grained andesite dykes by being brown rather than green. The most abundant mineral in the intrusions is plagioclase, predominantly andesine but locally grading to oligoclase or labradorite. Potash feldspar was not seen. Quartz ranges from *nil* to 15 per cent. The ferromagnesian minerals are amphibole, biotite, and chlorite, locally also pyroxene, clinozoisite, or epidote. Magnetite, hematite, sphene, apatite, and pyrite are accessory. The rocks are mostly quartz diorite and diorite.

Skarn

Garnet-epidote skarn is common in tuffs in drill core for a few tens of feet above and below magnetite, but is scarce elsewhere. It has replaced many of the andesite dykes in limestone, but is rare in the limestone itself, and has not been found in the main bodies of andesite. Only a few veinlets have been found in porphyry dykes. The few occurrences of skarn in tuff distant from ore consist of fracture veinlets of garnet and epidote, with an occasional associated massive pocket, scattered through volumes of tuff a few tens of feet across. Near ore the skarn is more or less massive, diminishing above the ore zone as pockets and veinlets in tuff. Below ore, skarn commonly continues to the bottoms of the drill-holes, but this distance is only a few tens of feet, and therefore the full extent and the distribution of skarn at depth are unknown. Locally the skarn contains a little coarse pyroxene, and small pockets of massive diopside occur in the magnetite.

Structure

The rock sequence and fold structure are uncertain. The limestone appears to overlie the tuffs and may at one time have occupied a syncline that plunged northeast, but it has flowed extensively, and other explanations are possible. If the andesite in the west part of the pit is a flow or flows, then it would appear to occupy an open syncline and to rest on tuffs. Much more work will have to be done, particularly northeast and north of the pit, before the relations can be clarified.

The rocks have been much broken. The widest shear and gouge zones are indicated on Figure 15. Additional shear zones are exposed in lifts between benches or are suggested by sections of crumbly drill core. Tight fractures are common, and some that transect banded tuff were seen to represent a few feet of movement, but on most of the breaks the amount and direction of movement, if any, is not apparent. Drill-hole sections such as Figure 15 suggest that ore and limestone may have been downthrown on the east side of a fault striking north-northwest through the middle of the pit, yet little surface evidence of such a fault was found.

Age

The age of rocks and ore is not known. No evidence of age was obtained from the Kennedy Lake area, and any suggestions as to the age of the rocks have to be based on lithologic comparisons with other areas on Vancouver Island. Most of the quartz diorite and diorite intrusions on the Island are known or presumed to be of Upper Jurassic age, but a few are known to be Tertiary. The Upper Triassic Quatsino limestone has been traced southeast to Nootka Sound, and observation of scattered exposures of limestone from there to Kennedy Lake and Draw Creek has led to a suggestion that all are Quatsino. However, it seems at least equally likely that the limestone on Draw Creek is Permian. Quatsino equivalents on the southern part of the Island tend to be thin and discontinuous, in contrast both with the Permian limestones and the limestone on Draw Creek, and the tuffs associated with the limestone on Draw Creek resemble descriptions of Sicker tuffs from Cowichan Lake much more closely than they do rocks associated with the Quatsino limestone.

Ore

The magnetite occurs in an irregular zone that tends to straddle the lower contact of the limestone but extends southwest and southeast into tuffs beyond the limestone. In general the zone reaches its greatest elevation in the northwest and is lowest in the southeast, but a definite strike and dip cannot be given. When the pit was mapped, only the northwest edge of the zone had been exposed, and knowledge of the zone has had to be built up mostly from study of diamond-drill core. The holes have been drilled on a 100-foot grid spacing through most of the pit, and more closely at the north end. This spacing is generally too wide to outline the occurrence of magnetite in any detail. In some parts of the pit there are clearly two or more bands or lenses of magnetite, one above the other, and separated by limestone or tuff. In other parts there appears to be a single band or lens, commonly containing tongues or inclusions of tuff or skarn. Elsewhere it is not clear how the drill-hole intersections should be related. Figure 15 illustrates the different situations. Over considerable areas the bands or lenses are flat or dip gently, but in several places there are abrupt changes in elevation of ore between drill-holes. These changes could be explained equally well by local steepening of the dip, by faulting, or by the pinching-out of an ore lens at one elevation and the start of a separate lens at another elevation. Such a change in elevation along a more or less straight line has led to the suggestion of the fault mentioned above. However, it does not appear that enough deep holes have been drilled west of the supposed fault to prove that deeper ore does not occur there. Indeed, it is not certain that any of the holes logged have reached the base of the mineralized zone. The best-known part of the zone is in the north end of the pit, where a single pod of magnetite was partly exposed and has been outlined by close drilling. The pod may be likened to a much-battered cigar; the cross-sectional shape changes rapidly along it, now square, now diamond shaped, now flat tabular, now steeply dipping tabular, etc. The width and depth are of the order of 200 feet, and the length is about 500 feet. The pod plunges at both ends. The upper part is in limestone, the lower part in tuff or, at the south end, resting on a diorite dyke.

The relationship of magnetite to diorite and porphyry dykes is unclear. Magnetite is commonly found above and (or) below a dyke, but it is not apparent whether it was deposited preferentially along the dyke contacts or whether it has been intruded by the dyke. The dykes do not contain veinlets of magnetite, and the few grains observed may be normal accessories in the diorite.

On the other hand, the magnetite is clearly later than the other rocks. Veinlets of it traverse andesite dykes and even the main mass of andesite. Veinlets and masses cut tuff and skarn. A few veinlets occur in limestone, although in most places contacts are smooth and gradational over a few inches. In or against limestone, magnetite contains pockets and veinlet-like bodies of calcite, and in exposures in the north part of the pit the magnetite is earthy and friable, suggesting surface leaching of intergranular calcite; these features probably result from incomplete replacement of the limestone by magnetite, followed by recrystallization of the calcite. In most drill-hole intersections the magnetite is uniformly massive, fine grained, and black.

Sulphide minerals are rare, and do not appear to be closely associated with magnetite or skarn. Pyrite is widely but very sparingly distributed. Pyrrhotite was found with minor magnetite in fresh tuff at the south rim of the pit. Small pockets of chalcopyrite were encountered in a few drill-holes, both in fresh andesite and with magnetite in skarn. A little arsenopyrite was found in magnetite in one drill-hole.

[References: Fyles, J. T., *B.C. Dept. of Mines,* Bull. 37, 1955, pp. 14–19; Hoadley, J. W., *Geol. Surv., Canada,* Mem. 272, 1953, p. 17; Lindeman, Einar, *Mines Branch, Ottawa,* Publ. No. 47, 1910; Ann. Repts., *Minister of Mines, B.C.,* 1902, 1960.]

BARKLEY SOUND (48° 125° N.E.)*

Iron

Tzartus Island (Empire Development Company Limited)

Company office, 736 Granville Street, Vancouver 2. This company optioned one recorded and seven Crown-granted claims on a steep hillside above Clifton Bay on the east coast of Tzartus Island. According to a report made available by the company, the mineral occurrence is in a gently east-dipping pile of bedded sediments and volcanics, chiefly of tuffaceous origin. To the west, granodiorite is in contact with these rocks while diorite occurs to the northeast. Magnetite and skarn occur in the tuffaceous volcanics, with numerous dykes and sills interrupting the continuity of the mineralization.

Dip-needle surveying and 2,270 feet of diamond drilling indicated a triangular-shaped layer of magnetite lying at or near the surface and not more than 25 feet thick. The base of the triangle extends along the west side of the ridge approximately at 830 feet elevation, with the apex to the east below an adit at 720 feet elevation.

An average of three persons was employed from January to mid-July.

Sarita River (Empire Development Company Limited)

Company office, 736 Granville Street, Vancouver 2. This company optioned seven Crown-granted and two recorded claims on the south side of Sarita River approximately 1½ miles from the river mouth. A geological survey indicated a contact between white crystalline limestone and quartz diorite close to the north boundary of the property and a parallel diorite-volcanic contact through the middle. A dip-needle survey disclosed an anomalous area in the vicinity of the Pachena Creek swamp adit on the Indian reserve. As not further indications were obtained, work was discontinued.

COWICHAN LAKE (48° 124° N.E.)*

Copper

Alpha, Beta, etc. (Albeta Mines Ltd.)

Company office, 764 Cowichan Lake Road, Lake Cowichan. Allan H. Harder, president and managing director; George E. Apps, general manager. The property consists of three Crown-granted and twenty-three recorded mineral claims and fractions along the east fork of Robertson River, 7 miles south of Mesachie Lake. Access from the end of the Forestry Department road up Robertson River is by way of four-fifths mile of newly constructed road and a bridge over the river.

It is reported the mineralization is chalcopyrite, with varying amounts of magnetite and minor values in gold and silver occurring in a garnetized skarn zone in altered, shattered volcanics lying adjacent to a granodiorite intrusive mass. Preliminary and detailed magnetometer surveying indicated and outlined two anomalous areas south of the main mineral outcrop at the junction of Long Creek and Robertson River.

In addition to the surveying, a crew of four men completed 97 feet of diamond drilling in one hole and 2,000 feet of trenching to an average depth of 20 feet on the skarn zone.

* By J. E. Merrett.

Shawnigan Lake (49° 123° N.W.)*

Iron

Willoron

This group of fifteen recorded claims is owned by Thomas Kirk and associates, 1143 Lockley Road, Victoria. The property is on Mount Wood, between Shawnigan Lake and Saanich Inlet, just north and west of Oliphant Lake, at an elevation of about 1,600 feet. A jeep-road leads 2 miles from No. 1 highway to Oliphant Lake and the property.

Showings of iron and copper mineralization in the vicinity are described in the Annual Report for 1902, page 221, under " Malahat Mountain," and the geology is discussed in Memoir 96, Geological Survey of Canada, page 271 *et seq.* The regional geology is illustrated on Map 42A, accompanying Memoir 96.

The rocks are a complex of Wark and Colquitz gneisses and possibly younger non-gneissic intrusives enclosing northwestward-trending lenses of Sutton limestone and garnet-diopside-epidote skarn. Magnetite is the principal metallic mineral. It occurs as lenses and fracture fillings in all the rock types, but in the main it is associated with the limestone lenses. Pyrrhotite, pyrite, and chalcopyrite occasionally are present in minor amounts.

The workings consist of thirteen open cuts, three old adits, and a shallow shaft. A dip-needle survey was made in 1961 by A. E. Aho, and a copy of the resulting map was made available to the writer by Mr. Kirk.

The principal showings, as numbered by the owners, are described from east to west.

No. 12 showing, on Willoron No. 15 mineral claim, consists of two veins of magnetite about 40 feet apart striking nearly north-south and dipping 75 to 80 degrees westward. The westerly vein is about 10 feet wide, the easterly one about 20 feet. About 50 feet to the north of the easterly vein, magnetite is exposed for a distance of about 20 feet, but the dip and strike are not apparent. The wallrocks are skarn.

No. 13 showing is on the south side of Willoron No. 6 mineral claim. A 10- by 10-foot pit exposes massive magnetite overlying skarn with a steep dip southward. At about 100 feet southward, magnetite is again exposed and is overlain by skarn. Results of the dip-needle survey suggest that the intervening distance may be underlain by magnetite.

No. 3 showing, on Willoron No. 13 mineral claim near its north boundary, is in an old adit and shallow shaft. It is a magnetite vein 7 feet wide, enclosed in diorite walls and dipping 80 degrees southward.

No. 4 showing, near the south side of Willoron No. 3 mineral claim and 300 feet northeast of No. 3 showing, is a magnetite-skarn contact exposed along a trench for a distance of 15 feet. The contact dips 40 to 45 degrees southwestward. The full width of the magnetite is not exposed.

No. 5 showing, on the west side and toward the north boundary of Willoron No. 3 mineral claim, is made up of stringers of magnetite in a fracture zone in skarn, dipping about 80 degrees southward. Limestone is exposed nearby.

No. 6 showing, on Willoron No. 1 mineral claim, is similar in character to No. 5 but is not in line of strike with it.

No. 7 showing, on Willoron No. 1 mineral claim 300 feet northeast of No. 6 showing, consists of two magnetite veins 6 and 3 feet wide, respectively, separated by 10 feet of skarn and silicified limestone. The zone dips steeply southward, and the footwall is diorite. The magnetite here shows appreciable pyrrhotite and chalcopyrite, in contrast to the other showings in which sulphides are fairly sparse.

* By N. D. McKechnie.

No. 8 showing, toward the east corner of Willoron No. 10 mineral claim, is a 5- to 6-foot zone of magnetite in limestone in a 10-foot adit. The magnetite noses out in the adit on a westerly plunge.

No. 10 showing, near the west corner of Willoron No. 2 mineral claim, is a small lens of magnetite in a short adit. At the east end of the magnetite lens is a smaller one containing pyrrhotite, pyrite, and chalcopyrite.

Continuity between any of the showings has not been established. The distribution of anomalies on the dip-needle map suggests that the magnetite is in lenses of limited lateral extent.

JORDAN RIVER (48° 124° S.E.)*

Copper

Sunloch and Gabbro (Cowichan Copper Co. Ltd.) Company office, 620 Howe Street, Vancouver 1; mine office, River Jordan. Oswood G. MacDonald, president; J. R. Billingsley, mine manager. An operating lease was obtained by Cowichan Copper Co. Ltd. from Sunro Mines Limited (controlled by The Consolidated Mining and Smelting Company of Canada, Limited) to remove ore from the Cave, Central, and River ore zones.

The rehabilitation of the surface plant and Sunro or main adit commenced in January and was completed in March. In order to improve underground ventilation, a vertical raise was driven with a raise platform from near the face of the Sunro adit to the surface. On completion of the raise and in preparation for the installation of the mill and crushing plants underground, additional drifting, crosscutting, raising, and chamber-slashing was done. The amount completed was as follows: Total drifting, 700 feet; total crosscutting, 140 feet; total raising, 925 feet; crushing-chamber, 74,600 cubic feet; mill-room chamber, 143,000 cubic feet; mill workshop chamber, 11,200 cubic feet; and fine-ore bin, 35,600 cubic feet.

A compressor-house, housing two 1,000-cubic-feet-per-minute electrically driven compressors, was erected on the surface at the British Columbia Electric Company penstock intake, and 2,000 feet of 8-inch water and air lines were installed from the power-house to the bottom of the ventilation shaft. The 2,300-volt power-line was extended 1,100 feet to the portal; 2,000 feet of 12,000-volt power-line and an underground substation were completed.

In the underground crushing plant a 40- by 48-inch Buchanan jaw crusher, a 36-inch Traylor pyrosphere, and a 48-inch Telsmith pyrosphere were installed and part of the conveyor system was completed. In the mill-plant area three mill foundations were poured, two mills installed, and most of the concrete floor poured.

The construction of mine and general offices, warehouse, and dry-house has been completed near the main portal.

At the year-end a total of seventy men was employed, of whom forty-five were employed underground.

* By J. E. Merrett.

REPORTS ON GEOLOGICAL, GEOPHYSICAL, AND GEOCHEMICAL WORK

Reports accepted to the end of 1958 for credit on assessment requirements for properties held under the *Mineral Act* and the *Placer-mining Act* since January 17, 1947, and reports on geochemical surveys accepted since April 6, 1951, are listed in the Annual Report for 1958. Starting with 1959, each Annual Report lists the reports accepted during the current calendar year. A copy of each report may be examined in the office of the Mining Recorder for the mining division in which the property is located. A second copy of each report is filed in the office of the Chief of the Mineralogical Branch, Department of Mines and Petroleum Resources, Victoria.

The property name is that which appears to be in most common use. It is not feasible to list all the claim names in each property. The author of each report is given and the principal for whom the report was written.

Reports Credited for Assessment, 1961

Geographic Position		Property / Owner or Principal / Author of Report / Date of Submission of Report	Kind of Work		
1° Quadr.	Quarter		Geological	Geophysical	Geochemical
49° 115°	N.W.	Special Placer-mining Lease 906 H. R. Morris. W. H. Myers. December 16, 1961.	×	×	—
49° 115°	S.W.	Mark Creek Group Reeves MacDonald Mines Limited. Roy A. Anderson. September 7, 1961.	—	—	×
49° 118°	N.W.	Amcana Group Amcana Gold Mines Limited. A. R. Allen. September 7, 1961.	—	×	—
49° 118°	S.E.	Raven and Crow Niagara Mining & Development Corporation Ltd. V. B. Bjorkman. May 11, 1961.	—	×	—
49° 119°	N.E.	Matt 1–75 Kennco Explorations (Western) Limited. C. S. Ney. December 1, 1961.	×	—	—
49° 120°	S.W.	Aku Group Kennco Explorations (Western) Limited. J. A. Gower and J. M. Anderson. May 17, 1961.	—	×	—
49° 120°	S.W.	Whip and Saw Groups Texas Gulf Sulphur Company. W. R. Bacon. July 18, 1961.	—	×	—
49° 124°	S.E.	Nel 1 and Nel 1 Fraction C. Campbell. C. F. Millar. June 9, 1961.	×	×	—
49° 125°	N.W.	Wildcat Nos. 1–6 Gulf Equipment & Finance Co. Ltd. H. H. Cohen. June 16, 1961.	—	×	—
50° 117°	N.E.	Silver Chief Larrie B. York and Loyd York. H. C. B. Leitch. May 5, 1961.	×	—	—

REPORTS CREDITED FOR ASSESSMENT, 1961—*Continued*

Geographic Position: 1° Quadr.	Geographic Position: Quarter	Property / Owner or Principal / Author of Report / Date of Submission of Report	Kind of Work: Geological	Kind of Work: Geophysical	Kind of Work: Geochemical
50° 120°	N.W.	Betty Lou and Lou Groups Canex Aerial Exploration Ltd. A. Allan. May 24, 1961.	...	×	...
50° 120°	S.W.	Cana, Bon, Call, Royal, Ezz, Pal, and Eon Royal Canadian Ventures Ltd. C. Warren Hunt and Virgil R. Chamberlain. October 2, 1961.	×	×	...
50° 120°	S.W.	Mint Group W. D. Barr. M. K. Lorimer. June 15, 1961.	...	×	...
50° 120°	S.W.	Peel Groups "A," "B," and "C" Peel Resources Limited. Franklin L. Price. November 22, 1961.	...	×	×
50° 120°	N.W.	Ralph 1–14 Harvey H. Cohen. Harvey H. Cohen. July 11, 1961.	...	×	...
50° 120°	S.W.	Ron 1–8 N. H. McDiarmid. Franklin L. Price. November, 1961.	...	×	×
50° 120°	N.W.	Ann 3 to 8 and Rover 1 and 2 Salmo Prince Mines Limited. L. B. Gatenby. January 30, 1961.	...	×	...
50° 120°	S.W.	Shot Claim Group Donald S. Paterson. Roderick Macrae. December 29, 1960.	...	×	...
50° 120°	N.W.	Soo 1 to 32 and Bare 1 to 4 Thomas Goodrick Wilson. H. Cohen. February 17, 1961.	...	×	...
50° 121°	N.W.	K.B. and Lodge Groups Northlodge Copper Mines Limited. L. B. Gatenby. January 25, 1961.	...	×	...
50° 121°	N.W.	Mox, C.N., and SB Groups Trojan Consolidated Mines Ltd. L. B. Gatenby. January 9, 1961.	...	×	...
50° 121°	S.E.	Shot, J.J.M., Nora, and Vulgar Consolidated Standard Mines Limited. C. W. Faessler. January 4, 1961.	...	×	...
50° 121°	S.E.	V.L. 14–21 Northwest Ventures Ltd. R. H. Seraphim. February 24, 1961.	...	×	...
50° 122°	N.W.	Owl Creek Gold Mines Nos. 1–4 Owl Creek Gold Mines Limited. Allan P. Fawley. June 5, 1961.	×	...	...
50° 122°	N.W.	Tenquille Group Phelps Dodge Corporation of Canada, Limited. D. C. Malcolm. September 25, 1961.	×	...	...
50° 127°	S.E.	Little Lake Group H. Clements and H. F. Benjamin. L. B. Gatenby. June 19, 1961.	×	×	...
50° 127°	N.W.	New Handy Andy R. P. Mason. John Lamb. December 19, 1961.	×	...	...

Reports Credited for Assessment, 1961—*Continued*

Geographic Position		Property Owner or Principal Author of Report Date of Submission of Report	Kind of Work		
1° Quadr.	Quarter		Geological	Geophysical	Geochemical
51° 123°	S.W.	Jo Group Phelps Dodge Corporation of Canada, Limited. J. H. Ratcliffe. September 25, 1961.	—	×	—
53° 122°	N.E.	Axe Nos. 69 to 72 Totem Minerals Ltd. Roderick Macrae. June 1, 1961.	—	×	—
54° 125°	S.E.	Bell Claim Group Carl L. Erickson. Roderick Macrae. December 20, 1961.	—	×	—
54° 125°	S.E.	Elk Nos. 1 to 12 Totem Minerals Ltd. Roderick Macrae. November 14, 1961.	—	×	—
55° 124°	N.W.	Duckling, Dorothy, and Eldor Groups Kennco Explorations (Western) Limited. R. W. Stevenson. September 25, 1961.	×	—	×
55° 125°	N.E.	Dorel, Lorrex, and Lorraine Kennco Explorations (Western) Limited. R. W. Stevenson. November 29, 1961.	×	—	×
55° 125°	N.W.	Fore 1 to 24 Fort Reliance Minerals Limited. G. T. Warren. January 16, 1961.	×	—	—
55° 125°	N.E.	Valley Group Kennco Explorations (Western) Limited. R. W. Stevenson. December 5, 1961.	—	—	×
55° 129°	N.W.	R.A.F. Nos. 1 to 3 Angelo Bugnello. R. A. Knutson. March 21, 1961.	×	×	—
56° 130°	S.E.	Adell and Seabee Groups Granduc Mines, Limited. G. W. H. Norman. February 3, 1961.	—	×	—
56° 130°	S.E.	Fox and Ox Groups Granduc Mines, Limited. G. W. H. Norman. April 7, 1961.	×	×	×
56° 130°	S.E.	Har Groups Granduc Mines, Limited. G. W. H. Norman. April 7, 1961.	×	×	—
56° 130°	S.E.	Max Group Granduc Mines, Limited. G. W. H. Norman. April 7, 1961.	×	×	×
56° 130°	S.E.	Mineral Lease No. 12 Newmont Mining Corporation of Canada Limited. D. A. Davidson. October 16, 1961.	×	—	—
56° 130°	S.E.	Queen Group Granduc Mines, Limited. G. W. H. Norman. January 17, 1961.	—	×	—
56° 130°	S.E.	Red, Tay, and Ted Groups Granduc Mines, Limited. G. W. H. Norman. April 7, 1961.	×	×	—
57° 131°	S.E.	Buy and Hab Groups Kennco Explorations (Western) Limited. D. A. Barr. September 19, 1961.	×	—	—

REPORTS CREDITED FOR ASSESSMENT, 1961—*Continued*

Geographic Position: 1° Quadr.	Geographic Position: Quarter	Property / Owner or Principal / Author of Report / Date of Submission of Report	Kind of Work: Geological	Kind of Work: Geophysical	Kind of Work: Geochemical
57° 131°	S.E.	G.C. Group Kennco Explorations (Western) Limited. D. A. Barr. September 20, 1961.	—	—	×
57° 131°	S.E.	G.C., Hab, and Buy Groups Kennco Explorations (Western) Limited. C. C. Kamm. August 23, 1961.	—	×	—
57° 131°	S.E.	G.C., Hab, and Buy Groups Kennco Explorations (Western) Limited. McPhar Geophysics Limited (Halloff and Bell). September 20, 1961.	—	×	—
57° 131°	S.E.	G.C., Hab, and Buy Groups Kennco Explorations (Western) Limited. H. W. Fleming. September 21, 1961.	—	×	—
58° 125°	N.W.	Pat and Pat No. 1 Harold R. Dicconson. James P. Elwell. January 5, 1961.	×	—	—
58° 131°	S.E.	Kid 1–12 Kennco Explorations (Western) Limited. D. A. Barr and E. A. Lawrence. May 9, 1961.	×	—	×
58° 132°	S.E.	Nan Group Totem Minerals Ltd. Roderick Macrae. December 20, 1961.	—	×	—
59° 130°	N.E.	Silvertip and Extention Group Peter Timar, Andrew Meszaros, Andrew Zborovsky. E. P. Chapman, Jr. June 9, 1961.	—	×	—
59° 130°	N.E.	Silvertip Group Andrew Zborovsky. P. C. Halloff and R. A. Bell. August 1, 1961.	—	×	—

Placer

CONTENTS

JADE IN BRITISH COLUMBIA*

Widespread interest has developed over the past few years in the cutting and polishing of minerals and rocks for pleasure and profit. This has led to a lively search for jade, which, due as much to the magic of the name as to the appeal of the material itself, is a rock now greatly in demand. The occurrence of alluvial jade boulders in the vicinity of Lillooet has resulted in the establishment of an active market for jade there. The widespread occurrence of the material in fair abundance has led to the present investigation, which it was hoped might give some indication of the bedrock source. The finding of new material is rapidly slowing down, and it is possible that very shortly the discovery of a jade boulder or cobble might become a rarity. Consequently, the discovery of commercial jade in place would be extremely important to the local trade, now dependent on boulders found along the river beds.

A measure of the interest in jade is given by the fact that in the past ten years and mostly in the last five it is estimated that considerably more than 100 tons of jade in the form of alluvial boulders has been removed from the lower Fraser River and certain of its tributaries. It is also estimated that about 50 tons has been sold in small amounts to lapidaries in Canada and the United States and in bulk shipments of larger amounts to dealers in Canada, the United States, West Germany, and China.

The price that the jade commands depends upon its quality, which is governed very largely by its colour and its freedom from flaws, such as fractures or the presence of objectionable minerals such as magnetite. A very large amount of the jade has been sold at prices of from 50 cents to $1 per pound; better than average individual boulders or cut slabs may command a price of from $2 to $5 a pound, and exceptional material, of which there is very little, will fetch a price of $10 a pound or more.

Jade occurs in British Columbia as alluvial boulders on parts of the Fraser River and certain of its tributaries and on Wheaton (Boulder) Creek at the head of Turnagain River. The jade along the Fraser River was extensively used by the Salish Indians of the area, chiefly for making cutting-tools rather than for personal adornment. It was the strength and toughness of the material and its ability to hold an edge that was recognized by them as making the jade superior to other rock for their purpose. In addition to the tools of early-day use, they made larger artifacts which were never used, but which, because of the labour involved in making them, were valued as " property pieces " which gave evidence of the wealth of the owner. The Indians along the lower Fraser River found the jade boulders and cut and worked them in their own way for many hundreds of years, and it was not until white traders of the last century introduced superior iron tools that the working of jade by the Indians ceased. The value of the Fraser River jade must have been well known to the native peoples because jade artifacts from the Fraser River were possessed by tribes of the Mainland Coast and Vancouver Island as well as by tribes of the Interior. The superiority of jade tools over others is shown by the fact that an adze blade 2 to 3 inches long was valued amongst the Tlingit at from one to three slaves.†

After the first influx of placer-miners from California in 1858, many of the bars along the Fraser and Bridge Rivers were reworked by Chinese miners in subsequent years. The story is current that the Chinese placer-miners recognized the jade boulders amongst the many that they were continually handling, and that ship-

* By Stuart S. Holland.
† Emmons, p. 18 (*see* list of references).

ments of jade to China were made in the years before 1900. It has not been possible to substantiate this rather interesting incident in the history of the Fraser River jade.

The present renewal of interest in the Fraser River jade began somewhat more than ten years ago when C. J. Hallesey, now retired in Kelowna but for many years a resident of Lytton, began collecting jade as a pastime. He and the late Captain Duncan, an enthusiastic jade collector, spent much time along the rivers. Hallesey's enthusiasm and interest was communicated to several of the local residents, who subsequently have built up small businesses dealing in jade. In the past five years the demand for jade by collectors and " rock hounds " has increased tremendously. A satisfactory price range is now established which makes it financially attractive for many of the local residents, Indian and white alike, to become part- or full-time jade hunters, collectors, polishers, and sellers.

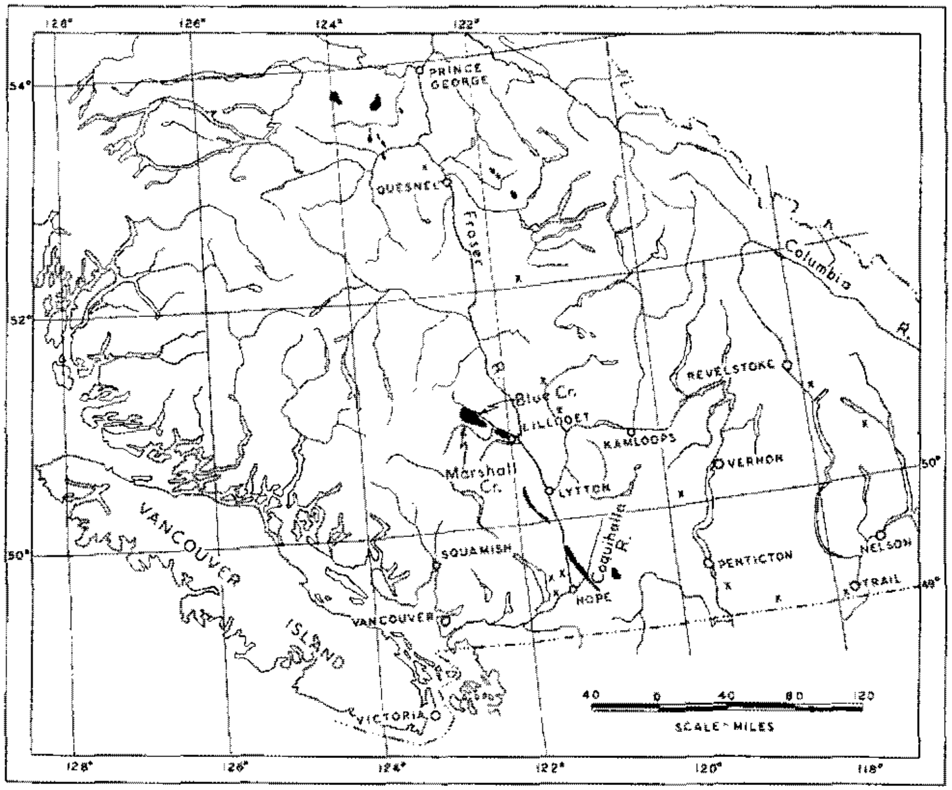


Figure 16. Index map of southern British Columbia showing main areas of serpentinite and serpentinized ultrabasic rock. Crosses mark small areas of serpentinite.

Jade boulders have been found along the bars of the Fraser River from as far downstream as Hope and upstream as far as the mouth of the Bridge River, and along the Bridge River almost to Mission Dam. Jade has also been found up Marshall Creek for at least 2 miles, along the Yalakom River as far as the mouth of Blue Creek, and found along Coquihalla River to the mouth of Dewdney Creek.

The right to mine alluvial jade is acquired under the *Placer-mining Act*. Many of the bars along the Fraser River below Lillooet are open to location, but the Bridge River, for about 18 miles upstream from its junction with the Fraser to Antoine Creek, flows through Indian Reserve land on which trespass is forbidden.

From Antoine Creek up to and beyond Hell Creek the river is held by placer-mining leases. As a consequence the ground available for casual collecting by "rock hounds" is restricted to parts of the Fraser, Yalakom, and Coquihalla Rivers and may not be of the best.

The jade occurs as pebbles, cobbles, and boulders of a few tens of pounds to as much as several tons in weight. The largest jade boulders seen were on Marshall Creek, about 1½ miles above its mouth. The largest of them is estimated to be about 10 tons weight, and several of 3 to 5 tons are present. It is reported that a boulder approximately 20 tons in weight was found in the lower canyon of Marshall Creek and broken up in 1960. There seem to have been concentrations of large jade boulders of a ton or more in weight on the Bridge River near Hell Creek and on the Bridge River downstream from the Horseshoe Bend. A boulder weighing about 800 pounds is known to have come from the Yalakom River. Boulders found on the Fraser River are considerably smaller in size, mostly in the range of several tens of pounds weight, but many of the finest quality have been found there.

The jade, as represented by material currently being found as well as by the material worked in the past by the natives, varies considerably in both colour and texture. The prevailing green ranges from light to dark and in shades of yellow green, olive green, greyish green, and dark spinach green with occasional small pieces or areas of better colour that might be described as leek green or sprout green. The colour invariably is in the yellow-green register; emerald greens are rarely, if ever, seen. Some very pale grey to white jade has been seen, but no true black, brown, mauve, pink, yellow, or other unusual colours have been observed.

Commonly there is a colour variation in any one piece, either between the surface of a boulder and the interior owing to the development of a dark-brown to black skin by oxidation of the ferrous iron or on an interior surface owing to slight mineralogical variations. Darkening of the jade through oxidation may penetrate to the interior of boulders along fracture or cleavage planes.

The jade from the Fraser and Bridge Rivers is almost wholly nephrite. No jadeite has been identified, and the illustration of a jadeite pebble by Emmons* is probably a misidentification based on the specimen's specific gravity of 3.35. The material more than likely is vesuvianite (specific gravity 3.35–3.45), which is known to occur at the head of Kwoiek Creek. The properties of nephrite which commonly can be used for identification are that it is subtranslucent and its specific gravity is approximately 3.0. The average specific gravity of a considerable number of samples ranging from 2.93 to 3.08 was found to be 2.99. The nephrite in very large part is peppered with small individual grains or aggregates of magnetite and occasionally chromite. The magnetite not only creates spots or dark areas on polished surfaces, but also undercuts so that the appearance and value of the polished material is reduced. Variations in specific gravity probably are more the result of magnetite contamination than of mineralogical variation.

In microscopic examination the nephrite is seen to consist very largely of bundles and sheaves of minute fibres of tremolite intergrown in a very characteristic felt-like texture. It is this nephritic fabric that makes the jade so tough. In some specimens a preferred orientation of the fibres results in a slight foliation that is discernible in hand samples. The tremolite, which is colourless in thin-section, varies somewhat in composition, chiefly in its content of ferrous iron, ranging from 3.6 to 5.4 per cent,† but it is this variation in iron content which seems to affect

* Emmons, G. E., "Jade in British Columbia and Alaska," Monograph No. 35, Museum of the American Indian, Heye Foundation, p. 16, 1923.

† Harrington, p. 64.

Jade boulders and diamond saw at E. Osterlund ranch, Yalakom River.

Close up of 24-inch diamond saw in operation.

the depth of colour of the nephrite in specimens. Jade samples from Coquihalla, Fraser, Bridge, and Yalakom Rivers and Marshall Creek are significantly alike in thin-section, showing only slight variation in amount of alteration to chlorite and in variation in grain size. In some thin-sections chlorite appears in irregular and occasionally lens-shaped areas of alteration in which the nephritic texture is retained. Specimens comprising tremolite fibres of greater length, a high percentage of which are in parallel orientation, could be called semi-nephrite, a term used by Turner* to describe comparable material from the South Island of New Zealand.

Some specimens which locally are called " intestinal jade " consist of intricately folded layers of pale greenish-grey nephrite in a matrix of darker-coloured nephritic material. Others comprising aggregates of nephrite nodules and lenses in a darker foliated matrix possibly represent a more advanced stage of deformation than " intestinal jade." In no instances, however, has jade of good quality been observed in this form.

Diopside is a constant but variable constituent of all the jade examined. The diopside occurs as aggregates and swarms of extremely small elongate green crystals disseminated throughout the mesh work of tremolite fibres and apparently has crystallized at the expense of the tremolite. In some jade rocks the diopside is sufficiently abundant to occur in lenses or layers enveloped by nephrite. When nodular and massive aggregates of diopside are present, a rock locally called " mottled jade " is the result. This latter material comprises dark greenish-black nephrite surrounding irregularly rounded masses of watery-white to greenish-grey and pale-brown aggregates that are dominantly diopside. This material has little or no value for jewellery but may be of some interest to lapidaries in cut surfaces large enough to display the pattern.

An association of nephrite with ultrabasic rocks is recognized wherever jade occurs; furthermore, it is evident from examination of thin-sections that the tremolite rocks are the recrystallization products of thermal and cataclastic metamorphism of basic rocks. It is significant that the jade along the Fraser River and its tributaries is found in close proximity to the outcrop areas of serpentinite and serpentinized peridotite that occur along the Fraser River fault zone between Coquihalla River and the head of the Yalakom. The alluvial jade boulders are derived from the erosion of nephritic lenses that were formed in certain favourable environments within the serpentinite belt, and the known distribution of large boulders indicates that there are several sources within the serpentinite belt that have shed shoulders into the rivers. No single source of jade at the head of the Yalakom or Bridge Rivers could have supplied all the material which has been found downstream as far as Hope, some 125 miles away. Rather, it is believed that there have been local sources at Marshall Creek, at the head of the Yalakom near the junction of Blue Creek, on the Bridge River at Hell Creek, on the Bridge River below the Horseshoe Bend, and at other places along the Fraser as far as the Coquihalla River near Dewdney Creek.

Although good-quality jade has not been found in place along the lower Fraser River and its tributaries, nevertheless jade does occur in bedrock at a location to which the writer was directed on the west side of Bridge River about 1,500 feet below the old cable ferry downstream from Applespring Creek. There, across a width of 18 inches to 2 feet, nodules, sheared lenses, and folded layers of pale greenish-grey waxy nephrite are enclosed by sheared tremolite lying along a pronounced fault which crosses the serpentinized rocks of the vicinity. The material is similar to the layered and nodular jade of some alluvial boulders, and this ex-

* Turner, F. J., p. 190.

posure may represent the type of bedrock occurrence from which some of the alluvial jade is derived.

At the present time the distribution pattern, and the size and number of boulders found, is the most significant factor in indicating the situation within the serpentinite belt where jade in place might be found by diligent and intelligent prospecting.

Jade boulders were first found on Wheaton (Boulder) Creek by W. J. Storie, of Cassiar, when he was placer-mining there in 1938. This information was not generally known until 1949, when Storie, who had subsequently restaked Percy Peacock's old lease as Placer-mining Lease No. 487, wrote the Department of Mines reporting the occurrence of jade on his lease. Later it was reported by Frank Bobner, who owned the next lease upstream, that a boulder estimated at 10 tons weight had been found.

Attempts were made at that time to market some of the jade, but the difficulties of the location and of breaking the boulders into pieces of manageable size combined to prevent any jade being sold at the best price then offered.* Storie's lease expired in 1951, and the ground was relocated as lease No. 628 in 1954 by Gerald Davis. In 1957 he broke up one of the large jade boulders and flew about 1,000 pounds of jade to the Cassiar road at McDame Lake. Most of this jade was sold to dealers in the United States.

When Wheaton Creek was visited during late July, 1961, no miners were working on the creek, and some inconvenience was experienced in not having anyone present who had precise knowledge of the jade occurrence. The only permanent resident is Earl Faulkner, whose cabin is on Turnagain River at the mouth of the creek. However, some jade boulders were found, as was the position from which Davis removed his large boulder.

In the lower 1½ miles of its course, Wheaton Creek flows through a narrow canyon above which the valley widens on the old Peacock lease (now P.M.L. No. 628), where the extensive placer-mining has been done. Above the old Peacock lease the creek is constricted and flows in a narrow canyon, where there has been little placer-mining, except for Bobner's old ground-sluice cut. The first jade boulder found by Storie was about half a mile north of the head of the lower canyon and was on Jack Wheaton's old Elvira lease.† Most of the known jade boulders are on P.M.L. No. 628, where there are extensive boulder piles left by placer-mining operations. A boulder of pale-green colour and possibly 300 pounds weight was seen on a rock pile close to the lower limit of lease No. 628; three other boulders, of which the largest is possibly 3 tons in weight, lie close together about 500 feet from the southern limit of the lease. Several other boulders were seen 200 feet farther south. No jade was seen on Bobner's old lease nor upstream from it to the south, and inquiries confirm the belief that no jade has been found along that part of the creek, as far as Alice Creek.

The jade seen on lease No. 628, except for one boulder, has a dark outer surface and may enclose some small lenticular masses of somewhat lighter green. Its colour tends to be dark and inferior to that of the average Bridge River material. No jade was sectioned that is devoid of magnetite spots and aggregates. In addition the rock has been subjected to stress which has developed a shear foliation that in very large measure seriously reduces the amount of unflawed material.

In thin-section the jade is seen largely to comprise bundles of tremolite fibres in typical nephritic fabric, and to be remarkably similar in general aspect to the Fraser River material. There is somewhat more alteration to irregular areas and

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* Said to be 75 cents per pound landed in Seattle.

† For a map *see* Fig. 1 in *B.C. Dept. of Mines,* Bull. No. 2, 1940.

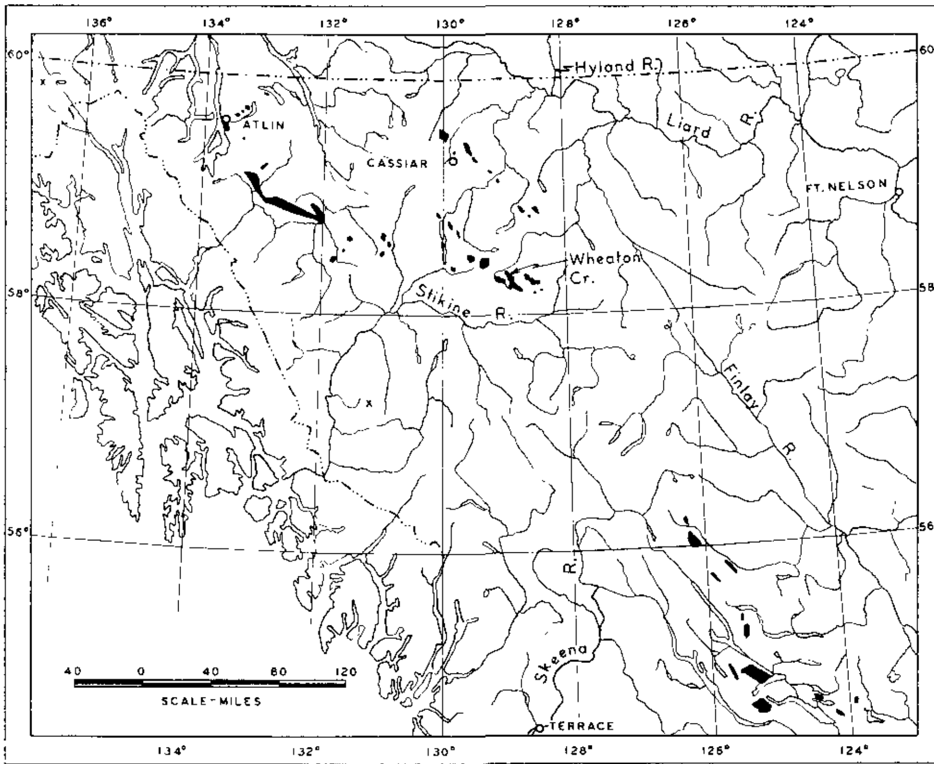


Figure 17. Index map of northern British Columbia showing main areas of serpentinite and serpentinized ultrabasic rock. Crosses mark small areas of serpentinite.

lenses of chlorite which might be reflected in a somewhat reduced hardness of the rock when it is worked.

Geological mapping along the creek* indicates that a band of serpentinite almost 2 miles wide crosses Wheaton Creek in a northwesterly direction and lies south of the southern limit of lease No. 628. The known jade boulders lie along the creek just north of the northern contact of the serpentinite mass. There is no doubt that the jade is derived from the erosion of nephrite lenses within the serpentinite, but there is no assurance that the lenses were localized along the northern margin of the mass.

The universal association of nephrite with serpentinite or ultrabasic intrusions, that is illustrated in British Columbia by the association of alluvial jade with serpentinite along a length of 125 miles in the Fraser River fault zone and with the serpentinite belt on Wheaton Creek, leads one to the belief that this association is probably more common than is generally suspected, and that other serpentinite bodies in British Columbia might have jade associated with them. The main serpentinite bodies known in British Columbia are shown on Figures 16 and 17. In addition to these, numerous serpentinite bodies occur which are too small to be shown even on the 4-mile geological maps issued by the Geological Survey of Canada. The discovery and identification of a green jade boulder amongst hundreds of green serpentinite boulders may not be easy, but the possibility of success seems sufficiently attractive to recommend search for alluvial jade in other sepentinite areas of the Province.

* *B.C. Dept. of Mines*, Bull. No. 2, 1940, p. 13.

In this connection it is worth recording that a jade boulder of excellent quality was found some years ago by Fred Allen, of Lower Post, on the Liard River at the mouth of the Hyland River. The direction of glacial movement across the Liard Plain in that vicinity is east-northeast (north 67 degrees east). The nearest serpentinite areas are about 60 miles in a southwesterly direction at Cassiar and at the head of Blue River.* These areas and the creeks draining them suggest themselves as likely jade prospecting terrain.

Pursuing the thought further, it is suggested that creeks draining serpentinite areas that are contiguous to the Fraser and Bridge Rivers, the several creeks adjacent to Wheaton Creek at the head of Turnagain River, and creeks draining the Atlin intrusion southeast of Mount O'Keefe and the Trembleur intrusions are worth a preliminary reconnaissance for jade.

[References: Anderson, E., "Asbestos and Jade Occurrences in Kobuk River Region Alaska," *Dept. of Mines, Alaska,* Pamphlet No. 3-R, 1945; Chesterman, C. W., "Nephrite in Marin County California," *Dept. of Natural Resources,* California Div. of Mines, Spec. Rept. 10-B, 1951; Crippin, R. A., "Nephrite Jade and Associated Rocks of Monterey County," *Dept. of Natural Resources,* California Div. of Mines, Spec. Rept. 10-A, 1951; Dawson, G. M., "Occurrence of Jade in B.C.," Canadian Record of Science, Vol. II, No. 6, 1887, pp. 364–378; Emmons, G. E., "Jade in British Columbia and Alaska," Monograph No. 35, 1923, Museum of the American Indian, Heye Foundation, New York; Foshag, W. F., "Mineralogical Studies on Guatemalan Jade," Smithsonian Miscellaneous Collection, Vol. 135, No. 5, 1957, pp. 1–60; Turner, F. J., "Geological Investigation of Nephrites, Serpentines, and 'Greenstones,'" Trans., *Roy. Soc. New Zealand,* Vol. 65, Pt. 2, 1935, pp. 187–210.]

* See *Geol. Surv., Canada,* Prelim. Paper 54-10.

ATLIN

SQUAW CREEK (59° 136° N.W.)*

Squaw Creek Placer (Ad Astra Minerals Ltd.)

Ad Astra Minerals Ltd., 526 Northern Hardware Building, Edmonton, Alta. (R. C. Sisson, president; R. G. McPhie, general manager), holds Placer-mining Lease No. 1412 on Squaw Creek and Special Placer-mining Lease No. 1447 which extends south for about 3 miles from the Yukon-British Columbia boundary on Squaw Creek about 3 miles above its junction with Tatshenshini River. A camp established on Squaw Creek is reached (from the Haynes Road) by 4 miles of road to Dalton Post, where the Tatshenshini River is crossed, then by 12 miles of rough truck-road to the creek. This access road lies in the Yukon.

The special lease extends southerly along a shallow late-glacial meltwater channel incised in stratified glacial sands and gravels. Ten drill-holes totalling about 400 feet, put down in 1955 by O. D. Frith for Datlasaka Mines Ltd., indicated a bedrock depression at least 8,000 feet long lying beneath the surface meltwater channel. Extremely high gold values were reported by Frith about 1,000 feet south of Squaw Creek at a point where bedrock lies at a depth of 80 feet.

In the summer of 1961 work was started at this point by J. Lynass, of Red Deer, Alta., under contract with the company. Two D-4 Caterpillar tractors with front-end loaders and a D-8 Caterpillar excavated gravel which was fed by a 400-foot conveyor belt to a vibrating-screen washing plant, from which the undersize went through 48 feet of steel sluices paved with rail Hungarian riffles. Operations ceased on August 4th when no gold had been recovered from two weeks' digging on two shifts, at which time a pit about 20 feet deep had been excavated.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1932, pp. 74–79; 1933, pp. 90–93; *B.C. Dept. of Mines,* Bull. No. 25, 1948, pp. 36–39.]

SPRUCE CREEK (59° 133° N.W.)†

Duncan Falconer continued to work alone on a drift on his lease.

PINE CREEK (59° 133° N.W.)†

Spruce Creek Placers Limited sluiced gravel on Pine Creek and Goldrun Creek. This operation, which continued to use a dragline and shovel, employed five men.

The Matson brothers sluiced ground on Pine Creek and did some exploratory drilling on Bull Creek.

Karl Sieger continued to work his lease near Discovery.

BIRCH CREEK (59° 133° N.E.)†

B. Yates sluiced ground on his lease on Birch Creek.

McKEE CREEK (59° 133° S.W.)†

Three men, Joe and Louis Piccolo and Albert Miller, hydraulicked a considerable amount of gravel on McKee Creek. Drifting was done by the partners during the winter months.

* By Stuart S. Holland.
† By W. C. Robinson.

OMINECA

McConnell Creek (56° 126° N.E.)*

McConnell Creek Placer

Two special placer-mining leases, Nos. 1536 and 1537, extending along McConnell Creek from its junction with Ingenika River to McConnell Lakes together with two placer-mining leases originally located by W. D. Savage, of Vancouver, are held by Guaranty Trust Co. of Canada.

In the autumn of 1960 a TD-14 tractor and a back hoe were driven from the end of the truck-road at Uslika Lake over the old winter tote-road to Aiken Lake, thence following the old trail to the pass at the head of Lay Creek and into McConnell Creek. In the early summer of 1961 a camp was established on the east side of McConnell Creek between the old Jensen workings and the head of the canyon at the mouth of Jensen (Meadow) Creek. The camp was serviced during the summer by aircraft from Fort St. James. During the season the ground between the mouth of Jensen Creek and the Jensen workings, an area 6,000 feet long by 2,000 feet wide, was systematically sampled by means of pits dug to a depth of about 12 feet with the back hoe. About thirty-two pits were dug at about 400-foot intervals along several lines. Channel samples of every 2 feet of depth were taken in each pit. These were panned down and part of the concentrate bottled and sent out for separation and weighing of the gold. W. D. Savage was in charge of the crew of from three to six men.

Pete Jensen, who returned in 1906 after having worked in the Klondyke and on the Nome beaches, spent thirty-five years working his placer ground on McConnell Creek. His workings are the most extensive along the creek, and he produced the bulk of the gold taken from the creek. Unfortunately there is no record of the gold he mined prior to 1931. But since that time, in the period 1931 to 1941, there is official record of 1,100 ounces having been produced.

The gold-bearing gravels lie above a compacted glacial-lake silt. The silt was overridden by an ice tongue which moved southward down the valley and compacted the lake silt which occupies the valley upstream from the head of the canyon. The upper surface of the silt was eroded, and as a consequence the silt surface is uneven and lies at varying depths below present creek level.

In the waning stages of ice occupation heavily charged meltwater streams flowed southward and southeastward from wasting ice tongues lying in the valleys between Frederickson Lake and Thutade Lake through McConnell Creek valley into the Ingenika River. At that time McConnell Creek valley up to a height of 300 to 400 feet above present creek level was occupied by a stagnant ice tongue, along the sides of which stratified materials were being deposited under a variety of ice contact environments. As the ice gradually melted, the reduced amount of meltwater deposited stratified sands and gravels on top of the compacted glacial-lake silts in the valley bottom. When the present drainage pattern was established, post-glacial gravels were deposited in alluvial fans above the glacial materials at the mouths of tributary valleys such as Snowslide Creek and others. There are topographic indications of a considerable amount of slumping of the ice contact materials which flank the valley sides and bottoms. Recent erosion, initiated through the downward cutting of Ingenika River, has not affected the present area, but has resulted in a canyon being incised from the mouth of McConnell Creek upstream for about 2 miles to a point just below the mouth of Jensen Creek.

* By Stuart S. Holland.

Placer gold is quite widely distributed in the stratified late-glacial gravels and cross-bedded sands and gravels lying above compacted silt. Gold occurs also in some flanking kame terraces, which, because of their origin, probably were discontinuous. As a placer occurrence, McConnell Creek presents the interesting feature of a creek in which there has been no stream erosion subsequent to the deposition of the auriferous gravels. As a consequence there has been no concentration of gold in the bed or along the course of the present creek.

Because of the nature of the occurrence, it will require thorough and closely spaced testing of the ground to follow and delimit any paystreaks that exist within the vast yardage of unconsolidated late-glacial materials that lie between the head of the canyon and the McConnell Lakes.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1908, pp. 80–84; *B.C. Dept. of Mines*, Bull. No. 2, 1932; *Geol. Surv., Canada*, Mem. 251, 1948, pp. 56–58.]

Germansen River (55° 124° N.W.)*

Gene Jack did some development work in the form of stripping and dam construction during 1961 preparatory to hydraulicking in the de Ganahl pit.

Manson Creek (55° 124° N.W.)*

Germansen Mines Limited is reported to have done some stripping and ditching on ground formerly held by Manson Creek Gold Mining Co. Ltd. on Manson Creek.

CARIBOO†

Hixon Creek (53° 122° S.W.)

Hixon Placers Inc. Company office, 2032 Third Avenue, Seattle, Wash.; mine office, Hixon. H. W. Hargood, president; J. E. Nasenius, superintendent. This company holds twenty-one placer leases on Hixon Creek, the camp being on Placer-mining Lease No. 2288, about 3 miles east of the Quesnel–Prince George highway. The work done on the property this year consisted in the laying of an extensive new 3-foot sluice-box, 750 feet long, above the large falls. The work involved 600 lineal feet of excavation to depths ranging from 6 to 30 feet. This work was done between May and November, and a crew averaging six men was employed. No hydraulic mining was done in 1961.

Little Hixon Creek.—D. and M. Rottacker erected a washing plant comprising trommel screens and washing-tables on their lease at the lower end of Little Hixon Creek and mined shallow gravels and decomposed bedrock with a mobile loader.

Willow River (53° 121° S.W.)

McJana Placers This company, under the supervision of R. E. MacDougall, continued to hydraulic at the head of the Lowhee pit. A No. 2 and a No. 5 monitor were used. Shortage of water restricted operations through much of the season, and at the time of the writer's visit in July only one man was employed. About 40,000 yards of gravel was moved. Work started on May 15th and continued until September 30th.

* By W. C. Robinson.
† By A. R. C. James.

Mosquito Creek.—Jack Gunn hydraulicked on his lease on the upper part of Mosquito Creek. Although shortage of water restricted the work to about three weeks, a good recovery of gold is reported to have been made.

Pundata Creek A number of leases on Pundata Creek were optioned by R. A. Coppage and associates. A small camp was erected and a washing plant was moved from Peters Creek and erected on the property. Late in the season an agreement was made jointly with Centennial Mines Ltd., Canex Aerial Exploration Ltd., and Tombac Exploration Ltd. to carry out tests on the ground. A pit 100 feet wide, 60 feet long, and 5 or 6 feet deep was excavated, and 1,194 cubic yards was put through the washing plant. Bad weather prevented conclusion of the work, but it is reported that the values were not encouraging, and the agreement was terminated.

Big Valley Creek.—Nolan Fisher sluiced gravel on his lease on the south side of Big Valley Creek near Nine Mile Lake.

Coffee Creek.—Arthur Delorme ground-sluiced on his lease on Coffee Creek.

George Creek.—James Lahay built a wing-dam and ground-sluiced on his lease on George Creek.

Jack of Clubs Lake.—Harold Christensen ground-sluiced 250 yards of gravel on his lease on the southeast side of Jack of Clubs Lake.

McLellan Gulch.—R. L. Bater reset 1,600 feet of pipe-line and hydraulicked with a No. 2 monitor.

Devils Lake Creek.—H. McGowan ground-sluiced in a small gulch near the headwaters of Devils Lake Creek.

Williams Creek (53° 121° S.W.)

Barkerville-Dakota Placer Explorations Ltd.—Company office, 119 Willow Street, North Kamloops. Eric Larsen drilled six test-holes with a Keystone drill, the average depth of hole being 52 feet. Some flume and penstock was also constructed. This company holds Placer-mining Leases Nos. 6065 and 6072.

Nick Broswick sank a 4-foot-square shaft 47 feet deep on his lease opposite the old Richfield court-house.

Antler Creek (53° 121° S.E.)

Antler Creek.—Arvid Holm ground-sluiced on his lease on upper Antler Creek.

Whiskey Flat.—A. Audet and V. Saur tested about 1,000 yards of gravel on Whiskey Flat, using two Denver panners in parallel.

China Creek.—John Kelly ground-sluiced on the south side of the creek.

California Gulch.—Peter McLanders did some hydraulicking and maintenance work on his lease. Work was limited by shortage of water.

Beggs Gulch.—Harry Wade did some stripping with a TD-18 bulldozer. Hydraulicking was limited by shortage of water.

Pinus Creek.—James Doody ground-sluiced 450 yards of gravel and did some test-pitting on his lease.

CUNNINGHAM CREEK (52° 121° N.E.)

Dumont Explorations Ltd. Company office, P.O. Box 838, Quesnel. John McGowan, president. This company holds a special lease extending 5 miles on Cunningham and Cunningham Pass Creeks, a special lease extending 2 miles on Antler Creek, and one ordinary lease on Cunningham Creek. Work done this year has been confined to drilling test-holes with a Kirk-Hillman and a Keystone drill. Several cross-sections of Kafue Dredge Company holes, drilled in 1924, were rechecked, and three cross-sections on lower Cunningham Creek were drilled.

Dan Jorgensen spent a few weeks ground-sluicing and testing ground on Placer-mining Lease No. 4429.

LIGHTNING CREEK (53° 122° S.E.)

Wingdam & Lightning Creek Mining Co. Ltd. Company office, 204, 509 Howe Street, Vancouver 1; mine office, Wingdam. R. A. Brossard, president; C. W. S. Tremaine, consulting engineer; J. C. S. Moore, manager. Capital: 10,000,000 shares, no par value. This company controls leases on Lightning Creek in the Wingdam area, 30 miles by road from Quesnel. The company's objective is to reopen the old Melvin workings and resume mining in the deep lead gravels of Lightning Creek.

Below the settlement of Stanley, the old channel of Lightning Creek follows the general direction of the present creek but is deeply buried under a varying succession of gravels, clays, and silts. The lowest part of the old channel is at a fairly uniform depth of 130 to 170 feet below the surface. Numerous attempts, some fairly successful, have been made to mine the deep level gravels since about 1865. The earlier workings were within a few miles of Stanley, but in 1896 the Lightning Creek Gold Gravels and Drainage Company acquired control of leases in the Wingdam area, which is 13 miles downstream from Stanley. From then until 1921 various attempts were made to work these leases, but from contemporary accounts the operations were badly managed and were unsuccessful. In 1931 a more serious and well-directed effort was made to mine the gravels, when the Sanderson shaft was reconditioned and preparations were made to mine the pay gravels on false bedrock at a depth of 120 feet. The Sanderson mine continued in production until 1939. Meanwhile, starting in 1935, a determined effort was made to mine the bedrock gravels at 165 feet from surface. The old Jones shaft, sunk many years before in the rimrock, was enlarged to four compartments and sunk to a depth of 280 feet. This shaft was renamed the Melvin shaft. From the bottom of the shaft, drives were made in the bedrock upstream and downstream, about 60 feet vertically below the bedrock channel, for a total distance of 3,200 feet. The channel gravels were drained by drill-holes, and at the end of 1936 the first raise was driven up into the gravels. In 1937 the Melvin workings produced 1,821 cubic yards of gravel, while the Sanderson workings produced 52,150 cubic yards and employed ninety men. On March 22, 1938, the Melvin workings were flooded by an inrush of water from Lightning Creek. There seems little doubt that the flooding occurred through the No. 1 downstream raise. It was well known that there was a dangerous area not far from this raise that had been weakened by extensive pumping operations in an area of old workings. It would appear certain that workings from the No. 1 downstream raise approached too close to this disturbed area, with the resultant cave-in and flooding with " slum " and water. Fortunately no one was drowned. However, this put an end to the Melvin mining operations. A concrete plug was placed in the connecting shaft between the Melvin and Sanderson workings, and the Sanderson mine continued to operate until April, 1939. Since that time the property has remained inactive until the present company resumed operations.

The company began work in May, 1961, when two 65-horsepower Flygt deep-well pumps were installed at the Melvin shaft and pumping-out of the water was commenced. These pumps were powered by a portable diesel-driven generator. Meanwhile the company retained Clough Engineering Ltd. to investigate and prepare a report on the feasibility of utilizing chemical grout in controlling underground water and " slum." By June it was evident that the water of Lightning Creek was still flowing into the workings through the old break-through. It was therefore decided to attempt to inject a grout plug into the No. 1 downstream raise by means of a drill-hole from the surface. This was successfully completed by the end of July, using a special cement grout. The work was supervised by Clough Engineering Ltd., and the drilling by Boyles Bros. Drilling Company Ltd. The hole was also utilized as a test-hole to examine gravels, sands, and clays down to bedrock. The pumping-out of the Melvin shaft was then continued until a deposit of silt or " slum " was encountered a short distance above the shaft bottom. Preparations were being made at the end of the year to deal with the silt.

Other work done at Wingdam included the rehabilitation of the old camp and buildings and the erection of a 20- by 44-foot cook-house and mess hall and 42- by 26-foot prefabricated office building. Repairs were carried out to the shafthouse and headframe. In November two 170-horsepower diesel-driven 200-kva. Westinghouse electric generators were installed in the old power-house building. A double-drum electrically driven mine hoist was being installed at the Melvin shaft at the end of 1961. A second 6-inch-diameter test-hole was drilled to bedrock by Boyles Bros. Drilling Company Ltd. under the supervision of Clough Engineering Ltd. in June. Subsoil profiles between ground surface and bedrock were established, and samples were recovered for testing. The No. 1 hole reached bedrock at 171 feet and the No. 2 hole at 135 feet. Both holes indicated a vertical thickness of 50 to 80 feet of silt in the drill-hole sections. This was found to be a firm and compact material with a normal water content of about 30 per cent. Tests were carried out with the injection of AM-9 chemical grout. Small batch tests indicated that AM-9 grout could be used to produce strong gels, and that it might be successfully used in grouting " slum " material above the gold-bearing gravels.

A crew of up to eighteen men was employed. Only one lost-time accident was reported.

Hannandor Gold Ltd.

Company office, Box 937, Quesnel. E. R. Wiegand, secretary. This company holds seven leases on Mostique (Mosquito) Creek and Lightning Creek, 28 miles by road from Quesnel. The property is approached by road running about a mile south of the Quesnel–Barkerville road. A washing plant was installed in 1960. This year the property and plant were subleased to Trommel Mining Ltd., which did a small amount of work.

Peters Creek

R. A. Coppage and associates optioned eight leases on Peters Creek. Several acres of ground were cleared and a 1,600-foot drainage ditch was made. A washing plant and dragline were installed at the property. Late in the season an agreement was made jointly with Centennial Mines Ltd., Canex Aerial Exploration Ltd., and Tombac Exploration Ltd. for testing to be carried out. Two lines of test-holes, totalling six holes, were drilled on Placer-mining Lease No. 6129 under the supervision of Oscar T. McShane. Depth of the holes ranged from 39 to 50 feet. Although previous reports on the property indicated the possibility of fair values, the results from these holes were reported to be disappointing, and the agreement was terminated.

Cottonwood River (53° 122° S.E.)

F. Goodheart ground-sluiced 600 yards of gravel on his lease about 3 miles above Cinema.

Les Thompson and Tony Neill operated a small suction pump in gravels at the lower end of the canyon near Cinema. The pump operated on the venturi principle and discharged gravels through a steel sluice-box, both pump and sluice-box being mounted on a float.

Mary Creek.—Erik Sorum sluiced 800 yards of gravel on his lease on Mary Creek. James Coreau did some sluicing, ditching, and brush clearing on his leases.

Swift River (52° 122° N.E.)

William Fisher hydraulicked 2,000 yards of gravel on his lease on the lower section of Swift River.

Quesnel River (52° 121° N.W.)

George Martin did some stripping with a bulldozer on his lease near Quesnel Forks.

Smith Placers Ltd. Company office, P.O. Box 39, Chilliwack. This company operated on the east side of Cariboo River near the mouth of Spanish Creek. A bench about 80 feet above the river level was mined by scraping the gravels onto a grizzly, where the oversize material was discarded down a steep bank into the river, while the undersize passed through sluice-boxes supplied with water from a diesel-driven pump at the river. Three men were employed under the supervision of Jim Robb.

Spanish Creek.—Adolf Anderson washed 4,000 yards of gravel on Placer-mining Lease No. 3454.

Rose Gulch.—R. H. Spooner ground-sluiced 400 yards of gravel and built 300 feet of 12-inch flume on his lease at the upper end of Rose Gulch.

E. Drew ground-sluiced a small amount of gravel at the lower end of Rose Gulch.

Cedar Creek.—Percy Ogden ground-sluiced on his leases north of Cedar Creek, using a small monitor. Some stripping was done in preparation for moving to a new location.

Nigger Creek.—Barney Boe supervised a small crew in preparing for a hydraulic operation in the old pit about half a mile from the mouth of the creek.

Keithley Creek (52° 121° N.E.)

Keithley Creek.—Clair Dunham ground-sluiced, cleared 500 feet of ditch, and prospected on Placer-mining Leases Nos. 5778 and 6103 in the upper section of Keithley Creek near the falls.

Ernest Lang worked with two men on his lease 1,700 feet below the confluence of Snowshoe and Keithley Creeks. A drift was driven about 170 feet on bedrock toward a buried channel indicated by previous drilling.

Four Mile Creek.—Lee Fournier ground-sluiced on his lease in the Placer Engineers pit near the mouth of the creek.

French Snowshoe Creek.—Albert Sandberg ground-sluiced on the left bank of French Snowshoe Creek.

HORSEFLY RIVER (52° 121° S.E.)

Black Creek.—Harold Armes did 59 feet of test drilling, sank a 16-foot shaft, and stripped 1,100 yards of overburden on his leases.

BRIDGE RIVER

CADWALLADER CREEK (50° 122° N.W.)*

Hurley River Mines, Ltd.

Hurley River Mines, Ltd., of Bralorne (Paul Polischuk, president), holds two Placer-mining Leases, Nos. 751 and 752, extending along Cadwallader Creek, upstream from its junction with Hurley River almost to the head of the canyon below Bralorne mine. Lease No. 751 covers a low bench about 500 feet long and 200 feet wide along the creek which had been worked during the 1930's by W. Freeman.

Early in the season Cadwallader Creek was diverted into and contained in a new channel along the foot of the rock bluffs on the east side of Freeman's old cabin. In late April a Lorain ¾-yard shovel was taken onto the upper lease in order to work along the channel from which the creek had been diverted.

The shovel dug along the old channel down to the water-table without exposing bedrock. The gravel was washed by a shaking screen, the oversize stacked on the side by a short conveyor belt, and the undersize, through $\frac{3}{16}$- by ½-inch aperture, was fed to two Wilfley tables. The table concentrates were sacked preparatory to shipment for recovery of their gold. A sample of table concentrates at the river assayed: gold, *nil*, and a sample from one of the sacks of table concentrates stacked at the head of the road assayed: gold, 0.66 ounce per ton. The operation had ceased by late September, at which time a length of about 150 feet along the old channel had been worked. It is estimated that not more than about 1,000 cubic yards of gravel had been washed.

Mining on the property was done under lease by B.C. Placer Mining & Refining Ltd.

MARSHALL CREEK (50° 122° N.W.)†

Mr. and Mrs. Wickham operated a small suction dredge on the Doyle lease for a short period at the end of the summer.

FRASER RIVER

HILL'S BAR (49° 121° S.E.)†

Kenneth A. Kent and partners operated a small suction dredge at Hill's Bar for several months at the latter end of the year.

SIMILKAMEEN

GRANITE CREEK (49° 120° N.W.)‡

Geojimal Mining Development Co. Ltd.

Company office, 120 Second Avenue, Chilliwack; J. A. Robb, manager. The company worked on Placer-mining Lease No. 1333 on Granite Creek, three-quarters of a mile upstream from its mouth. The rock drift driven in 1960 was continued and turned to the right to parallel the buried chan-

* By Stuart S. Holland.
† By A. R. C. James.
‡ By David Smith.

nel of Granite Creek overhead. Several raises were driven upward, breaking into the gravels above. Results are not known. A crew of three men was employed.

TULAMEEN RIVER (49° 120° N.W.)*

Gra-Dorphan Mines Ltd. Company office, P.O. Box 8, Murrayville. A group of placer-mining leases covering the river valley and in the immediate area of the former El Alamein mine were located some 3 miles above Tulameen. Stripping was carried out using a D-6 tractor equipped with a front-end loader. A crew of five men was employed. Results were not disclosed.

LARDEAU†

Hladinec Placer (50° 117° N.E.) W. Hladinec and three associates, of Trout Lake, own Placer-mining Lease No. 456, at the main falls on Lardeau Creek, 5 miles by road from Ferguson. In the previous two years the creek had been diverted by a tunnel and log dam which dried up the pot-hole below the falls. In 1961 the job of digging out the material in the hole was completed. It was reported that very little gold was found at bedrock.

NELSON†

FIFTEEN MILE CREEK (49° 117° S.E.)

Skookum Uranium Placer F. H. Stegmen and one man operated for two months for this Spokane company on Fifteen Mile Creek, about 1 mile from the Nelway–Trail highway. The creek has been diverted to another channel, and the gravel in the creek bed is put over a series of grizzlies and screens, with the fines going through sluice-boxes. The gravel is moved by means of a scraper and hoist arrangement.

CRANBROOK‡

Monilee (49° 116° S.W.) This placer-mining lease is near the falls on the Moyie River, 14 miles southwest of Cranbrook. It is held by D. J. Oscarson, of Kimberley, and operated by two parties who subleased the property in 1958. Each party is driving an adit toward an old course in the river, and activities are confined to week-ends.

T. O. Bloomer drove No. 1 tunnel 30 feet in gravel and a further 70 feet along-side and 4 feet below the elevation of the old channel. Several test-holes were drilled into the channel. There was no recovery.

P. Kotush and two partners drove No. 2 tunnel 50 feet in bedrock and a winze for 20 feet to get to the bottom of the old channel.

Keller (49° 116° S.W.) This lease is 2 miles north of the falls on the Moyie River and near the mouth of Weaver Creek. A shaft was in the process of being sunk by C. Bruhaug and M. Petrosky, of Kimberley, but the operation was suspended in July, 1961, following a fatal accident to one of the partners.

* By David Smith.
† By J. D. McDonald.
‡ By D. R. Morgan.

FORT STEELE*

Expander Mines & Petroleums Ltd. (49° 115° N.W.) Company office, 5504 One Hundred and Ninth Street, Edmonton, Alta. M. J. Pritchard, president and manager. This company was formerly known as the Boreas Mines Limited, but the name was changed to Expander Mines & Petroleums Ltd. in 1961. The property, comprising four placer-mining leases, is near the mouth of Fisher Creek, a tributary of the Wild Horse River, 5 miles northwest of Fort Steele. During 1961 a party of three men drilled eleven shallow holes in gravel and sluiced 291 cubic yards of material. A fair amount of gold was recovered.

Maus Creek (49° 115° N.W.)

A crew of two men under the direction of G. R. Castles, of Lethbridge, Alta., completed a headframe and continued to sink a shaft on the Maus Creek Placers.

KIMBERLEY*

Lisbon Creek (49° 115° N.W.)

This placer-mining lease is near the confluence of Lisbon and Perry Creeks, 9 miles south of Kimberley, and can be reached by road from Wycliffe. The lease was owned by the late Dan McIntosh, of Cranbrook, but was subleased to R. E. Williams and W. Kludash, of Kimberley. A small tunnel being driven alongside the creek was abandoned early in the year because of water. Some sluicing was done in the bottom of a cut nearby.

REVELSTOKE†

McCulloch Creek (51° 118° S.E.)

Gold Acres Development Ltd. Registered office, Box 463, Revelstoke. L. Latham, president; G. Laforme, manager. This company has leased from McCulloch Gold Placer Mining Co., Limited, of Revelstoke, nine placer-mining leases which extend to the headwaters of McCulloch Creek. The camp is at an elevation of 4,100 feet. It is reached by a road which leaves the Big Bend highway at Mile 57 and follows the north side of Goldstream River for 5 miles, then turns and follows the east side of McCulloch Creek for 3 miles.

A large section of hydraulic pipe, which was installed in 1960, was damaged by a snowslide. In the spring of 1961 the pipe was repaired and the installation completed. Very little sluicing was done due to abnormally low water in McCulloch Creek. About 200 cubic yards of gravel was washed through a small sluice-box, recovering 17 ounces of coarse gold and 55 ounces of amalgam. The average number of men employed during the months of May, June, and July was five.

Argo Exploration & Mining Company Limited Registered office, 201, 1027 West Broadway, Vancouver 9; mine office, 1202 First Street West, Revelstoke. H. B. Zavitz, president; A. E. Horne, managing director. Capital: 10,000 shares, no par value. This company holds twenty-seven mineral claims and four placer leases on the headwaters of Graham Creek, a tributary of French Creek. The property is acces-

* By D. R. Morgan.
† By J. D. McDonald.

sible by road from Mile 57 on the Big Bend highway. The road follows the north side of the Goldstream River for 5 miles, then turns and follows McCulloch Creek to its headwaters, crosses a 6,000-foot summit, and extends down into the headwaters of Graham Creek, a distance of 13½ miles. The top section of road was improved in 1961, and the bridge over McCulloch Creek was replaced.

The camp and hydraulic system was moved half a mile downstream from its location in 1960. Pressure-box, hydraulic pipe, and sluice-boxes were installed. A pit above the sluice-boxes was bulldozed out, along with sample cuts in the gravel. An average of six men was employed for six months. The property suspended operations in October due to winter conditions.

Structural Materials and Industrial Minerals

CONTENTS

ASBESTOS

Cassiar Asbestos Corporation Limited*

Mount McDame (59° 129° S.W.). Head office, 1001, 85 Richmond Street West, Toronto, Ont.; mine office, Cassiar. F. M. Connell, president; J. D. Christian, general manager; J. G. Barry, general superintendent. The property is 86 miles by road southwesterly from Mile 648.8 on the Alaska Highway. The mine is on McDame Mountain at an elevation of approximately 6,300 feet. The mill and townsite are in Troutline Creek valley at 3,500 feet elevation. The property has been described in previous Annual Reports.

In 1961 mining was carried on from February 25th to December 20th. Ore was mined from benches at elevations of 6,140, 6,110, 6,080, 6,050, and 6,020 feet in the open pit. During the mining season 540,128 tons of ore and 1,990,520 tons of waste were broken. The rock reject plant at the mine treated 345,342 tons of ore and rejected 116,767 tons of waste. The aerial tram-line operated from March 2nd to December 18th. The mill operated for 307 days to process 465,840 tons of ore, which yielded 45,530 tons of fibre. The fibre produced is premium-grade low-iron chrysotile.

During 1961 exploratory work on the property consisted of 842 feet of diamond drilling, which was done from the lower cirque.

Throughout the year an average crew of 462 men was employed.

Plant expansion included an addition to the rock reject circuit, an addition to the mill, and the erection of a new power-house building. An additional extension to the mill was started at the end of the year. New construction of the townsite included the erection of a new bank building and a new Anglican rectory.

Naltesby Lake†

(53° 123° N.E.) A large number of asbestos claims were recorded in an area southwest of Prince George, especially in the vicinity of Naltesby Lake, following the publication of

* By W. C. Robinson.
† By A. R. C. James.

Geological Survey of Canada Information Circular No. 4 in March, 1961, which reported the occurrence of asbestos showings in ultrabasic rocks in this area. In general it would seem that many of the showings were found to be disappointing, no large programmes of work were carried out this year, and many of the claims were allowed to revert to the Crown.

Canadian Johns-Manville Company Limited*

Naltesby Lake (53° 123° N.E.). Company office, 1955 West Fourth Avenue, Vancouver 9; Yukon field engineer, R. G. Jury. The company recorded three groups of claims, totalling fifty-eight in all. Two of the groups were on Bobtail Mountain, immediately east of Naltesby Lake, extending from close by the lake-shore to 5 miles east of the lake. The third group was 14 miles due south of Naltesby Lake.

A two-man prospecting and mapping party worked on the three claim groups from July 21st to October 30th. Trails were made from Naltesby and Keith Lakes to the claim groups, and dip-needle surveys and geological mapping were carried out. The company reports that no chrysotile asbestos deposits of any significant economic importance were discovered. Very small occurrences of short-fibre material were found on Bobtail Mountain near the southeast end of Naltesby Lake and on the claims 14 miles south of the lake.

[References: *Geol. Surv., Canada,* Lord, C. S., and Jenness, S. E., Inf. Circ. No. 4, Fieldwork 1960; *Geol. Surv., Canada,* Map 49-1960, Prince George.]

DRD Group†

Williams Lake (52° 122° S.E.). During May, 1961, D. Rottacker, of Williams Lake, located twenty-two mineral claims, the DRD Nos. 1 to 22, on a chrysotile asbestos-bearing serpentine exposure 1 mile south of the east end of Williams Lake. In August, Bell Asbestos Mines Ltd. prospected the property, mapped the geology, and stripped several areas with a bulldozer.

The showings are a few hundred feet above the valley floor near the base of a conspicuous light-coloured bare patch on the hillside at the head of a small gully 2 miles northwest of the Pacific Great Eastern Railway siding at Onward. Access is by means of an abandoned logging-road that branches west off the Onward–Springhouse road at the sharp bend one-half mile south of the railway crossing.

In the immediate vicinity of the workings, bedrock exposures are scarce and consist of small scattered knobs of serpentinized peridotite. The serpentine is associated with rocks mapped as part of the Permian(?) Cache Creek group (*Geol. Surv., Canada,* Map 12-1959, Quesnel). Similar small patches of serpentine with Cache Creek group rocks are known in the area east and northeast of the DRD claims (*Geol. Surv., Canada,* Map 59-1959, Quesnel Lake). For the most part, the peridotite has been sheared and altered into typical " fish scale " serpentine consisting of thin lens-shaped fragments a few inches in diameter. In certain zones more intense shearing has reduced the rock to clayey gouge, and in still other places the rock has remained in unsheared but fractured chunks.

Rather harsh, short, cross-fibre chrysotile asbestos occurs in serpentine in the main open cuts distributed as shown on Figure 18. A few very small scattered showings have been found beyond the limits of the diggings. The fibre is in veinlets from hair-line to one-half inch wide, most being in the $\frac{1}{32}$- to $\frac{1}{8}$-inch range. The wider veinlets have one or more central partings, with the result that fibre lengths are short, the longest measured being one-quarter inch. Fibre this long is rare. The

* By A. R. C. James.
† By J. W. McCammon.

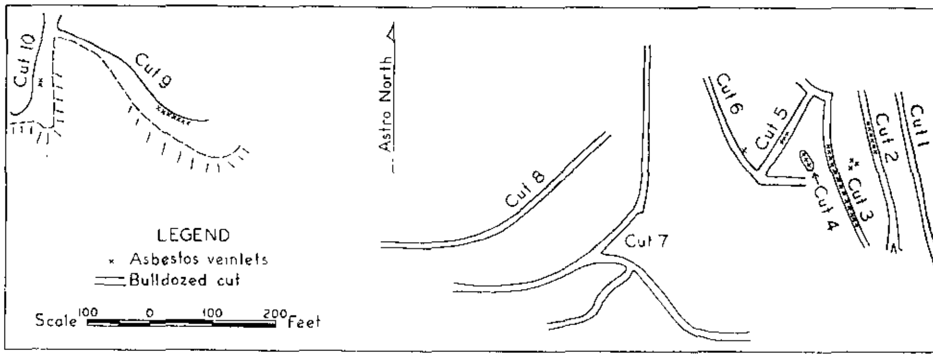


Figure 18. Main workings on DRD claims, Williams Lake.

veinlets show no readily apparent strike pattern. Along strike the veins pinch and swell and seldom persist for more than 1 or 2 feet. The asbestos is obvious only in the more massive unsheared parts of the serpentine, none being evident in the "fish scale" rock, and only traces showing in parts of the highly sheared rock.

Approximately 4,000 feet of open cutting was done on the property in 1961. No fibre was exposed in cut No. 1. In cut No. 2, veinlets of asbestos were exposed along the bottom and west wall for 52 feet. The veinlets were generally 1 or more feet apart, but in places clustered closer together. Because of the random orientation of the veins, lineal measurements for grade estimation are not reliable; however, some were made to get a rough idea of the amount of fibre visible. One 3-foot section contained 2.2 per cent fibre, and short sections contained 5 to 6 per cent fibre, but the zone as a whole averaged less than 1 per cent fibre content. Bulk sampling would undoubtedly give higher yields. In cut No. 3 a fibre zone 140 feet long was uncovered in the bottom and walls. The veins were similar in occurrence to those in cut No. 2. Measurement on a 2-foot section near the centre of the cut gave an indicated fibre content of 5 per cent. Cut No. 4 exposed scattered veinlets over most of its length. Near the centre of cut No. 5, scattered veinlets were uncovered in a massive section of serpentine about 9 feet long. One or two short segments of fibre-bearing veinlets were found in the wall near the south end of cut No. 6. No fibre was seen in cut No. 7 or 8. In cut No. 9, scattered veinlets were exposed along the side and bottom for 55 feet near the east end. A massive block of serpentine in the floor near the centre of cut No. 10 contained a few small veinlets of fibre.

From what could be seen at the time of examination, at the middle of August, it would appear that the fibre occurs in rather small, irregular, and discontinuous patches without forming sizeable zone, and most of the fibre is one-eighth inch long or less.

BARITE*

Mountain Minerals Limited

Company office, Meech Building, P.O. Box 275, Lethbridge, Alta.; quarry office, Brisco. R. A. Thrall, managing director; William MacPherson, superintendent. This company operates two barite properties at alternative intervals in the Windermere Valley, south of Golden. The major operation is at Brisco (50° 116° N.E.) and the other at Parson (51° 116° S.W.). A description of the properties has been included in the 1958 Annual Report.

The Brisco operation was active for a nine-month period in 1961, during which period a crew of three men quarried, crushed, and shipped 5,026 tons of barite to

* By D. R. Morgan.

the company's processing plant at Lethbridge. The production was obtained from the new quarry which was started in 1960. No other development work was done.

At the Parson property 948 tons of chemical-grade barite was mined for shipment to Montreal. The barite came from the drift that was opened in 1958.

Baroid of Canada Ltd. (50° 116° N.E.) Company office, 44 King Street West, Toronto, Ont. J. A. Martino, president; T. A. Studer, manager; Harold K. Beggs, plant superintendent. This company operated the former Giant Mascot lead and zinc property at Spillimacheen, south of Golden. It was purchased in 1960, and the agreement included the whole property comprising forty-five Crown-granted claims and one recorded claim. Most of the activities in 1961 were directed to the recovery of barite from the tailings dump of the old mine. A new set of separation tables was installed in the mill, and it is estimated more than 1,500 tons of barite was recovered. Six men were employed for a period of three months.

Elkhorn Mining Co. Ltd. Windermere (50° 115° S.W.). Company office, 1302 Eleventh Avenue Southwest, Calgary, Alta. Alfred Pegg, president. This company optioned the Lucky group of four mineral claims from T. Cameron, of Windermere, for a period of two months during 1961. The claims are located on the west slope of the Stanford Range, 1 mile east of the Cranbrook–Radium highway and 6 miles south of Windermere. A small shipment of barite was sent to a processing plant at Rosaland, Alta. The option was relinquished in October. Two men were employed.

BERYL*

International Beryllium Corporation Ltd. Hellroaring Creek (49° 116° N.E.). Company office, 417, 837 West Hastings Street, Vancouver 1. This company held a controlling interest in thirty-two claims in the Hellroaring Creek area in the early part of 1961. In an effort to find beryl crystals in a pegmatite showing, several trenches were dug. The operation was abandoned after approximately one week. Six men were employed.

BUILDING-STONE†

International Marble & Stone Company Ltd.‡ Sirdar (49° 116° S.W.). Company office, 540 Howe Street, Vancouver 1; main office, 4106 MacLeod Trail, Calgary, Alta.; plant office, Sirdar. W. R. Rookes, president; W. Czbiorr, plant superintendent. Capital: 3,000,000 shares, 50 cents par value. This is a newly organized company which has taken over the former plant and quarry of Kootenay Granite Products Limited at Sirdar. The plant is 2 miles north of Sirdar on the Kootenay Bay–Creston highway. In addition to this plant, the company has options or has obtained other holdings of granite, quartzite, and marble, including the Lawrence Simpson Quarry at Ymir (granite); a dolomite quarry on Swift Creek, south of Salmo (marble); a quartzite quarry on Sheep Creek (quartzite slabs); the Feeney Marble Quarry on the Salmo–Creston cut-off (marble); and a silica prospect on La France Creek, near Boswell.

Products manufactured by the company are stucco chips, terrazo chips, roofing chips and granules, turkey and chicken grit, structural stone.

* By D. R. Morgan.
† By J. E. Merrett, except as noted.
‡ By J. D. McDonald.

The plant at Sirdar was in operation for the last five months in 1961. Improvements were made to the dust-collection system. An average of four men was employed for five months at the Sirdar operation. Some road and development work was done at the other quarries.

Valley Granite Products Limited

Cheam View (49° 121° S.W.). Company office, 410 Mayfair Avenue, Chilliwack; plant, Cheam View. K. Jessiman, general manager. The quarry and plant are on the west side of the Trans-Canada highway, 11 miles northeast of Rosedale. A crew of six men produced approximately 8,000 tons of granite products, including bird and poultry grits, stucco dash, and sand-blast materials.

Evans, Coleman & Evans Limited (Gilley Quarry)

Pitt River (49° 122° S.W.). Company office, north foot of Columbia Street, New Westminster. E. Thorsen, production manager; Francis J. MacDonald, quarry superintendent. The quarry is on Pitt River, immediately south of its confluence with Munro Creek. During a three-month operating period a crew of twenty men produced 60,000 tons of quartz diorite.

Indian River Quarries Limited.—Granite Falls (49° 122° S.W.). In September, D. Milavsky, 630 Taylor Street, Vancouver 3, acquired this property near the north end of Indian Arm and shipped 857 tons of granite which had been quarried previously.

British Columbia Slate Co. Ltd.

Nelson Island (49° 124° N.E.). Company office, 813, 475 Howe Street, Vancouver 1; granite quarry, Nelson Island. Philip Graham, president. This company acquired the assets of Vancouver Granite Co. Limited, and during the year removed 1,000 tons of quarry rubble, from which was produced split-face granite for building-finish veneers.

CEMENT*

British Columbia Cement Company Limited. — Bamberton (48° 123° N.W.). Head office, 540 Burrard Street, Vancouver 1. W. F. Foster, president; B. M. Brabant, executive vice-president; R. E. Haskins, vice-president in charge of production. During 1961 this company operated its cement plant at partial capacity.

Lafarge Cement of North America Ltd.—Lulu Island (49° 123° S.E.). This company operated its cement plant at partial capacity during 1961.

CLAY AND SHALE†

Clayburn-Harbison Ltd.

(49° 122° S.E.) Head office, 1025 West Seventy-seventh Avenue, Vancouver 14; plants, Kilgard and Abbotsford. R. M. Hungerford, president; G. H. Peterson, general manager. Two plants are operated by this company—one at Kilgard, where sewer-pipe and flue-linings are manufactured, and the other at Abbotsford, where face-brick and refractories are made. Clay was produced from two underground and two open-pit operations. The two underground mines are at Kilgard, where a crew of five men produced 13,988 tons of clay from the Fireclay mine and a crew of two men produced 2,201 tons of clay from the New Fireclay mine. A crew of three men produced 13,089 tons of clay from the No. 9 pit on the mountain above the Fireclay portal. An additional 9,182 tons of clay was

* By R. B. Bonar.
† By J. E. Merrett, except as noted.

produced by two men working at the Selby pit, immediately west of the Abbotsford microwave station.

Richmix Clays Limited.—Kilgard (49° 122° S.E.). Office and plant, 2890 Kent Avenue, Vancouver 12; quarry, Kilgard. G. W. Richmond, manager. One man mined and trucked to the Vancouver plant 5,621 tons of fireclay.

Haney Brick and Tile Ltd.

Haney (49° 122° S.W.). Company office and plant, Haney. E. G. Baynes, president; J. Hadgkiss, managing director. Clay is removed from a pit adjacent to the plant or from the surface outcrop and trucked to the plant. In the pit, a ½-cubic-yard-capacity gasoline-shovel is used for digging and loading, while the surface outcrop is worked only during the summer months. At that time a ripper and grader is used to remove the top 2 or 3 inches of clay over a wide area. The loosened material is sun-dried and trucked to the plant air-drying area. Further drying is done in a rotary wood-fired kiln, the product being conveyed to a dry-pan for grinding. Brick and tile are formed by a stiff-mud extrusion process and then dried in a controlled-temperature drying-room. After drying, the products are burned in down-draught beehive kilns.

During 1961 this company acquired the B.C. Clay Products Limited business after the plant of the latter company was destroyed by fire. Manufactured clay products now include partition tile, drain-tile, face-brick, building-brick, flue-lining, curoval tile, and flower-pots.

In 1961 two men were employed on clay removal and thirty-three men were employed in the plant. Production was 18,772 tons of clayware, of which 32 per cent consisted of drain-tile, 12 per cent of structural materials, and 56 per cent of processed clay products.

Mainland Clay Products Limited

Barnet (49° 122° S.W.). Head office, 8699 Angus Drive, Vancouver 14; plant, Garnet. This company, a subsidiary of Pitkethly Brothers Limited, employing a crew of three men, produced 2,150 tons of red clay building-bricks and firebricks at the plant adjacent to the highway on the north slope of Burnaby Mountain. Clay for the building-bricks was obtained from an adjacent pit, and fireclay was obtained from Kilgard.

Fairey & Company Limited.*—Vancouver (49° 123° S.E.). L. T. Fairey, manager. This company produced a variety of fireclay blocks, shapes, and high-temperature cements. Local and imported raw materials were used.

British Columbia Lightweight Aggregates Ltd.†—Saturna Island (48° 123° N.E.). This company has a shale expanding plant and quarry at Lyall Harbour on Saturna Island.

Evans, Coleman & Evans Limited (formerly Baker Brick & Tile Company Limited).†—Victoria (48° 123° N.E.). Office and works, 3191 Douglas Street, Victoria. Face-brick, flue-lining, drain-tile, and flower-pots were manufactured at this plant from local surface clay.

DIATOMITE‡

Fairey & Company Limited

Quesnel (53° 122° S.E.). Company office and plant, 661 Taylor Street, Vancouver 3. L. T. Fairey, president. Four carloads (450 cubic yards) of diatomite were quarried on Lot 6182, on the east bank of the Fraser River about 6 miles

* By J. W. McCammon.
† By R. B. Bonar.
‡ By A. R. C. James.

north of Quesnel. The material was excavated by a local contractor. It is used in making insulating-back and as a concrete admixture.

GYPSUM*

Western Gypsum Products Limited Windermere (50° 115° S.W.). Company office, 306 Electric Railway Chambers, Winnipeg 2, Man.; quarry office, Athalmer. N. W. Puttock, general manager; A. E. Portman, superintendent. This company operates a large gypsum property on the north side of Windermere Creek, 8 miles east of Windermere. The property was formerly owned and operated by the Columbia Gypsum company, but was acquired by the present company in 1957, mainly to supply gypsum to its processing plants at Vancouver and Calgary. The gypsum is quarried, crushed, and shipped by rail.

The 1961 production was mined from the No. 2 quarry, which has been in operation since 1958. The quarry is 400 feet long and 300 feet wide, with the walls sloped back to a 45-degree angle. The gypsum is extracted in 15-foot lifts, and the rock is blasted and loaded by power-shovel. It is then trucked 11 miles by private road to a crushing plant adjacent to the Kootenay Central Railway, near Wilmer. The mill was built in 1960, and a description is included in the 1960 Annual Report.

Total production during 1961 was 158,023 tons, of which 153,865 tons was crushed and shipped by rail and the remainder placed on stockpile. The operations were confined to a nine-month period with an average crew of fourteen men.

United Gypsum Corporation Ltd. Canal Flats (50° 115° S.W.). Office address, 549 Howe Street, Vancouver 1. This company holds twenty-seven claims beside Lussier River near the confluence of Roam Creek, 16 miles southeast of Canal Flats. The property is reached by 21 miles of old logging-road that branches off the Cranbrook–Radium highway north of Skookumchuck. No drilling was done in 1961, and the equipment used in 1960 was removed from the property during the summer.

LIMESTONE

Limestone in the Vernon Area†

Many of the rocks in the Vernon area are limy, but only two or three sizeable deposits of a good grade of limestone are known. Previously published reports mentioning " an abundance of limestone " and " much of it comparatively free of impurities " are misleading.

At least four limestone lenses are exposed in the Permian(?) Cache Creek rocks along the Salmon River valley between Westwold and Falkland. The largest and purest lens forms a knoll across the front of the main slope on the north side of the valley 6 miles west of Falkland. The lens consists of vertical thick and thin beds of limestone that have a maximum aggregate thickness of 500 feet and are exposed for nearly three-quarters of a mile along a northwesterly strike. The limestone is light grey. It contains irregular zones and patches of light-coloured chert, white quartz, and argillaceous material. The weathered surface is rough due to the impurities. An analysis of a sample consisting of random chips collected along the top of the exposure is shown as No. 1 in the table on page 148.

* By D. R. Morgan.
† By J. W. McCammon.

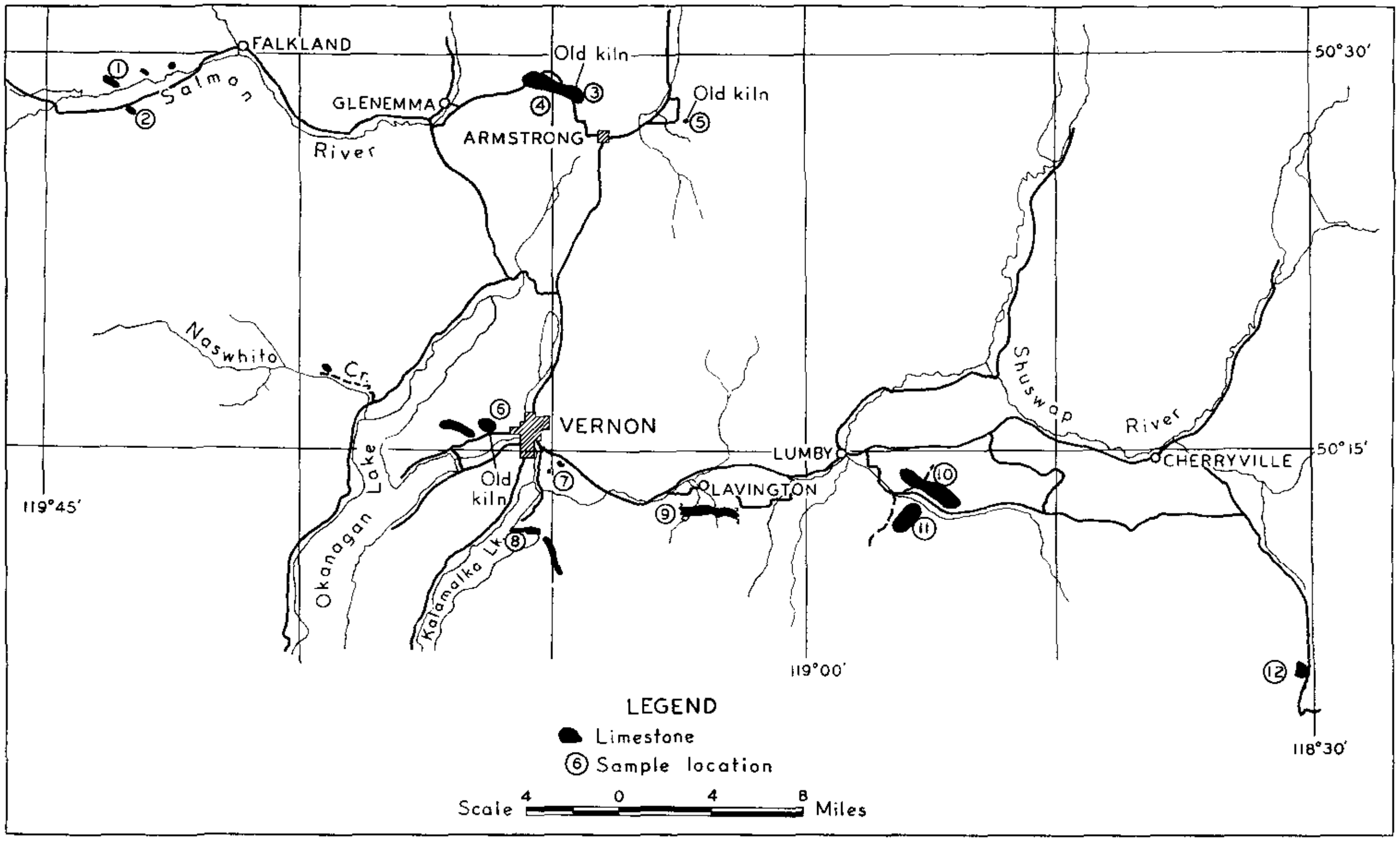


Figure 19. Limestone in the Vernon area.

A mile and one-half to the east a second lens of limestone is exposed in bluffs beside the railway track. The lens is 150 feet wide and extends for 1,000 feet northwestward up the sidehill. The rock is fine grained, dark grey to black, and contains abundant stringers and nodules of dark chert and siliceous brown-weathering material.

Another mile and one-half farther east scattered outcrops of impure, dark, thin-bedded limestone intermixed with black slaty argillite extend for 1,500 feet up the north side of the valley.

On the south side of the valley, No. 97 highway passes through a shallow rock cut 5.8 miles west of Falkland. A 200-foot-wide band of black, fine-grained, thin-bedded, impure limestone is exposed in the cut. The beds are contorted and faulted and cut by narrow veinlets of white calcite and narrow, sheared volcanic dykes. The limestone can be traced for 600 feet southeastward up the hill, where it disappears beneath overburden. A sample across 200 feet of strata exposed in the road cut had the analysis shown as No. 2 in the table below.

The purest and one of the largest deposits of limestone in the Vernon area forms a northwest-trending band across the top of a hill 2 to 4 miles northwest of Armstrong on the road to Glenemma. One exposure of the band, consisting of coarse-grained white limestone, can be seen in an open field one-quarter mile east of the road, 3.7 miles from Armstrong. The rock is badly fractured and is cut by at least one igneous dyke. An area of bare rock approximately 200 feet in diameter is exposed. In it are a small abandoned quarry and the remains of two pot kilns. This is apparently the deposit described by Goudge (Ref. 2), from which he took a sample that had the analysis shown as No. 3 in the following table. One-quarter mile due east of this deposit, flat-lying beds of similar coarse-grained white limestone in an area 200 feet wide and 300 feet long are exposed by a side road and in the adjacent fields. One mile northwest of the first deposit a side road joins the Glenemma road from the south. A good exposure of the limestone occurs in the bush a few hundred feet west of this road half a mile south of the junction. The rock can be traced for one-quarter mile from north to south and for 1,200 feet from east to west. It is medium to coarse grained and white to white and grey streaked. Scattered siliceous stringers and inclusions stand out on weathered surfaces. Sample No. 4 consisted of chips cut at 30-foot intervals across 1,200 feet from west to east near the south end of the exposure. A fourth exposure of the limestone band forms 50- to 100-foot-high bluffs, 300 feet north of the Glenemma road, 5.7 miles from Armstrong. The bluffs are below the road and run parallel to it for more than 1,000 feet. The rock exposed is white to grey streaked limestone similar in appearance to that of sample No. 4. Half a mile to the west past the bluffs, some coarse-grained white and grey streaked limestone has been excavated from a pit on the south side of the road.

More than thirty years ago a quarry was opened on a small limestone lens on Lot 989 about 3½ miles northeast of Armstrong. Some stone was ground for agricultural use and some was burned for quicklime in a pot kiln beside the quarry. The limestone exposure is 40 feet wide and can be traced 160 feet along the north bank of Kendry Creek. The rock is coarse grained and of a light-grey to cream colour. A sample of chips from across the 40-foot face of the quarry had the analysis shown as No. 5 in the following table.

A few small impure lenses of limestone occur in the lower valley of Fortune Creek, 2 miles south of Kendry Creek. In the vicinity of Meighan Creek, 1 mile south of Fortune Creek, the country rock is limy quartzite, which would be of no use as a source of lime.

Some small scattered pods of limestone are exposed on the hillside north of the end of the road that goes up the left bank of Naswhito Creek. The rock is highly siliceous and occurs mixed with cherty argillite.

Two bodies of limestone are exposed on the hillside above the north road from Vernon to Okanagan Landing. The first can be seen beside the road, 1.6 miles west of Thirty-second Street. Here the limestone forms humps and bare patches on the grassy open sidehill over an area roughly half a mile in diameter. The stone is medium- to dark-grey medium-grained limestone containing white quartz and calcite veinlets and lenses. The remains of an old kiln lie at the side of the road, 1.8 miles west of Thirty-second Street. The city of Vernon once burned lime in the kiln for use in the sewage-treatment plant, but stopped because of the poor quality of the stone. Analysis No. 6 shows the composition of a sample consisting of random chips collected from the top of the largest hummock. The second body of limestone borders the road for 1,000 feet about a mile west of the old kiln. From the road it extends as a ¼-mile-wide band curving up over the hill to the northwest for nearly 2 miles. The rock consists of thin beds of dark-grey medium- to fine-grained limestone with interbedded ribbons of chert and veins of white quartz.

Highly siliceous limestone is exposed in a 500-foot-diameter area on the north slope of an isolated bare hill 2 miles southeast of Vernon. The outcrops are behind some farm buildings one-quarter mile south of No. 6 highway. The rock is dark grey and weathers light grey with a rough surface due to included impurities. Fractures are abundant and white calcite veins are numerous. Analysis No. 7 represents a sample consisting of chips taken at random across the exposure.

A band of rock that extends across the south side of " Rattlesnake Point " on Kalamalka Lake, 4 miles south of Vernon, is shown on Map 1059A (Ref. 1) as consisting of limestone. Where examined, this rock was found to consist of scattered bands of limestone a few inches thick interbedded with white quartzite and limy quartzite. A sample across 30 feet of the best-looking material had the analysis shown as No. 8 in the table. A zone of similar rock forms part of the south face of Vernon Hill, half-way between Vernon and Lavington.

A 500-foot-wide band of siliceous limestone extends for nearly 2½ miles along the south side of Coldstream Valley 1 mile south of Lavington. The logging-road up the west side of Brewer Creek passes through a cut in the band. From the road continuous limestone outcrops can be followed for one-third mile westward to a fault contact with volcanic rocks. The band is exposed on a bare knoll on the ridge between Brewer and Craster Creeks and also on the nose that runs north from Bluenose Mountain down the east side of Craster Creek. The rock is white and grey streaked and coarse grained. Knots and lenses of light chert and inclusions of volcanic material are abundant. A sample of chips taken at 10-foot intervals along a 500-foot exposure on the Brewer Creek logging-road had the analysis shown as No. 9 in the table.

Two large zones of fairly pure Permian(?) limestone occur in Creighton Valley, 4 miles southeast of Lumby. The largest forms a 3-mile-long band across the southwest end of a prominent mid-valley hill known locally as the " Camel's Hump." The band averages more than half a mile wide. It is bordered on the southwest by sandy beds and argillite and on the northwest by volcanic flows. The rock is medium to fine grained, dark to light grey, and weathers light grey. In some places it is brecciated and the fractures are healed with white calcite. Argillaceous streaks and inclusions of black chert occur in other places. About a mile and a half from the north end of the band the rock is very dark and fetid and contains numerous fossil shell fragments. A sample of chips taken at random over the surface of the band had the analysis shown as No. 10 in the table. The second zone is a mile southwest of the first. It forms steep bluffs along the west face of a 1,500-foot-high hill on the east side of a small tributary valley. A road up the valley passes within half a mile of the deposit. Exposures of limestone indicate a northeast-trending band 600 feet wide and 1 mile long. The rock is medium to fine grained and light grey to white. It is highly fractured, is brecciated in places, and contains discontinuous lenses of white chert and veinlets of white quartz. A sample of randomly spaced chips from the top of the lens had the composition shown as sample No. 11 in the table.

Bands of rock shown on Map 1059A (Ref. 1) as limestone similar to that at Rattlesnake Point were examined at several locations along the Shuswap River. In all cases the only rock found was calcareous white quartzite; no true limestone was seen.

A large zone of Cache Creek rocks that contains limestone is crossed by No. 6 Highway near Monashee Pass. The only limestone outcrop within easy access comes to within 100 yards of the highway 14.6 miles from Cherryville. The rock forms steep high bluffs for more than 1,000 feet along the west side of the road. It is generally medium- to fine-grained medium-grey limestone, partly massive and partly showing bedding that strikes east-west and dips steeply south. The limestone is bordered on the south by granite and on the north by rusty greywacke. The rock is highly jointed and contains a considerable amount of chert in rusty stringers and contorted 6- to 8-inch-thick bands. A sample of chips collected at 10-foot intervals across 200 feet at the south end of the bluffs had the analysis shown as No. 12 in the table.

Vernon Area Limestone Analyses

Sample No.	Insol.	R_2O_3	Fe_2O_3	MnO	MgO	CaO	P_2O_5	S	Ig. Loss	H_2O
1	6.50	0.28	0.24	0.04	1.56	50.13	0.02	0.03	41.32	0.10
2	25.26	1.26	0.97	0.04	0.82	39.76	0.03	0.06	32.61	0.13
3[1]	1.10	0.23	0.10	......	0.24	55.04	Trace	*Nil*	......	......
4	1.62	0.20	0.09	0.04	0.23	54.44	0.01	0.01	43.35	0.04
5	3.88	0.56	0.40	0.14	0.30	53.07	0.04	0.09	42.00	0.08
6	5.14	1.00	0.62	0.07	2.16	49.92	0.05	0.01	41.68	0.07
7	19.88	1.14	0.83	0.04	0.51	43.41	0.04	Trace	34.82	0.11
8	59.26	3.14	1.00	*Nil*	1.06	20.20	0.07	0.05	14.58	0.17
9	22.39	10.96	3.36	0.06	2.66	33.80	0.05	Trace	28.18	0.19
10	3.84	0.82	0.50	0.07	0.48	52.66	0.03	0.01	42.05	0.13
11	4.02	0.30	0.26	0.04	0.26	53.07	0.02	Trace	42.16	0.10
12	5.79	1.84	0.83	0.04	1.99	49.55	0.01	Trace	40.37	0.20

[1] By M. F. Goudge.

[References: (1) *Geol. Surv., Canada,* Map 1059A, Vernon, 1960; (2) *Bureau of Mines, Canada,* Publ. No. 811, 1944, pp. 204–205.]

Norkay (The Consolidated Mining and Smelting Company of Canada, Limited)*

Fort Steele (50° 115° N.W.). This property is located on the north side of the Kootenay River 5 miles northwest of Wardner, or 2 miles west of the Bull River. The quarry is owned and operated under contract by The Consolidated Mining and Smelting Company of Canada, Limited, to supply dolomite flux for the iron-reduction plant at Kimberley. Most of the material to date has been loaded from a talus slope, and 9,700 tons of screened product was shipped to the plant during 1961. The material was shipped by rail. Two men were employed in the quarry.

* By D. R. Morgan.

Fraser Valley Lime Supplies*

Popkum (49° 121° S.W.). Head office, 7, 583 Edmonds Street, Burnaby. Thomas Mairs, manager. The quarry and crushing plant are on the east side of the Trans-Canada highway adjoining the southernmost tip of Indian Reserve No. 1, three-quarters of a mile east of Popkum station on the Canadian National Railway. Limestone is quarried in 25-foot benches by horizontal jackleg-drilled holes. The broken rock is transported by truck to the adjacent crushing plant, which produces agricultural lime and industrial filler. A small auxiliary crusher was added to the crushing equipment. An average crew of ten men quarried 7,533 tons of limestone, from which was produced 7,436 tons of crushed lime products.

Beale Quarries Division (Lafarge Cement of North America Ltd.)*

Vananda (49° 124° N.W.). Head office, 1051 Main Street, Vancouver 4; quarry office, Vananda. W. D. Webster, quarry superintendent. The quarry, crushing plant, and loading-dock are on the east coast of Texada Island, 1 mile south of Vananda. Open-pit bench-mining methods were used to produce 536,422 tons of limestone, of which 478,951 tons was crushed. The major portion of the crushed rock was shipped from the island and was primarily for cement manufacture, although it did include pulp rock and sized limerock. In addition 73,026 tons of rip-rap limerock was produced and shipped. A crew of twenty-six was employed.

Ideal Cement Company Ltd.*

Vananda (49° 124° N.W.). British Columbia office, 1155 West Georgia Street, Vancouver 5; quarry office, Vananda. W. S. Beale, manager, Rock Products Division; J. K. Johnson, superintendent. Rock quarries were operated on Lot 25, 2 miles south of Vananda and adjacent to the crushing plant and loading-dock at Marble Bay. A washing section was added to the crushing plant in order to produce an improved product. During 1961 seventeen men quarried, by open-pit benching methods, 190,000 tons of limestone, of which 163,000 tons was crushed and shipped. The materials shipped included rip-rap rock, pulp rock, cement rock, and rock for metallurgical uses.

Imperial Limestone Company Limited*

Vananda (49° 124° N.W.). Office, 7309½ East Marginal Way, Seattle 8, Wash.; plant and quarry office, Vananda. John Jack, manager; Don McKay, superintendent. The quarry and primary crushing plant is on Lot 500, near the summit of a small hill 1 mile west of Spratt Bay on the east coast of Texada Island. At the quarry crushing plant the limestone is sorted into white and grey fractions. The select white limestone is trucked to the plant at Vananda for further crushing to produce stucco dash and whiting. Run-of-pit material and the sorted grey limestone is trucked to the nearby Lafarge Cement crushing plant.

In 1961 a crew of six men was employed and 27,000 tons of limestone was mined, crushed, and shipped. In addition, a crusher, storage hopper, and reclaiming tunnel were installed at the Spratt Bay plant-site.

Gypsum Lime & Alabastine Limited*

Blubber Bay (49° 124° N.W.). Head office, 50 Maitland Street, Toronto 5, Ont.; British Columbia office, 1105 West Pender Street, Vancouver 1; quarry office, Blubber Bay; lime plants, Blubber Bay and Vancouver. A. W. Jones, British Columbia area manager; Arthur Pitt, Blubber Bay plant

* By J. E. Merrett.

manager. This company is a subsidiary of Dominion Tar and Chemical Company Limited. The limestone quarry is approximately 2 miles south of Blubber Bay on Texada Island.

A crew of fifteen men was employed at the quarry and crushing plant and forty-five men in the lime plant. Open-pit bench-mining methods were used to produce 320,224 cubic yards of limerock, of which 231,352 cubic yards was shipped.

Koeye River (Widsten Marine Services Limited)*

Koeye River (51° 127° N.W.). Company office, Bella Bella; mine office, Koeye River. A. O. Widsten, manager. Limestone is mined by benching methods from the west pit of two adjacent quarries on the north side of Koeye River, less than a mile from its mouth on Fitz Hugh Sound, 6 miles south of Namu. In an eight-month period a crew of five men produced and shipped 10,114 tons of limestone to the Crown Zellerbach Canada Limited paper-mill at Ocean Falls.

British Columbia Cement Company Limited†

Cobble Hill (48° 123° N.W.). Head office, 540 Burrard Street, Vancouver 1. W. F. Foster, president; B. M. Brabant, executive vice-president; R. E. Haskins, vice-president in charge of production. Limestone for the Bamberton cement plant is quarried by this company from a deposit at Cobble Hill on Vancouver Island. In 1961, 226,572 tons of raw material was mined.

MAGNESITE‡

The Consolidated Mining and Smelting Company of Canada, Limited

Perry Creek (49° 115° N.W.). Head office, Trail. This property occupies a 5-mile strip between St. Mary River and Perry Creek, approximately 2 to 7 miles southwest of Marysville. It is owned by The Consolidated Mining and Smelting Company of Canada, Limited, and comprises eighteen Crown-granted claims and three located claims. The property can be reached by road from Wycliffe.

The company conducted a bulldozer trenching programme, excavating 6,611 cubic yards of material from nine trenches, at the south end of the property during a short period in 1961. The field work was under the supervision of G. W. Webber.

MARL*

Cheam Marl Products Ltd.

Popkum (49° 121° S.W.). Office, 13 South Fletcher Street, Chilliwack. R. S. Davidson, manager. A crew of four men was employed to excavate marl and overlying humus from a post-glacial deposit accumulated on the floor of Cheam Lake. In past years a ditch was dug to drain the lake. Recent production was obtained by a dragline working in the area north of the former lake. The materials produced were either trucked wet to the consumer or stockpiled on a draining-pad. A crew of three men produced 37,931 tons of marl and 7,073 cubic yards of topsoil in 1961.

* By J. E. Merrett.
† By R. B. Bonar.
‡ By D. R. Morgan.

MICA*

Georgian Mineral Industries Ltd. Cedarside (52° 119° N.E.). Company office, 301, 513 Eighth Avenue Southwest, Calgary, Alta. G. C. Short, president; George Brunette, mine manager; H. Gilmour, plant manager. This company operates a mica-grinding plant at Cedarside near Valemount. Schist from a quarry on Canoe River 1½ miles upstream and west of the railway is used as raw material for the plant. The schist consists chiefly of muscovite and quartz with minor garnet, biotite, and feldspar. The schist is interbedded with layers of quartzite. In the quarry the beds strike north 60 degrees east and dip about 10 degrees northwest. When examined the main quarry was approximately 200 feet in diameter with a face 10 to 15 feet high. A hard 1- to 4-foot-thick capping of quartzite lay along the lip of the quarry and a hump of similar rock was exposed in the centre of the floor. A bulldozer was being used to strip a trench parallel to the face, 50 feet to the northwest.

Broken rock is trucked 3 miles to the plant, which is located near the south end of the sawmill yard on the west side of the railway track at Cedarside siding. At the plant the schist is fed from a feed hopper through a dryer to a hammer mill, thence to gyratory screens and a Kipp-Kelley air separator. Five sizes of mica are made, and these can be blended to suit the customer. During 1961 about 125 tons of mica was produced in the process of tuning up and testing the mill.

POZZOLAN†

Canadian Pozzolan Industries Limited (52° 122° N.E.) Registered office, 475 Howe Street, Vancouver 1; company office, 1118, 355 Burrard Street, Vancouver 1. J. G. Fleming, president; J. C. Mills, vice-president. This is a private company which, in 1961, commenced to quarry pozzolanic shale on a lease on Lot 122, immediately south of the confluence of the Quesnel and Fraser Rivers. The quarry is situated close to the Pacific Great Eastern Railway, and a spur line extends into the quarry. Excavation of the shale was carried out by local contractors. In 1961 a pilot run of approximately 100 tons of shale was quarried. This was shipped to the company's mill at Britannia Beach, where it was dried and ground.

SAND AND GRAVEL

Data on sand and gravel production are presented in a table on the following pages. References to detailed descriptions previously published are shown in the table as follows: (MM 1959) meaning the report appeared in the Annual Report of the Minister of Mines for 1959.

The following abbreviations are used in the table for the types of sand and gravel produced: AA=asphalt aggregate; SA=sized aggregate; WS=washed and sized aggregate; RP=run-of-pit material; AP asphalt paving mix; RM=ready-mix concrete.

* By J. W. McCammon.
† By A. R. C. James.

Sand and Gravel Pits

Location	Operator	Equipment and Plant	Men	Production
Fort St. John	Columbia Bitulithic Limited	Paving	..	AP=118,755 tons.
Fort McLeod	Columbia Bitulithic Limited	Paving	....	AP=42,313 tons.
Kitimat	Kitimat Concrete Products (1961) Ltd.	Dragline, conveyor, washing, crushing, screening	10	RP and WS.
Prince George—				
(1) North Nechako Road	Central Sand and Gravel Ltd. (J. W. Phillips, president)	Scoopmobile, Cedar Rapids two-deck screening plant, ready-mix plant	11	No. 4 sand and ⅜-in. sand, 11,953 yd.; ⅜-, ¾-, 1-, and 1½-in. rock, 15,314 yd.; RP concrete gravel, 1,174 yd.; fill gravel, 6,018 yd.; Total, 34,459 yd.
(2) Parcel Y, Lot 2507, Plan 833, Central Fort George	Wilson Construction Co. Ltd.	Bucyrus-Erie shovel, portable crushing and screening plant	6	No sand and gravel sold; custom crushing for paving plant.
Creston—Goat River bank	Louis Salvador and Son	Crushing, screening, washing	4	WS.
Wynndel—beside highway 4½ mi. north of town	F. Merriam	Crushing, screening	1	SA and AA.
Nelson—Anderson Creek above Fairview district	Premier Sand and Gravel Company Limited (A. Shrieves, president)	Dragline, crushing, screening (MM 1959)	4	SA.
Trail—				
(1) Ferraro pit, Casino Road, 2 mi. south of Trail	Korpack Cement Products Limited, Trail	Portable crushing, screening	3	SA.
(2) McGauley pit, Casino Road, 1 mi. south of Trail	McGauley Ready-Mix Concrete Company (J. McGauley, owner)	Scraper, crushing, screening, washing, ready-mix	3	WS.
Castlegar—McGauley pit, river bank east of Castlegar	McGauley Ready-Mix Concrete Company, Trail	Loader, crushing	2	SA.
Vancouver—Granville Island	Columbia Bitulithic Limited	Paving plant	—	AP=24,839 tons.
North and West Vancouver—				
(1) Mouth of Capilano River	Capilano Crushing Co. Ltd., 1 West First Ave., Vancouver	Washing plant	23	WS=234,452 yd.
(2) Capilano Indian Reserve	Routledge Gravel Limited (T. C. Routledge, president)	Scraper, portable crusher, washing and screening	24	WS=191,000 yd.
(3) Lynn Creek mouth, lower end of Brooksbank Ave.	Routledge Gravel Limited	Scraper, portable crusher, washing and screening		
(4) Seymour Creek mouth, foot of Riverside Drive	Seymour Gravel Company Limited (E. S. Livesey, manager)	Dragline shovel, portable crusher, washing and screening	6	WS=55,550 yd., supplied to Jamieson Construction's concrete mix and paving plants.
(5) West end of East Keith Road, east of Seymour Creek	E. R. Taylor Construction Co. Ltd., Deep Cove Highway	Shovel, paving plant	1[1]	AA=19,560 yd.
Indian Arm—pit, Bishop Creek; plant, Barnet	Indian Arm Sand & Gravel Co. Ltd., Barnet	Shovel; conveyors and screening plant under construction	6	WS=5,000 yd., stockpiled at Bishop Creek.
City of Port Moody—Barnet Highway 1½ mi. west of Port Moody	City of Port Moody	Front end loader	—	Sand fill.

Coquitlam Municipality—				
(1) Junction of Laurentian and Austin Roads, west end of Westwood Road	Corporation of the District of Coquitlam	Front-end loader, portable crushing and screening	.....	....
(2) North Road and Lougheed Highway	Burquitlam Sand & Gravel Co. Ltd. (A. J. Percy, manager)	Front-end loader	2	RP and fill=71,083 yd.
(3) South end of Schoolhouse Road (T. B. Allard and Son, owner)	F. W. Monssen Construction Ltd.	Front-end loader, crushing and screening	5	RP and crushed aggregate=51,000 yd.
(4) Pipeline Road, Coquitlam River, 1 mi. north of Lougheed Highway	Deeks-McBride Ltd., 1051 Main St., Vancouver, and Columbia Bitulithic Limited	Shovel, new 600-tons-per-day crushing, washing, and screening plant; ready-mix; paving plant in same pit	5	WS and RM=123,600 yd. AP=21,032 tons.
(5) Westwood Road	Independent Ventures Limited, 2065 Coquitlam Ave., Port Coquitlam	Shovel, crushing and screening	1	RP and SA=42,241 yd.
(6) Pipeline Road, 2 mi. north of Lougheed Highway	F. Dotten, 677 Fairview St., New Westminster	Shovel, crushing and screening	2[1]	RP and crushed aggregate=10,000 yd.
(7) Pipeline Road, 2¾ mi. north of Lougheed Highway, Taylor pit	S. & S. Sand & Gravel Limited, 1101 Eighth Ave., New Westminster	Shovel	1[1]	RP=33,829 yd.
(8) Pipeline Road, 3¼ mi. north of Lougheed Highway	S. & S. Sand & Gravel Limited, 1101 Eighth Ave., New Westminster	Front-end loader, crushing, screening, and washing	4	RP and WS=42,108 yd.
(9) Pipeline Road, 3½ mi. north of Lougheed Highway	Jack Cewe Blacktop Ltd., 309 Cedar St., New Westminster	Shovel, paving plant	9	AP=100,000 tons.
(10) East side of Coquitlam River, 2½ mi. north of Lougheed Highway	Scott Bros. Gravel Co. Ltd., Port Coquitlam (G. Scott, manager)	Shovel, front-end loader, crushing, washing, and screening	35	RP and WS=175,000 yd.
Port Coquitlam—Fraser River at Mary Hill, 2 mi. south of Port Coquitlam	Evans, Coleman & Evans Limited, foot of Columbia St., New Westminster	Shovel, 500-tons-per-hour processing plant	25	RP and WS=750,000 yd.
Pitt Meadows Municipality—				
(1) 1 mi. northwest of Port Hammond	Haney Brick and Tile Ltd.	Front-end loader	2[1]	Sand=3,160 yd.
(2) Bonson Road, 1 mi. north of Fraser River	Lasser Trucking & Contracting Co. Ltd.	Front-end loader	.....	RP and topsoil.
Maple Ridge Municipality—				
(1) Grant Hill, 1 mi. east of Albion and adjoining Kirkpatrick pit	Corporation of the District of Maple Ridge	....	.....	Fill.
(2) Grant Hill, 1 mi. north of above pit	McIntosh Sand and Gravel, Haney	Shovel, screening	3[1]	RP and SA=18,000 yd.
(3) Grant Hill, north of McIntosh pit	Henry Van Boeyen, Albion	....	.....	RP.
(4) Grant Hill, 1 mi. north of municipal pit	Valley Ready-Mix, Albion	Shovel, washing, screening, and mixing near Albion landing	1[1]	RP=45,000 yd.
(5) East end of No. 27 Road, Alouette River	Kirkpatrick Sand and Gravel Co. Ltd., Haney	Shovel, crushing, washing, and screening	3	RP and WS=7,451 yd.
(6) Lougheed Highway, 1 mi. east of Whonock	R. E. George, Whonock	Front-end loader	1[1]	RP=1,658 yd.
Mission Municipality—				
(1) 1 mi. east of Stave Falls power-house	Corporation of the District of Mission	Screening plant	.....	....
(2) 3½ mi. east of Stave River power-house	Corporation of the District of Mission	Screening plant	.....	....
(3) Dewdney Road, 1.8 mi. south of Steelhead	Department of Highways	Small pit	.....	....
(4) Hulla Island, mouth of Stave River	Routledge Sand and Gravel Co. Ltd., Lower Capilano P.O.	Portable crushing, screening, and washing	3[1]	WS=9,500 yd.

[1] Part time.

Sand and Gravel Pits—Continued

Location	Operator	Equipment and Plant	Men	Production
Dewdney—Lougheed Highway, 2 mi. west of Squakum	Department of Highways	Front-end loader	.	
Kent Municipality—				
(1) West end of Cemetery Road, south of Mount Agassiz	Corporation of the District of Kent	Shovel and front-end loader in rock quarry and large gravel pit	.	
(2) 3 mi. south and 1½ mi. west of Harrison Hot Springs	Department of Highways	Front-end loader	. .	
Chilliwack Municipality—				
(1) Minto Landing and 1½ mi. west of Vedder Crossing	Corporation of the Township of Chilliwhack	Various operators obtain gravel from these properties on a royalty basis; shovels, front-end loaders, screening, and crushing	. . .	RP and SA.
(2) Chilliwack Creek	B. and G. Sand and Gravel Co. Ltd. (A. K. Gregory, manager)	Scraping from river bottom; screening and washing	2[1]	WS=6,500 yd.
(3) Cultus Lake	Columbia Bitulithic Limited	Paving	—	AP=25,618 tons.
Sumas Municipality—				
(1) Northeast slope of Sumas Peak	Dawson Wade & Company Limited	Shovel, large pit	—	Fill.
(2) At foot and east of Taggart Peak	H. Quadling, owner; various operators	Front-end loader, screening	—	Fill.
(3) 1 mi. east of Abbotsford	Corporation of the District of Sumas		. .	Fill.
(4) Vye Road (Eighth Ave.), 4 mi. south of Abbotsford	Corporation of the District of Sumas	Shovel, screening, and Columbia Bitulithic paving plant	—	AP=28,539 tons and fill.
Matsqui Municipality—				
(1) 1 mi. east of Abbotsford	Blackham's Construction Limited	Screening	3[1]	SA=13,944 yd.
(2) 2 mi. east of Abbotsford	Department of Highways	New large pit	—	Fill gravel for new Trans-Canada Highway.
(3) Tretheway Road, ¾ mi. north of Clearbrook	Department of Highways	Two adjoining pits	—	
(4) Tretheway Road, ½ mi. north of Clearbrook	Deeks-McBride Ltd., 1051 Main St., Vancouver	Screening, washing, and ready-mix; shovel and front-end loader	2	WS, RP, and RM=15,140 yd.
(5) Clearbrook Road, ½ mi. north of border	Abbotsford Gravel Sales Ltd.	Scraper, front-end loader, screening; ready-mix plant of Totem Trucking Ltd.	2	SA and RM=27,574 yd.
(6) Twelfth Ave., ¼ mi. west of Clearbrook Road	Valley Rite-Mix Ltd., Abbotsford	Screening, crushing, and ready-mix concrete	5[1]	SA and RM=9,769 yd.
(7) Corner of King (Sixteenth Ave.) and Foy (316th St.)	Valley Rite-Mix Ltd., Abbotsford	Shovel	—	RP.
(8) Aberdeen Road (288th St.), 1½ mi. north of border	Department of Highways	Shovel; large pit	—	RP; fill gravel for new Trans-Canada Highway.
(9) Lefevre Road (280th St.), 1¼ mi. north of border	Corporation of the District of Matsqui	Shovel, screening, and Columbia Bitulithic paving plant	—	SA and AP=41,890 tons.
(10) Lefevre Road at Eighth Ave.	R. Caplette, North Vancouver	Front-end loader	2[1]	RP=1,500 yd.
Langley Municipality—				
(1) Northwest corner of Jackman Road and Eighth Ave.	Corporation of the Township of Langley	Shovel	—	Fill.

Langley Municipality—*Continued*				
(2) ½ mi. west of Carvolth Road above Twenty-fourth Ave.	Corporation of the Township of Langley		..	Fill.
(3) *At Matsqui boundary north of* Eighth Ave.	*Dupont Bros.*	Front-end loader	1[1]	RP=750 yd. approx.
(4) At Matsqui boundary south of Eighth Ave.	Emil Anderson Construction Co. Ltd.	Front-end loader	—	RP=1,000 yd. approx.
(5) North of northeast corner of Jackman Road and Eighth Ave.	S. O'Malenick, Jackman Road	Front-end loader	1[1]	RP=1,000 yd.
(6) ¼ mi. north of corner of Jackman Road and Eighth Ave.	J. Craig, Trans-Canada Highway, Langley	Front-end loader	1[1]	RP=1,680 yd.
(7) Boundary Road at Surrey boundary	Border Sand & Gravel Ltd.	Loader, washing, crushing, and screening	2	WS=18,000 yd.
(8) Dogwood Ave. and Brown Road	Kitsul Bros., 24306 Trans-Canada Highway	Loader	1[1]	RP=18,000 yd.
(9) Bradshaw and Berry Roads	Hornby General Machinery Company, Cloverdale	Screening and crushing; shovel	2[1]	RP and SA=13,058 yd.
(10) 2962 Lambert Road	Highland Sand and Gravel Company Limited and Evans, Coleman & Evans Limited	Scraper, front-end loader, washing, crushing, and screening	5	RP and WS=4,800 yd.
(11) Sixteenth Ave. at Surrey border	Department of Highways	Shovel	...	Fill for Deas Throughway extension.
Surrey Municipality—				
(1) North Bluff Road (Sixteenth Ave.) at 192nd St.	Department of Highways	Shovel	....	Fill for Deas Throughway extension.
(2) East end of Stokes Road (Twentieth Ave.)	Corporation of the District of Surrey	Shovel	...	Fill.
(3) Stokes Road, ½ mi. east of 184th St.	A. B. Longstaff & Son Ltd.	Shovel	1[1]	RP=16,344 yd.
(4) Larsen Road (Twenty-eighth Ave.) at 193rd St.	Deeks-McBride Limited, 1051 Main St., Vancouver	Scraper, portable crushing, screening, washing, and ready-mix	2	WA and RM=23,909 yd.
(5) South of McLellan Road at Delta boundary	Corporation of the District of Surrey	Shovel and asphalt plant	...	RP and AP.
(6) Fifty-third Ave. at Delta boundary	Colebrook Sand & Gravel Company, Limited	Front-end loader, crushing, screening, and washing	3	RP and WS=49,000 yd.
(7) 15945—112th Ave., North Surrey	Richmond Sand and Gravel Ltd.	Loader, portable washing and screening	3	RP and WS=30,000 yd.
(8) 112th Ave. east of Pike (160th) St.	Steeves and Mann Equipment Ltd.	Two shovels	1	RP=33,230 yd.
(9) 104th St., 1 mi. south of Port Mann	S.U.B. Quarries	Front-end loader	4	RP=1,622 yd.; closed since May.
Delta Municipality—				
(1) 10720 Eighty-fourth Ave.	Knight Gravel, Ltd.	Shovel, loader, and screening	11[1]	RP and SA=33,322 yd.
(2) ¼ mi. south of west end of Seventy-second Ave.	Locke Holmes, 5508 Forty-seventh Ave., Ladner	Pit leased from Industrial Peat Products Ltd.; shovel; Perini Pacific Company had screening and asphalt plant in same pit	1	RP, SA, AP, and RP=93,456 yd.
(3) ½ mi. west of Scott Road at Sixty-eighth Ave.	Linton's Construction Co. Ltd.	Two shovels, screening, and Western Paving Ltd. plant	4	RP=102,837 yd.
(4) Corner of First Ave. and Fifty-sixth St.	Corporation of the District of Delta	Shovel, large pit	—	Fill.

[1] Part time.

Sand and Gravel Pits—Continued

Location	Operator	Equipment and Plant	Men	Production
Howe Sound—				
(1) Britannia Beach	Construction Aggregates Ltd.	Scraper, loader, crushing, screening, and washing	10	WS=410,000 yd.
(2) Hastings Creek, 1 mi. south of Port Mellon	Evans, Coleman & Evans Limited, foot of Columbia St., New Westminster	Shovel, crushing, screening, and washing	25	WS=400,000 yd.
Powell River—				
(1) Haslam Lake Road, 3 mi. northeast of Westview	G. & H. Sand and Gravel Company Ltd.	Screening, washing, and ready-mix	2[1]	WS and RM=2,500 yd.
(2) Allen Road, 3 mi. northeast of Westview	P. Massichuk	Screening	1[1]	RP and SA=4,292 yd.
(3) Cranberry Lake Road	Parsons Tractor Services Ltd.	Crushing and screening	4[1]	RP and SA=9,753 yd.
Vancouver Island—				
(1) Keating Cross Road	Butler Brothers Supplies Ltd.	Diesel-driven shovels, overhead loader, washing and sizing	6	RM, RP, WS=173,928 yd.
(2) Saanich	McIntyre & Harding Gravel Company Limited (now Keystone Concrete Limited)	Diesel-driven shovels, washing and sizing	14	WS=29,379 yd.
(3) Royal Bay	Evans, Coleman & Evans Limited	Plant No. 1—scraper on a slack-line cableway, shovel, crushing, screening, and washing; Plant No. 2—diesel-driven shovel, washing and cleaning	11	WS=230,480 yd.
(4) Langford Lake	McRae Bros. Ltd.	Overhead loader	2	RP.
(5) Langford Lake	Midland Pit (George F. Fox)	Overhead loader, cleaning and sizing	—	SA.
(6) 4 mi. from Duncan on Lake Cowichan road	Butler Brothers Supplies (Duncan) Ltd.	Overhead loader, washing, sizing, and ready-mix	3	RP, WS, RM=20,410 yd.
(7) Adjacent to Island Highway at Cassidy	Cassidy Sand and Gravel Ltd. (now Evans, Coleman & Evans Limited)	Overhead loaders, washing and sizing	6	WS=23,880 yd.
(8) 2½ mi. from Courtenay	S. H. Marriott Sand and Gravel	Mobile loader, rotary screening	3	SA.

[1] Part time.

SILICA

Mountain Minerals Limited* Golden (51° 116° S.W.). Company office, Meech Building, P.O. Box 273, Lethbridge, Alta. R. A. Thrall, managing director; William MacPherson, superintendent. This company holds leases covering a silica deposit on the southwestern slope of Moberly Mountain, 5 miles northeast of Golden. The showings are at an elevation of 5,000 feet, and can be reached by a 6-mile road leading from the Golden–Field highway, 1 mile east of Golden. A description of the property is included in the 1959 Annual Report.

Minor development was carried out for a short period during 1961, and a small number of samples of silica were shipped for testing purposes.

Winlaw† (49° 117° N.E.) Harold Avis, of Winlaw, located two mineral claims in October, 1960, and four more in January, 1961, on a quartz lens 4 miles due east of Winlaw station. An unsuccessful attempt to diamond drill the quartz was made in the early spring of 1961.

The claims are at 5,000 feet elevation on the east side of the north fork of Winlaw (Cedar) Creek, 2¼ miles upstream from the forks. They can be reached by driving 3½ miles from Highway No. 6 to the end of the road to the abandoned farms on the terrace 2 miles east of Winlaw. From the end of the road the forestry trail is followed up the ridge west of the north fork for 2 miles. From this point one can continue up the ridge, around the head of the north fork, and back down the ridge on the east side to the deposit, an additional 2 miles, or one can drop down to the north fork and climb 1,400 feet up the east bank to the deposit, a distance of about 1 mile.

The showing consists of an irregular pod of massive, barren, milky-white quartz 150 feet wide from north to south and about 200 feet long from east to west. At the west end the quartz is intergrown with coarse perthitic feldspar and fingers out into pink porphyritic syenite. To the north there is a fairly sharp gradation from pure quartz into a 100-foot-wide zone of intergrown quartz and feldspar and then porphyritic syenite. To the east the outcrop of quartz ends in earthy overburden, and from there on only talus and scattered outcrops of the syenite are visible. Along the south side the contact is obscured, but syenite can be found in place close to the quartz. Jointing is strongly developed in several directions in the quartz. Apart from a few scattered rusty spots and a few places where minute scales of specularite occur on joint faces, no impurities were recognized in the main body of quartz. One sample consisting of chips taken at 5-foot intervals from north to south across the centre of the exposure had the following percentage analysis: SiO_2=99.12; Fe=0.007; Al_2O_3=0.60; Ig. loss=0.27.

Oliver Silica Quarry‡ (49° 119° S.W.) Pacific Silica Limited. Registered office, 717 West Pender Street, Vancouver 1; quarry office, Box 397, Oliver. I. A. Hunter, manager. The Oliver silica quarry is on the Gypo mineral claim, owned by The Consolidated Mining and Smelting Company of Canada, Limited, and operated under a lease by Pacific Silica Limited. The claim is less than one-quarter of a mile west of Highway No. 97, 1 mile north of Oliver. Estimated production for the year was 39,500 tons, and shipments made were 8,300 tons sacked and 27,000 tons in bulk. Two accidents were reported. New construction included the start of a washing plant. A crew of twenty-six was employed.

* By D. R. Morgan.
† By J. W. McCammon.
‡ By David Smith.

Petroleum and Natural Gas

CONTENTS

GENERAL ADMINISTRATION

By K. B. Blakey

For purposes of administration of the *Petroleum and Natural Gas Act,* the Department is divided between a General Administrative Section and the Petroleum and Natural Gas Branch. The former, under the direction of the Chief Commissioner, is responsible for the administration of the *Petroleum and Natural Gas Act,* which includes all matters related to and affecting title to Crown petroleum and natural-gas rights. The regulations governing geophysical operations are also administered by the Chief Commissioner.

The Petroleum and Natural Gas Branch, under the direction of the Chief of the Branch, is responsible for administration of the "Regulations Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas" made pursuant to the *Petroleum and Natural Gas Act.* The regulations specify the conditions which must be employed for efficiency and safe practice in the drilling, completion, and abandonment of wells; for well spacing; prevention of waste; conservation; and all related matters.

As at December 31, 1961, 33,925,009 acres, or approximately 53,000 square miles, of Crown petroleum and natural-gas rights, issued under the *Petroleum and Natural Gas Act,* were held in good standing by operators ranging in stature from small independent companies to major international ones. The form of title held, total number issued, and acreage in each case were as follows:—

Form of Title	Number	Acreage
Permits	424	25,898,913
Natural-gas licences	5	159,027
Drilling reservations	32	546,699
Leases (all types)	2,006	7,320,370
Total		33,925,009

Details of land disposition for the years 1947 to 1960, inclusive, may be found on page A 61 of the 1960 Annual Report.

The area of major land-holding interest, development, and production lies in the northeastern corner of the Province, in that segment of British Columbia roughly flanked by the Rocky Mountain Trench. Other acreage is held in the Prince Rupert, Williams Lake, and Fernie Land Recording Districts, in areas generally referred to as the Groundhog Basin area, Chilcotin River area, and Flathead River area respectively. In addition, some 4,000,000 acres are held in the coastal regions of the Mainland, the Queen Charlotte Islands, and Vancouver Island.

During the year, land disposition was changed by the following transactions:—

	Issued	Terminated	Decrease (—) or Increase (+)
Permits	46	120	—76
Natural-gas licences	1	8	—7
Drilling reservations	18	18	......
Leases—			
Petroleum and natural gas	562	36	+526
Natural gas	12	......	+12
Petroleum	......	......	......

Petroleum and natural-gas revenue which has accrued to the Crown from all sources from April 1, 1947, to December 31, 1961, is shown in the accompanying table.

Petroleum and Natural-gas Revenues

	1947–54[1]	1954	1955	1956	1957	1958	1959	1960	1961	Cumulative, 1947–61
Rentals and Fees										
Permits	$8,337,460	$2,425,599	$3,465,295	$2,773,067	$2,737,989	$3,307,732	$3,000,337	$3,202,923	$2,856,551	$32,106,953
Drilling reservations	......	......	......	......	......	5,147	76,115	136,945	59,989	278,196
Natural-gas licences	......	......	......	......	......	10,157	4,521	29,648	12,638	56,964
Petroleum, natural-gas, and petroleum and natural-gas leases	......	1,147	78,288	122,157	430,177	990,383	1,695,153	3,339,790	3,616,123	10,273,218
Total rentals	$8,337,460	$2,426,746	$3,543,583	$2,895,224	$3,168,166	$4,313,419	$4,776,126	$6,709,306	$6,545,301	$42,715,331
Sale of Crown Reserves										
Permits	......	$788	$605,307	$1,614,325	$1,342,813	$4,144,059	$3,486,337	$1,650,324	$1,493,679	$14,337,632
Drilling reservations	......	......	......	......	......	72,370	1,004,711	2,136,105	3,082,821	6,296,007
Leases	......	......	......	......	......	293,694	6,499,766	2,400,198	3,065,391	12,259,049
Total Crown reserve sales	......	$788	$605,307	$1,614,325	$1,342,813	$4,510,123	$10,990,814	$6,186,627	$7,641,891	$32,892,688
Royalties										
Gas	......	$761	$2,612	$2,826	$7,264	$433,546	$492,053	$912,102	$1,152,396	$3,003,560
Oil	......	......	17	37,196	104,569	140,158	231,403	219,156	207,392	939,891
Processed products	......	......	......	......	......	62,105	69,998	76,059	119,405	327,567
Total royalties	......	$761	$2,629	$40,022	$111,833	$635,809	$793,454	$1,207,317	$1,479,193	$4,271,018
Miscellaneous fees	......	$3,604	$12,392	$12,428	$10,027	$12,870	$14,722	$13,220	$23,817	$103,080
Total petroleum and natural-gas revenues	$8,337,460	$2,431,899	$4,163,911	$4,561,999	$4,632,839	$9,472,221	$16,575,116	$14,116,470	$15,690,202	$79,982,117

[1] Administered under the Department of Lands and Forests until March 31, 1953. Details of revenue are not available by calendar years; total revenues are shown under permits by fiscal years ending March 31st for the period 1947–54. The detailed amounts of revenue for each fiscal year, 1947 to 1954, are shown on page A 61 of the 1960 Annual Report.

PETROLEUM AND NATURAL GAS BRANCH

Victoria

The Petroleum and Natural Gas Branch is subdivided, for administrative purposes, into five sections, each of which is headed by a supervisor who is responsible for a specific phase of Branch work. These sections and the supervisors in charge are as follows:—

J. D. Lineham	Chief of the Branch
R. R. McLeod	Reservoir Engineering
A. N. Lucie-Smith	Reserves and Evaluation
W. L. Ingram	Development Engineering
S. S. Cosburn	Geology
T. A. Mackenzie	Statistics and Well Records

The headquarters staff includes also two engineers, two geologists, two engineering assistants, three clerks, one clerk-stenographer, and one clerk-typist.

Charlie Lake

G. E. Blue	District Engineer
H. B. Fulton	Field Geologist
D. L. Johnson	Field Engineer
H. A. Sharp	Engineering Assistant
M. A. Churchill	Engineering Assistant

The field-office staff includes also two general assistants and one clerk-stenographer. Two university students were employed during the summer months.

The field office is situated at Charlie Lake, a small community on the Alaska Highway about 5 miles northwest of Fort St. John.

GENERAL REVIEW

By J. D. Lineham

During 1961 the general level of activity in the development of the petroleum and natural-gas industry in British Columbia increased substantially over that of any previous year. Although most phases of activity were above average, the increases in development drilling and production were the most significant.

The main activity again was concentrated in northeastern British Columbia, although the Fernie-Flathead area, the Lower Mainland region, and Graham Island received some attention.

Reports of geological and geophysical work submitted by companies to the Petroleum and Natural Gas Branch indicate that nineteen companies operating in northeastern British Columbia carried out exploration involving 116 seismic crew-months, nine companies had geological parties in the field, and three structure test-holes were drilled. The greatest seismic activity was in March, when thirty-nine crews operated. Seismic programmes were conducted also in the Lower Mainland region and in waters adjacent to Graham Island. Two surface geological parties carried out investigations in the southeastern part of the Province in the general Fernie-Flathead area.

The increase in the number of development wells drilled in the known oil fields was responsible for the marked increase in total drilling activity in 1961, and also for the high ratio of successful-to-abandoned wells. It is of interest to note that 73 per cent of all wells drilled in 1961 were completed as potential oil or gas producers. More than 1,000,000 feet of hole was drilled at 237 locations by fifty-four drilling rigs owned by twenty contractors. The 151 wells completed, an increase of 80 per cent over 1960, included sixty-four gas-well completions and eighty-eight oil-well completions. The fifty-five abandonments represent a 17-per-cent decrease from the number of abandonments in 1960. Drilling was again concentrated during the winter months, at the beginning and end of the year, the greatest intensity being in December, when forty-two drilling rigs were active.

Although exploratory drilling decreased slightly from the previous year, significant oil and gas discoveries were made in widely separated parts of the Peace River District. Oil discoveries resulted mainly in extensions to existing producing fields rather than the discovery of new pools. In the case of gas, several significant new discoveries, in previously unproductive areas, were made in geologic formations ranging from Lower Cretaceous Bluesky down to Middle Devonian. The most important gas discoveries were made in the Triassic Schooler Creek formation at Cypress, in the Mississippian at Judy Creek, and in the Middle Devonian at Beaver River, Komie, and Tsea.

Production of oil and gas increased over 1960 by 17 per cent and 23 per cent respectively to 1,017,826 barrels and 103,122,789,000 cubic feet. The number of producible oil wells increased 84 per cent to 191, and gas wells 27 per cent to 293. At the end of 1961 the number of wells actually being produced included 114 oil wells and 138 gas wells, which represented an increase from the end of 1960 of 119 per cent and 31 per cent respectively. The production of sulphur showed an 8-per-cent decrease, whereas the production of the natural-gas by-products condensate/pentanes plus, propane, and butane showed increases of 8 per cent, 23 per cent, and 5 per cent respectively.

Pipe-line construction in 1961 resulted in increased production and the development of known oil and gas fields. British Columbia's oil-transportation facilities were expanded through construction by Trans-Prairie Pipelines (B.C.) Ltd., Western Pacific Products and Crude Oil Pipeline Ltd., and British Columbia Oil Transmission Co. Ltd. Extension of the oil-gathering system, owned by Trans-Prairie, to the Peejay, Milligan Creek, Beatton River, and Beatton River West oil fields was completed in February. Construction by Western Pacific Products and Crude Oil Pipelines Ltd. of the 505-mile 12-inch oil pipe-line from Taylor to Kamloops was approved on January 31st and completed before the end of 1961. The application by British Columbia Oil Transmission Co. Ltd. to install an oil-gathering line from the Blueberry field to Taylor was approved on June 5th. The line was nearing completion at the end of the year.

Gas-gathering facilities were extended to include the Beg field and additional wells in the Buick Creek field.

Reserves of crude oil, natural gas, and natural-gas by-products showed marked gains at the end of 1961 as compared to 1960. Crude-oil reserves increased approximately 53 per cent to 104,212,368 barrels, raw natural gas 72 per cent to 5.79 trillion cubic feet, gas liquids 47 per cent to 120,799,706 barrels, and sulphur 45 per cent to 3,336,630 short tons.

FIELD OFFICE

By G. E. Blue

Field Work

Field work, done for the purpose of enforcing the "Regulation Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas" and to obtain technical and other data required by the Department, was accomplished from the permanent field headquarters at Charlie Lake and from a trailer office established at Fort Nelson during the winter months.

The field staff carried out comprehensive inspections of all phases of drilling and producing operations in northeastern British Columbia and investigated complaints by landowners of damage resulting from seismic operations conducted under the " Geophysical Regulations." A total distance of 99,146 miles was driven by the field staff in performance of their duties.

Drilling activity was greater during 1961 than in any previous year. Therefore, a large part of the inspection work involved both exploratory and development drilling operations. A total of 118 routine inspections was made of drilling rigs, and fifty-one abandoned well-sites were examined.

The rapidly increasing number of productive oil and gas wells necessitated the allocation of more time to the production phase of development. Detailed inspections were made of 260 producing wells. In furtherance of the policy of fast-checking gas meters on producing wells at least once a month, 1,390 meters were checked during the year and seven complete meter inspections were made.

The continuing programme of measurement of reservoir temperatures and pressures resulted in 145 bottom-hole survey runs being made by the Branch-owned bottom-hole unit. In addition, a number of " spot " pressure surveys were made for comparison with surveys made by operating companies. Due to the rapid increase in development drilling, the majority of the runs were made to measure original temperatures and pressures on newly completed wells. The charts obtained from all runs were scanned and calculated at the Charlie Lake office.

The absolute open-flow potential tests on gas wells, witnessed by the field staff, numbered sixty-four. The results of these tests were calculated by Branch staff.

A Coleman 10,000-pounds-per-square-inch dead-weight tester was added in July to field-office facilities. This tester, which is used to calibrate bottom-hole pressure bombs, will serve as the standard for the Province. It is planned to install a temperature bath to be used in conjunction with the dead-weight tester. During the period from July to the end of the year, thirty Amerada bombs were calibrated, using air-calibration procedure. There is no charge for calibration of bottom-hole bombs used in wells in northeastern British Columbia.

Renovation of the second floor of the office building commenced in December to provide additional office accommodation and space for a field laboratory. The laboratory will be used primarily for calibration of dead-weight testers; bottom-hole bombs and gauges; crude-oil gravity and basic sediment and water tests; and Tutweiler hydrogen sulphide and gas gravity determinations.

Geological Laboratory

Well Samples and Core

Unless otherwise directed, any operator who drills a well for petroleum and natural gas is required to take a sample of bit-cuttings at least every 10 feet of depth.

All material from core boxes must be preserved in labelled boxes not more than 30 inches inside length and must be delivered to the geological laboratory at Charlie Lake.

Samples from wells with drilling authorities issued before March 1, 1961, continued to go to the geological laboratory in Victoria to be washed and bottled, and samples from wells with drilling authorities issued after March 1, 1961, were processed at Charlie Lake. During 1961, 60,209 samples were washed and bottled at Victoria and Charlie Lake.

All the core from British Columbia wells is stored at Charlie Lake, as well as samples from all wells drilled since September, 1957. The Victoria sample library and the Geological Survey of Canada in Calgary each has a set of samples from wells drilled in British Columbia since 1948.

Core Storage

The core-storage facilities, capable of holding approximately 20,000 5-foot core boxes, were completed in December, 1960.

All operators holding core obtained from their wells were requested, early in January, to forward their core to Charlie Lake for permanent retention in the central core-house. The transfer of core was completed by July, and at the end of the year 14,046 boxes of core were stored and catalogued. This represented more than 75,000 feet of cored rock from 600 wells drilled in all parts of the Province, although the majority of it was obtained from wells drilled in the northeastern British Columbia district. Due to the excellent co-operation of the companies that had retained core during the period when the Department lacked facilities, it is estimated that less than 1 per cent of the total core actually recovered from wells is missing. Only 5 per cent of the core recalled from companies had to be reboxed, at a nominal cost to the operators, because of inadequate boxes, poor identification, or damage. The Branch logged all core where any doubt existed as to the correct sequence.

Core and Sample Examination

The core-examination facilities were made available to the public during February, although collection of company-stored core was proceeding at the time. During the year 5,051 boxes of core from 273 wells were studied by company personnel and privately interested individuals. Thus over one-third of the total core stored was withdrawn from the files for examination purposes.

Sample examination facilities, although not used to capacity during the year, were frequently in demand. Considerable core was examined in these quarters when the core-examination facilities were overcrowded.

Sample Library

The sample library at Charlie Lake includes bit-cutting samples from all wells drilled after September, 1957. A total of 199,355 samples from 532 wells is contained in glass vials filed in 7,410 trays. These samples are catalogued to permit fast and accurate reference.

Bit-cutting samples of wells drilled prior to September, 1957, are available for examination at Branch headquarters in Victoria. The Calgary office of the Geological Survey of Canada also has an almost complete set.

Sample-washing

Installation of a mechanical sample-washing machine was completed in April. This machine washes and dries samples in a continuous operation. An auxiliary sample-splitting unit, which was designed and constructed by Branch staff, has proved to be very efficient. This unit splits a sample into three cuts and directs each into a separate bottle, thus reducing the time required for sample-handling.

Samples processed at Charlie Lake were from wells drilled in other than coastal areas and approved by Drilling Authorities issued after March 1st. Consequently, only 18,836 samples from fifty-nine wells were washed, filed, and distributed at the field office, whereas 41,373 samples were processed at Victoria.

EXPLORATION

By S. S. Cosburn

In northeastern British Columbia, despite continued research, muskeg operations remained seasonal with concentration of activity during freeze-up. Seismic exploration increased in 1961, mostly due to work in the plains region of the Fort Nelson area, where Middle Devonian gas-bearing carbonates continued to provide the stimulus for intensive exploration. In northeastern British Columbia in 1961, 550 seismic crew-weeks were completed, compared to 427 crew-weeks in 1960 (one crew-week represents approximately fifty working-hours). Geological mapping in the folded foothills belt declined about 15 per cent in 1961; nine companies employed geological field parties between the Wapiti River and the northern boundary. Three structure test-holes were drilled as follows:—

Structure Test-holes

Month	Company	Number Drilled	Area
January	Atlantic Refining	1	94-P-3
March	Atlantic Refining	1	94-P-3
December	Union Oil Company of Canada	1	94-A-5

D. L. Griffin studied Devonian strata in the Racing River area in conjunction with J. E. Hughes, of the Mineralogical Branch.

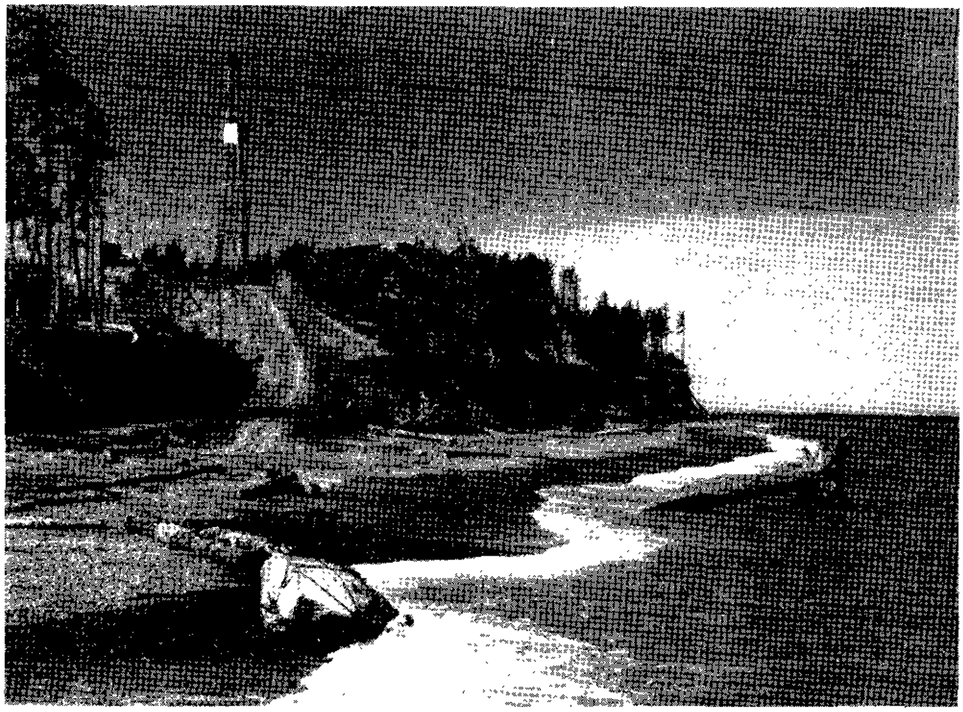
In the Fernie-Flathead area geological mapping was done by two companies. In the Vancouver area a marine seismic survey was conducted near Point Roberts. In Hecate Strait, off Graham Island, two weeks were spent in studying submarine geology.

Of 237 wells drilled in British Columbia during 1961, ninety-five were drilled as exploratory wells. Exploration was concentrated in northeastern British Columbia, where ninety-two exploratory wells were drilled. Two wells were drilled in the Vancouver-Chilliwack area to test the Tertiary and Cretaceous sediments of the lower Fraser Valley, and one was drilled as a further test of the Tertiary sediments on Graham Island.

Major geological objectives for wildcat exploration in northeastern British Columbia were the Devonian reservoirs of the Northern Plains, the Mississippian and Triassic of the Foothills region, and the oil trend of the Triassic Halfway formation. In addition, exploratory outpost wells were drilled in an effort to extend known fields. Of the 234 wells drilled in northeastern British Columbia, 230 were located on the plains and four in the foothills.

Exploratory drilling during 1961 resulted in twenty-five discovery wells in northeastern British Columbia—three of oil and twenty-two of gas.

The most significant oil discovery was that in the Triassic Boundary Lake zone in Sinclair et al Flatrock 16-34-84-13, which would indicate a considerable extension of the Boundary Lake field southward. Both Union HB Woodrush d-55-H and Pacific SR West Canadian Peejay d-33-I found oil in the Triassic Halfway formation in stratigraphic traps associated with the pinchout of that formation.



Richfield et al Cape Ball, Cape Ball, Graham Island. (Commonwealth Drilling Company Ltd. photo.)

Geological field work in Hecate Strait. Geologist, left, and professional diver, right. Cape Ball in right background. (Richfield Oil Corporation photo.)

The thick sequence of Middle Devonian carbonates underlying the Northern Plains region constituted an important objective for exploration following the gas discoveries at Clarke Lake, Kotcho Lake, and Petitot River in recent years. Exploratory drilling in these carbonates during 1961 yielded four new gas discoveries. West Nat Imp Clarke Lake b-78-J found gas some 4 miles east of the presently defined Clarke Lake field and West Nat Kathy b-30-F established gas 7 miles north of the Kotcho Lake field. Pan Am A-1 Komie a-51-A and Texaco NFA Tsea b-68-K both encountered gas in Middle Devonian strata north and west of Kotcho Lake field, indicating that favourable reservoir conditions may be relatively widespread. Gas was discovered also in the Upper Devonian in Atlantic Pac North Kotcho c-22-F. The Mississippian Rundle group yielded gas in Texaco NFA Judy c-53-D approximately 10 miles north of Kotcho Lake field. Amerada Pac Ft St John W 11-17-83-19 discovered gas in the Permian Belloy formation 5 miles west of Fort St. John.

A total of eleven new gas discoveries in the Triassic was recorded—six in the Halfway formation and five in the upper Schooler Creek reservoirs. Four exploratory wells drilled along the Halfway oil trend—Pacific SR West Cdn Peejay d-52-I, Sinclair Pacific Weasel d-50-A, Triad BP Birley a-5-A, and Whitehall et al Milligan d-75-G—each found gas in stratigraphic traps in the Triassic Halfway formation close to its pinchout. The Halfway pool in the Bubbles field was extended northward by the Pac Imp N Bubbles d-95-B discovery, and the Farrell Creek well a-9-L was completed in 1961 as a Halfway gas well after being previously abandoned. A significant discovery by the HB Cypress b-27-F resulted in gas from the upper carbonate of the Schooler Creek in the structurally favourable foothills region. Sinclair et al N Julienne c-54-H, approximately 4 miles north of the previous Julienne discovery, also yielded gas from the upper Schooler Creek. The upper carbonate of the Schooler Creek, which constitutes the reservoir in the Nig Creek-Laprise Creek area, was tested successfully by FJP Union Birch b-62-I and Pacific Pan Am N Beg a-4-D. Union HB Alder c-39-I discovered gas in the upper portion of the eroded Schooler Creek to the west of Milligan Creek.

Four discoveries were made in the Bullhead group of the Lower Cretaceous. Imp et al Rigel 6-27-88-18 found Dunlevy gas 3 miles southeast of the Texaco Roseland well, while Pure et al Big Nancy b-70-B and Pure RO Corp Firebird d-89-D discovered gas in the Gething in the Milligan Creek area. Triad BP Pickell Creek reported gas in the Lower Cretaceous Bluesky-Gething.

DEVELOPMENT

By W. L. Ingram

The year 1961 showed significant growth in drilling activity in northeastern British Columbia. Other areas of the Province were relatively unexplored, with only three active locations in the southwest corner and no drilling activity in the Cariboo or Flathead areas where previous interest had been shown.

The number of wells completed was almost double that of 1960, and the percentage of successful ventures increased from 47 to 73 per cent. This rise indicates the increased development of the known oil pools resulting from the construction of the oil pipe-line to Kamloops.

Completed wells totalled 151, compared to eighty-four during 1960. These included eighty-eight* oil and sixty-four* gas wells. Fifty-five locations were abandoned, eleven fewer than in 1960.

* Includes Texaco NFA Boundary Lake 6-25-85-14, completed as a gas and oil well.

At the end of 1961 thirty wells were being drilled, while none were suspended pending further drilling. The number of wells operated fluctuated from a monthly total of forty-two at the peak of the winter drilling season to nine during the spring thaw.

Thirty-nine wells were reportedly worked over during the year to complete new pools, stimulate producing wells, repair damaged equipment, or to abandon potential wells.

Five new fields were designated as Beg, Charlie Lake, Laprise Creek East, Petitot River, and Snyder Creek, and amendments were made to sixteen existing fields. These bring the designated fields to thirty-five as of December 31, 1961.

One of the principal duties of the development engineering section is that of dealing with applications for Drilling Authorities. During 1961 a total of 222 such applications were received and approved. Each application involves consideration of the proposed drilling programme, the title clearance of the petroleum and natural-gas rights, and the various conditions regarding the submission of geological and engineering data. Further approval is required for any proposed alteration to the completion, suspension, or abandonment methods that may be used.

At the time of approval of a Drilling Authority the location is classified as Development, Exploratory Outpost, or Exploratory Wildcat, based upon its relative position to other completed wells. This classification is used as the basis for submission of well information to the Branch. A Development well may be defined as a well located in a spacing area that is contiguous to another spacing area containing a completed well. The general term " Exploratory " is used to describe all locations that do not meet this condition, and then a further division is made into Outpost and Wildcat well locations. Wildcat well locations are those greater than 4½ miles from a completed well, and Outpost well locations are in the area between Development and Exploratory Wildcat well locations. Consideration is given to each geological pool, and locations to be drilled to pools above or below known pools are classified as shallow-pool and deep-pool tests respectively.

A programme of well drilling for the eventual injection of fluids into the Milligan Creek oil reservoir was commenced during the year. This injection system will be used in an attempt to increase the recovery of oil as the pool is drained by production.

The salt-water disposal well Pacific Ft St John 3-30-83-18(6) received a total of 32,794 barrels for return into the Belloy formation from nearby producing gas wells. This well serves only a small number of the wells producing significant quantities of salt water, and the conversion or drilling of another well elsewhere in the Province may become necessary. At the present time most of the salt water produced is contained in surface pits near the producing wells for disposal by evaporation. The dispersement of salt water must be carefully controlled as arable land may be rendered sterile for several years if contaminated.

Two major fires were reported in 1961 at producing oil wells in the Blueberry area. One was extinguished in eight hours, while the other required the work of a professional fire-fighter and burned uncontrolled for over six days.

The exploration carried out in northeastern British Columbia by geophysical and well-drilling companies has greatly contributed to the opening of new lands for settlement. Many of the areas that were without road connection to the populated areas now have year-round access, except possibly during spring break-up. Proper road construction by the oil companies to areas previously considered inaccessible has been a major factor in encouraging settlers to clear land in these new areas. The area north of the Nelson River, previously isolated except during the winter, is now served by a permanent bridge constructed by the Provincial Government, and a permanent access is under construction to the Milligan-Beatton River area.

A tabulation of the general statistics concerning well operation and production data is shown in Table 5, and a summary of the wells drilled during 1961 is shown in Table 6.

The designated fields as of December 31, 1961, are shown in Table 7.

PRODUCTION

By T. A. Mackenzie

Crude Oil

The 1961 production of crude oil in British Columbia was 1,017,826 barrels, representing a 17-per-cent increase over 1960 (*see* Table 14). The Boundary Lake field produced 643,746 barrels in 1961, a 6-per-cent decrease from 1960. This decrease can be attributed to the discontinuance of refining facilities in the area. The production of eight smaller fields and of other areas north of Fort St. John was 374,080 barrels. This represents an increase of 104 per cent over 1960, attributable to the completion of an oil-gathering pipe-line system, permitting the movement of oil to the refinery at Taylor.

The number of producible oil wells completed in the Boundary Lake field in 1961 showed a 110-per-cent increase over the 1960 total, whereas in the other fields and areas the number of producible oil wells increased by 21 per cent. The Triassic Boundary Lake and the Triassic Halfway pools continue to be the most important productive oil horizons. For well count of producing and producible oil wells *see* Table 12.

Natural Gas

The 1961 production of natural gas showed an increase of 23 per cent over that of 1960. The 103,122,789 M s.c.f. produced came from twenty-three natural-gas fields and other areas.

The fields which produced more than 5 billion cubic feet of gas each were the Bubbles, Buick Creek, Buick Creek West, Fort St. John, Fort St. John Southeast, Jedney, Kobes-Townsend, Laprise Creek, Laprise Creek East, and Nig Creek fields.

Eighty-five per cent of the natural gas produced was from the following formations: Triassic upper carbonate of Schooler Creek (33 per cent), Lower Cretaceous Buick Creek (17 per cent), Triassic Halfway (15 per cent), Triassic Baldonnel (10 per cent), and Permian Belloy (10 per cent). For well count of natural-gas wells *see* Table 13.

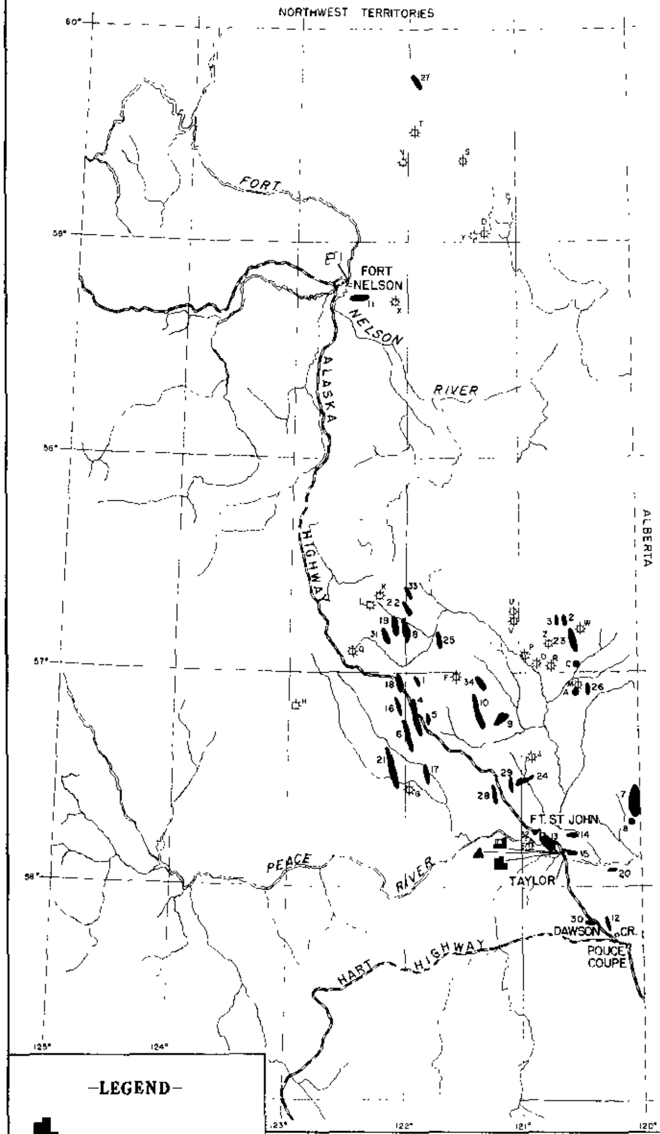
In 1961 marketed sales of natural gas, including imported Alberta natural gas, amounted to 114,839,340 M s.c.f., of which 85,487,658 M s.c.f. was exported to the United States. Of this latter amount, 70,899,576 M s.c.f. was natural gas produced in British Columbia. The marketed sales of natural gas reported by distributors within the Province amounted to 29,812,532 M s.c.f. and was distributed as follows: Residential, 11,626,813 M s.c.f.; commercial, 4,014,052 M s.c.f.; and industrial, 14,171,667 M s.c.f.

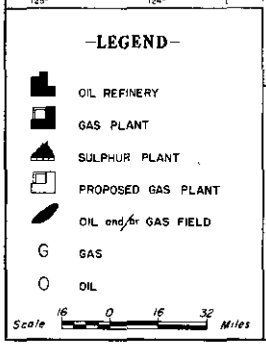
Natural-gas Liquids and Sulphur

Condensate/Pentanes Plus.—The 1961 production of condensate/pentanes plus amounted to 813,724 barrels, as compared to 750,848 barrels in 1960, a gain of 8 per cent.

OIL & GAS FIELDS OF N.E. BRITISH COLUMBIA

SHOWING 1961 DISCOVERY WELLS





FIELDS & POOLS — DEC. 31, 1961

1	Aitken Cr.	G, O	Gething
2	Beatton River	O	Halfway
3	Beatton River West	O	Bluesky-Gething
4	Blueberry	G	Dunlevy
		G	Baldonnel
		G	Charlie Lake
		G, O	Mississippian
5	Blueberry East	G	Baldonnel
		G	Halfway
		G	Mississippian
6	Blueberry West	G	Dunlevy
		G	Baldonnel
7	Boundary Lake	G	Bluesky-Gething
		G	Gething
		G	Baldonnel
		O	Boundary Lake
		O	Halfway
8	Bubbles	G	U.C. of Schooler Cr
9	Buick Creek	G	Buick Creek
		G	Charlie Lake
10	Buick Creek West	G	Buick Creek
		G	Baldonnel
		G	Halfway
11	Clarke Lake	G	Devonian Carbonate
12	Dawson Creek	G	Cadotte
13	Fort St John	O	Gething
		G	Cadomin
		G	Baldonnel
		O	Charlie Lake
		G	Halfway
		G, O	Belloy
14	Fort St John Airport	G	Cadomin
		G	Baldonnel
		G	Halfway
15	Fort St. John S E	G	Cadomin
		G	Baldonnel
		G	Halfway
		G	Belloy
16	Gundy Creek	G	Baldonnel
		G	Charlie Lake
17	Halfway	G	Baldonnel
		G	Halfway
18	Highway	G	Dunlevy
		G	Baldonnel
		G	Mississippian
19	Jedney	G	U.C. of Schooler Cr.
		G	Halfway
20	Parkland	G	Upper Devonian
21	Kobes-Townsend	G	Dunlevy
		G	Charlie Lake
		G	Halfway
		G	Mississippian
22	Laprise Creek	G	U.C. of Schooler Cr
23	Milligan Creek	O	Halfway
24	Montney	G	Bluesky-Gething
		G	Charlie Lake
		G	Halfway
25	Nig Creek	G	U.C. of Schooler Cr
26	Peejay	O	Halfway
27	Petitot River	G	Devonian Carbonate
28	Red Creek	G	Charlie Lake
		G	Halfway
29	Stoddart	G	Belloy
30	Sunrise	G	Cadotte
31	Beg	G	U.C. of Schooler Cr.
		G	Halfway
32	Charlie Lake	O	Gething
33	Laprise Cr. East	G	U.C. of Schooler Cr.
34	Snyder Cr.	O, G	Dunlevy

DISCOVERY WELLS—1961

A	Pac SR West Cdn Peejay d-33 I	O	Triassic Halfway
B	Sinclair et al Flatrock 16-34-83-14	O	Triassic Boundary Lake
C	Union HB Woodrush d 55 H	O	Triassic Halfway
D	Atlantic Pac N Kotcho c 22 F	G	Upper Devonian
E	Amerada Pac Ft St John W 11-17-83-19	G	Permian Belloy
F	FJP Union Birch b 62 I	G	Triassic Schooler Creek
G	Ft St John Petroleums Farrel a 9-L	G	Triassic Halfway
H	HB Cypress b 27 F	G	Triassic Schooler Creek
J	Imp et al Rigel 6-27-88-18	G	Lower Cretaceous Dunlevy
K	Pac Imp N Bubbles d-95-B	G	Triassic Halfway
L	Pac Pan Am Dome N Beg a-4 D	G	Triassic Schooler Creek
M	Pac SR West Cdn Peejay d-52 I	G	Triassic Halfway
N	Pan Am A I Kamie a 51 A	G	Devonian Carbonate
O	Pure et al Big Nancy b 70-B	G	Lower Cretaceous Gething
P	Pure RO Corp Firebird d 89 D	G	Lower Cretaceous Gething
Q	Sinclair et al N Julienne a-54 H	G	Triassic Schooler Creek
R	Sinclair Pacific Weasel d 50 A	G	Triassic Halfway
S	Texaco NFA Judy c-53 D	G	Mississippian Rundle
T	Texaco NFA Teea b-68 K	G	Devonian Carbonate
U	Triad BP Birley a 5 A	G	Triassic Halfway
V	Triad BP Pickell Creek c 88 I	G	L.C. Bluesky-Gething
W	Union HB Alder c-39 I	G	Triassic Schooler Creek
X	West Nat Imp Clarke Lake b 78 J	G	Devonian Carbonate
Y	West Nat Kathy b 30 F	G	Devonian Carbonate
Z	Whitehall et al Milligan d 75 G	G	Triassic Halfway

Figure 20. Petroleum and natural-gas fields, 1961.

Butane.—The production of butane in the same period amounted to 319,231 barrels, as compared to 303,187 barrels in 1960, a gain of 5 per cent.

Propane.—The production of propane was 154,717 barrels, as compared to 125,366 barrels in 1960, a gain of 23 per cent.

Sulphur.—The production of sulphur decreased 8 per cent in 1961, with an output of 55,655 short tons, as compared to 60,454 short tons in 1960. This decrease was due to a lower sulphur content of the natural gas processed in 1961.

PIPE-LINES

By A. N. Lucie-Smith

Gas-gathering System

The gas-gathering system was extended by Gas Trunk Line of British Columbia Ltd. from the terminal of the 18-inch line in the Blueberry field by 23½ miles of 16-inch line and 16½ miles of 12-inch line in a northwesterly direction to the Beg gas field and thence in a northerly direction to the north Jedney gas field. In addition, Sun Oil company installed a feeder system, consisting of 20,000 feet of 8-inch, 6-inch, and 4-inch pipe, to connect its Buick Creek gas wells with the field terminal of the gathering system of Westcoast Transmission Company Ltd.

Oil-gathering System

The oil-gathering system, owned and operated by Trans-Prairie Pipelines Ltd., was extended early in the year to the Peejay, Milligan Creek, Beatton River, and West Beatton River oil fields. This system now comprises 163.4 miles of 8-inch, 6-inch, and 4-inch pipe with an over-all capacity of not less than 20,000 barrels of crude oil per day. A second oil-gathering system, connecting the Blueberry oil field with the terminal of the 12-inch oil transmission-line at Taylor, was completed, and at the end of 1961 was awaiting the certificate of inspection. This system, owned by British Columbia Oil Transmission Co. Ltd. and operated by Sun Oil Company, consists of 70 miles of 8-inch pipe with feeders of 12 miles of 4-inch pipe and 3 miles of 6-inch pipe, and is estimated to have a capacity of 15,000 barrels of crude oil per day.

Oil Transmission-line

Western Pacific Products and Crude Oil Pipelines Ltd. completed 505 miles of 12-inch oil transmission-line from Taylor to Kamloops, where it was connected with the main line of Trans Mountain Oil Pipe Line Company to Vancouver. This line, with an estimated ultimate capacity of 75,000 barrels a day, was being filled at the end of 1961.

RESERVES

By A. N. Lucie-Smith

Proved recoverable reserves of crude oil and natural gas increased substantially during 1961, the increases being 52.9 per cent for oil and 72.4 per cent for gas. A summary of these reserves, together with explanatory notes, is given in Table 8. The increase of established reserves of disposable gas in 1961 was 117 per cent.

The construction of the 12-inch oil pipe-line from Taylor to connect with the main line of Trans Mountain Oil Pipe Line Company at Kamloops gave great impetus, especially during the latter half of the year, to development drilling in the Boundary Lake and Blueberry fields and to exploration drilling along the Halfway oil trend from Boundary to Beatton, West Beatton, and northward. The Boundary Lake zone discoveries at Sinclair et al Flatrock 16-34-83-14 and 9-22-83-14 have *not yet been fully tested and may result in a considerable extension southward of the* Boundary Lake field.

An extension of the Peejay field to the north was proved by the successful completion of Pacific SR West Cdn Peejay d-33-I in the Halfway formation. The Halfway discovery last year at Wildmint has been extended by further drilling, but

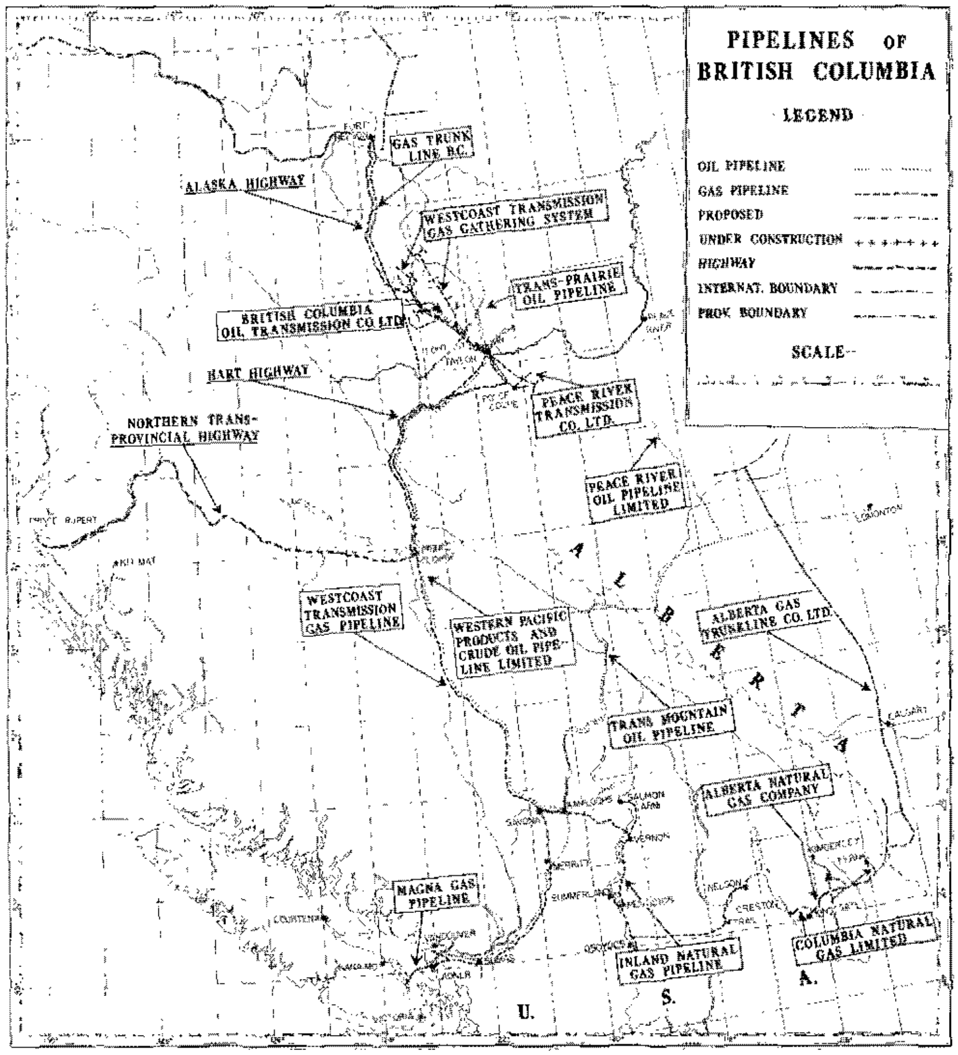


Figure 21. Oil and gas pipe-lines, existing and proposed.

the Woodrush discovery well turned to gas and was abandoned. The well that discovered oil in 1960 in the Dunlevy formation at Blueberry is now classed as a statutory gas well, while an attempt to extend the oil reserve in the Gething at Aitken Creek met with failure. Oil was discovered in both the Belloy and Charlie Lake formations in Amerada Pacific Ft St John West 11-17-83-19, south of the Peace River, but the well was completed as a statutory gas well in the Belloy; the oil in a thin-section (" C " Sand) of the Charlie Lake formation will probably be included by effecting a dual completion early next year.

The large increase in gas reserves is due mainly to the inclusion of a part of the probable reserves in order to report established disposable reserves instead of proved reserves so that the figures can be used directly by the National Energy Board; to a revision of the figures for the Clarke Lake field, where a study of the lithology of the Middle Devonian reef showed it to be wider than previously estimated; to the extension northward of the main reef at Kotcho by the successful completion of West Nat Kathy b-30-F; and to the extensions of the Buick Creek, Nig, Beg, Jedney, Bubbles, and East Laprise fields.

Several gas discoveries in formations ranging from the Bluesky to the Halfway were made while exploring for oil along the Peejay, Milligan, Beatton, and West Beatton oil trend at Pacific SR West Cdn Peejay d-52-I, Pure et al Big Nancy b-70-B, Triad BP Pickell Creek c-88-I, Pure ROC Firebird d-89-D, Union HB Alder c-39-I, and Triad BP Birley a-5-A, but, as far as reserves were concerned, the important gas discoveries were made in the Middle Devonian formation at Tsea, Komie, and Beaver River, in the Mississippian at Judy Creek, and in the upper carbonate of the Schooler Creek formation at Cypress. Another discovery of gas was made in the Schooler Creek upper carbonate in Sinclair Pacific Julienne Creek b-39-D and, along the same trend, in Sinclair et al North Julienne c-54-H, the former well also discovering commercial gas in the Halfway formation. Commercial gas in small quantity was also discovered in the Upper Devonian at Kotcho in Atlantic Pacific North Kotcho c-22-F.

Of the potential gas discoveries made in the Devonian carbonate last year, exploration wells at Evie Lake, Deer Lake, and Kledo were abandoned, a second well drilled at Beaver River was an outstandingly successful completion, and the Cam Lake well on the Petitot River trend has not yet been fully tested.

The occurrence of commercial gas in the Halfway formation in Ft St John Farrell a-9-L, which had previously been abandoned, may eventually prove to be a southward extension of the Kobes-Townsend field in this formation.

Due to the large increase of gas reserves in the vicinity of Fort Nelson and in the area to the north and to the additional potential indicated by this year's successful wildcats, it is expected that a start may soon be made on the projected 30-inch gas trunk line from Fort Nelson 245 miles south to tie into the main gas transmission-line at Chetwynd. It is probable that this prospect will supply the incentive for increased drilling activity throughout this area in the winter of 1962/63.

RESERVOIR DATA

By R. R. McLeod

The Reservoir Engineering Section of the Branch is responsible for the general evaluation of oil and gas reservoirs. This involves study and assessment of the various reservoir characteristics that are significant to the performance and operating efficiencies of the individual wells and the reservoir as a whole. These characteristics, listed in the following tables, are of primary importance not only for the establishment of production rates, but also for predictions of oil and gas recovery and estimates of reserves.

A production rate limit is established by the Branch before any well is allowed to produce, in order to guard against possible damage to the well and reservoir by too rapid a rate of production.

This limit in the case of an oil well is established by a maximum permissible rate formula which initially is based on the thickness of the oil-bearing section and the known reservoir characteristics. If these characteristics are not known, reference values are set to ensure protection for a new well until more detailed information can be compiled for the reservoir.

The production rate limit for gas wells is established at 25 per cent of the open flow potential determined by field tests run in accordance with procedures issued by the Branch.

The rock characteristics given in Tables 1 and 2 are the porosity, which is the volume of pore space in the rock capable of containing fluid, expressed as a percentage of the bulk volume of the rock; the permeability, which is a measure of the ease with which fluid will flow through the rock, expressed in millidarcy units; and the water saturation, which is the fraction of the pore space in the rock occupied by water, expressed as a percentage of the total pore space. The difference between 100 per cent and the water saturation is the percentage of the total pore space occupied by oil or gas.

The properties of each gas are its specific gravity relative to air and its compressibility factor, which is a number expressing the ratio between the actual volume occupied by the gas at reservoir temperature and pressure and the volume of the gas under the same conditions as predicted by the perfect gas laws.

The properties of each oil given are its gravity, the measure of the density of the oil under stock-tank conditions expressed in degrees A.P.I., and its shrinkage, the ratio between a unit volume of oil in the stock tank and the volume that the same oil with its dissolved gas occupied in the reservoir.

The absolute open flow potential (A.O.F.P.) of a gas well is a measure of the theoretical ability of a well to produce gas if the pressure in the well bore opposite the producing interval were reduced to zero.

The M.P.R. of an oil well is a calculated maximum permissible rate based on the amount of recoverable oil in the drainage area of the well.

The fundamental data for porosity, permeability, and fluid saturation are obtained from analyses of cores, usually less than 4 inches in diameter, from a well spacing area of about 160 acres. The ratio of the volume of rock sampled to the volume of rock potentially productive is very small indeed, about 1 part in 80,000,000 if the productive interval is cored completely on 160-acre spacing. It is less if the productive interval is not completely cored.

STATISTICS AND WELL RECORDS

By T. A. Mackenzie

Statistics

Information concerning the British Columbia oil and gas industry is collected, classified, and tabulated by the Petroleum and Natural Gas Branch and is made available in statistical content and form to all interested parties in accordance with the regulations.

The release of well information follows a pattern agreed upon and accepted by the members of the Technical Committee of the Mines Ministers' Conference, with the object of making well data available on a timely and uniform basis. Additional information concerning the collection operations of pipe-lines, gas-processing plants, refineries, and marketers is compiled and published.

Under the direction of the above-mentioned Technical Committee, the Statistical Subcommittee, composed of government and industry representatives was formed in 1955. Its primary objectives are as follows:—

(1) Standardization of forms designed for the same purpose but which are required individually by both Provincial and Federal Governments under different formats.
(2) Standardization of forms to accommodate machine accounting procedures for reporting production statistics to the Provincial Governments.
(3) Amendment of existing model report forms to conform with present requirements.
(4) Investigation of ways and means of obtaining the co-operation of both Provincial and Federal Government agencies for the earlier availability of information on all phases of the oil and gas industry.

The reporting forms presently in use by the Branch are:—

*(1) Well-names Register.
(2) Application for a Drilling Authority.
(3) Application to Amend a Drilling Authority.
(4) Application to Change a Well Name.
(5) Application to Abandon a Well.
(6) Application to Alter a Well.
(7) New Oil Well Report.
(8) New Gas Well Report.
(9) Application for M.P.R.-Oil.
(10) Application to Commingle Production before Measurement.
(11) Battery Test Data Report.
(12) Monthly Proration and Production Report.
(13) Monthly Disposition Report and Crown Royalty Statement.
(14) Monthly Oil Gathering Operations Report.
(15) Monthly Gas Gathering Operations Report.
(16) Monthly Natural Gas Plant Statement.
(17) Monthly Natural Gas Processing Statement.
(18) Monthly Sulphur Plant Operations Report.
(19) Monthly Refinery Operations Report.
(20) Monthly Crude Oil and Condensate/Pentanes Plus Purchasers' Statement.
(21) Monthly Liquefied Petroleum Gas Purchasers' Statement.
(22) Well Completion Report.
(23) Supplement to Well Completion Report.
(24) Work-over Report.
*(25) Work-over Card.
*(26) Monthly Operations Report.
(27) Application for a Rig Licence.
(28) Monthly Water Flood Operations Report.
(29) Monthly Natural Gas and/or Liquid Petroleum Gas Injection Operations Report.
(30) Statement of Nomination and Estimated Requirements for British Columbia Crude Oil, Condensate/Pentanes Plus.

Following a directive issued by the Technical Committee of the Mines Ministers, the Subcommittee on Uniform Nomenclature—Petroleum Products was formed in the early part of 1961. The objective of the Subcommittee was to define in precise terms certain words and phrases commonly used in the petroleum and natural-gas industry. Several meetings were held toward achieving these ends. The recommendations of the Subcommittee were presented at the Meeting of the

* Branch use only.

Mines Ministers' Conference in September, 1961, and with the exception of a change in the definition of natural gas and the addition of a preamble, the definitions were accepted by the Technical Committee, the Interprovincial Petroleum and Natural Gas Committee, and the Mines Ministers. This concluded the work of the Subcommittee, of which the Branch was a member.

In March, 1961, the Statistical Subcommittee met with representatives of the Dominion Bureau of Statistics for the purpose of finalizing the means by which joint collection of gas-distribution statistics could be effected. As an outcome of this meeting, it was decided to form a group to be known as the " Provincial-D.B.S. Committee on Oil and Gas Statistics," the members to be Statistical Subcommittee personnel together with appropriate members from the Dominion Bureau of Statistics and other Federal agencies. The Committee would meet to establish and revise, as required, statistical forms on the production, transportation, and distribution of oil and gas and to foster the joint collection of these statistics, eliminating as much duplication of effort as possible. The Committee held its second meeting at Toronto on September 21 and 22, 1961, immediately following the Eighteenth Annual Conference of the Provincial Ministers of Mines.

Schedule of Wells

Each year a volume is prepared dealing with the wells drilled for petroleum and natural gas in British Columbia during that year. It covers the period from 8 a.m. January 1st to 8 a.m. January 1st of the succeeding year. The following well information is listed when applicable: Well name, Drilling Authority number, classification, operator, title and number, location, co-ordinates, spud date, rig release date, ground elevation, Kelly bushing elevation, total depth, well status, interval open to production, casing, logs, cores, samples, drill-stem tests, and geological markers.

The foregoing information is condensed from reports submitted to the Branch by the operators of the listed wells.

Reports

Weekly Report

The weekly report is prepared for Branch use from data collected from the operators by the field office at Charlie Lake. The week is from 8 a.m. Friday to the following 8 a.m. Friday. The report provides the following information as it occurs:—

(1) New locations.
(2) New locations pending.
(3) Locations cancelled.
(4) Well-name changes.
(5) Change of well classification.
(6) Rigs operating.
(7) Suspended wells.
(8) Completed wells—oil and gas.
(9) Abandoned wells.
(10) Change of well status.
(11) Workovers.
(12) Box score—
Total wells drilled in British Columbia.
Total producible oil wells.
Total producible gas wells.

Monthly Oil and Gas Report

The Monthly Oil and Gas Report is prepared from returns made monthly by the operators (*see* reporting forms listed elsewhere). Figures are carried cumulatively for the year on a comparative basis with the preceding year.

The contents of this report are as follows:—

Summary Statistics

Crude oil—
- Number of producing and producible oil wells—field totals.
- Oil production—field totals.
- Number of producing and producible oil wells by field and pool.
- Oil production by field and pool.
- Oil disposition.
- Value of oil sales to British Columbia producer.
- New oil wells placed on production.

Natural gas—
- Number of producing and producible gas wells—field totals.
- Gas production—field totals.
- Number of producing and producible gas wells by field and pool.
- Gas production by field and pool.
- Gas disposition.
- Value of gas sales to British Columbia producer.
- New gas wells placed on production.

Water—
- Water production—field totals.
- Water production by field and pool.
- Water disposition.

Natural-gas liquids and sulphur—
- Production and disposition of condensate/pentanes plus, butane, propane, and sulphur.
- Value of natural-gas liquids and sulphur.

Approved maximum permissible rates.

This report is compiled and mailed to subscribers approximately two weeks after receipt of returns from the operators.

Drilling and Land Report

The Drilling and Land Report is published concurrently with the Monthly Oil and Gas Report. The Drilling Section is largely prepared from data obtained from the operators. The contents of the report are as follows:—

A. Drilling Section—
- Summary statistics.
- Drilling Authorities approved.
- Locations outstanding.
- Locations cancelled.
- Change of well status.
- Change of well name.
- Wells suspended.
- Drilling and completions.
- Estimated oil production.
- Drilling/service rig licences issued.
- Drilling/service rig licences cancelled.
- Well data released from confidential status.

B. Land Section—

Acreage synopses.
Permits.
Leases.
Natural-gas licences.
Miscellaneous.
Disposition of permits, leases, licences, and drilling reservations.

PUBLICATIONS

Write to the Chief, Petroleum and Natural Gas Branch, for the following:

Regulations Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas .... $0.50 per copy

Monthly Crude Oil and Natural Gas Production by Field/Area and Pool—

1961	$5.00	1957	$2.00
1960	5.00	1956	1.00
1959	5.00	1955	.75
1958	3.00	1954	.50

Schedule of Wells Drilled for Oil and Natural Gas in British Columbia (1906–1959), Volume I .... $7.50 per copy

Schedule of Wells Drilled for Oil and Natural Gas in British Columbia (1960), Volume II .... $5.00 per copy

List of Petroleum and Natural Gas Publications, Services, and Maps .... Free

Oil and Gas Field Descriptions .... $0.50 per copy

Annual Report reprints .... Free

Stratigraphic Correlation Chart—

28 by 40 inches .... $1.25 per copy

14 by 20 inches .... .75 per copy

List of Released Geological Reports on Oil and Gas Permits .... $0.50 per list

Representative Well Logs of Northeastern British Columbia .... $2.00 per copy

Area maps (2 inches=1 mile) .... $2.00 each

Regional maps (1 inch=2 miles) .... Price on application

Oil and Gas Field Boundary Plats .... $0.35 per copy

Write to the Chief Commissioner for the following:

Petroleum and Natural Gas Act .... $0.35 per copy

Permit and Lease Grid System .... $1.00 per copy

Geophysical Regulations .... $0.25 per copy

Official Specification of Geographic Position of a Petroleum and Natural Gas Permit (approximately 220 permit specifications) .... $0.10 per permit

Monthly Oil and Gas Report (Summary Statistics) .... $6.00 per calendar year or $0.75 per copy

Drilling and Land Report (Monthly) .... $6.00 per calendar year or $0.75 per copy

List of Leases in Peace River District showing Lease Number, Lessee, Acreage, Issue Date, Years, and Ex. Permit Number .... $1.00 per list

List of Permits in Peace River District showing Permit Number, Permittee, Acreage, and Issue Date .... $0.50 per list

Additions and Revisions to Permit, Licence, and Lease Maps (Monthly Report) .... $1.00 per copy

Permit and Lease Location Maps .... Price on application

TABLES

TABLE 1.—SEISMIC EXPLORATION, 1961

NOTE.—Unless otherwise indicated, exploration method is reflection seismic survey. For indicating location, the National Topographic Series map numbering system is used.

Company	Location of Exploration	Number of Seismic Crews
January		
British American Oil Co.	94-J-9	1
California Standard Co.	94-G-2	1
Hudson's Bay Oil & Gas Co.	94-P-13	1
Hudson's Bay Oil & Gas Co.	94-H-15	1
Imperial Oil Limited	94-J-16, 9	2
Imperial Oil Limited	94-G-14	1
Imperial Oil Limited	94-I-16	1
Mobil Oil of Canada	94-I-15	1
Pacific Petroleums	94-I-16	1
Pan American	93-I-9[1]	1
Pan American	94-G-14, 94-O-1, 2	1
Pure Oil Company	94-J-1	1
Pure Oil Company	94-J-8	1
Pure Oil Company	94-P-3	2
Pure Oil Company	94-J-16	2
Richfield Oil Corp.	94-P-6	1
Richfield Oil Corp.	94-I-3	1
Richfield Oil Corp.	94-P	1
Shell Oil Company	94-N-11, 12	1
Shell Oil Company	94-O-16	1
Shell Oil Company	94-H-12, 94-N-11	1
Shell Oil Company	94-I-13, 14	1
Shell Oil Company	94-J-7	1
Shell Oil Company	94-J-10	1
Shell Oil Company	94-P-3	1
Sinclair Canada Oil Co.	94-G-2	1
Sohio Petroleum Company	94-J-12	1
Texaco Exploration	94-A-5	1
Texaco Exploration	94-I-10	1
Triad Oil Co. Ltd.	94-H-2	1
Union Oil Co. of Canada	94-H-2	1
Western Natural Gas Co.	94-J-10, 94-I-14	1
February		
Atlantic Refining	94-A-12	1
British American	94-J-9	1
California Standard	94-P-7	1
California Standard	94-J-15	1
Hudson's Bay Oil & Gas Co.	94-P-14	1
Hudson's Bay Oil & Gas Co.	94-H-15	1
Hudson's Bay Oil & Gas Co.	94-G-7	1
Imperial Oil Limited	94-P-8	1
Imperial Oil Limited	94-I-11	1
Mobil Oil of Canada	94-I-5	1
Pacific Petroleums	94-I-16	1
Pan American	94-P-12, 94-O-8, 9, 10	1
Pan American	93-I-9[1]	1
Pure Oil Company	94-J	2
Pure Oil Company	94-J-16	1
Pure Oil Company	94-J	1
Pure Oil Company	94-J-1	1
Pure Oil Company	94-P-3	1
Pure Oil Company	94-P-3	1
Richfield Oil Corp.	94-I-3	1
Richfield Oil Corp.	94-P-13	1
Richfield Oil Corp.	94-J-8	1
Shell Oil Company	94-O-16, 94-I-13, 14	1
Shell Oil Company	94-N-11	1
Shell Oil Company	94-I-14, 13	1
Shell Oil Company	94-N-14	1
Shell Oil Company	94-J-10	1
Sinclair Canada Oil	94-G-2	1
Sinclair Canada Oil	94-I-15	1
Sohio Petroleums	94-I-14	1
Texaco Exploration	94-I-10	1
Triad Oil Company	94-H-12	1
Union Oil Co. of Canada	94-H-2	1
Western Natural Gas	94-I-12	1
Western Natural Gas	94-J-16	1
Western Natural Gas	94-B-12	1
March		
Atlantic Refining	94-A-12	1
British American	94-J-9	1
Hudson's Bay Oil & Gas Co.	94-H-15	1
Hudson's Bay Oil & Gas Co.	94-G-7	1
Hudson's Bay Oil & Gas Co.	94-P-14	1
Imperial Oil Limited	94-A-5	1
Imperial Oil Limited	94-I-11	1
Imperial Oil Limited	94-I-7	1
Imperial Oil Limited	94-I-2	1
Imperial Oil Limited	94-I-11	1
Mobil Oil of Canada	94-I-5	1
Pacific Petroleums	94-J-2	1
Pan American	94-O-2, 7, 10, 15	1
Pan American	93-I-9[1]	1
Pure Oil Company	94-J	4
Pure Oil Company	94-J	1
Pure Oil Company	94-J	1
Pure Oil Company	94-J	1
Pure Oil Company	94-P-3	2
Pure Oil Company	94-P-3	1
Richfield Oil Corp.	94-I-3	1
Richfield Oil Corp.	94-P-5, 13	1
Richfield Oil Corp.	94-J-8	1
Richfield Oil Corp.	94-O-1	1
Shell Oil Company	94-I-13, 14, 94-P-12	1
Shell Oil Company	94-P-3	1
Shell Oil Company	94-B-6	1
Shell Oil Company	94-B-11	1
Shell Oil Company	94-I-13, 14	1
Shell Oil Company	94-J-10	1
Sinclair Canada Oil	94-I-15, 94-G-2	1
Texaco Exploration	94-P-2	1
Triad Oil Company	94-H-2	1
Western Natural Gas	94-P-12	1
Western Natural Gas	94-I-12	1
April		
British American	94-G-7, 6	1
California Standard	94-G-2	1
Imperial Oil Limited	94-I-11	1
Richfield Oil Corp.	([2])	1
May		
British American	94-G-6, 7	1
Richfield Oil Corp.	([2])	1

[1] Combination reflection-refraction.
[2] Vancouver area near Point Roberts, Marine Seismic Survey 92-G.

TABLE 1.—SEISMIC EXPLORATION, 1961—*Continued*

Company	Location of Exploration	Number of Seismic Crews
June		
British American	94-G-6, 7	1
Imperial Oil Limited	93-I-15	1
July		
British American	94-G-6, 7	1
Imperial Oil Limited	93-I-15	1
August		
British American	94-A-7	1
Imperial Oil Limited	93-I-13	1
September		
Imperial Oil Limited	93-I-13	1
Richfield Oil Corp.	94-J-16	1
Sinclair Canada Oil	94-G-10	1
October		
Imperial Oil Limited	93-I-13, 93-P-3	1
Richfield Oil Corp.	94-J-16	1
Shell Oil Company	94-P-3, 4	1
Shell Oil Company	94-J-10	1
November		
Atlantic Refining	94-H-3	1
Imperial Oil Limited	93-P-3	1
Ohio Oil Company	94-J-16	1
Pure Oil Company	94-J-7, 10	1
Richfield Oil Corp.	94-J-16	1
Shell Oil Company	94-P-3, 4	1
Shell Oil Company	94-J-10	1
Sinclair Canada Oil	94-A-1	1
December		
Amerada Petroleum	94-P-16	1
Atlantic Refining	94-H-4	1
French Petroleum	94-B-9	1
Hudson's Bay Oil & Gas Co.	94-B-10	1
Hudson's Bay Oil & Gas Co.	94-H-2, 94-A-16	1
Ohio Oil Company	94-G-15	1
Pacific Petroleums	94-B-9, 16, 94-A-12	1
Shell Oil Company	94-P-3, 4	1
Shell Oil Company	94-J-10	1
Shell Oil Company	94-G-3, 6	1
Sinclair Canada Oil	94-I-11, 14	1
Triad Oil Company	94-J-7	1

TABLE 2.—SURFACE GEOLOGICAL EXPLORATION, 1961

Company	Location of Exploration	Number of Geologists
May		
British American	Northeastern B.C.	4
Husky	93-O 7, 10	2
Shell Oil Company	93-I-1	4
Shell Oil Company	93-I-15	4
Shell Oil Company	93-P-13	4
Sinclair Canada Oil	82-G-10	2
Union Oil Company	94-K-14	5
June		
British American	Northeastern B.C.	4
California Standard	94-K-13, 94-M-9	5
Husky	93-O-7, 10	2
Pan American	94-K-8	6
Plymouth	94-G-11	2
Shell Oil Company	93-I-1	4
Shell Oil Company	93-I-15	4
Shell Oil Company	93-P-13	4
Sinclair Canada Oil	82-G-10	2
Texaco Exploration	93-I-1	5
Union Oil Company	94-K-14, 94-N-8	5
July		
British American	94-M-9	4
California Standard	94-M-9	5
Pan American	94-K-8	6
Shell Oil Company	93-I-1	4
Shell Oil Company	93-I-15	4
Shell Oil Company	93-P-13	4
Sinclair Canada Oil	82-G-10	2
Texaco Exploration	93-I-1	5
Union Oil Company	94-N-8, 94-K-1	5
August		
British American	93-I-1	4
California Standard	94-M-9	5
Pan American	94-K-8, 94-B-3	6
Shell Oil Company	93-I-1	4
Shell Oil Company	93-I-15	4
Shell Oil Company	93-P-13	4
Texaco	93-P-12	5
Union Oil Company	94-G-5	5
September		
British American	82-J-3	2
Pan American	94-B-3	6
Shell Oil Company	93-I-1	4
Shell Oil Company	93-I-15	4
Shell Oil Company	93-P-13	4
Texaco	93-P-12	5
Union Oil Company	94-G-5	5

TABLE 3.—OIL-FIELD RESERVOIR DATA

Field	Pool	Rock Type	Age	Trap	Drive Mechanism	Av. Porosity (per Cent)	Av. Thickness (Ft.)	Av. Permeability (Md.)	Av. Water Saturation (per Cent)	Shrinkage	Gravity Degrees (A.P.I.)	Original Pressure (Psig.)	Av. M.P.R.[1] (Bbl./Day)
Beatton River	Halfway	Sandstone	Triassic	Stratigraphic-structural	Undetermined	17.5	13.0	130.0	25.0	0.86	40.0	1,190	114
Beatton River West	Bluesky-Gething	Sandstone	Lower Cretaceous	Stratigraphic	Undetermined	13.3	13.0	65.0	25.0	0.80	42.0	1,040	82
Blueberry	Mississippian	Limestone	Mississippian	Structural-stratigraphic	Gas cap and possible water	7.7	61.0	38.0[2]	25.0	0.745	40.0	2,710	214
Boundary Lake	Boundary Lake	Limestone	Triassic	Structural-stratigraphic	Depletion with small gas cap	19.2	14.2	45.0	5.8	0.77	35-36	1,825	140
Fort St. John	Charlie Lake	Sandstone	Triassic	Stratigraphic	Gas cap	13.8	6.4	570.0	25.0	0.79	36.0	1,950	37
Milligan Creek	Halfway	Sandstone	Triassic	Stratigraphic-structural	Undetermined	23.0	24.0	430.0	8.0	0.86	41.0	1,190	320
Peejay	Halfway	Sandstone	Triassic	Stratigraphic-structural	Undetermined	14.4	16.8	90.0	16.0	0.83	39.0	1,380	127
Wildmint	Halfway	Sandstone	Triassic	Stratigraphic-structural	Undetermined	21.6	15.8	380.0	8.0	0.86	39–40	1,208	199

[1] Maximum permissible rate. [2] Plus fractures.

TABLE 4.—GAS-FIELD RESERVOIR DATA

Field	Pool	Rock Type	Age	Trap	Av. Porosity (per Cent)	Av. Thickness (Ft.)	Av. Permeability (Md.)	Av. Water Saturation (per Cent)	Compressibility Factor	Specific Gravity (Air=1.0)	Original Pressure (Psig.)	Av. A.O.F.P.[1] (M S.C.F./Day[2])
Aitken Creek	Gething	Sandstone	Lower Cretaceous	Structural	12.1	25.5	......	21.7	0.790	0.685	1,526	......
Beg	U.C. of Sch. Cr.	Limestone	Triassic	Structural	9.5	88.3	64.7[3]	22.6	0.861	0.670	1,630	2,951
Beg	Halfway	Sandstone	Triassic	Structural	10.3	105.0	8.5	37.4	0.836	0.674	1,826	4,370
Blueberry	Dunlevy	Sandstone	Lower Cretaceous	Structural	10.9	60.0	10.3	25.0	0.820	0.650	1,366	1,365
Blueberry	Baldonnel	Limestone	Triassic	Structural	10.6	23.8	37.1	29.6	0.810	0.687	1,639	4,443
Blueberry	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	9.9	31.0	......	30.0	0.823	0.645	2,380	......
Blueberry	Mississippian	Limestone	Mississippian	Structural	15.9	55.0	106.4	20.0	0.841	0.670	2,792	17,000
Blueberry East	Baldonnel	Limestone	Triassic	Structural	11.1	22.0	47.7	25.0	0.781	0.684	1,886	7,100
Blueberry East	Halfway	Sandstone	Triassic	Structural	10.0	39.0	7.3	25.0	0.767	0.733	2,066	6,400
Blueberry East	Mississippian	Limestone	Mississippian	Structural	12.3	30.0	32.5	30.5	0.871	0.612	2,686	3,575
Blueberry West	Dunlevy	Sandstone	Lower Cretaceous	Structural	9.5	39.0	61.8	25.0	0.821	0.658	1,406	5,250
Blueberry West	Baldonnel	Limestone	Triassic	Structural	9.7	24.0	83.7	22.8	0.819	0.648	1,726	5,400
Boundary Lake	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	17.7	15.0	......	19.3	0.844	0.634	1,276	3,925
Boundary Lake	Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	15.8	63.0	......	32.5	0.830	0.641	1,393	11,700
Boundary Lake	Baldonnel	Limestone	Triassic	Structural	12.9	24.5	......	35.1	0.814	0.670	1,453	4,616
Boundary Lake	Halfway	Sandstone	Triassic	Structural	6.4	8.6		23.4	0.841	0.632	1,686	......
Bubbles	U.C. of Sch. Cr.	Limestone	Triassic	Structural	9.9	133.4	33.3	17.7	0.831	0.665	1,596	11,098
Buick Creek	Buick Creek	Sandstone	Lower Cretaceous	Structural-stratigraphic	13.3	38.0	139.8	23.7	0.847	0.646	1,286	12,580
Buick Creek	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	8.0	5.0	......	10.4	0.834	0.670	1,536	7,887
Buick Creek West	Buick Creek	Sandstone	Lower Cretaceous	Structural	10.9	73.7	165.0	31.9	0.854	0.693	1,309	26,890
Buick Creek West	Baldonnel	Limestone	Triassic	Stratigraphic	11.4	19.8	44.9	11.5	0.828	0.675	1,521	3,250
Buick Creek West	Halfway	Sandstone	Triassic	Structural	12.3	69.9	20.8	49.8	0.750	0.773	1,715	8,500
Clarke Lake	Devonian	Limestone	Devonian	Stratigraphic	9.7	150.0	247.8	13.2	0.935	0.670	2,886	73,330
Dawson Creek	Cadotte	Sandstone	Lower Cretaceous	Structural-stratigraphic	17.3	50.3	31.0	35.0	0.921	0.580	686	5,733
Fort St. John	Cadomin	Sandstone	Lower Cretaceous	Structural	12.4	12.0	421.0	40.0	0.844	0.610	1,340	29,000
Fort St. John	Baldonnel 'A'	Limestone	Triassic	Structural	16.2	33.0	120.4	28.0	0.809	0.670	1,604	13,960
Fort St. John	Baldonnel 'A/B'	Limestone	Triassic	Structural	10.7	62.3	101.6	27.0	0.818	0.686	1,601	19,480
Fort St. John	Charlie Lake	Sandstone	Triassic	Stratigraphic	10.9	5.0	......	30.0	0.802	0.670	1,882	......
Fort St. John	Halfway	Sandstone	Triassic	Structural	11.1	37.4	22.6	25.0	0.808	0.679	2,006	10,000
Fort St. John	Belloy	Limestone	Permian	Structural-stratigraphic	11.1	44.5	59.3	25.0	0.828	0.670	2,756	13,500
Fort St. John Airport	Cadomin	Sandstone	Lower Cretaceous	Structural	17.5	25.0	......	40.0	0.832	0.640	1,443	......
Fort St. John Airport	Baldonnel 'A'	Limestone	Triassic	Structural	10.0	25.0	......	28.0	0.813	0.670	1,614	......
Fort St. John Airport	Halfway	Sandstone	Triassic	Structural	10.0	15.0	......	25.0	0.804	0.670	2,039	1,400
Fort St. John Southeast	Cadomin	Sandstone	Lower Cretaceous	Structural	15.8	22.0	64.2	40.0	0.847	0.620	1,376	2,400
Fort St. John Southeast	Baldonnel 'A'	Limestone	Triassic	Structural	14.7	35.0	30.0	28.0	0.813	0.670	1,626	13,680
Fort St. John Southeast	Halfway	Sandstone	Triassic	Structural	9.8	37.8	14.5	25.0	0.798	0.670	2,107	11,083
Fort St. John Southeast	Belloy	Limestone	Permian	Structural-stratigraphic	9.2	23.3	62.2	25.0	0.871	0.626	2,814	15,500

[1] Absolute open flow potential. [2] Thousands of standard cubic feet per day. [3] Plus fractures.

TABLE 4.—GAS-FIELD RESERVOIR DATA—*Continued*

Field	Pool	Rock Type	Age	Trap	Av. Porosity (per Cent)	Av. Thickness (Ft.)	Av. Permeability (Md.)	Av. Water Saturation (per Cent)	Compressibility Factor	Specific Gravity (Air=1.0)	Original Pressure (Psig.)	Av. A.O.F.P.[1] (M S.C.F./Day)[2]
Gundy Creek	Dunlevy	Sandstone	Lower Cretaceous	Structural	15.6	8.0	......	23.0	0.822	0.626	1,650	805
Gundy Creek	Baldonnel	Limestone	Triassic	Structural	8.9	22.0	69.3	19.2	0.840	0.636	1,790	4,150
Gundy Creek	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	6.5	10.0	......	25.0	0.813	0.653	2,339	5,550
Halfway	Baldonnel	Limestone	Triassic	Structural	7.9	32.3	5.9[3]	35.0	0.812	0.653	1,646	10,860
Halfway	Halfway	Sandstone	Triassic	Structural	12.0	62.0	49.1	25.0	0.800	0.670	2,223	3,300
Highway	Dunlevy	Sandstone	Lower Cretaceous	Structural	8.6	20.0	84.9	25.0	0.839	0.650	1,346	540
Highway	Baldonnel	Limestone	Triassic	Structural	10.0	22.0	124.0	25.1	0.812	0.663	1,666	5,812
Highway	Mississippian	Limestone	Mississippian	Structural	11.0	83.0	104.7	19.7	0.898	0.611	3,145	41,000
Jedney	U.C. of Sch. Cr.	Limestone	Triassic	Structural	8.8	124.0	33.7	19.0	0.852	0.693	1,553	12,764
Jedney	Halfway	Sandstone	Triassic	Structural	12.7	151.0	16.4	19.5	0.842	0.673	1,692	10,580
Kobes-Townsend	Dunlevy	Sandstone	Lower Cretaceous	Structural	12.5	101.6	17.9	19.8	0.797	0.651	1,486	3,526
Kobes-Townsend	Charlie Lake	Sandstone	Triassic	Structural	16.3	76.6	......	25.0	0.812	0.646	2,586	5,160
Kobes-Townsend	Halfway	Sandstone	Triassic	Structural	7.6	289.0	5.1	28.0	0.810	0.650	2,636	10,895
Kobes-Townsend	Mississippian	Limestone	Mississippian	Structural	4.9	30.0	10.4	16.2	0.859	0.640	3,025	7,500
Laprise Creek	U.C. of Sch. Cr.	Limestone	Triassic	Structural	10.6	106.0	43.5	22.4	0.837	0.686	1,523	7,500
Laprise Creek East	U.C. of Sch. Cr.	Limestone	Triassic	Structural	11.5	154.1	21.8	10.1	0.813	0.679	1,526	8,325
Montney	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	17.0	15.0	......	45.0	0.862	0.620	1,266	895
Montney	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	20.0	37.0	......	30.0	0.817	0.670	1,746	4,900
Montney	Halfway	Sandstone	Triassic	Structural	14.6	20.0	67.1	33.5	0.757	0.730	1,846	10,000
Nig Creek	U.C. of Sch. Cr.	Limestone	Triassic	Structural	10.8	69.5	61.3	21.5	0.849	0.678	1,613	15,559
Parkland	Upper Devonian	Limestone	Devonian	Structural-stratigraphic	19.0	72.0	......	13.7	1.014	0.620	4,900	16,200
Petitot River	Devonian Carbonate	Limestone	Devonian	Structural-stratigraphic	8.6	95.4	......	12.6	0.929	0.674	2,782	198,500
Red Creek	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	18.0	5.0	......	32.0	0.788	0.668	1,741	2,400
Red Creek	Halfway	Sandstone	Triassic	Structural	13.3	16.0	18.1	25.0	0.698	0.810	2,089	3,500
Snyder Creek	Dunlevy	Sandstone	Lower Cretaceous	Structural-stratigraphic	12.0	10.5	......	30.0	0.858	0.623	1,275	9,900
Stoddart	Belloy	Limestone	Permian	Structural-stratigraphic	15.8	26.0	105.9[3]	12.0	0.822	0.680	2,411	21,000
Sunrise	Cadotte	Sandstone	Lower Cretaceous	Structural-stratigraphic	20.6	69.0	36.2	35.0	0.909	0.590	686	5,700

[1] Absolute open flow potential. [2] Thousands of standard cubic feet per day. [3] Plus fractures.

TABLE 5.—SUMMARY OF DRILLING AND PRODUCTION STATISTICS, 1961

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Well Data													
Drilling Authorities issued	19	12	8	4	7	4	3	29	22	35	30	49	222
Wells spudded	19	18	7	2	2	8	3	22	24	29	31	42	207
Rigs operated during month	36	37	33	9	9	13	12	21	26	30	28	42	—
Rigs operating at end of month	32	28	8	7	6	9	8	15	20	22	19	30	—
Development footage	30,129	22,245	34,597	9,751	15,359	31,988	18,875	102,540	95,802	91,240	85,201	107,747	610,689[1]
Exploratory outpost footage	21.210	35,146	14,895	285	—	4.100	976	490	17,575	14,667	29.021	41,725	188,218[1]
Exploratory wildcat footage	76.238	41,672	13,820	2,162	1.043	904	10,151	22,144	11,105	8,270	32,010	29,259	221,742[1]
Footage drilled, total	127,577	99,063	63,312	12,198	16,402	36,992	30,002	125,174	124,482	114,177	146,232	178,731	1,020,649[1]
Wells abandoned	7	13	12	1	—	1	—	2	1	2	7	9	55
Service wells	—	—	—	—	—	—	—	—	—	—	—	1	1
Oil Wells													
Completed	1	—	4	1	2	2	1	11	15	15	18	18	88[2]
Producible	106[3]	105[3]	109	109[3]	111	113	114	125	140	155	173	191	191
Produced	32	47	77	9	17	22	64	61	75	101	93	114	—
Production (bbl.)	65,541	87,443	102,645	2,748	40,028	25,562	50,800	51,926	88,657	144,092	140.712	217,672	1,017,826
Average daily production (bbl.)	2,145	2,915	3,422	92	1,334	852	1,693	1,731	2,973	4,803	4,690	7,256	—
Gas Wells													
Completed	9	9	11	1	2	2	3	2	3	10	9	3	64[2]
Producible	238[3]	248[3]	259	260	262	263[3]	266	269[3]	272	282	291	293[3]	293
Produced	117	120	124	124	115	121	124	120	120	120	128	138	—
Production (M s.c.f.)[4]	8,535,501	8,358,138	9,580.000	9,024,024	8,666,983	7,700,914	7,661,719	7,901,136	8,131,763	8,362,158	8.977,700	10,222,753	103,122,789
Average daily production (M s.c.f.)	284,517	278,605	319,333	300,801	288,899	256,697	255,391	263,371	271,059	282,376	302.753	329,766	—
Natural-gas By-products													
Condensate/pentanes plus (bbl.)	71,682	68,680	79,077	67,604	73,736	67,956	68,643	70,583	65,548	66,790	50,886	62,539	813,724
Butane (bbl.)	32,360	30,169	29,271	25,687	25.459	24,383	24,467	24,415	27,385	27,912	11,905	35,818	319,231
Propane (bbl.)	17,166	15,733	14,448	10,428	10,985	11,542	8,946	10,133	12,615	13,478	7,330	21,913	154,717
Sulphur (short tons)	5,685	5,295	5,895	5,230	4,580	4,315	4,020	4,362	2,484	3,545	4,918	5,326	55,655

[1] This amends annual totals as shown in monthly reports.
[2] Includes Texaco NFA Boundary Lake 6-25-85-14, completed as a gas and oil well.
[3] Adjustment due to change of well status.
[4] Excludes solution gas.

TABLE 6.—WELLS DRILLED AND DRILLING, 1961

Drilling Authority No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1961 Footage	Status at Dec. 31, 1961
773	Amerada Boundary 16-20-85-13	Sept. 1, 1961	Sept. 14, 1961	4,380	4,380	Dry and abandoned.
771	Amerada Boundary 14-29-85-13	Aug. 14, 1961	Aug. 31, 1961	4,590	4,590	Triassic Boundary Lake oil well.
799	Amerada Boundary 8-5-85-14	Sept. 14, 1961	Oct. 10, 1961	4,470	4,470	Lower Cretaceous Dunlevy gas well.
692	Amerada Boundary Lake 11-24-85-14	Dec. 25, 1960	Jan. 14, 1961	4,625	770	Dry and abandoned.
751	Amerada Boundary A11-24-85-14	June 7, 1961	June 18, 1961	3,975	3,975	Triassic Baldonnel gas well.
736	Amerada Boundary 16-24-85-14	May 9, 1961	May 28, 1961	4,640	4,640	Triassic Boundary Lake and Halfway oil well.
864	Amerada Ft St John W 6-5-83-19	Dec. 8, 1961			4,205	Drilling.
697	Amerada Pac Ft St John W 11-17-83-19	Dec. 29, 1960	Mar. 18, 1961	6,624	5,899	Permo-Carboniferous gas well.
723	Amerada Oval 16-3-86-15	Feb. 21, 1961	Mar. 17, 1961	4,833	4,833	Dry and abandoned.
716	Atlantic Pac E Kotcho b-19-G	Jan. 30, 1961	Mar. 13, 1961	7,072	7,072	Dry and abandoned.
673	Atlantic Pac North Kotcho c-22-F	Nov. 28, 1960	Jan. 24, 1961	7,023	453	Wabamun Devonian gas well.
781	Apache Pacific Fort Nelson d-76-G	Sept. 14, 1961	Oct. 20, 1961	7,265	7,265	Dry and abandoned.
859	BA Pocketknife b-6-L	Dec. 8, 1961			1,306	Drilling.
891	Champlin Midwest Osborn 1-23-88-15	Dec. 28, 1961			2,056	Drilling.
765	Dome Boundary 16-11-84-14	Sept. 12, 1961	Sept. 24, 1961	4,316	4,316	Triassic Boundary Lake oil well.
768	Dome Boundary 8-22-85-14	Aug. 14, 1961	Aug. 28, 1961	4,387	4,387	Triassic Boundary Lake oil well.
764	Dome Boundary 8-11-86-14	Aug. 30, 1961	Sept. 10, 1961	4,342	4,342	Triassic Boundary Lake oil well.
808	Dome Boundary 8-14-86-14	Sept. 30, 1961	Oct. 10, 1961	4,267	4,267	Triassic Boundary Lake oil well.
696	Dome Prosper Holman Creek b-48-B	Dec. 23, 1960	Jan. 28, 1961	3,900	3,846	Dry and abandoned.
666	Dome Provo Laprise Creek a-33-H	Feb. 2, 1961	Feb. 25, 1961	4,470	4,470	Triassic upper carbonate of Schooler Creek gas well.
665	Dome Provo Laprise a-46-H	Mar. 1, 1961	Mar. 16, 1961	4,519	4,519	Triassic upper carbonate of Schooler Creek gas well.
762	Dome Provo Laprise b-57-H	Aug. 12, 1961	Aug. 25, 1961	4,349	4,349	Dry and abandoned.
837	Dome Provo E Laprise a-81-H	Nov. 3, 1961	Nov. 19, 1961	4,260	4,260	Triassic upper carbonate of Schooler Creek gas well.
809	Dome Provo E Laprise d-91-H	Oct. 3, 1961	Oct. 27, 1961	4,112	4,112	Triassic upper carbonate of Schooler Creek gas well.
873	Dome CDP C&E W Laprise c-82-G	Dec. 4, 1961			4,947	Drilling.
834	FJP Union Birch b-62-I	Oct. 30, 1961	Nov. 24, 1961	4,170	4,170	Triassic upper carbonate of Schooler Creek gas well.
611	Fraser Valley Chilliwack 14-19-26	Nov. 30, 1959			630	Drilling.
706	HB Union Chinchaga a-96-C	Jan. 20, 1961	Apr. 1, 1961	8,739	8,739	Dry and abandoned.
827	HB Cypress a-86-C	Oct. 30, 1961			3,616	Drilling.
737	HB Cypress b-27-F	Mar. 16, 1961	Oct. 11, 1961	9,135	9,135	Triassic Schooler Creek gas well.
647	HB Pacific Pocketknife c-80-L	Oct. 4, 1960	Jan. 29, 1961	5,061	1,106	Dry and abandoned.
842	Imp Pac Boundary 6-29-83-13	Nov. 3, 1961	Nov. 16, 1961	4,477	4,477	Dry and abandoned.
888	Imp Pac Boundary 14-31-84-13	Dec. 28, 1961			3,315	Drilling.
813	Imp Pac Boundary 6-5-85-13	Oct. 16, 1961	Oct. 26, 1961	4,311	4,311	Triassic Boundary Lake oil well.
878	Imp Pac Boundary 8-5-85-13	Dec. 3, 1961	Dec. 12, 1961	4,337	4,337	Triassic Boundary Lake oil well.
832	Imp Pac Boundary 14-5-85-13	Nov. 8, 1961	Nov. 17, 1961	4,313	4,313	Triassic Boundary Lake oil well.
882	Imp Pac Boundary 16-5-85-13	Dec. 13, 1961	Dec. 29, 1961	4,335	4,335	Triassic Boundary Lake oil well.
789	Imp Pac Boundary 6-6-85-13	Sept. 4, 1961	Sept. 15, 1961	4,285	4,285	Triassic Boundary Lake oil well.
795	Imp Pac Boundary 8-6-85-13	Sept. 17, 1961	Sept. 26, 1961	4,305	4,305	Triassic Boundary Lake oil well.
792	Imp Pac Boundary 14-6-85-13	Sept. 11, 1961	Sept. 20, 1961	4,279	4,279	Triassic Boundary Lake oil well.
796	Imp Pac Boundary 16-6-85-13	Sept. 21, 1961	Oct. 4, 1961	4,255	4,255	Triassic Boundary Lake oil well.
763	Imp Pac Boundary 6-7-85-13	Aug. 18, 1961	Aug. 28, 1961	4,308	4,308	Triassic Boundary Lake oil well.

807	Imp Pac Boundary 8-7-85-13	Oct. 4, 1961	Oct. 15, 1961	4,330	4,330	Triassic Boundary Lake oil well.
775	Imp Pac Boundary 16-7-85-13	Aug. 29, 1961	Sept. 10, 1961	4,335	4,335	Triassic Boundary Lake oil well.
847	Imp Pac Boundary 6-8-85-13	Nov. 18, 1961	Nov. 27, 1961	4,337	4,337	Triassic Boundary Lake oil well.
906	Imp Pac Boundary 8-8-85-13	Dec. 30, 1961			2,200	Drilling.
767	Imp Pac Boundary 14-8-85-13	Nov. 30, 1961	Dec. 10, 1961	4,330	4,330	Triassic Boundary Lake oil well.
889	Imp Pac Boundary 16-8-85-13	Dec. 12, 1961	Dec. 27, 1961	4,345	4,345	Triassic Boundary Lake oil well.
760	Imp Pac Boundary 6-17-85-13	Aug. 8, 1961	Aug. 21, 1961	4,301	4,301	Triassic Boundary Lake oil well.
738	Imp Pac Boundary 14-17-85-13	Mar. 21, 1961	Apr. 2, 1961	4,345	4,345	Triassic Boundary Lake oil well.
734	Imp Pac Boundary 6-18-85-13	Mar. 8, 1961	Mar. 20, 1961	4,292	4,292	Triassic Boundary Lake oil well.
774	Imp Pac Boundary 8-20-85-13	Aug. 22, 1961	Sept. 3, 1961	4,353	4,353	Triassic Boundary Lake oil well.
843	Imp Pac Boundary 14-10-84-14	Nov. 4, 1961	Nov. 17, 1961	4,460	4,460	Triassic Boundary Lake oil well.
872	Imp Pac Boundary 16-24-84-14	Dec. 10, 1961	Dec. 24, 1961	4,465	4,465	Triassic Boundary Lake oil well.
861	Imp Pac Boundary 8-34-84-14	Nov. 28, 1961	Dec. 9, 1961	4,125	4,125	Triassic Boundary Lake oil well.
883	Imp Pac Boundary 14-34-84-14	Dec. 11, 1961	Dec. 22, 1961	4,075	4,075	Triassic Boundary Lake oil well.
846	Imp Pac Boundary 16-34-84-14	Nov. 17, 1961	Nov. 26, 1961	4,105	4,105	Triassic Boundary Lake oil well.
833	Imp Pac Boundary 6-35-84-14	Oct. 27, 1961	Nov. 7, 1961	4,188	4,188	Triassic Boundary Lake oil well.
815	Imp et al Boundary 8-35-84-14	Oct. 15, 1961	Oct. 25, 1961	4,233	4,233	Triassic Boundary Lake oil well.
805	Imp Pac Boundary 14-35-84-14	Oct. 6, 1961	Oct. 15, 1961	4,155	4,155	Triassic Boundary Lake oil well.
797	Imp Pac Boundary 16-35-84-14	Sept. 21, 1961	Oct. 5, 1961	4,185	4,185	Triassic Boundary Lake oil well.
804	Imp et al Boundary 6-36-84-14	Sept. 30, 1961	Oct. 9, 1961	4,295	4,295	Triassic Boundary Lake oil well.
814	Imp et al Boundary 8-36-84-14	Oct. 10, 1961	Oct. 20, 1961	4,320	4,320	Triassic Boundary Lake oil well.
793	Imp et al Boundary 14-36-84-14	Sept. 10, 1961	Sept. 18, 1961	4,271	4,271	Triassic Boundary Lake oil well.
798	Imp et al Boundary 16-36-84-14	Sept. 19, 1961	Sept. 28, 1961	4,283	4,283	Triassic Boundary Lake oil well.
761	Imp et al Boundary 6-1-85-14	Aug. 8, 1961	Aug. 18, 1961	4,245	4,245	Triassic Boundary Lake oil well.
770	Imp et al Boundary 8-1-85-14	Aug. 20, 1961	Aug. 29, 1961	4,247	4,247	Triassic Boundary Lake oil well.
776	Imp et al Boundary 16-1-85-14	Aug. 30, 1961	Sept. 8, 1961	4,270	4,270	Triassic Boundary Lake oil well.
788	Imp Pac Boundary 8-2-85-14	Sept. 2, 1961	Sept. 11, 1961	4,246	4,246	Triassic Boundary Lake oil well.
777	Imp Pac Boundary 16-2-85-14	Sept. 12, 1961	Sept. 21, 1961	4,230	4,230	Triassic Boundary Lake oil well.
767	Imp Pac Boundary 8-11-85-14	Aug. 18, 1961	Sept. 1, 1961	4,285	4,285	Triassic Boundary Lake oil well.
821	Imp Pac Boundary 14-11-85-14	Oct. 21, 1961	Oct. 30, 1961	4,286	4,286	Triassic Boundary Lake oil well.
759	Imp Pac Boundary 14-12-85-14	Aug. 7, 1961	Aug. 17, 1961	4,310	4,310	Triassic Boundary Lake oil well.
758	Imp Pac Boundary 6-13-85-14	Aug. 7, 1961	Aug. 17, 1961	4,303	4,303	Triassic Boundary Lake oil well.
848	Imp Pac Boundary 8-14-85-14	Nov. 18, 1961	Nov. 28, 1961	4,305	4,305	Triassic Boundary Lake oil well.
905	Imp Kyklo b-73-F	Dec. 23, 1961			1,433	Drilling.
828	Imp et al Rigel 6-27-88-18	Oct. 28, 1961	Nov. 18, 1961	4,340	4,340	Lower Cretaceous Dunlevy gas well.
863	Imp Pac Sirius d-21-I	Nov. 20, 1961	Dec. 7, 1961	4,200	4,200	Dry and abandoned.
791	McCoy Dome Bubbles d-42-B	Sept. 13, 1961	Sept. 29, 1961	4,663	4,663	Triassic upper carbonate of Schooler Creek gas well.
693	McCoy Dome Bubbles c-72-B	Dec. 20, 1960	Jan. 8, 1961	4,670	225	Dry and abandoned.
685	Mobil W Sahtaneh d-88-I	Dec. 14, 1960	Mar. 1, 1961	8,260	4,382	Dry and abandoned.
876	Mobil W Sahtaneh c-89-I	Dec. 6, 1961			5,607	Drilling.
898	Ohio Boundary 14-5-86-13	Dec. 18, 1961			4,109	Drilling.
766	Pacific Pan Am Dome N Beg a-4-D	Sept. 10, 1961	Nov. 6, 1961	5,607	5,607	Triassic upper carbonate of Schooler Creek gas well.
855	Pacific Pan Am Dome N Beg d-15-D	Nov. 22, 1961	Dec. 30, 1961	4,940	4,940	Triassic upper carbonate of Schooler Creek gas well.
895	Pacific Boundary 16-14-85-14	Dec. 20, 1961			4,480	Drilling.
750	Pac Imp N Bubbles d-95-D	June 21, 1961	July 31, 1961	5,076	5,076	Triassic Halfway gas well.
820	Pacific Imperial Jedney d-53-C	Oct. 16, 1961	Nov. 23, 1961	5,322	5,322	Triassic upper carbonate of Schooler Creek and Halfway gas well.

TABLE 6.—WELLS DRILLED AND DRILLING, 1961—*Continued*

Drilling Authority No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1961 Footage	Status at Dec. 31, 1961
868	Pacific Imperial Jedney b-73-C	Nov. 27, 1961			5,303	Drilling.
691	Pacific Sunray Imp Jedney b-84-C	Dec. 28, 1960	Feb. 9, 1961	5,290	3,670	Triassic Halfway gas well.
778	Pacific et al Jedney c-86-C	Aug. 30, 1961	Oct. 14, 1961	5,502	5,502	Triassic Halfway gas well.
779	Pacific et al Jedney a-17-F	Aug. 28, 1961	Oct. 3, 1961	5,285	5,285	Triassic Halfway gas well.
715	Pacific Sunray Imp E Laprise a-22-E	Jan. 25, 1961	Feb. 9, 1961	4,336	4,336	Triassic upper carbonate of Schooler Creek gas well.
690	Pacific Sunray Imp E Laprise a-33-E	Dec. 27, 1960	Jan. 21, 1961	4,453	3,486	Triassic upper carbonate of Schooler Creek gas well.
725	Pacific SR West Cdn Peejay d-33-I	Feb. 22, 1961	Mar. 13, 1961	3,775	3,775	Triassic Halfway oil well.
893	Pacific SR West Cdn Peejay d-43-I	Dec. 31, 1961			55	Drilling.
713	Pacific SR West Cdn Peejay d-52-I	Jan. 27, 1961	Feb. 11, 1961	3,750	3,750	Triassic Halfway gas well.
894	Pacific SR West Cdn W Peejay d-11-J	Dec. 14, 1961	Dec. 29, 1961	3,804	3,804	Dry and abandoned.
682	Pan Am Beaver River d-73-K	Jan. 23, 1961	Dec. 6, 1961	13,581	13,857	Middle Devonian carbonate gas well; whipstocked at 12,285 ft.
680	Pan Am Cam Lake c-25-L	Feb. 2, 1961	Mar. 18, 1961	7,090	7,090	Dry and abandoned.
681	Pan Am et al Dilly a-27-K	Dec. 27, 1960	Feb. 10, 1961	7,154	6,155	Dry and abandoned.
877	Pan Am et al Dilly a-30 K	Dec. 4, 1961			6,202	Drilling.
705	Pan Am July a-65-K	Feb. 3, 1961	Mar. 18, 1961	6,913	6,913	Dry and abandoned.
527	Pan Am A-1 Komie a-51-A	Dec. 27, 1959	Jan. 22, 1961	7,812	181	Middle Devonian carbonate gas well.
683	Pan Am Komie c-94-I	Dec. 26, 1960	Mar. 13, 1961	8,440	8,126	Dry and abandoned.
707	Pure R O Corp Firebird d-89-D	Jan. 29, 1961	Feb. 15, 1961	3,860	3,860	Lower Cretaceous Gething gas well.
720	Pure et al Big Nancy b-70-B	Feb. 19, 1961	Mar. 9, 1961	3,906	3,906	Lower Cretaceous Gething gas well.
675	Pure Imperial Bull b-67-J	Dec. 11, 1960	Feb. 2, 1961	8,267	4,795	Dry and abandoned.
892	Pure Pac Cheves c-5-A	Dec. 12, 1961			2,986	Drilling.
874	Pure ROC Donis d-61-D	Dec. 11, 1961	Dec. 30, 1961	3,920	3,920	Dry and abandoned.
839	Pure et al W Milligan d-67-G	Nov. 24, 1961	Dec. 8, 1961	3,780	3,780	Dry and abandoned.
701	Pure R O Corp Prespatou d-99-A	Jan. 4, 1961	Jan. 26, 1961	4,129	4,129	Dry and abandoned.
838	Pure et al Sam d-88-F	Nov. 2, 1961	Nov. 17, 1961	3,895	3,895	Dry and abandoned.
822	Pure Pacific Tanaka c-94-L	Oct. 26, 1961	Dec. 25, 1961	8,472	8,472	Dry and abandoned.
884	Richfield Pure Abbotsford 16-17-16	Dec. 5, 1961			3,117	Drilling.
754	Richfield et al Cape Ball d-41-L	July 16, 1961	Aug. 20, 1961	7,988	7,988	Dry and abandoned.
702	Sinclair et al Attachie 7-12-84-23	Jan. 19, 1961	Feb. 3, 1961	2,750	2,750	Dry and abandoned.
732	Sinclair et al Beg b-99-B	Mar. 16, 1961	Mar. 23, 1961	1,513	1,513	Junked and abandoned.
739	Sinclair et al Beg b-A99-B	Mar. 25, 1961	May 21, 1961	5,437	5,437	Triassic Halfway gas well.
711	Sinclair et al Beg a-21-F	Jan. 23, 1961	Feb. 27, 1961	5,252	5,252	Triassic upper carbonate of Schooler Creek and Halfway gas well.
748	Sinclair et al Beg b-42-F	June 18, 1961	July 23, 1961	5,116	5,116	Triassic upper carbonate of Schooler Creek and Halfway gas well.
733	Sinclair et al Beg d-64-F	Feb. 28, 1961	Apr. 13, 1961	5,101	5,101	Triassic upper carbonate of Schooler Creek and Halfway gas well.
741	Sinclair et al Beg b-84-F	Apr. 15, 1961	May 22, 1961	5,095	5,095	Triassic upper carbonate of Schooler Creek and Halfway gas well.
747	Sinclair et al Beg b-95-F	July 10, 1961	Aug. 19, 1961	5,428	5,428	Triassic Halfway gas well.

541	Sinclair et al Beg d-10-G	Oct. 26, 1960	Jan. 6, 1961	5,610	......	Triassic upper carbonate of Schooler Creek and Halfway gas well.
740	Sinclair et al Beg b-6-K	Apr. 24, 1961	June 17, 1961	5,326	5,326	Triassic upper carbonate of Schooler Creek and Halfway gas well.
749	Sinclair et al Beg a-28-K	June 25, 1961	Aug. 8, 1961	5,648	5,648	Triassic upper carbonate of Schooler Creek and Halfway gas well.
786	Sinclair et al Beg b-59-K	Aug. 31, 1961	Oct. 15, 1961	5,426	5,426	Triassic upper carbonate of Schooler Creek and Halfway gas well.
772	Sinclair et al W Beg c-58-F	Aug. 20, 1961	Oct. 9, 1961	5,863	5,863	Triassic upper carbonate of Schooler Creek gas well.
841	Sinclair Boundary 14-11-84-14	Nov. 7, 1961	Nov. 18, 1961	4,485	4,485	Triassic Boundary Lake oil well.
865	Sinclair Boundary 16-11-84-14	Dec. 16, 1961			4,502	Drilling.
803	Sinclair Boundary 6-14-84-14	Oct. 4, 1961	Oct. 17, 1961	4,485	4,485	Triassic Boundary Lake oil well.
866	Sinclair Boundary 8-14-84-14	Nov. 25, 1961	Dec. 10, 1961	4,503	4,503	Triassic Boundary Lake oil well.
755	Sinclair Boundary 14-15-84-14	July 11, 1961	July 24, 1961	4,277	4,277	Triassic Boundary Lake oil well.
752	Sinclair Boundary 16-15-84-14	June 16, 1961	June 27, 1961	4,400	4,400	Triassic Boundary Lake oil well.
780	Sinclair Boundary 6-22-84-14	Aug. 26, 1961	Sept. 8, 1961	4,230	4,230	Triassic Boundary Lake oil well.
742	Sinclair Boundary 8-22-84-14	May 28, 1961	June 12, 1961	4,360	4,360	Triassic Boundary Lake oil well.
794	Sinclair Boundary 14-22-84-14	Sept. 10, 1961	Sept. 22, 1961	4,165	4,165	Triassic Boundary Lake oil well.
727	Sinclair Boundary 16-22-84-14	Feb. 27, 1961	Mar. 20, 1961	4,430	4,430	Triassic Boundary Lake oil well.
802	Sinclair Boundary 6-27-84-14	Nov. 20, 1961	Dec. 10, 1961	4,130	4,130	Triassic Boundary Lake oil well.
743	Sinclair Boundary 8-27-84-14	May 10, 1961	May 26, 1961	4,160	4,160	Triassic Boundary Lake oil well.
853	Sinclair Boundary 14-27-84-14	Dec. 18, 1961			3,667	Drilling.
753	Sinclair Boundary 16-27-84-14	Aug. 12, 1961	Aug. 23, 1961	4,160	4,160	Triassic Boundary Lake oil well.
679	Sinclair et al N Conroy Creek d-45-K	Dec. 3, 1960	Jan. 21, 1961	5,070	997	Dry and abandoned.
698	Sinclair et al Datcin b-46-G	Dec. 22, 1960	Feb. 12, 1961	6,306	4,590	Dry and abandoned.
870	Sinclair et al Datcin a-54-G	Dec. 12, 1961			4,925	Drilling.
831	Sinclair et al Flatrock 9-22-83-14	Oct. 30, 1961	Nov. 18, 1961	4,939	4,939	Triassic Boundary Lake oil well.
703	Sinclair et al Flatrock 6-29-83-14	Jan. 20, 1961	Feb. 23, 1961	4,985	4,985	Dry and abandoned.
825	Sinclair et al Flatrock 16-34-83-14	Oct. 22, 1961	Nov. 22, 1961	4,535	4,535	Triassic Boundary Lake oil well.
658	Sinclair Pac Julienne Creek b-39-D	Oct. 24, 1960	Feb. 24, 1961	6,275	202	Triassic Baldonnel gas well.
757	Sinclair et al N Julienne c-54-H	Aug. 17, 1961	Nov. 10, 1961	6,340	6,340	Triassic Schooler Creek gas well.
421	Sinclair Pac Klua Ck a-55-L (B11-1)	Jan. 30, 1959	Feb. 20, 1961	8,614		Dry and abandoned.
694	Sinclair Pacific Lichen d-31-A	Dec. 24, 1960	Feb. 18, 1961	6,470	4,989	Dry and abandoned.
914	Sinclair et al Peejay d-58-E	Dec. 30, 1961			519	Drilling.
881	Sinclair et al Peejay d-59-E	Dec. 10, 1961	Dec. 26, 1961	3,900	3,900	Triassic Halfway oil well.
648	Sinclair Pac Robertson Creek d-39-J	Oct. 3, 1960	Apr. 10, 1961	9,141	3,802	Dry and abandoned.
709	Sinclair Pacific Weasel d-50-A	Jan. 19, 1961	Feb. 18, 1961	3,680	3,680	Triassic Halfway gas well.
726	Sinclair Pacific Weasel d-33-B	Feb. 22, 1961	Mar. 7, 1961	3,727	3,727	Dry and abandoned.
897	Sohio C & E Ekwan a-55-G	Dec. 15, 1961			3,622	Drilling.
784	Sohio Septimus 4-34-81-19	Sept. 14, 1961	Nov. 11, 1961	6,220	6,220	Dry and abandoned.
785	Sun et al Blueberry d-19-K	Oct. 4, 1961	Nov. 29, 1961	6,649	6,649	Mississippian Rundle oil well.
746	Sun et al Blueberry d-30-K	June 4, 1961	Aug. 16, 1961	6,693	6,693	Mississippian Rundle oil well.
783	Sun et al Blueberry d-40-K	Sept. 13, 1961	Nov. 21, 1961	6,681	6,681	Mississippian Rundle oil well.
851	Sun et al Blueberry b-60-K	Dec. 5, 1961			4,791	Drilling.
745	Sun et al Blueberry 6-25-88-25	June 5, 1961	Aug. 23, 1961	6,581	6,581	Mississippian Rundle oil well.
850	Sun et al Blueberry 14-25-88-25	Dec. 6, 1961			4,576	Drilling.
719	Sun Boundary 16-23-85-14	Mar. 6, 1961	Mar. 21, 1961	4,580	4,580	Triassic Boundary Lake oil well.

TABLE 6.—WELLS DRILLED AND DRILLING, 1961—*Continued*

Drilling Authority No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1961 Footage	Status at Dec. 31, 1961
744	Sun Buick c-16-B	June 2, 1961	July 5, 1961	4,709	4,709	Lower Cretaceous Buick Creek gas well.
756	Sun Buick d-19-B	Sept. 4, 1961	Sept. 17, 1961	3,650	3,650	Lower Cretaceous Buick Creek gas well.
818	Sun Buick d-11-C	Oct. 13, 1961	Oct. 27, 1961	3,835	3,835	Lower Cretaceous Buick Creek gas well.
871	Sun Buick b-42-C	Dec. 11, 1961	Dec. 31, 1961	3,895	3,895	Dry and abandoned.
671	TGT Tooga Lake c-27-K	Dec. 28, 1960	Feb. 19, 1961	6,727	6,122	Dry and abandoned.
844	Texaco NFA Boundary 16-7-85-13	Nov. 6, 1961	Nov. 16, 1961	4,315	4,315	Triassic Boundary Lake oil well.
862	Texaco NFA Boundary 6-7-86-13	Nov. 27, 1961	Dec. 18, 1961	4,353	4,353	Triassic Boundary Lake oil well.
811	Texaco NFA Boundary 6-18-86-13	Oct. 12, 1961	Oct. 22, 1961	4,311	4,311	Triassic Boundary Lake oil well.
901	Texaco NFA Boundary 16-19-86-13	Dec. 27, 1961	....	....	3,600	Drilling.
836	Texaco NFA Boundary 16-31-86-13	Nov. 3, 1961	Nov. 25, 1961	4,770	4,770	Triassic Halfway gas well.
823	Texaco NFA Boundary 16-22-85-14	Oct. 24, 1961	Nov. 6, 1961	4,366	4,366	Triassic Boundary Lake oil well.
687	Texaco NFA Boundary Lake 6-25-85-14	Dec. 12, 1960	Jan. 14, 1961	4,646	31	Triassic Baldonnel gas well.
845	Texaco NFA Boundary 8-27-85-14	Nov. 8, 1961	Nov. 21, 1961	4,375	4,375	Triassic Boundary Lake oil well.
812	Texaco NFA Boundary 16-27-85-14	Oct. 7, 1961	Oct. 23, 1961	4,340	4,340	Triassic Boundary Lake oil well.
857	Texaco NFA Boundary 8-34-85-14	Nov. 23, 1961	Dec. 6, 1961	4,331	4,331	Triassic Boundary Lake oil well.
860	Texaco NFA Boundary 16-1-86-14	Nov. 28, 1961	Dec. 14, 1961	4,402	4,402	Triassic Boundary Lake oil well.
829	Texaco NFA Boundary 6-12-86-14	Oct. 23, 1961	Nov. 4, 1961	4,393	4,393	Triassic Boundary Lake oil well.
900	Texaco NFA Boundary 14-12-86-14	Dec. 18, 1961	....	....	4,350	Drilling.
880	Texaco NFA Boundary 6-13-86-14	Dec. 4, 1961	Dec. 15, 1961	4,340	4,340	Triassic Boundary Lake oil well.
858	Texaco NFA Boundary 16-13-86-14	Nov. 18, 1961	Nov. 30, 1961	4,312	4,312	Triassic Boundary Lake oil well.
885	Texaco NFA Boundary 6-24-86-14	Dec. 8, 1961	Dec. 22, 1961	4,320	4,320	Triassic Boundary Lake oil well.
835	Texaco NFA Boundary 14-36-86-14	Oct. 31, 1961	Nov. 24, 1961	4,710	4,710	Dry and abandoned.
787	Texaco NFA Buick d-96-I	Sept. 10, 1961	Sept. 28, 1961	3,877	3,877	Lower Cretaceous Buick Creek gas well.
728	Texaco NFA Buick d-93-J	Mar. 1, 1961	Mar. 23, 1961	4,265	4,265	Lower Cretaceous Buick Creek and Triassic Charlie Lake gas well.
717	Texaco NFA Judy c-53-D	Feb. 1, 1961	Mar. 30, 1961	7,322	7,322	Mississippian Rundle gas well.
565	Texaco NFA Maxhamish Lake c-15-L	Jan. 13, 1960	Jan. 25, 1961	6,902	....	Dry and abandoned.
819	Texaco NFA Nig a-69-A	Oct. 16, 1961	Nov. 10, 1961	4,445	4,445	Triassic upper carbonate of Schooler Creek gas well.
729	Texaco NFA Nig c-36-B	Feb. 28, 1961	Mar. 18, 1961	4,510	4,510	Triassic upper carbonate of Schooler Creek gas well.
790	Texaco NFA Nig d-71-B	Sept. 14, 1961	Oct. 7, 1961	4,467	4,467	Triassic upper carbonate of Schooler Creek gas well.
852	Texaco NFA Nig b-44-G	Nov. 16, 1961	Dec. 18, 1961	4,420	4,420	Triassic upper carbonate of Schooler Creek gas well.
731	Texaco NFA Silver b-65-J	Feb. 26, 1961	Mar. 17, 1961	4,163	4,163	Dry and abandoned.
704	Texaco NFA Tsea b-68-K	Jan. 12, 1961	Mar. 29, 1961	7,110	7,110	Middle Devonian carbonate gas well.
710	Texaco NFA Wendy c-90-G	Jan. 17, 1961	Feb. 5, 1961	4,042	4,042	Dry and abandoned.
708	Texaco NFA Wolfe 1-8-88-14	Jan. 19, 1961	Feb. 18, 1961	5,663	5,663	Dry and abandoned.
896	Triad Beatton d-49-J	Dec. 13, 1961	Dec. 23, 1961	3,790	3,790	Triassic Halfway oil well.
816	Triad Beatton d-50-J	Oct. 17, 1961	Oct. 29, 1961	3,760	3,760	Triassic Halfway oil well.

869	Triad et al Beatton d-41-K	Nov. 25, 1961	Dec. 11, 1961	3,760	3,760	Triassic Halfway oil well.
699	Triad BP N Beatton R d-87-D	Jan. 18, 1961	Jan. 29, 1961	4,023	4,023	Dry and abandoned.
824	Triad W Beatton d-29-K	Nov. 2, 1961	Nov. 10, 1961	3,373	3,373	Dry and abandoned.
854	Triad W Beatton d-30-K	Nov. 10, 1961	Nov. 17, 1961	3,440	3,440	Dry and abandoned.
724	Triad BP Birley a-5-A	Feb. 15, 1961	Mar. 3, 1961	4,100	4,100	Triassic Halfway gas well.
672	Triad BP Conroy Creek c-100-A	Dec. 1, 1960	Mar. 20, 1961	9,896	5,204	Dry and abandoned.
695	Triad BP Pickell Creek c-88-I	Dec. 30, 1960	Jan. 14, 1961	4,054	3,537	Lower Cretaceous Bluesky-Gething gas well.
718	Triad BP E Pickell d-50-L	Feb. 2, 1961	Feb. 13, 1961	3,978	3,978	Dry and abandoned.
800	Union Aitken b-52-L	Sept. 20, 1961	Oct. 3, 1961	4,358	4,358	Dry and abandoned.
721	Union HB Alder c-39-I	Feb. 9, 1961	Feb. 24, 1961	3,765	3,765	Triassic upper carbonate of Schooler Creek gas well.
904	Union KCL ROC Bearberry d-71-J	Dec. 19, 1961	Jan. 1, 1962	3,768	3,768	Dry and abandoned.
849	Union HB Bluebell b-31-H	Nov. 9, 1961	Nov. 20, 1961	3,678	3,678	Dry and abandoned.
712	Union HB Laurel a-53-D	Jan. 23, 1961	Feb. 5, 1961	3,665	3,665	Dry and abandoned.
899	Union HB Milligan b-53-G	Dec. 21, 1961			3,715	Drilling.
826	Union HB Milligan b-62-G	Nov. 20, 1961	Nov. 30, 1961	3,794	3,794	Triassic Halfway oil well.
875	Union HB Milligan b-83-G	Dec. 4, 1961	Dec. 18, 1961	3,789	3,789	Triassic Halfway injection well.
840	Union HB Wildmint b-24-A	Oct. 31, 1961	Nov. 17, 1961	3,825	3,825	Triassic Halfway oil well.
919	Union HB Wildmint d-25-A	Dec. 31, 1961			506	Drilling.
867	Union HB Wildmint b-45-A	Nov. 22, 1961	Dec. 13, 1961	3,835	3,835	Dry and abandoned.
810	Union HB Wildmint d-45-A	Oct. 18, 1961	Oct. 28, 1961	3,710	3,710	Triassic Halfway oil well.
730	Union HB Wildmint d-57-A	Feb. 26, 1961	Mar. 9, 1961	3,830	3,830	Dry and abandoned.
830	Union HB Willow b-10-H	Oct. 25, 1961	Nov. 6, 1961	3,785	3,785	Triassic Halfway gas well.
890	Union HB Woodrush d-55-H	Dec. 15, 1961	Dec. 29, 1961	3,750	3,750	Triassic Halfway oil well.
700	West Nat Imp Clarke Lake b-78-J	Jan. 26, 1961	Mar. 19, 1961	6,520	6,520	Middle Devonian carbonate gas well.
817	West Nat et al Evie D-14-F	Oct. 23, 1961	Dec. 8, 1961	7,925	7,925	Dry and abandoned.
688	West Nat et al Fort Nelson b-70-I	Dec. 18, 1960	Jan. 20, 1961	6,422	3,808	Middle Devonian carbonate gas well.
856	West Nat Ft Nelson a-52-J	Dec. 1, 1961			3,483	Drilling.
677	West Nat Kathy b-30-F	Dec. 9, 1960	Jan. 24, 1961	6,785	2,416	Middle Devonian carbonate gas well.
714	West Nat Kotcho a-9-F	Jan. 30, 1961	Mar. 13, 1961	6,966	6,966	Dry and abandoned.
879	West Nat Kotcho b-54-K	Dec. 17, 1961			4,169	Drilling.
722	West Nat Petitot b-90-K	Feb. 17, 1961	Mar. 17, 1961	6,732	2,021	Middle Devonian carbonate gas well; directionally drilled from West Nat Petitot River a-81-L at 4,711 ft.
676	West Nat Petitot River a-81-L	Dec. 29, 1960	Feb. 17, 1961	6,720	6,098	Dry and abandoned.
801	White Rose Sec Montney 6-5-87-18	Sept. 21, 1961	Oct. 26, 1961	4,779	4,779	Triassic Halfway gas well.
689	Whitehall et al Milligan d-75-G	Feb. 19, 1961	Mar. 5, 1961	3,753	3,753	Triassic Halfway gas well.

TABLE 7.—OIL AND GAS FIELDS DESIGNATED AS OF DECEMBER 31, 1961

Field	Date Designated	Date(s) Revised	Field Location	Pool(s)	Number of Wells	Discovery Well(s)	Pool(s) Discovered	Battery Name	Battery Location	Number of Wells in Battery
Aitken Creek	Feb. 15, 1960	Jan. 1, 1961	N.T.S. 94-A-13	3	2	Union Aitken Creek b-42-L, oil Union Aitken Creek a-53-L (3), gas	3 3			... ...
Beatton River	Aug. 7, 1959		N.T.S. 94-H-2	11	6	Triad Beatton River b-38-J, oil	11	Triad Beatton 'J' Battery	b-38-J/94-H-2	4
Beatton River West	Aug. 7, 1959	Jan. 1, 1961	N.T.S. 94-H-2	2	5	Triad West Beatton River d-39-K, oil	2	Triad West Beatton 'K' Battery	d-48-K/94-H-2	4
Beg	July 1, 1961		N.T.S. 94-G-1	8, 11	10	Sinclair et al Beg b-17-K, gas Sinclair et al Beg d-10-G, gas	8 11			... ...
Blueberry	Feb. 7, 1958	Dec. 22, 1958 Feb. 15, 1960 May 27, 1960 Oct. 1, 1961	N.T.S. 94-A-12, 94-A-13 Tp. 88, R. 25, W. of 6th M.	5, 7, 9, 13	19	Sun et al Blueberry c-32-D (2), gas Sun et al Blueberry d-87-D (1), gas Sun et al Blueberry a-61-L, gas Sun et al Blueberry c-82-L (11), oil Sun et al Blueberry a-34-D (10), gas	5 7 9 13 13			... ...
Blueberry East	Dec. 22, 1958		N.T.S. 94-A-13	7, 11, 13	2	Sun et al E Blueberry b-38-C (7), gas Sun et al E Blueberry b-36-C (17), gas	7, 11 13			... ...
Blueberry West	Feb. 7, 1958	July 1, 1961	N.T.S. 94-A-12, 94-B-9, 94-B-16 Tp. 88, R. 25, W. of 6th M.	5, 7	3	Sun et al W Blueberry d-82-I (9), gas Sun et al W Blueberry d-19-L (12), gas	5 7			... .
Boundary Lake	Oct. 30, 1956	Feb. 7, 1958 Aug. 7, 1959 Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1961	Tp. 84, 85, 86, R. 13, W. of 6th M. Tp. 84, 85, 86, R. 14, W. of 6th M.	2, 3, 7, 10, 11	138	Pacific Boundary 8-15-85-14, gas Pacific Boundary 12-10-85-14, gas Texaco NFA Boundary L 6-6-86-13 (1), oil Sun Boundary Lake 6-23-85-14, oil	2, 7 3 10 11	Amerada Boundary Battery No. 1 Amerada Boundary Battery No. 2 Amerada Boundary Battery No. 3 Dome Boundary Battery No. 11 Dome Boundary Battery No. 12 Dome Boundary Battery No. 26 Imperial Boundary Battery No. 6-1 Imperial Boundary Battery No. 6-2 Imperial Boundary Battery No. 6-3 Imp Pac Boundary Battery No. 12-5 Imp Pac Boundary Battery No. 12-8 Imperial Boundary Battery No. 16-11 Imperial Boundary Battery No. 6-17 Imperial Boundary Battery No. 14-7 Ohio Boundary Battery No. 1 Ohio Boundary Battery No. 2 Sinclair Boundary Battery No. 1 Sun Boundary Battery No. 8-23 Texaco Boundary Battery No. A-1	Lsd. 5, 6, Sec. 29-85-13, W. of 6th M. 16-13-85-14, W. of 6th M. 16-18-85-13, W. of 6th M. 8-11-86-14, W. of 6th M. 16-12-85-14, W. of 6th M. 16-26-85-14, W. of 6th M. 6-1-85-14, W. of 6th M. 6-2-85-14, W. of 6th M. 6-3-85-14, W. of 6th M. 12-5-85-13, W. of 6th M. 12-8-85-13, W. of 6th M. 16-11-85-14, W. of 6th M. 6-17-85-13, W. of 6th M. 14-7-85-13, W. of 6th M. 9-19-85-13, W. of 6th M. 14-8-86-13, W. of 6th M. 8-22-84-14, W. of 6th M. 8-23-85-14, W. of 6th M. 6-6-86-13, W. of 6th M.	3 5 2 4 4 10 5 4 4 2 2 6 5 1 4 1 10 4 12
Bubbles	Nov. 24, 1959	Feb. 15, 1960 May 27, 1960 Jan. 1, 1961	N.T.S. 94-G-1, 94-G-8, 94-H-4	8	13	Pacific Imperial Bubbles b-33-I, gas	8			...
Buick Creek	Feb. 7, 1958	Aug. 7, 1959 Jan. 1, 1961 July 1, 1961 Oct. 1, 1961	N.T.S. 94-A-11, 94-A-14	6, 9	13	Texaco NFA Buick Creek d-98-I (1), gas Texaco NFA Buick Creek d-83-J (4), gas	6 9			... ...
Buick Creek West	Feb. 7, 1958	Jan. 6, 1959 Feb. 15, 1960	N.T.S. 94-A-11, 94-A-14	6, 7, 11	13	Pacific W Buick Creek c-83-K (13A), oil Pacific West Buick Creek b-78-C (2), gas Pacific West Buick Creek d-58-C (8), gas Pacific West Buick Creek b-23-E (1), gas	6 6 7 11			... ...
Charlie Lake	Jan. 1, 1961		Tp. 84, R. 18, W. of 6th M.	3	1	Imp Pac Charlie 13-5-84-14, oil	3			...
Clarke Lake	Feb. 15, 1960	May 27, 1960 Jan. 1, 1961	N.T.S. 94-J-9, 94-J-10, 94-J-15, 94-J-16	15	4	West Nat Imp Clarke Lake d-88-L, gas	15			...
Dawson Creek	Feb. 7, 1958		Tp. 79, R. 15, W. of 6th M.	1	4	Pacific Sc Dawson Ck 1-15-79-15 (1), gas	1			...
Fort St. John	Aug. 22, 1955	Feb. 7, 1958 Feb. 15, 1960 Jan. 1, 1961	Tp. 83, R. 18, W. of 6th M.	4, 7, 9, 11, 12	28	Pacific Ft St John A3-29-83-18 (31), gas Pacific Ft St John 14-15-83-18 (7), gas Pacific Ft St John 3-14-83-18 (9), oil Pacific Ft St John 1-20-83-18 (30), gas Imp Pac Ft St John 9-19-83-18 (45), oil Pacific Ft St John 14-21-83-18 (4), gas	4 7 9 11 12 12	Pacific Ft St John Tank Farm No. 2	10-14-83-18, W. of 6th M.	2
Fort St. John Airport	Feb. 7, 1958		Tp. 83, R. 17, W. of 6th M.	4, 7, 11	3	Pacific Airport 8-32-83-17 (3), gas Pacific Airport 9-32-83-17 (97), gas Pacific Airport 12-34-83-17 (10), gas	4 7 11			... ...
Fort St. John Southeast	Feb. 7, 1958		Tp. 82, 83, R. 17, W. of 6th M.	4, 7, 11, 12	15	Pac Ft St John SE 10-31-82-17 (80), gas Pac Ft St John SE A4-10-83-17 (55), gas Pac Ft St John SE 10-33-82-17 (22), gas Pac Ft St John SE 4-10-83-17 (12), gas	4 7 11 12			... ...
Gundy Creek	Feb. 7, 1958	Jan. 6, 1959	N.T.S. 94-B-16	7, 9	4	West Nat Gundy Creek c-80-A, gas West Nat Gundy Creek b-69-A, gas	7 9			... ...
Halfway	Dec. 22, 1958		Tp. 86, 87, R. 25, W. of 6th M.	7, 11	3	Sun et al Halfway 5-1-87-25, gas Sun et al Halfway 8-11-87-25, gas	7 11			... ...
Highway	Feb. 7, 1958		N.T.S. 94-B-16	5, 7, 13	5	Sun et al Highway b-3-I, gas Phillips Highway b-25-I (1), gas Phillips Highway a 90-I (4), gas	5 7 13			... ...
Jedney	Aug. 7, 1959	Nov. 24, 1959 Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1961	N.T.S. 94-G-1, 94-G-8	8, 11	15	Pacific et al Jedney b-88-J, gas Pacific Imp Jedney d-99-J, gas	8 11			... ...
Kobes-Townsend	Dec. 22, 1958	Feb. 15, 1960	N.T.S. 94-B-8, 94-B-9	5, 9, 11, 13	9	Phillips Kobes a-3-A (4), gas Phillips Kobes d-94-I (1), gas Phillips Townsend a-20-H (A-1), gas	5 9, 11 13			... ...
Laprise Creek	Feb. 15, 1960	Jan. 1, 1961 Apr. 1, 1961	N.T.S. 94-G-8, 94-H-5	8	8	Dome Basco Laprise Ck a-35-H, gas	8			...
Laprise Creek East	Jan. 1, 1961	Apr. 1, 1961	N.T.S. 94-G-8, 94-H-5	8	10	Pacific Sunray Imp E Laprise d-68-E, gas	8			...
Milligan Creek	Feb. 7, 1958	Aug. 7, 1959 Feb. 15, 1960 Jan. 1, 1961	N.T.S. 94-H-2	11	11	Union-H.B. Milligan Creek d-73-G, oil Whitehall et al Milligan d-75-G, gas	11 11	Union-HB Milligan Creek Battery No. 1	a-64-G/94-H-2	7
Montney	Feb. 7, 1958	Jan. 6, 1959	Tp. 87, R. 18, W. of 6th M. Tp. 86, 87, R. 19, W. of 6th M.	2, 9, 11	3	Pac Sunray Montney 16-32-86-19 (3), gas Pac Sunray Montney 14-36-86-19 (2), gas Pac Sunray Montney 14-31-86-19 (5), gas	2 9 11			... ...
Nig Creek	Aug. 7, 1959	Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1961	N.T.S. 94-H-4	8	9	Texaco NFA Nig Creek a-79-B (1), gas	8			...
Parkland (formerly Kiskatinaw)	Feb. 7, 1958		Tp. 81, R. 15, W. of 6th M.	14	1	Pacific Imp Parkland 6-29-81-15, gas	14			...
Peejay	Feb. 15, 1960	May 27, 1960 Jan. 1, 1961	N.T.S. 94-A-16	11	8	Sinclair Pac Peejay d-39-E (B8-3), oil	11	Sinclair Pac Peejay Battery No. 39-E	39-E/94-A-16	6
Petitot River	Apr. 1, 1961		N.T.S. 94-P-12, 94-P-13	15	3	West Nat Petitot River d-24-D, gas	15			...
Pouce Coupe	Aug. 22, 1955	Feb. 7, 1958 Jan. 1, 1961	Entire field deleted	—	—		—			...
Red Creek	Feb. 7, 1958	Aug. 7, 1959 Feb. 15, 1960	Tp. 85, R. 21, W. of 6th M.	9, 11	2	Pacific Red Creek 5-27-85-21 (36), gas	9, 11			...
Snyder Creek	Apr. 1, 1961		N.T.S. 94-A-14	5	1	Union Snyder Creek a-28-K (1), gas	5			...
Stoddart	Jan. 6, 1959	Feb. 15, 1960	Tp. 86, R. 20, W. of 6th M.	12	2	Pacific Stoddart 4-24-86-20 (85), gas	12			...
Sunrise	Feb. 7, 1958	Jan. 1, 1961	Tp. 78, 79, R. 16, W. of 6th M.	1	3	Pacific Sunrise 10-7-79-16 (3), gas	1			...

Numerical list of pools:—

1. Lower Cretaceous Cadotte sandstone.
2. Lower Cretaceous Bluesky-Gething sandstone.
3. Lower Cretaceous Gething sandstone.
4. Lower Cretaceous Cadomin sandstone.
5. Lower Cretaceous Dunlevy sandstone.
6. Lower Cretaceous Buick Creek sandstone.
7. Triassic Baldonnel carbonate (includes Baldonnel "A" and "B" of Fort St. John area).
8. Triassic upper carbonate of Schooler Creek.
9. Triassic Charlie Lake sandstone and carbonate.
10. Triassic Boundary Lake carbonate.
11. Triassic Halfway sandstone.
12. Permian Belloy carbonate.
13. Mississippian Rundle carbonate.
14. Upper Devonian Wabamun carbonate.
15. Middle Devonian carbonate.

TABLE 8.—RESERVES OF RECOVERABLE CRUDE OIL, NATURAL GAS, AND NATURAL-GAS PRODUCTS AT DECEMBER 31, 1961

	Proved		Established		
	Crude Oil (Bbl.)	Raw Gas[1] (M S.C.F.)	Disposable Gas (M S.C.F.)	Gas Liquids (Bbl.)	Sulphur (Short Tons)
Reserves remaining at December 31, 1960	68,158,777	3,361,824	2,987,200	74,305,834	2,062,621
Production during 1961	1,017,826	103,123	91,687[2]	2,910,855[2]	82,118[2]
Adjustments made during 1961[3]	−333,873	+306,999	+1,421,387	+14,681,886	+414,453
Reserves discovered during 1961	37,405,290	2,229,000	2,166,600	34,722,841	941,674
Reserves remaining at December 31, 1961	104,212,368	5,794,700	6,483,500	120,799,706	3,336,630

[1] Excludes solution gas and gas in gas caps of oil reservoirs while still in the stage of primary recovery.

[2] The production of residual gas, gas liquids, and sulphur are the quantities calculated from gas analyses to have been produced with the raw gas, both sweet and sour, and are not the quantities actually extracted. The actual quantity of gas delivered to the transmission-line during 1961 was 95,967 million cubic feet, and the amounts of gas liquids and sulphur actually extracted were 1,287,672 barrels and 55,655 short tons respectively.

[3] Reserves are continually under revision as data are provided by additional drilling and production. The adjustments made for disposable gas, gas liquids, and sulphur are unusually high due to the inclusion for the first time of a percentage (usually 50 per cent) of the probable reserves to determine established reserves.

TABLE 9.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1961

Field	Drilling Authority No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Aitken Creek	485	Union Aitken Creek b-42-L	b-42-L/94-A-13	Gething	32
Beatton River	396	Triad Beatton River d-28-J	d-28-J/94-H-2	Halfway	27
	395	Triad Beatton River d-29-J	d-29-J/94-H-2	Halfway	207
	309	Triad Beatton River b-38-J	b-38-J/94-H-2	Halfway	115
	393	Triad Beatton River d-39-J	d-39-J/94-H-2	Halfway	107
Beatton River West	538	Triad West Beatton River d-38-K	d-38-K/94-H-2	Bluesky-Gething	109
	408	Triad West Beatton River d-39-K	d-39-K/94-H-2	Bluesky-Gething	47
	441	Triad West Beatton River d-48-K	d-48-K/94-H-2	Bluesky-Gething	94
	515	Triad West Beatton River d-57-K	d-57-K/94-H-2	Bluesky-Gething	78
	512	Triad West Beatton River d-59-K	d-59-K/94-H-2	Bluesky-Gething	78
Blueberry	549	Sun et al Blueberry c-A29-K	c-29-K/94-A-12	Mississippian	380
	746	Sun et al Blueberry d-30-K	d-30-K/94-A-12	Mississippian	267
	242	Sun et al Blueberry d-50-K (13)	d-50-K/94-A-12	Mississippian	302
	205	Sun et al Blueberry d-82-L (11)	d-82-L/94-A-12	Mississippian	110
	272	Sun et al Blueberry d-46-D (16)	d-46-D/94-A-13	Mississippian	78
	745	Sun et al Blueberry 6-25-88-25	6-25-88-25 W6M	Mississippian	146
Boundary Lake	590	Amerada Cr BC-B Boundary 14-18-85-13	14-18-85-13 W6M	Boundary Lake	151
	628	Amerada Boundary Lake 16-18-85-13	16-18-85-13 W6M	Boundary Lake	181
	563	Amerada Cr BC-C Boundary 14-20-85-13	14-20-85-13 W6M	Boundary Lake	164
	591	Amerada Cr BC-C Boundary 6-29-85-13	6-29-85-13 W6M	Boundary Lake	125
	771	Amerada Boundary 14-29-85-13	14-29-85-13 W6M	Boundary Lake	138
	629	Amerada Boundary Lake 14-13-85-14	14-13-85-14 W6M	Boundary Lake	125
	580	Amerada Cr BC-B Boundary 16-13-85-14	16-13-85-14 W6M	Boundary Lake	137
	639	Amerada Boundary Lake 6-24-85-14	6-24-85-14 W6M	Boundary Lake	89
	608	Amerada Cr BC-D Boundary 8-24-85-14	8-24-85-14 W6M	Boundary Lake	131
	736	Amerada Boundary 16-24-85-14	16-24-85-14 W6M	Boundary Lake	163
	736	Amerada Boundary 16-24-85-14	16-24-85-14 W6M	Halfway	96
	361	Decalta Boundary Lake 14-32-85-13	14-32-85-13 W6M	Boundary Lake	93
	624	Dome Boundary Lake 6-12-85-14	6-12-85-14 W6M	Boundary Lake	187
	625	Dome Boundary Lake 8-12-85-14	8-12-85-14 W6M	Boundary Lake	175
	602	Dome Boundary Lake 16-12-85-14	16-12-85-14 W6M	Boundary Lake	171
	603	Dome Boundary Lake 8-13-85-14	8-13-85-14 W6M	Boundary Lake	181
	768	Dome Boundary Lake 8-22-85-14	8-22-85-14 W6M	Boundary Lake	130
	575	Dome Boundary Lake 6-26-85-14	6-26-85-14 W6M	Boundary Lake	138
	550	Dome Boundary Lake 8-26-85-14	8-26-85-14 W6M	Boundary Lake	132
	573	Dome Boundary Lake 14-26-85-14	14-26-85-14 W6M	Boundary Lake	186
	465	Dome Boundary Lake 16-26-85-14	16-26-85-14 W6M	Boundary Lake	167
	574	Dome Boundary Lake 6-35-85-14	6-35-85-14 W6M	Boundary Lake	149
	488	Dome Boundary Lake 8-35-85-14	8-35-85-14 W6M	Boundary Lake	118

528	Dome Boundary Lake 14-35-85-14	14-35-85-14 W6M	Boundary Lake	69
606	Dome Boundary Lake 16-35-85-14	16-35-85-14 W6M	Boundary Lake	144
642	Dome Boundary Lake 8-2-86-14	8-2-86-14 W6M	Boundary Lake	13
605	Dome Boundary Lake 16-2-86-14	16-2-86-14 W6M	Boundary Lake	120
764	Dome Boundary Lake 8-11-86-14	8-11-86-14 W6M	Boundary Lake	116
765	Dome Boundary 16-11-86-14	16-11-86-14 W6M	Boundary Lake	59
808	Dome Boundary 8-14-86-14	8-14-86-14 W6M	Boundary Lake	68
296	Imp Pac Boundary 14-20-84-13	14-20-84-13 W6M	Boundary Lake	105
369	Imp Pac Boundary 16-31-84-13	16-31-84-13 W6M	Boundary Lake	154
813	Imp Pac Boundary 6-5-85-13	6-5-85-13 W6M	Boundary Lake	187
832	Imp Pac Boundary 14-5-85-13	14-5-85-13 W6M	Boundary Lake	182
789	Imp et al Boundary 6-6-85-13	6-6-85-13 W6M	Boundary Lake	147
795	Imp Pac Boundary 8-6-85-13	8-6-85-13 W6M	Boundary Lake	123
792	Imp Pac Boundary 14-6-85-13	14-6-85-13 W6M	Boundary Lake	160
796	Imp Pac Boundary 16-6-85-13	16-6-85-13 W6M	Boundary Lake	168
763	Imp Pac Boundary 6-7-85-13	6-7-85-13 W6M	Boundary Lake	178
807	Imp Pac Boundary 8-7-85-13	8-7-85-13 W6M	Boundary Lake	198
368	Imp Pac Boundary 14-7-85-13	14-7-85-13 W6M	Boundary Lake	172
775	Imp Pac Boundary 16-7-85-13	16-7-85-13 W6M	Boundary Lake	205
847	Imp Pac Boundary 6-8-85-13	6-8-85-13 W6M	Boundary Lake	193
760	Imp Pac Boundary 6-17-85-13	6-17-85-13 W6M	Boundary Lake	24
738	Imp Pac Boundary 14-17-85-13	14-17-85-13 W6M	Boundary Lake	185
734	Imp Pac Boundary 6-18-85-13	6-18-85-13 W6M	Boundary Lake	183
523	Imp Pac Boundary 8-18-85-13	8-18-85-13 W6M	Boundary Lake	88
524	Imp Pac Boundary 6-20-85-13	6-20-85-13 W6M	Boundary Lake	179
774	Imp Pac Boundary 8-20-85-13	8-20-85-13 W6M	Boundary Lake	54
250	Imp Pac Boundary 1-23-84-14	1-23-84-14 W6M	Boundary Lake	50
846	Imp Pac Boundary 16-34-84-14	16-34-84-14 W6M	Boundary Lake	154
833	Imp Pac Boundary 6-35-84-14	6-35-84-14 W6M	Boundary Lake	154
805	Imp Pac Boundary 14-35-84-14	14-35-84-14 W6M	Boundary Lake	173
797	Imp Pac Boundary 16-35-84-14	16-35-84-14 W6M	Boundary Lake	163
804	Imp et al Boundary 6-36-84-14	6-36-84-14 W6M	Boundary Lake	61
814	Imp et al Boundary 8-36-84-14	8-36-84-14 W6M	Boundary Lake	140
793	Imp et al Boundary 14-36-84-14	14-36-84-14 W6M	Boundary Lake	137
798	Imp et al Boundary 16-36-84-14	16-36-84-14 W6M	Boundary Lake	151
761	Imp et al Boundary 6-1-85-14	6-1-85-14 W6M	Boundary Lake	135
770	Imp et al Boundary 8-1-85-14	8-1-85-14 W6M	Boundary Lake	118
521	Imp et al Boundary 14-1-85-14	14-1-85-14 W6M	Boundary Lake	202
776	Imp et al Boundary 16-1-85-14	16-1-85-14 W6M	Boundary Lake	141
501	Imp Pac Boundary 6-2-85-14	6-2-85-14 W6M	Boundary Lake	125
788	Imp Pac Boundary 8-2-85-14	8-2-85-14 W6M	Boundary Lake	165
493	Imp Pac Boundary 14-2-85-14	14-2-85-14 W6M	Boundary Lake	236
777	Imp Pac Boundary 16-2-85-14	16-2-85-14 W6M	Boundary Lake	197
362	Imperial Pacific Boundary 6-3-85-14	6-3-85-14 W6M	Boundary Lake	198
379	Imperial Pacific Boundary 8-3-85-14	8-3-85-14 W6M	Boundary Lake	209
363	Imperial Pacific Boundary 14-3-85-14	14-3-85-14 W6M	Boundary Lake	154

TABLE 9.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1961—*Continued*

Field	Drilling Authority No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Boundary Lake	359	Imperial Pacific Boundary 16-3-85-14	16-3-85-14 W6M	Boundary Lake	218
	267	Imperial Pacific Boundary 16-4-85-14	16-4-85-14 W6M	Boundary Lake	189
	360	Imperial Pacific Boundary 8-10-85-14	8-10-85-14 W6M	Boundary Lake	188
	227	Imperial Pac Boundary 11-10-85-14	11-10-85-14 W6M	Boundary Lake	113
	282	Imperial Pacific Boundary 6-11-85-14	6-11-85-14 W6M	Boundary Lake	128
	769	Imp Pac Boundary 8-11-85-14	8-11-85-14 W6M	Boundary Lake	107
	821	Imp Pac Boundary 14-11-85-14	14-11-85-14 W6M	Boundary Lake	297
	356	Imperial Pac Boundary 16-11-85-14	16-11-85-14 W6M	Boundary Lake	155
	759	Imp Pac Boundary 14-12-85-14	14-12-85-14 W6M	Boundary Lake	179
	758	Imp Pac Boundary 6-13-85-14	6-13-85-14 W6M	Boundary Lake	142
	848	Imp Pac Boundary 8-14-85-14	8-14-85-14 W6M	Boundary Lake	181
	815	Imp Pac Boundary 8-35-85-14	8-35-85-14 W6M	Boundary Lake	163
	618	Ohio Boundary Lake Crown 6-19-85-13	6-19-85-13 W6M	Boundary Lake	147
	632	Ohio Boundary Lake 8-19-85-13	8-19-85-13 W6M	Boundary Lake	117
	635	Ohio Boundary Lake 14-19-85-13	14-19-85-13 W6M	Boundary Lake	131
	636	Ohio Boundary Lake 16-19-85-13	16-19-85-13 W6M	Boundary Lake	32
	604	Ohio Boundary Lake 14-8-85-13	14-8-85-13 W6M	Boundary Lake	55
	667	Pacific Boundary Lake 11-14-85-14	11-14-85-14 W6M	Halfway	8
	752	Sinclair Boundary 16-15-84-14	16-15-84-14 W6M	Boundary Lake	169
	780	Sinclair Boundary 6-22-84-14	6-22-84-14 W6M	Boundary Lake	106
	742	Sinclair Boundary 8-22-84-14	8-22-84-14 W6M	Boundary Lake	166
	794	Sinclair Boundary 14-22-84-14	14-22-84-14 W6M	Boundary Lake	138
	727	Sinclair Boundary 16-22-84-14	16-22-84-14 W6M	Boundary Lake	105
	802	Sinclair Boundary 6-27-84-14	6-27-84-14 W6M	*	131
	743	Sinclair Boundary 8-27-84-14	8-27-84-14 W6M	Boundary Lake	134
	753	Sinclair Boundary 16-27-84-14	16-27-84-14 W6M	Boundary Lake	119
	755	Sinclair Boundary 14-15-85-14	14-15-85-14 W6M	Boundary Lake	92
	646	Sun Boundary Lake 6-23-85-14	6-23-85-14 W6M	Boundary Lake	171
	652	Sun Boundary Lake 8-23-85-14	8-23-85-14 W6M	Boundary Lake	67
	643	Sun Boundary Lake 14-23-85-14	14-23-85-14 W6M	Boundary Lake	202
	719	Sun Boundary Lake 16-23-85-14	16-23-85-14 W6M	Boundary Lake	219
	101	Texaco NFA Boundary L 6-6-86-13 (1)	6-6-86-13 W6M	Boundary Lake	114
	152	Texaco NFA Boundary L 14-6-86-13	14-6-86-13 W6M	Boundary Lake	87
	844	Texaco NFA Boundary 16-7-86-13	16-7-86-13 W6M	Boundary Lake	197
	811	Texaco NFA Boundary 6-18-86-13	6-18-86-13 W6M	Boundary Lake	192
	823	Texaco NFA Boundary 16-22-85-14	16-22-85-14 W6M	Boundary Lake	141
	656	Texaco NFA Boundary Lake 14-25-85-14	14-25-85-14 W6M	Boundary Lake	62
	845	Texaco NFA Boundary 8-27-85-14	8-27-85-14 W6M	Boundary Lake	156
	812	Texaco NFA Boundary 16-27-85-14	16-27-85-14 W6M	Boundary Lake	149
	183	Texaco NFA Boundary L 6-31-85-14	6-31-85-14 W6M	Boundary Lake	107

	167	Texaco NFA Boundary L 14-31-85-14	14-31-85-14 W6M	Boundary Lake	100
	218	Texaco NFA Boundary L 16-31-85-14	16-31-85-14 W6M	Boundary Lake	122
	857	Texaco NFA Boundary 8-34-85-14	8-34-85-14 W6M	Boundary Lake	202
	662	Texaco NFA Boundary Lake 6-36-85-14	6-36-85-14 W6M	Boundary Lake	30
	657	Texaco NFA Boundary Lake 14-36-85-14	14-36-85-14 W6M	Boundary Lake	156
	206	Texaco NFA Boundary L 16-36-85-14	16-36-85-14 W6M	Boundary Lake	137
	663	Texaco NFA Boundary Lake 6-1-86-14	6-1-86-14 W6M	Boundary Lake	110
	664	Texaco NFA Boundary Lake 14-1-86-14	14-1-86-14 W6M	Boundary Lake	110
	860	Texaco NFA Boundary 16-1-86-14	16-1-86-14 W6M	*	100
	829	Texaco NFA Boundary 6-12-86-14	6-12-86-14 W6M	Boundary Lake	112
	593	Texaco NFA Boundary Lake 16-12-86-14	16-12-86-14 W6M	Boundary Lake	155
	880	Texaco NFA Boundary 6-13-86-14	6-13-86-14 W6M	*	119
	858	Texaco NFA Boundary 16-13-86-14	16-13-86-14 W6M	Boundary Lake	89
	633	Texaco NFA Boundary Lake 14-24-86-14	14-24-86-14 W6M	Boundary Lake	107
Charlie Lake	269	Imp Pac Charlie 13-5-84-18	13-5-84-18 W6M	Gething	36
Fort St. John	171	Imp Pac Ft St John 9-19-83-18 (45)	9-19-83-18 W6M	Belloy	85
	34	Pacific Ft St John 3-14-83-18 (9)	3-14-83-18 W6M	Charlie Lake	46
	214	Pacific Ft St John 10-14-83-18 (76)	10-14-83-18 W6M	Charlie Lake	14
	225	Pacific Ft St John 1-23-83-18 (81)	1-23-83-18 W6M	Charlie Lake	23
	216	Pacific Ft St John 9-23-83-18 (78)	9-23-83-18 W6M	Charlie Lake	65
Milligan Creek	409	Union-HB Milligan Creek d-42-G	d-42-G/94-H-2	Halfway	514
	435	Union-HB Milligan Creek d-43-G	d-43-G/94-H-2	Halfway	463
	401	Union-HB Milligan Creek d-52-G	d-52-G/94-H-2	Halfway	357
	398	Union-HB Milligan Creek d-53-G	d-53-G/94-H-2	Halfway	469
	402	Union-HB Milligan Creek d-54-G	d-54-G/94-H-2	Halfway	290
	826	Union-HB Milligan b-62-G	b-62-G/94-H-2	Halfway	228
	440	Union-HB Milligan Creek d-63-G	d-63-G/94-H-2	Halfway	213
	341	Union-HB Milligan Creek d-64-G	d-64-G/94-H-2	Halfway	320
	248	Union-HB Milligan Creek d-73-G	d-73-G/94-H-2	Halfway	155
	436	Union-HB Milligan Creek d-74-G	d-74-G/94-H-2	Halfway	192
Peejay	612	Sinclair et al Peejay d-18-E	d-18-E/94-H-2	Halfway	51
	589	Sinclair et al Peejay d-28-E	d-28-E/94-H-2	Halfway	101
	543	Sinclair et al Peejay d-29-E	d-29-E/94-H-2	Halfway	70
	578	Sinclair et al Peejay d-38-E	d-38-E/94-H-2	Halfway	114
	418	Sinclair Pac Peejay d-39-E (B8-3)	d-39-E/94-H-2	Halfway	288
	577	Sinclair et al Peejay d-48-E	d-48-E/94-H-2	Halfway	191
	588	Sinclair et al Peejay d-49-E	d-49-E/94-H-2	Halfway	141
Other areas	841	Sinclair Boundary 14-11-84-14	14-11-84-14 W6M	*	108
	803	Sinclair Boundary 6-14-84-14	6-14-84-14 W6M	*	103
	866	Sinclair Boundary 8-14-84-14	8-14-84-14 W6M	*	65
	725	Pacific SR West Cdn Peejay d-33-I	d-33-I/94-A-15	*	5
	569	Phillips-SR-West Cdn-Peejay d-80-E	d-80-E/94-H-2	Halfway	60
	840	Union-HB Wildmint b-24-A	b-24-A/94-H-2	*	27
	810	Union-HB Wildmint d-45-A	d-45-A/94-H-2	Halfway	186
	530	Union-HB Wildmint d-46-A	d-46-A/94-H-2	Halfway	364
	584	Union-HB Wildmint d-56-A	d-56-A/94-H-2	Halfway	218

* Held confidential as of December 31, 1961.

Table 10.—Yearly Crude-oil Production, 1957–61

Field and Pool	1957			1958			1959			1960			1961		
	Oil (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Oil (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Oil (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Oil (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Oil (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)
Aitken Creek															
Gething	....	....	....	....	....	....	**4,396** 4,396	**2,836** 2,836	....	**12,830** 17,226	**6,584** 9,420	....	**3,249** 20,475	**1,610** 10,869	....
Field totals	....	....	....	....	....	....	**4,396** 4,396	**2,836** 2,836	....	**12,830** 17,226	**6,584** 9,420	....	**3,249** 20,475	**1,610** 10,869	....
Beatton River															
Halfway	....	....	....	**1,601** 1,601	**2,701** 2,701	....	**5,447** 7,048	**5,192** 7,893	....	**1,719** 8,767	**2,654** 10,547	....	**32,163** 40,930	**63,654** 74,021	....
Field totals	....	....	....	**1,601** 1,601	**2,701** 2,701	....	**5,447** 7,048	**5,192** 7,893	....	**1,719** 8,767	**2,654** 10,547	....	**32,163** 40,930	**63,654** 74,021	....
Beatton River West															
Bluesky-Gething	....	....	....	....	....	....	**1,069** 1,069	**398** 398	....	**1,020** 2,089	**204** 602	....	**10,133** 12,222	**3,708** 4,300	....
Field totals	....	....	....	....	....	....	**1,069** 1,069	**398** 398	....	**1,020** 2,089	**204** 602	....	**10,133** 12,222	**3,708** 4,300	....
Blueberry															
Dunlevy	....	....	....	....	....	....	....	....	....	**1,613** 1,613	**5,017**[1] 5,017[1]	....	**1,855** 3,468	 4,981	....
Mississippian	**4,375** 4,375	**8,614** 8,614	....	**2,964** 7,339	**4,273** 12,887	....	**2,850** 10,189	**2,407** 15,294	....	**51,040** 61,229	**50,988** 66,282	....	**17,060** 78,289	**17,113** 82,262	**33** 33
Field totals	**4,375** 4,375	**8,614** 8,614	....	**2,964** 7,339	**4,273** 12,887	....	**2,850** 10,189	**2,407** 15,294	....	**52,653** 62,842	**56,005**[1] 71,299[1]	....	**18,915** 81,757	**17,113** 87,193	**33** 33
Boundary Lake															
Charlie Lake	....	....	....	....	....	....	....	....	....	**819** 819	**835** 855	....	 819	 821	....
Boundary Lake	**199,220** 307,241	**124,445** 177,957	**205** 466	**354,388** 661,629	**219,558** 397,515	**232** 698	**688,821** 1,350,450	**484,931** 882,446	**79** 777	**682,361** 2,032,811	**482,211** 1,364,657	**185** 962	**640,929** 2,673,740	**413,179** 1,754,500	**132** 1,094
Halfway	....	....	....	....	....	....	....	....	....	**495** 495	**191** 191	....	**2,817** 3,312	**2,343** 2,531	....
Field totals	**199,220** 307,241	**124,445** 177,957	**205** 466	**354,388** 661,629	**219,558** 397,515	**232** 698	**688,821** 1,350,450	**484,931** 882,446	**79** 777	**683,675** 2,034,125	**483,237** 1,365,683	**185** 962	**643,746** 2,677,871	**415,522** 1,757,852	**132** 1,004
Buick Creek West															
Buick Creek	**3,086** 3,086	**2,123** 2,123	**25** 25	**4,762** 7,848	**1,412** 3,535	**492** 517	 7,848	 3,536	 517	 7,848	 3,535	 517	 7,848	 3,475	 517
Field totals	**3,086** 3,086	**2,123** 2,123	**25** 25	**4,762** 7,848	**1,412** 3,535	**492** 517	 7,848	 3,535	 517	 7,848	 3,535	 517	 7,848	 3,475	 517

Charlie Lake															
Gething	**3,997**	**2,355**	**5**	**10,441**	**8,130**	**8**	**7,010**	**10,121**	....	**2,091**	**3,815**	....	**2,086**	**8,921**	....
	3,997	2,355	5	14,438	10,485	13	21,448	20,606	13	23,539	24,421	13	25,625	32,924	13
Field totals	**3,997**	**2,355**	**5**	**10,441**	**8,130**	**8**	**7,010**	**10,121**	....	**2,091**	**3,815**	....	**2,086**	**8,921**	....
	3,997	2,355	5	14,438	10,485	13	21,448	20,606	13	23,539	24,421	13	25,625	32,924	13
Fort St. John															
Charlie Lake	**126,776**	**93,285**	**158**	**119,977**	**134,255**	**27**	**100,601**	**182,515**	....	**97,597**[1]	**218,059**	....	**38,639**	**199,739**	**9**
	158,695	110,264	230	278,672	244,519	257	379,273	427,034	257	476,870	645,093	257	515,509	833,801	266
Belloy	**7,866**	**41,336**	**7**	**6,705**	**41,943**	....	**9,234**	**129,774**	....	**132**	**1,330**	....	....	....	....
	16,962	53,032	28	23,667	94,975	28	32,901	224,749	28	33,033	226,079	28	33,033	222,213	28
Field totals	**134,642**	**134,621**	**165**	**126,882**	**176,198**	**27**	**109,835**	**312,289**	....	**97,729**[1]	**219,389**	....	**38,639**	**199,739**	**9**
	175,657	163,296	258	302,339	339,494	285	412,174	651,783	285	509,903	871,172	285	548,542	1,056,014	294
Milligan Creek															
Halfway	....	....	....	**12,880**	**1,826**	....	**44,277**	**8,624**	....	**7,722**	**2,689**	**37**	**155,296**	**37,516**	**23**
	....	....	....	12,880	1,826	....	57,157	10,450	....	64,879	13,139	37	220,175	50,430	60
Field totals	....	....	....	**12,880**	**1,826**	....	**44,277**	**8,624**	....	**7,722**	**2,689**	**37**	**155,296**	**37,516**	**23**
	....	....	....	12,880	1,826	....	57,157	10,450	....	64,879	13,139	37	220,175	50,430	60
Peejay															
Halfway	....	....	....	....	....	....	**1,045**	**302**	....	**5,519**	**1,389**	....	**108,476**	**43,994**	....
	....	....	....	....	....	....	1,045	302	....	6,564	1,691	....	115,040	45,656	....
Field totals	....	....	....	....	....	....	**1,045**	**302**	....	**5,519**	**1,389**	....	**108,476**	**43,994**	....
	....	....	....	....	....	....	1,045	302	....	6,564	1,691	....	115,040	45,656	....
Other Areas															
Boundary Lake	....	....	....	....	....	....	....	....	....	....	....	....	**488**	**488**	....
	....	....	....	....	....	....	....	....	....	....	....	....	488	488	....
Halfway	....	....	....	....	....	....	....	....	....	**2,127**	**7,771**	....	**4,635**	**1,374**	....
	....	....	....	....	....	....	....	....	....	2,127	7,771	....	6,762	9,012	....
Areas totals	....	....	....	....	....	....	....	....	....	**2,127**	**7,771**	....	**5,123**	**1,862**	....
	....	....	....	....	....	....	....	....	....	2,127	7,771	....	7,250	9,500	....
Totals, fields and areas	**345,320**	**272,158**	**400**	**513,718**	**414,098**	**759**	**864,750**	**827,100**	**79**	**867,085**[1]	**783,737**[1]	**222**	**1,017,826**	**793,639**	**197**
	494,356	354,345	754	1,008,074	768,443	1,513	1,872,824	1,595,543	1,592	2,739,909[1]	2,379,280[1]	1,814	3,757,735	3,132,234	2,011

[1] Amended.
1957 to 1960, inclusive: Solution-gas volumes in M c.f. at 14.4 psia. and 60° F.
1961: Solution-gas volumes in M c.f. at 14.65 psia. and 60° F.
NOTE.—Field totals for the year in bold-face type; cumulative totals in light-face type.

TABLE 11.—YEARLY NATURAL-GAS PRODUCTION, 1957–61[1]

Field and Pool	1957 Gas (M S.C.F.)	1957 Water (Bbl.)	1958 Gas (M S.C.F.)	1958 Water (Bbl.)	1959 Gas (M S.C.F.)	1959 Water (Bbl.)	1960 Gas (M S.C.F.)	1960 Water (Bbl.)	1961 Gas (M S.C.F.)	1961 Water (Bbl.)
Beg										
S.C.-upper carbonate	....	....	....	....	....	....	....	....	**157,384** 157,384	....
Halfway	....	....	....	....	....	....	....	....	**372,291** 372,291	....
Field totals	....	....	....	....	....	....	....	....	**529,675** 529,675	....
Blueberry										
Dunlevy	....	....	**71,672** 71,672	....	**566,952** 638,624	**153** 153	**1,043,084**[2] 1,681,708[2]	**262** 415	**1,228,051** 2,881,002	**291** 706
Baldonnel	....	....	**262,152** 262,152	**585** 585	**1,477,849** 1,740,001	**6,856** 7,441	**1,241,369** 2,981,370	**13,519** 20,960	**918,216** 3,848,605	**29,619** 50,579
Field totals	....	....	**333,824** 333,824	**585** 585	**2,044,801** 2,378,625	**7,009** 7,594	**2,284,453**[2] 4,663,078[2]	**13,781** 21,375	**2,146,267** 6,729,607	**29,910** 51,285
Blueberry East										
Baldonnel	....	....	**153,713** 153,713	**132** 132	**391,109** 544,822	**335** 467	 544,822	 467	 535,506	 467
Halfway	....	....	**87,963** 87,963	**861** 861	**217,457** 305,420	**2,137** 2,998	 305,420	 2,998	 300,197	 2,998
Mississippian	....	....	**143,071** 143,071	**3,845** 3,845	**131,994** 275,065	**4,318** 8,163	 275,065	 8,163	 270,361	 8,163
Field totals	....	....	**384,747** 384,747	**4,838** 4,838	**740,560** 1,125,307	**6,790** 11,628	 1,125,307	 11,628	 1,106,064	 11,628
Blueberry West										
Dunlevy	....	....	**45,558** 45,558	**3** 3	**184,635** 230,193	 3	**125,664** 355,857	 3	**90,313** 440,085	**4** 7
Baldonnel	....	....	**115,148** 115,148	**1,099** 1,099	**459,752** 574,900	**4,748** 5,847	**254,274** 829,174	**5,558** 11,405	**101,353** 916,348	**1,648** 13,053
Field totals	....	....	**160,706** 160,706	**1,102** 1,102	**644,387** 805,093	**4,748** 5,850	**379,938** 1,185,031	**5,558** 11,408	**191,666** 1,356,433	**1,652** 13,060
Boundary Lake										
Gething	....	....	....	....	....	....	**143,621** 143,621	....	**1,314,916** 1,456,081	....
Bluesky-Gething	....	....	....	....	....	....	**51,832** 51,832	....	**360,005** 410,951	....
Baldonnel	....	....	....	....	....	....	**48,618** 48,618	....	**613,005** 660,792	**199** 199
Field totals	....	....	....	....	....	....	**244,071** 244,071	....	**2,287,926** 2,527,824	**199** 199

Bubbles										
S.C.-upper carbonate	...	...	...	...	**1,152,499**	...	**8,427,918**	...	**8,217,338**	...
	...	...	...	...	1,152,499	...	9,580,417	...	17,633,930	...
Field totals	...	...	...	...	**1,152,499**	...	**8,427,918**	...	**8,217,338**	...
	...	...	...	...	1,152,499	...	9,580,417	...	17,633,930	...
Buick Creek										
Buick Creek	...	...	...	...	**22,278**	...	**1,205,309**	...	**7,450,505**	**1,092**
	...	...	...	...	22,278	...	1,227,587	...	8,657,100	1,092
Charlie Lake	...	...	...	...	...	...	...	...	**1,327,711**	**262**
	...	...	...	...	...	...	...	...	1,327,711	262
Field totals	...	...	...	...	**22,278**	...	**1,205,309**	...	**8,778,216**	**1,354**
	...	...	...	...	22,278	...	1,227,587	...	9,984,811	1,354
Buick Creek West										
Buick Creek	**629,522**	...	**7,475,506**	...	**12,316,669**	...	**13,017,158**	...	**9,740,479**	...
	629,522	...	8,105,028	...	20,421,697	...	33,438,855	...	42,607,530	...
Baldonnel	...	...	**16,590**	...	...	...	**122,132**	...	**690,416**	...
	...	...	16,590	...	16,590	...	138,722	...	826,766	...
Halfway	**1,234**	...	**2,085,810**	...	**1,547,060**	**510**	**1,034,126**	**764**	**730,887**	**828**
	1,234	...	2,087,044	...	3,634,104	510	4,668,230	1,274	5,319,290	2,102
Field totals	**630,756**	...	**9,577,906**	...	**13,863,729**	**510**	**14,173,416**	**764**	**11,161,782**	**828**
	630,756	...	10,208,662	...	24,072,391	510	38,245,807	1,274	48,753,586	2,102
Dawson Creek										
Cadotte	...	...	**879,224**	...	**820,704**	**1,761**	**1,019,397**	**1,316**	**817,341**	...
	...	...	879,224	...	1,699,928	1,761	2,719,325	3,077	3,490,166	3,077
Field totals	...	...	**879,224**	...	**820,704**	**1,761**	**1,019,397**	**1,316**	**817,341**	...
	...	...	879,224	...	1,699,928	1,761	2,719,325	3,077	3,490,166	3,077
Fort St. John										
Cadomin	**69,493**	...	...	...	**16,693**	...	...	...	...	...
	113,185	...	113,185	...	129,878	...	129,878	...	127,657	...
Baldonnel "A"	**487,484**	...	**3,021,202**	**79**	**2,010,069**	**1,205**	**2,157,613**	**2,605**	**2,937,831**	**2,557**
	566,921	...	3,588,123	79	5,598,192	1,284	7,755,805	3,889	10,561,012	6,446
Baldonnel "A/B"	**1,142,154**	...	**7,761,641**	**67**	**5,459,849**	**704**	**5,174,274**	**4,132**	**3,969,848**	**7,825**
	1,142,154	...	8,903,795	67	14,363,644	771	19,537,918	4,903	23,173,668	12,728
Halfway	**1,931,032**	...	**12,203,733**	**570**	**7,747,474**	**3,909**	**6,002,529**	**2,355**	**4,949,990**	**1,369**
	1,931,032	...	14,134,765	570	21,882,239	4,479	27,884,768	6,834	32,357,928	8,203
Belloy	**713,327**	...	**2,987,885**	**88**	**1,366,130**	**653**	**968,010**	**654**	**831,702**	**673**
	713,327	...	3,701,212	88	5,067,342	741	6,035,352	1,395	6,763,849	2,068
Field totals	**4,343,490**	...	**25,974,461**	**804**	**16,600,215**	**6,471**	**14,302,426**	**9,746**	**12,689,371**	**12,424**
	4,466,619	...	30,441,080	804	47,041,295	7,275	61,343,721	17,021	72,984,114	29,445

[1] For solution gas *see* Table 10. [2] Amended.

1957 to 1960, inclusive: Volumes in M c.f. at 14.4 psia. and 60° F.

1961 volumes in M c.f. at 14.65 psia. and 60° F.

NOTE.—Field totals for the year in bold-face type; cumulative totals in light-face type.

The following designated gas fields have not produced and therefore are not included in this table: Aitken Creek, Clarke Lake, Fort St. John Airport, Milligan Creek, Petitot River, and Sunrise.

TABLE 11.—YEARLY NATURAL-GAS PRODUCTION, 1957–61[1]—*Continued*

Field and Pool	1957		1958		1959		1960		1961	
	Gas (M S.C.F.)	Water (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)
Fort St. John Southeast										
Cadomin	**13,046**	....	**172,095**	....	**323,715**	....	**603,447**	....	**651,471**	....
	13,046	....	185,141	....	508,856	....	1,112,303	....	1,744,754	....
Baldonnel "A"	**185,208**	....	**1,269,930**	....	**854,018**	....	**785,804**	....	**677,447**	....
	185,208	....	1,455,138	....	2,309,156	....	3,094,960	....	3,719,483	....
Halfway	**351,101**	....	**2,750,928**	**58**	**2,083,359**	**1,650**	**3,927,039**	**2,856**	**2,700,080**	**3,385**
	351,101	....	3,102,029	58	5,185,418	1,708	9,112,457	4,564	11,656,714	7,949
Belloy	**1,361,374**	....	**9,521,470**	**287**	**7,759,092**	**6,554**	**7,142,814**	**11,460**	**5,796,781**	**9,537**
	1,361,374	....	10,882,844	287	18,641,936	6,841	25,784,750	18,301	31,140,612	27,838
Field totals	**1,910,729**	....	**13,714,423**	**345**	**11,020,214**	**8,204**	**12,459,104**	**14,316**	**9,825,779**	**12,922**
	1,910,729	....	15,625,152	345	26,645,366	8,549	39,104,470	22,865	48,261,568	35,787
Gundy Creek										
Baldonnel	....	....	**14,920**	....	**100,489**	....	**390,983**	**58**	**197,971**	**428**
	....	....	14,920	....	115,409	....	506,392	58	695,704	486
Baldonnel-Charlie Lake	....	....	**164,966**	....	**994,660**	**30**	**420,275**	**553**	**27,676**	**857**
	....	....	164,966	....	1,159,626	30	1,579,901	583	1,580,561	1,440
Field totals	....	....	**179,886**	....	**1,095,149**	**30**	**811,258**	**611**	**225,647**	**1,285**
	....	....	179,886	....	1,275,035	30	2,086,293	641	2,276,265	1,926
Halfway										
Baldonnel	....	....	**696,185**	**3,151**	**2,186,727**	**19,744**	**552,654**	**3,164**	**436,060**	**106**
	....	....	696,185	3,151	2,882,912	22,895	3,435,566	26,059	3,812,878	26,165
Halfway	....	....	**172,622**	**7**	**529,001**	....	**407,342**	**143**	**442,003**	**30**
	....	....	172,622	7	701,623	7	1,108,965	150	1,532,005	180
Field totals	....	....	**868,807**	**3,158**	**2,715,728**	**19,744**	**959,996**	**3,307**	**878,063**	**136**
	....	....	868,807	3,158	3,584,535	22,902	4,544,531	26,209	5,344,883	26,345
Highway										
Dunlevy	....	....	....	....	**112,975**	**65**	**171,513**	**21**	**122,689**	**11**
	....	....	....	....	112,975	65	284,488	86	402,312	97
Baldonnel	....	....	**153,431**	**210**	**881,652**	**10,673**	**310,747**	**26,913**	**187,055**	**13,473**
	....	....	153,431	210	1,035,083	10,883	1,345,830	37,796	1,509,871	51,269
Mississippian	....	....	**543,787**	**512**	**1,653,052**	**7,431**	**974,502**	**7,045**	**626,765**	**7,286**
	....	....	543,787	512	2,196,839	7,943	3,171,341	14,988	3,743,876	22,274
Field totals	....	....	**697,218**	**722**	**2,647,679**	**18,169**	**1,456,762**	**33,979**	**936,509**	**20,770**
	....	....	697,218	722	3,344,897	18,891	4,801,659	52,870	5,656,059	73,640
Jedney										
S.C.-upper carbonate	....	....	....	....	**524,694**	....	**8,023,038**	**238**	**7,293,419**	....
	....	....	....	....	524,694	....	8,547,732	238	15,694,985	238
Halfway	....	....	....	....	**182,918**	....	**3,363,109**	**6,368**	**3,600,628**	**10,491**
	....	....	....	....	182,918	....	3,546,027	6,368	7,086,018	16,859
Field totals	....	....	....	....	**707,612**	....	**11,386,147**	**6,606**	**10,894,047**	**10,491**
	....	....	....	....	707,612	....	12,093,759	6,606	22,781,003	17,097

Kobes Townsend										
Dunlevy	......	......	......	......	**474,202**	**30**	**741,577**	**104**	**994,463**	**100**
	......	......	......	......	474,202	30	1,215,779	134	2,189,452	234
Charlie Lake	......	......	**237,735**	**135**	**1,025,106**	**556**	**1,159,718**	**803**	**1,525,270**	**385**
	......	......	237,735	135	1,262,841	691	2,422,559	1,494	3,906,403	1,879
Halfway	......	......	**347,656**	**125**	**1,819,326**	**592**	**1,742,674**	**633**	**1,719,101**	**198**
	......	......	347,656	125	2,166,982	717	3,909,656	1,350	5,561,902	1,548
Mississippian	......	......	**1,364,204**	**516**	**3,694,522**	**19,118**	**2,716,029**	**51,696**	**2,197,296**	**17,271**
	......	......	1,364,204	516	5,058,726	19,634	7,774,755	71,330	9,839,103	88,601
Field totals	......	......	**1,949,595**	**776**	**7,013,156**	**20,296**	**6,359,998**	**53,236**	**6,436,130**	**17,954**
	......	......	1,949,595	776	8,962,751	21,072	15,322,749	74,308	21,496,860	92,262
Laprise Creek										
S.C.-upper carbonate	......	......	......	......	......	......	**710,364**	......	**6,136,841**	......
	......	......	......	......	......	......	710,364	......	6,835,058	......
Field totals	......	......	......	......	......	......	**710,364**	......	**6,136,841**	......
	......	......	......	......	......	......	710,364	......	6,835,058	......
Laprise Creek East										
S.C.-upper carbonate	......	......	......	......	......	......	**321,637**	......	**5,340,129**	......
	......	......	......	......	......	......	321,637	......	5,656,266	......
Field totals	......	......	......	......	......	......	**321,637**	......	**5,340,129**	......
	......	......	......	......	......	......	321,637	......	5,656,266	......
Montney										
Bluesky-Gething	......	......	**87,084**	......	......	......	**59,916**	......	......	......
	......	......	87,084	......	87,084	......	147,000	......	144,486	......
Charlie Lake	......	......	**271,356**	......	......	......	**12,842**	......	......	......
	......	......	271,356	......	271,356	......	284,198	......	279,338	......
Halfway	**94,117**	......	**1,284,892**	**52**	**833,773**	**508**	**922,545**	**545**	**445,574**	**433**
	94,117	......	1,379,009	52	2,212,782	560	3,035,327	1,105	3,428,997	1,538
Field totals	**94,117**	......	**1,643,332**	**52**	**833,773**	**508**	**895,303**	**545**	**445,574**	**433**
	94,117	......	1,737,449	52	2,571,222	560	3,466,525	1,105	3,852,821	1,538
Nig Creek										
S.C.-upper carbonate	......	......	......	......	......	......	......	......	**6,963,972**	**5,680**
	......	......	......	......	......	......	......	......	6,963,972	5,680
Field totals	......	......	......	......	......	......	......	......	**6,963,972**	**5,680**
	......	......	......	......	......	......	......	......	6,963,972	5,680
Parkland										
Upper Devonian	**623,544**	......	**1,679,539**	......	**1,813,524**	......	**2,283,830**	......	**2,505,673**	......
	623,544	......	2,303,083	......	4,116,607	......	6,400,437	......	8,796,663	......
Field totals	**623,544**	......	**1,679,539**	......	**1,813,524**	......	**2,283,830**	......	**2,505,673**	......
	623,544	......	2,303,083	......	4,116,607	......	6,400,437	......	8,796,663	......
Red Creek										
Charlie Lake	......	......	......	......	......	......	**233,669**	......	**602,573**	......
	......	......	......	......	......	......	233,669	......	832,246	......
Halfway	......	......	**377,371**	......	**254,145**	**4,717**	**335,328**	**9,670**	**357,634**	**9,862**
	......	......	377,371	......	631,516	4,717	966,844	14,387	1,307,945	24,249
Field totals	......	......	**377,371**	......	**254,145**	**4,717**	**568,997**	**9,670**	**960,207**	**9,862**
	......	......	377,371	......	631,516	4,717	1,200,513	14,387	2,140,191	24,249

[1] For solution gas *see* Table 10.

TABLE 11.—YEARLY NATURAL-GAS PRODUCTION, 1957–61[1]—*Continued*

Field and Pool	1957		1958		1959		1960		1961	
	Gas (M S.C.F.)	Water (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)	Gas (M S.C.F.)	Water (Bbl.)
Snyder Creek										
Dunlevy	....	....	....	....	....	....	....	....	**742,565** 742,565	....
Field totals	....	....	....	....	....	....	....	....	**742,565** 742,565	....
Stoddart										
Belloy	**448,851** 448,851	....	**5,217,258** 5,666,109	....	**5,138,555** 10,804,664	....	**5,342,266** 16,146,930	**490** 490	**3,748,626** 19,619,443	**1,287** 1,777
Field totals	**448,851** 448,851	....	**5,217,258** 5,666,109	....	**5,138,555** 10,804,664	....	**5,342,266** 16,146,930	**490** 490	**3,748,626** 19,619,443	**1,287** 1,777
Other Areas										
Schooler Creek	....	....	....	....	....	....	....	....	**94,812** 94,812	....
Baldonnel "A"	**56,366** 350,617	....	 350,617	....	 350,617	....	 350,617	....	 344,621	....
S.C.-upper carbonate	....	....	....	....	....	....	....	....	**28,672** 28,672	....
Charlie Lake	**167,089** 167,089	....	 167,089	....	 167,089	....	 167,089	....	 161,232	....
Devonian Carbonate	....	....	....	....	....	....	....	....	**139,961** 139,961	....
Areas totals	**223,455** 517,706	....	 517,706	....	 517,706	....	 517,706	....	**263,445** 772,298	....
Totals, fields and areas	**8,274,942** 8,692,322	....	**63,638,297** 72,330,619	**12,382** 12,382	**69,128,708** 141,459,327	**98,957** 111,339	**85,592,590**[2] 227,051,917[2]	**153,925** 265,264	**103,122,789** 326,292,120	**127,187** 392,451

[1] For solution gas *see* Table 10. [2] Amended.

TABLE 12.—NUMBER OF PRODUCING AND PRODUCIBLE OIL WELLS BY MONTH, 1960 AND 1961

Field and Pool	Year	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
		P^1	P^2	P^1	P^2	P^1	P^2	P^1	P^2	P^1	P^2	P^1	P^2	P^1	P^2	P^1	P^2	P^1	P^2	P^1	P^2	P^1	P^2	P^1	P^2
Aitken Creek																									
Gething	1960	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Field totals	1960	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Beatton River																									
Halfway	1960	1	4	1	4	1	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
	1961	**0**	**4**	**0**	**4**	**4**	**4**	**4**	**4**	**3**	**4**	**1**	**4**	**1**	**4**	**0**	**4**	**0**	**4**	**3**	**5**	**3**	**5**	**3**	**6**
Field totals	1960	1	4	1	4	1	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
	1961	**0**	**4**	**0**	**4**	**4**	**4**	**4**	**4**	**3**	**4**	**1**	**4**	**1**	**4**	**0**	**4**	**0**	**4**	**3**	**5**	**3**	**5**	**3**	**6**
Beatton River West																									
Bluesky-Gething	1960	0	5	1	5	1	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5
	1961	**0**	**5**	**0**	**5**	**3**	**5**	**0**	**5**	**1**	**5**	**2**	**5**	**2**	**5**	**0**	**5**	**0**	**5**	**2**	**5**	**3**	**5**	**0**	**5**
Field totals	1960	0	5	1	5	1	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5
	1961	**0**	**5**	**0**	**5**	**3**	**5**	**0**	**5**	**1**	**5**	**2**	**5**	**2**	**5**	**0**	**5**	**0**	**5**	**2**	**5**	**3**	**5**	**0**	**5**
Blueberry																									
Mississippian	1960	1	3	1	3	1	4	1	4	0	4	0	4	0	4	2	4	2	4	2	4	2	4	3	4
	1961	**1**	**4**	**2**	**4**	**0**	**4**	**1**	**4**	**0**	**4**	**1**	**4**	**3**	**4**	**4**	**6**	**3**	**6**	**3**	**6**	**4**	**8**	**4**	**8**
Field totals	1960	1	3	1	3	1	4	1	4	0	4	0	4	0	4	2	4	2	4	2	4	2	4	3	4
	1961	**1**	**4**	**2**	**4**	**0**	**4**	**1**	**4**	**0**	**4**	**1**	**4**	**3**	**4**	**4**	**6**	**3**	**6**	**3**	**6**	**4**	**8**	**4**	**8**
Boundary Lake																									
Single completion—Charlie Lake	1960	0	1	1	1	0	1	1	1	1	1	1	1	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	0	0	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Boundary Lake	1960	22	28	23	31	27	38	24	38	30	41	34	46	39	51	48	54	45	55	49	56	27	59	41	61
	1961	**18**	**61**	**32**	**61**	**49**	**64**	**1**	**65**	**0**	**66**	**0**	**68**	**43**	**69**	**51**	**78**	**61**	**93**	**73**	**105**	**60**	**115**	**92**	**127**
Halfway	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	1961	**1**	**3**	**0**	**3**	**1**	**3**	**1**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**
Multiple completion—Boundary Lake-Halfway	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Field totals	1960	22	29	24	32	27	39	25	39	31	42	35	46	39	51	48	54	45	55	49	57	28	60	42	62
	1961	**19**	**64**	**32**	**64**	**50**	**67**	**2**	**67**	**0**	**69**	**1**	**71**	**44**	**72**	**53**	**81**	**64**	**96**	**76**	**108**	**63**	**118**	**94**	**130**
Buick Creek West																									
Buick Creek	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
	1961	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**
Field totals	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
	1961	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**

P^1—Producing. P^2—Producible.

TABLE 12.—NUMBER OF PRODUCING AND PRODUCIBLE OIL WELLS BY MONTH, 1960 AND 1961—*Continued*

Field and Pool	Year	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
Charlie Lake																									
Gething	1960	1	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Field totals	1960	1	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Fort St. John																									
Charlie Lake	1960	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	1961	**4**	**4**	**4**	**4**	**4**	**4**	**2**	**4**	**0**	**4**	**3**	**4**	**2**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
Belloy	1960	0	1	0	1	0	1	0	1	0	1	0	1	1	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Field totals	1960	4	5	4	5	4	5	4	5	4	5	4	5	5	5	4	5	4	5	4	5	4	5	4	5
	1961	**4**	**5**	**4**	**5**	**4**	**5**	**2**	**5**	**0**	**5**	**3**	**5**	**2**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**
Milligan Creek																									
Halfway	1960	0	9	2	9	4	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9
	1961	**0**	**9**	**0**	**9**	**7**	**9**	**0**	**9**	**7**	**9**	**7**	**9**	**6**	**9**	**0**	**9**	**4**	**9**	**7**	**9**	**8**	**10**	**0**	**10**
Field totals	1960	0	9	2	9	4	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9
	1961	**0**	**9**	**0**	**9**	**7**	**9**	**0**	**9**	**7**	**9**	**7**	**9**	**6**	**9**	**0**	**9**	**4**	**9**	**7**	**9**	**8**	**10**	**0**	**10**
Peejay																									
Halfway	1960	2	2	0	6	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	2	7
	1961	**6**	**7**	**6**	**7**	**6**	**7**	**0**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**0**	**7**	**0**	**7**	**6**	**7**	**6**	**7**	**6**	**8**
Field totals	1960	2	2	0	6	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	2	7
	1961	**6**	**7**	**6**	**7**	**6**	**7**	**0**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**0**	**7**	**0**	**7**	**6**	**7**	**6**	**7**	**6**	**8**
Other Areas																									
Bluesky-Gething	1960	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Boundary Lake	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**6**	**1**	**7**
Halfway	1960	1	1	1	4	3	4	0	0	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
	1961	**0**	**4**	**1**	**3**	**1**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**5**	**2**	**6**	**2**	**8**
Areas totals	1960	1	2	1	5	3	5	0	5	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
	1961	**0**	**4**	**1**	**3**	**1**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**6**	**2**	**12**	**3**	**15**
Totals, fields and areas	1960	33	63	35	73	42	82	31	82	35	84	39	88	45	93	55	96	52	97	57	99	36	102	52	104
	1961	**32**	**106**	**47**	**105**	**77**	**109**	**9**	**109**	**17**	**111**	**22**	**113**	**64**	**114**	**61**	**125**	**75**	**140**	**101**	**155**	**93**	**174**	**114**	**191**

Table 13.—Number of Producing and Producible Gas Wells by Month, 1960 and 1961

Field and Pool	Year	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
Aitken Creek																									
Gething	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Field totals	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Beg																									
Single completion—S.C.-upper carbonate	1960	0	0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**1**	**1**
Halfway	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**1**	**0**	**3**	**0**	**2**	**0**	**2**	**1**	**2**	**1**	**2**
Multiple completion—S.C.-upper carbonate-Halfway	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**3**	**0**	**4**	**0**	**4**	**0**	**6**	**0**	**6**	**0**	**7**	**0**	**7**	**3**	**7**	**5**	**7**
Field totals	1960	0	0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**2**	**0**	**3**	**0**	**3**	**0**	**4**	**0**	**6**	**0**	**7**	**0**	**8**	**0**	**10**	**0**	**10**	**0**	**10**	**4**	**10**	**7**	**10**
Blueberry																									
Single completion—Dunlevy	1960	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	1961	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
Baldonnel	1960	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2
	1961	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Charlie Lake	1960	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	0	2	0	2	0	2	0	2
	1961	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**
Mississippian	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Multiple completion—Dunlevy-Baldonnel	1960	1	1	1	1	1	1	1	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2
	1961	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Field totals	1960	7	8	7	8	7	8	7	9	7	9	7	10	6	10	6	11	8	11	8	11	8	11	8	11
	1961	**8**	**11**	**8**	**11**	**8**	**11**	**8**	**11**	**8**	**11**	**8**	**11**	**8**	**11**	**7**	**11**	**8**	**11**	**8**	**11**	**8**	**11**	**8**	**11**
Blueberry East																									
Single completion—Mississippian	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Multiple completion—Baldonnel-Halfway	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Field totals	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
	1961	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**
Blueberry West																									
Dunlevy	1960	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	1961	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Baldonnel	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Field totals	1960	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	1961	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

P1—Producing. P2—Producible.

TABLE 13.—NUMBER OF PRODUCING AND PRODUCIBLE GAS WELLS BY MONTH, 1960 AND 1961—*Continued*

Field and Pool	Year	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
Boundary Lake																									
Single completion— Gething	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2
	1961	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**
Baldonnel	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	1961	**0**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**0**	**3**	**0**	**3**	**2**	**3**	**1**	**3**	**1**	**4**	**0**	**4**	**0**	**4**	**1**	**4**
Halfway	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Multiple completion—Bluesky-Gething Baldonnel	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Field totals	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	3	3	3	3	4
	1961	**3**	**6**	**4**	**6**	**4**	**6**	**4**	**6**	**3**	**6**	**3**	**6**	**5**	**6**	**4**	**6**	**4**	**7**	**3**	**7**	**3**	**7**	**3**	**8**
Bubbles																									
S.C.-upper carbonate	1960	6	9	6	10	6	10	7	10	7	10	7	10	7	11	7	11	8	11	8	11	8	11	8	12
	1961	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**13**	**8**	**13**	**8**	**13**	**8**	**13**
Field totals	1960	6	9	6	10	6	10	7	10	7	10	7	10	7	11	7	11	8	11	8	11	8	11	8	12
	1961	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**12**	**8**	**13**	**8**	**13**	**8**	**13**	**8**	**13**
Buick Creek																									
Single completion—Buick Creek	1960	1	5	1	5	1	5	2	5	2	5	2	5	2	5	2	5	2	5	2	5	2	5	2	5
	1961	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**6**	**5**	**6**	**5**	**8**	**5**	**9**	**6**	**9**	**9**	**9**
Multiple completion—Buick Creek-Charlie Lake	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Field totals	1960	1	6	1	6	1	6	2	6	2	6	2	6	2	6	2	6	2	6	2	6	2	6	2	6
	1961	**5**	**6**	**6**	**6**	**6**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**8**	**7**	**8**	**7**	**10**	**7**	**11**	**8**	**11**	**11**	**11**
Buick Creek West																									
Buick Creek	1960	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9
	1961	**8**	**9**	**8**	**9**	**8**	**9**	**8**	**9**	**8**	**9**	**8**	**9**	**8**	**9**	**8**	**9**	**8**	**9**	**8**	**9**	**8**	**9**	**8**	**9**
Baldonnel	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	2	1	2	1	2	1	2
	1961	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Halfway	1960	2	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	1	2	2	2
	1961	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Field totals	1960	10	12	10	12	10	12	10	12	10	12	9	12	9	12	10	12	10	13	11	13	10	13	11	13
	1961	**11**	**13**	**11**	**13**	**11**	**13**	**11**	**13**	**11**	**13**	**12**	**13**	**12**	**13**	**11**	**13**	**12**	**13**	**11**	**13**	**11**	**13**	**11**	**13**
Clarke Lake																									
Devonian Carbonate	1960	0	3	0	3	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
	1961	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**
Field totals	1960	0	3	0	3	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
	1961	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**

Dawson Creek																									
Cadotte	1960	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
	1961	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
Field totals	1960	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
	1961	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
Fort St. John																									
Single completion—																									
Cadomin	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
	1961	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
Baldonnel "A"	1960	2	6	2	6	2	6	2	6	2	6	2	6	2	6	2	6	2	6	2	6	3	6	5	6
	1961	4	6	5	6	5	6	5	6	4	6	4	6	4	6	4	6	4	6	4	6	5	6	5	6
Baldonnel "A/B"	1960	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	1961	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6	6
Halfway	1960	7	7	7	7	7	7	7	7	7	7	6	7	5	6	5	6	5	6	5	6	5	6	5	6
	1961	5	6	5	6	5	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	5	6
Belloy	1960	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3
	1961	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	2
Multiple completion—Charlie Lake-Halfway	1960	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	1961	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Field totals	1960	17	24	17	24	17	24	17	24	17	24	16	24	16	24	16	24	16	24	16	24	17	24	19	24
	1961	18	24	19	24	19	24	18	24	17	24	17	24	17	24	17	24	16	24	17	24	18	24	19	23
Fort St. John Airport																									
Cadomin	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Baldonnel "A"	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Halfway	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Field totals	1960	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3
	1961	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3
Fort St. John Southeast																									
Cadomin	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Baldonnel "A"	1960	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	2	1	2	2	2	2	2
	1961	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Halfway	1960	3	6	3	6	3	6	3	6	3	6	3	6	3	6	3	6	3	6	3	6	4	6	4	6
	1961	4	6	4	6	4	6	4	6	3	6	3	6	3	6	3	6	3	6	3	6	3	6	3	6
Belloy	1960	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6
	1961	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	4	6	4	6	4	6	4	6
Field totals	1960	10	15	10	15	10	15	10	15	10	15	10	15	10	15	10	15	11	15	10	15	12	15	12	15
	1961	11	15	11	15	11	15	11	15	10	15	10	15	10	15	10	15	9	15	9	15	9	15	9	15
Gundy Creek																									
Single completion—Baldonnel	1960	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	1961	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Multiple completion—																									
Dunlevy-Baldonnel	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Baldonnel-Charlie Lake	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
	1961	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1
Field totals	1960	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4	1	4
	1961	1	4	1	4	1	4	1	4	1	4	1	4	2	4	2	4	1	4	2	4	2	4	1	4

TABLE 13.—NUMBER OF PRODUCING AND PRODUCIBLE GAS WELLS BY MONTH, 1960 AND 1961—*Continued*

Field and Pool	Year	Jan. P1	Jan. P2	Feb. P1	Feb. P2	Mar. P1	Mar. P2	Apr. P1	Apr. P2	May P1	May P2	June P1	June P2	July P1	July P2	Aug. P1	Aug. P2	Sept. P1	Sept. P2	Oct. P1	Oct. P2	Nov. P1	Nov. P2	Dec. P1	Dec. P2
Halfway																									
Single completion—Baldonnel	1960	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
	1961	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Multiple completion—Baldonnel-Halfway	1960	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Field totals	1960	1	3	1	3	1	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3
	1961	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**
Highway																									
Single completion—Dunlevy	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Baldonnel	1960	0	3	0	3	0	3	0	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3
	1961	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**
Multiple completion—Baldonnel-Mississippian	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Field totals	1960	2	5	2	5	2	5	2	5	3	5	3	5	3	5	3	5	3	5	3	5	3	5	3	5
	1961	**3**	**5**	**3**	**5**	**3**	**5**	**3**	**5**	**2**	**5**	**2**	**5**	**2**	**5**	**2**	**5**	**2**	**5**	**2**	**5**	**2**	**5**	**2**	**5**
Jedney																									
Single completion—S.C.-upper carbonate	1960	3	5	3	5	4	5	3	5	3	5	3	5	4	5	4	5	4	5	4	5	4	5	4	6
	1961	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**5**	**4**	**6**	**4**	**5**	**4**	**5**	**4**	**5**
Halfway	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	1	2	2	2	2	2	2	2	2	2
	1961	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**1**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**5**	**2**	**5**	**3**	**5**
Multiple completion—S.C.-upper carbonate-Halfway	1960	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	1961	**3**	**4**	**3**	**4**	**3**	**4**	**3**	**4**	**3**	**4**	**3**	**4**	**3**	**4**	**3**	**4**	**3**	**4**	**3**	**4**	**3**	**5**	**3**	**5**
Field totals	1960	6	10	6	10	7	10	6	10	6	10	6	10	7	10	8	10	9	10	9	10	9	10	9	11
	1961	**9**	**11**	**9**	**12**	**9**	**12**	**9**	**12**	**8**	**12**	**9**	**12**	**9**	**12**	**9**	**12**	**9**	**12**	**9**	**14**	**9**	**15**	**10**	**15**
Kobes-Townsend																									
Single completion—Dunlevy	1960	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	2	3	2	3
	1961	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Charlie Lake	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**
Mississippian	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Multiple completion—Charlie Lake-Halfway	1960	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	1961	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**1**	**2**
Charlie Lake-Mississippian	1960	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	1961	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**
Field totals	1960	6	9	6	9	6	9	6	9	6	9	6	9	6	9	6	9	6	9	6	9	7	9	7	9
	1961	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**7**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**9**	**9**	**9**	**8**	**9**	**8**	**9**

Laprise Creek																									
S.C.-upper carbonate	1960	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	5	4	6	6	6
	1961	**6**	**6**	**6**	**7**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**
Field totals	1960	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	5	4	6	6	6
	1961	**6**	**6**	**6**	**7**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**
Laprise Creek East																									
S.C.-upper carbonate	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	3	3	4	4	6
	1961	**6**	**7**	**6**	**8**	**8**	**8**	**8**	**8**	**6**	**8**	**8**	**8**	**8**	**8**	**7**	**8**	**8**	**8**	**7**	**9**	**8**	**10**	**10**	**10**
Field totals	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	3	3	4	4	6
	1961	**6**	**7**	**6**	**8**	**8**	**8**	**8**	**8**	**6**	**8**	**8**	**8**	**8**	**8**	**7**	**8**	**8**	**8**	**7**	**9**	**8**	**10**	**10**	**10**
Milligan Creek																									
Halfway	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Field totals	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Montney																									
Bluesky-Gething	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Charlie Lake	1960	0	1	1	1	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Halfway	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**
Field totals	1960	2	3	3	3	3	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	1	3	1	3
	1961	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**	**0**	**3**
Nig Creek																									
S.C.-upper carbonate	1960	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6
	1961	**6**	**6**	**6**	**6**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**8**	**6**	**8**	**7**	**9**
Field totals	1960	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6
	1961	**6**	**6**	**6**	**6**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**7**	**6**	**8**	**6**	**8**	**7**	**9**
Parkland																									
Upper Devonian	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Field totals	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Petitot River																									
Devonian Carbonate	1960	0	1	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
	1961	**0**	**2**	**0**	**2**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**
Field totals	1960	0	1	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
	1961	**0**	**2**	**0**	**2**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**
Red Creek																									
Single completion—Halfway	1960	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Multiple completion—Charlie Lake-Halfway	1960	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Field totals	1960	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1961	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**

TABLE 13.—NUMBER OF PRODUCING AND PRODUCIBLE GAS WELLS BY MONTH, 1960 AND 1961—*Continued*

Field and Pool	Year	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2
Snyder Creek																									
Dunlevy	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Field totals	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Stoddart																									
Belloy	1960	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	1961	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Field totals	1960	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	1961	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Sunrise																									
Cadotte	1960	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3
	1961	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**
Field totals	1960	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3
	1961	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**	**0**	**3**
Other Areas																									
Single completion—																									
Cadotte	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
	1961	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**
Notikewin	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Bluesky-Gething	1960	0	2	0	3	0	3	0	3	0	3	0	3	0	3	0	4	0	4	0	4	0	4	0	4
	1961	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**
Gething	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**	**0**	**2**
Dunlevy	1960	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
	1961	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**6**	**0**	**7**	**0**	**7**
Jurassic-Triassic	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Schooler Creek	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**2**
S.C.-upper carbonate	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	2	0	3	0	3	0	3
	1961	**0**	**3**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**4**	**0**	**5**	**1**	**8**	**1**	**9**
Baldonnel "A"	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**1**
Baldonnel	1960	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10
	1961	**0**	**10**	**0**	**11**	**0**	**11**	**0**	**10**	**0**	**10**	**0**	**10**	**0**	**9**	**0**	**9**	**0**	**9**	**0**	**9**	**0**	**9**	**0**	**9**
Charlie Lake	1960	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5
	1961	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**	**0**	**5**
Halfway	1960	0	5	0	5	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6
	1961	**0**	**6**	**0**	**9**	**0**	**10**	**0**	**10**	**0**	**10**	**0**	**10**	**0**	**11**	**0**	**12**	**0**	**11**	**0**	**12**	**0**	**13**	**0**	**13**

Permo-Carboniferous	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
	1961	0	2	0	2	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3
Belloy	1960	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
	1961	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
Mississippian	1960	0	6	0	6	0	7	0	8	0	8	0	9	0	9	0	9	0	9	0	9	0	9	0	9
	1961	0	9	0	8	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9
Kiskatinaw	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Upper Devonian	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Devonian Carbonate	1960	0	5	0	6	0	8	0	8	0	9	0	9	0	10	0	11	0	11	0	11	0	11	0	11
	1961	1	13	1	13	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	2	15
Multiple completion—																									
S.C.-upper carbonate-Halfway	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1
Baldonnel-Halfway	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	0	1	0	1	0	1	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
Schooler Creek-Mississippian	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Baldonnel-Halfway-Mississippian	1960	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	1961	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Areas totals	1960	0	50	0	52	0	56	0	57	0	58	0	59	0	60	0	62	0	63	0	64	0	64	0	64
	1961	1	68	1	73	1	79	1	79	1	79	1	79	1	80	1	81	1	80	1	85	3	91	4	93
Totals, fields and areas	1960	79	196	80	201	81	206	82	208	83	209	81	211	81	213	83	216	88	218	88	228	100	225	103	230
	1961	117	238	120	248	124	259	125	260	115	262	121	263	124	266	120	269	120	271	120	282	128	290	138	293

TABLE 14.—MONTHLY CRUDE-OIL PRODUCTION BY FIELDS/AREAS AND POOLS, 1960 AND 1961

(Quantities in barrels.)

Field	Pool	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Aitken Creek	Lower Cretaceous Gething	1960	2,344	2,405	1,618	267	...	...	606	...	...	450	2,558	2,582	12,830
		1961	1,266	954	1,029	...	...	...	...	...	...	...	...	...	3,249
Beatton River	Triassic Halfway	1960	536	337	846	...	...	...	...	...	...	...	...	...	1,719
		1961	...	...	3,596	832	4,303	1,475	1,527	...	...	7,069	12,139	1,222	32,163
Beatton River West	Lower Cretaceous Bluesky-Gething	1960	...	657	363	...	...	...	...	...	...	...	...	...	1,020
		1961	...	...	1,966	...	63	1,174	1,116	...	...	1,669	4,145	...	10,133
Blueberry	Lower Cretaceous Dunlevy	1960	...	...	...	...	...	223	...	...	61	645	258	426	1,613
		1961	318	186	167	143	168	168	195	185	131	132	62	...	1,855
	Mississippian Rundle	1960	2,451	2,039	3,382	707	...	...	...	2,905	2,990	539	9,637	26,390	51,040
		1961	1,505	1,551	...	74	...	1,052	815	1,145	339	1,914	4,816	3,849	17,060
Boundary Lake	Triassic Charlie Lake (excluding Boundary Lake)	1960	...	78	...	86	273	382	...	...	...	...	...	...	819
		1961	...	...	...	...	...	...	...	...	...	...	...	...	...
	Triassic Boundary Lake	1960	74,171	62,182	60,127	16,168	48,139	65,013	95,722	75,882	77,880	65,344	6,238	35,495	682,361
		1961	28,202	56,206	68,637	326	...	581	39,206	45,703	75,538	82,570	37,497	206,463	640,929
	Triassic Halfway	1960	...	...	...	...	...	...	...	...	...	...	110	385	495
		1961	121	...	248	239	...	...	...	248	1,076	79	806	...	2,817
Charlie Lake	Lower Cretaceous Gething	1960	534	...	...	...	...	...	...	529	400	384	244	...	2,091
		1961	644	980	458	...	...	4	...	...	...	...	...	...	2,086
Fort St. John	Triassic Charlie Lake	1960	8,201	7,476	8,006	8,808	7,864	8,846	8,637	8,091	7,296	7,542	7,712	9,118[1]	97,597[1]
		1961	8,614	5,258	3,335	1,134	...	880	1,122	4,645	2,656	4,204	4,413	2,378	38,639
	Permian Belloy	1960	...	...	...	...	...	...	132	...	...	...	...	...	132
		1961	...	...	...	...	...	...	...	...	...	...	...	...	...
Milligan Creek	Triassic Halfway	1960	...	1,891	5,831	...	...	...	...	...	...	...	...	...	7,722
		1961	...	...	9,665	...	28,043	16,056	5,034	...	8,917	33,797	53,784	...	155,296
Peejay	Triassic Halfway	1960	812	...	...	...	...	...	...	...	...	...	...	4,707	5,519
		1961	24,871	21,973	12,872	...	7,451	4,172	1,785	...	...	12,658	20,948	1,746	108,476
Other areas	Triassic Boundary Lake	1960	...	...	...	...	...	...	...	...	...	...	...	...	...
		1961	...	...	...	...	...	...	...	...	...	...	...	488	488
	Triassic Halfway	1960	664	190	1,273[1]	...	...	...	...	...	...	...	...	...	2,127
		1961	...	335	672	...	...	...	...	...	...	...	2,102	1,526	4,635
Totals		1960	89,713	77,255	81,446	26,036	56,276	74,464	105,097	87,407	88,627	74,904	26,757	79,103[1]	867,085[1]
		1961	65,541	87,443	102,645	2,748	40,028	25,562	50,800	51,926	88,657	144,092	140,712	217,672	1,017,826

[1] Amended.

The Buick Creek West Field did not produce and therefore is not included in this table.

TABLE 15.—MONTHLY NATURAL-GAS PRODUCTION BY FIELDS/AREAS AND POOLS, 1960 AND 1961

(Quantities in M s.c.f.)

Field	Pool	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Aitken Creek	Lower Cretaceous	1960	(1,096)	(1,179)	(1,261)	(123)	...	...	(297)	...	...	(278)	(1,190)	(1,160)	(6,584)
		1961	**(690)**	**(350)**	**(570)**	...	...	...	...	...	...	...	...	...	**(1,610)**
Beatton River	Triassic Halfway	1960	(735)	(462)	(1,457)	...	...	...	...	...	...	...	...	...	(2,654)
		1961	...	...	**(6,168)**	**(2,172)**	**(10,335)**	**(4,191)**	**(4,337)**	...	...	**(11,265)**	**(22,822)**	**(2,364)**	**(63,654)**
Beatton River West	Lower Cretaceous	1960	...	(131)	(73)	...	...	...	...	...	...	...	...	...	(204)
	Bluesky-Gething	**1961**	...	...	**(627)**	...	**(25)**	**(417)**	**(754)**	...	...	**(508)**	**(1,377)**	...	**(3,708)**
Beg	Triassic upper	1960	...	...	...	...	...	...	...	...	...	...	...	...	...
	carbonate of	**1961**	...	...	...	...	...	...	...	...	...	...	**13,281**	**144,103**	**157,384**
	Schooler Creek														
	Triassic Halfway	1960	...	...	...	...	...	...	...	...	...	...	...	...	...
		1961	...	...	...	...	...	...	...	...	...	...	**99,842**	**272,449**	**372,291**
Blueberry	Lower Cretaceous	1960	83,766	85,921	87,221	86,045	87,050	80,362	76,294	81,407	77,202	98,941[1]	92,535[1]	106,340[1]	1,043,084[1]
	Dunlevy	**1961**	**114,644**	**114,587**	**107,215**	**101,890**	**106,033**	**99,233**	**109,056**	**101,102**	**100,044**	**104,244**	**106,697**	**106,000**	**1,270,745**
	Lower Cretaceous	1960	...	...	...	...	...	(4,455)	...	...	(562)	...	...	...	(5,017)[1]
	Dunlevy	**1961**	...	...	...	...	...	...	...	...	...	...	...	...	...
	Triassic Baldonnel	1960	138,311	129,161	139,614	128,046	129,936	79,000	69,302	65,484	70,594	134,162	74,790	82,969	1,241,369
		1961	**100,587**	**72,713**	**81,311**	**86,277**	**79,713**	**78,266**	**67,439**	**46,881**	**74,717**	**70,027**	**72,012**	**45,579**	**875,522**
	Mississippian	1960	(1,637)	(2,047)	(4,634)	(916)	...	...	...	(6,818)	(6,283)	(594)	(9,794)	(18,265)	(50,988)
	Rundle	**1961**	**(2,154)**	**(2,569)**	...	**(414)**	...	**(627)**	**(750)**	**(966)**	**(293)**	**(4,049)**	**(2,718)**	**(2,573)**	**(17,113)**
Blueberry West	Lower Cretaceous	1960	8,694	12,638	10,975	11,601	11,941	9,661	12,371	11,623	9,291	9,557	8,560	8,752	125,664
	Dunlevy	**1961**	**8,066**	**7,001**	**8,077**	**7,964**	**8,895**	**7,350**	**9,723**	**9,206**	**7,963**	**8,707**	**4,703**	**2,658**	**90,313**
	Triassic Baldonnel	1960	32,488	42,455	39,254	41,218	40,756	41,146	53	888	4,331	4,598	6,644	443	254,274
		1961	...	...	...	...	...	...	...	...	**2,150**	**11,915**	**56,742**	**30,546**	**101,353**
Boundary Lake	Lower Cretaceous	1960	...	...	...	...	...	...	...	...	...	...	...	...	...
	Gething	**1961**	**142,249**	**127,927**	**130,277**	**137,860**	**121,659**	**41,584**	**112,935**	**111,692**	**96,802**	**80,707**	**85,781**	**125,443**	**1,314,916**
	Lower Cretaceous	1960	...	...	...	...	...	...	...	...	...	...	40,856	154,597	195,453
	Bluesky-Gething	**1961**	**50,043**	**31,717**	**41,086**	**47,551**	**38,013**	**3,159**	**27,932**	**40,023**	**26,782**	**23,060**	**13,898**	**16,741**	**360,005**
	Triassic Baldonnel	1960	...	...	...	...	...	...	...	...	...	...	4,000	44,618	48,618
		1961	**38,033**	**35,319**	**78,902**	**55,577**	**52,717**	**3,967**	**61,880**	**79,380**	**77,873**	**50,936**	**39,957**	**38,464**	**613,005**
	Triassic Charlie	1960	...	(91)	...	(36)	(437)	(271)	...	...	...	...	...	...	(835)
	Lake (excluding	**1961**	...	...	...	...	...	...	...	...	...	...	...	...	...
	Boundary Lake)														
	Triassic Boundary	1960	(62,892)	(58,532)	(39,136)	(9,215)	(26,720)	(40,287)	(60,018)	(48,290)	(55,490)	(55,324)	(5,355)	(20,952)	(482,211)
	Lake	**1961**	**(16,650)**	**(42,797)**	**(46,914)**	**(306)**	...	**(1,939)**	**(23,586)**	**(28,022)**	**(46,096)**	**(47,515)**	**(21,195)**	**(138,159)**	**(413,179)**
	Triassic Halfway	1960	...	...	...	...	...	...	...	...	...	...	(41)	(150)	(191)
		1961	**(60)**	...	**(478)**	**(450)**	...	...	...	**(232)**	**(594)**	**(65)**	**(464)**	...	**(2,343)**
Bubbles	Triassic upper	1960	674,494	693,479	710,519	680,810	784,773	685,338	680,489	643,252	686,264	732,281	674,451	781,768	8,427,918
	carbonate of	**1961**	**800,402**	**712,371**	**789,603**	**664,835**	**712,069**	**594,500**	**563,181**	**567,711**	**649,417**	**674,321**	**734,266**	**754,662**	**8,217,338**
	Schooler Creek														
Buick Creek	Lower Cretaceous	1960	65,579	58,611	61,804	76,359	123,258	104,954	119,098	118,357	114,403	120,140	119,149	123,597	1,205,309
	Buick Creek	**1961**	**231,953**	**437,787**	**568,314**	**674,892**	**703,360**	**715,108**	**625,136**	**677,980**	**635,950**	**661,213**	**688,316**	**830,496**	**7,450,505**
	Triassic Charlie	1960	...	...	...	...	...	...	...	...	...	...	...	...	...
	Lake	**1961**	...	...	**48,939**	**117,272**	**150,057**	**141,442**	**149,157**	**154,767**	**144,222**	**141,302**	**141,075**	**139,478**	**1,327,711**

[1] Amended.

1960: Volumes in M c.f. at 14.4 psia. and 60° F.

1961: Volumes in M c.f. at 14.65 psia. and 60° F.

The following designated gas fields did not produce and therefore are not included in this table: Aitken Creek, Blueberry East, Clarke Lake, Fort St. John Airport, Milligan Creek, Petitot River, and Sunrise.

TABLE 15.—MONTHLY NATURAL-GAS PRODUCTION BY FIELDS/AREAS AND POOLS, 1960 AND 1961—*Continued*

(Quantities in M s.c.f.)

Field	Pool	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Buick Creek West	Lower Cretaceous Buick Creek	1960	1,244,778	1,167,092	1,193,046	1,141,607	1,182,358	1,078,138	1,054,628	1,029,958	977,737	963,363	1,007,743	976,710	13,017,158
		1961	912,457	881,769	932,881	874,365	767,815	767,180	693,331	763,745	782,236	779,374	754,617	830,709	9,740,479
	Triassic Baldonnel	1960	......	......	......	......	......	......	......	......	......	6,859	47,457	67,816	122,132
		1961	61,329	55,091	60,455	52,872	56,963	57,742	65,772	61,603	47,526	56,660	55,525	58,878	690,416
	Triassic Halfway	1960	128,670	103,818	75,798	117,960	89,919	64,383	68,317	99,705	86,595	73,643	61,152	64,166	1,034,126
		1961	50,526	76,698	83,809	81,277	52,986	66,944	58,724	43,849	29,847	48,798	61,102	76,327	730,887
Charlie Lake	Lower Cretaceous Gething	1960	(1,044)	......	......	......	......	......	......	(1,107)	(597)	(600)	(467)	......	(3,815)
		1961	(6,822)	(1,324)	(775)	......	......	......	......	......	......	......	......	......	(8,921)
Dawson Creek	Lower Cretaceous Cadotte	1960	93,127	87,167	91,042	87,296	88,918	84,689	71,579	82,801	79,589	83,591	84,819	84,779	1,019,397
		1961	81,053	74,238	71,465	32,085	74,089	71,096	63,343	71,908	69,019	73,356	73,164	62,525	817,341
Fort St. John	Triassic Baldonnel "A"	1960	168,486	163,926	173,287	168,610	167,037	163,258	155,984	161,474	148,373	169,809	189,625	327,744	2,157,613
		1961	327,198	281,967	323,800	203,931	205,672	229,849	247,687	250,106	203,962	130,005	235,101	298,553	2,937,831
	Triassic Baldonnel "A/B"	1960	489,355	449,431	468,568	406,862	429,934	405,037	399,318	419,318	385,054	429,772	452,476	439,149	5,174,274
		1961	440,944	382,757	402,374	381,808	309,680	326,550	201,209	225,374	265,274	323,836	308,360	401,682	3,969,848
	Triassic Charlie Lake	1960	(18,633)	(17,996)	(18,559)	(20,318)	(16,870)	(19,859)	(14,215)	(16,683)	(18,318)	(18,219)	(18,328)	(20,061)	(218,059)
		1961	(21,908)	(19,179)	(10,906)	(3,376)	......	(3,068)	(11,605)	(28,344)	(14,026)	(32,574)	(35,285)	(19,468)	(199,739)
	Triassic Halfway	1960	614,354	566,823	590,326	540,253	499,237	467,256	403,866	423,048	403,509	458,699	514,970	520,188	6,002,529
		1961	517,748	442,034	477,560	433,119	415,089	400,185	375,758	391,409	358,725	366,541	347,354	424,468	4,949,990
	Permian Belloy	1960	88,060	69,348	75,758	93,079	64,041	72,499	78,818	80,237	71,391	91,894	88,992	93,893	968,010
		1961	96,320	74,777	83,408	70,403	78,047	76,622	51,994	59,974	67,840	57,808	54,265	60,244	831,702
	Permian Belloy	1960	......	......	......	......	......	......	(1,330)	......	......	......	......	......	(1,330)
		1961	......	......	......	......	......	......	......	......	......	......	......	......	......
Fort St. John Southeast	Lower Cretaceous Cadomin	1960	45,713	42,938	46,364	46,257	40,426	51,569	47,354	54,469	53,213	60,848	53,017	61,279	603,447
		1961	61,802	51,002	23,686	55,110	55,535	54,438	42,085	61,023	54,021	62,520	60,337	69,912	651,471
	Triassic Baldonnel "A"	1960	68,541	64,016	66,829	62,140	53,675	63,604	58,668	62,449	75,787	64,702	75,007	70,386	785,804
		1961	63,461	55,503	61,243	56,579	57,332	58,235	46,459	50,900	55,520	53,183	52,866	66,166	677,447
	Triassic Halfway	1960	336,978	298,251	336,810	329,209	326,140	343,967	320,807	318,987	302,576	318,421	323,686	371,207	3,927,039
		1961	336,045	262,144	277,654	256,563	206,426	208,158	194,679	188,715	201,713	183,856	177,742	206,385	2,700,080
	Permian Belloy	1960	617,337	568,494	604,139	603,630	594,208	641,134	582,008	586,821	567,457	595,392	601,210	580,984	7,142,814
		1961	567,285	512,060	557,322	525,895	441,938	490,458	332,102	467,836	474,835	472,824	428,174	526,052	5,796,781
Gundy Creek	Triassic Baldonnel	1960	30,477	40,409	8,239	33,987	38,034	51,654	52,590	42,552	39,446	22,735	13,441	17,419	390,983
		1961	11,198	1,531	17,829	12,686	30,105	38,500	30,992	3,046	713	7,665	19,987	23,719	197,971
	Triassic Baldonnel-Charlie Lake	1960	62,062	64,595	56,109	31,654	54,408	47,918	38,854	40,948	11,890	10,284	1,553	......	420,275
		1961	......	......	......	......	......	......	11,952	2,878	......	5,345	7,501	......	27,676
Halfway	Triassic Baldonnel	1960	46,546	43,274	45,585	78,589	41,621	40,258	41,962	44,421	40,951	43,562	42,912	42,973	552,654
		1961	43,282	29,477	36,306	38,655	40,926	37,394	37,601	39,356	35,298	26,273	31,175	40,317	436,060
	Triassic Halfway	1960	......	......	......	......	11,603	56,657	54,532	55,795	57,721	60,815	56,333	53,886	407,342
		1961	49,083	42,356	44,174	41,479	41,323	29,545	26.829	38,491	34,635	26,919	34,118	33,051	442,003
Highway	Lower Cretaceous Dunlevy	1960	15,522	14,682	14,719	14,227	14,914	12,851	14,966	14,282	12,829	13,994	14,410	14,117	171,513
		1961	12,421	10,597	12,105	11,785	13,194	12,360	11.585	2,983	3,365	9,896	11,018	11,380	122,689
	Triassic Baldonnel	1960	21,353	16,351	13,490	14,999	19,896	36,605	42,391	37,814	32,095	29,227	25,707	20,819	310,747
		1961	14,280	29,457	28,107	30,356	12,587	9,174	12,147	11,874	10,938	10,323	10,386	7,426	187,055
	Mississippian Rundle	1960	104,262	89,734	80,858	85,416	88,174	81,183	81,932	80,495	73,180	73,945	67,417	67,906	974,502
		1961	64,980	55,794	61,524	59,547	60,452	48,087	52,740	50,435	42,435	40.252	42,864	47,655	626,765
Jedney	Triassic upper carbonate of Schooler Creek	1960	601,682	551,519	684,185	669,281	670,915	631,300	675,915	688,189	708,236	711,772	699,544	730,500	8,023,038
		1961	720,058	636,407	694,585	595,658	660,379	462,878	535,237	482,061	614,120	610,378	655,510	626,148	7,293,419
	Triassic Halfway	1960	156,825	157,254	241,524	285,915	292,024	251,983	270,675	282,629	370,224	371,909	301,412	380,735	3,363,109
		1961	410,446	335,978	357,700	235,630	276,531	225,490	243,375	346,003	245,172	316,962	348,244	259,097	3,600,628

Kobes-Townsend	Lower Cretaceous Dunlevy	1960	65,243	63,845	57,813	59,302	63,311	60,439	60,215	63,047	49,769	64,187	65,418	68,988	741,577
		1961	**75,063**	**74,533**	**108,384**	**102,394**	**74,948**	**85,191**	**61,899**	**35,865**	**77,926**	**81,832**	**98,808**	**117,620**	**994,463**
	Triassic Charlie Lake	1960	91,379	84,830	91,543	89,999	105,933	110,649	107,514	102,596	87,744	100,542	95,276	91,713	1,159,718
		1961	**109,777**	**133,075**	**170,677**	**156,871**	**95,791**	**142,926**	**107,861**	**116,085**	**134,233**	**109,380**	**107,807**	**140,787**	**1,525,270**
	Triassic Halfway	1960	199,861	144,811	177,972	117,273	125,731	129,641	140,471	149,430	132,821	119,477	133,993	141,193	1,742,674
		1961	**138,132**	**138,003**	**148,288**	**139,468**	**124,761**	**133,434**	**126,000**	**143,820**	**134,852**	**133,455**	**167,812**	**191,076**	**1,719,101**
	Mississippian Rundle	1960	258,997	257,437	307,590	243,020	235,307	192,853	216,723	214,646	195,104	179,953	195,178	219,221	2,716,029
		1961	**176,869**	**181,962**	**217,987**	**215,627**	**190,075**	**154,537**	**168,685**	**201,540**	**171,949**	**163,473**	**176,162**	**178,430**	**2,197,296**
Laprise Creek	Triassic upper carbonate of Schooler Creek	1960											205,520	476,078	681,598
		1961	**486,667**	**433,471**	**505,752**	**536,309**	**543,447**	**346,912**	**515,223**	**475,141**	**539,422**	**602,294**	**602,310**	**549,893**	**6,136,841**
Laprise Creek East	Triassic upper carbonate of Schooler Creek	1960											84,564	265,839	350,403
		1961	**273,139**	**352,272**	**542,381**	**521,060**	**457,615**	**314,903**	**424,047**	**435,526**	**463,340**	**413,619**	**536,095**	**606,132**	**5,340,129**
Milligan Creek	Triassic Halfway	1960		(676)	(2,013)										(2,689)
		1961			**(1,909)**		**(7,066)**	**(4,236)**	**(1,094)**		**(2,150)**	**(7 535)**	**(13,526)**		**(37,516)**
Montney	Lower Cretaceous Bluesky-Gething	1960	10,965	5,316	5,910	3,912	5,905	5,676	6,416	6,187	5,214	4,415			59,916
		1961													
	Triassic Charlie Lake	1960		6,457	6,385										12,842
		1961													
	Triassic Halfway	1960	69,673	69,141	75,287	73,245	77,023	72,946	61,864	77,761	63,909	64,795	64,433	52,468	822,545
		1961	**58,870**	**52,220**	**54,922**	**50,862**	**49,283**	**42,597**	**27,342**	**29,953**	**27,922**	**29,857**	**21,746**		**445,574**
Nig Creek	Triassic upper carbonate of Schooler Creek	1960													
		1961	**201,545**	**510,300**	**615,032**	**666,032**	**621,857**	**466,084**	**574,214**	**530,780**	**652,980**	**659,063**	**686,780**	**799,305**	**6,963,972**
Parkland	Upper Devonian	1960	269,466	291,785	224,471	316,708	1,211	138,176	199,127	184,694	177,821	166,723	182,347	131,301	2,283,830
		1961	**213,081**	**198,128**	**226,113**	**210,310**	**216,176**	**197,269**	**204,646**	**154,440**	**185,137**	**233,103**	**215,966**	**251,304**	**2,505,673**
Peejay	Triassic Halfway	1960	(196)											(1,193)	(1,389)
		1961	**(10,879)**	**(8,524)**	**(5,007)**		**(3,382)**	**(1,858)**	**(1,452)**			**(5.599)**	**(6,860)**	**(433)**	**(43,994)**
Red Creek	Triassic Charlie Lake	1960								6,533	52,017	56,447	58,517	60,155	233,669
		1961	**57,940**	**45,219**	**63,546**	**58,569**	**56,530**	**52,386**	**41,471**	**43.196**	**42.891**	**43.915**	**47,230**	**49,680**	**602,573**
	Triassic Halfway	1960	44,107	27,158	17,057	1,042	34,882	40,145	17,827	12,340	31,228	35,115	36,779	37,648	335,328
		1961	**35,500**	**27,052**	**34,888**	**33,567**	**34,292**	**30,087**	**27,212**	**32,115**	**13,421**	**30,877**	**30,381**	**28,242**	**357,634**
Snyder Creek	Lower Cretaceous Dunlevy	1960													
		1961	**30,761**	**66,935**	**79,307**	**69,482**	**78,287**	**53,650**	**74,225**	**78,654**	**70.421**	**68,720**	**63,268**	**8,855**	**742,565**
Stoddart	Permian Belloy	1960	440,481	410,517	447,614	430,280	472,891	481,901	464,030	426,362	440,681	479,811	463,298	384,400	5,342,266
		1961	**347,984**	**310,366**	**346,606**	**315,492**	**290,674**	**322,526**	**243,435**	**218,573**	**199,855**	**299 543**	**381,464**	**472,108**	**3,748,626**
Other areas	Triassic Schooler Creek	1960													
		1961											**20,748**	**74,064**	**94,812**
	Triassic upper carbonate of Schooler Creek	1960													
		1961											**10,382**	**18,290**	**28,672**
	Triassic Boundary Lake	1960													
		1961												**(488)**	**(488)**
	Triassic Halfway	1960	(178)	(1,037)	(6,556)										(7,771)
		1961			**(185)**								**(634)**	**(555)**	**(1,374)**
	Devonian carbonate	1960													
		1961	**2,280**	**3,543**	**4,406**	**4,060**	**3,662**	**2,918**	**3,419**	**3,137**	**4,300**	**3,821**	**4,761**	**99,654**	**139,961**
Monthly totals	Natural gas	1960	7,387,632	6,942,684	7,327,705	7,199,831	7,067,390	6,878,830	6,746,958	6,770,999	6,696,246	7,026,380[1]	7,329,191[1]	8,218,744[1]	85,592,590[1]
		1961	**8,535,501**	**8,358,138**	**9,580,000**	**9,024,024**	**8,666,983**	**7,700,914**	**7,661,719**	**7,901,136**	**8,131,763**	**8,362,158**	**8,977,700**	**10,222,753**	**103,122,789**
	Solution gas (oil wells)	1960	(86,411)	(82,151)	(73,689)	(30,608)	(44,027)	(64,872)	(75,860)	(72,898)	(81,250)	(75,015)[1]	(35,175)[1]	(61,781)[1]	(783,737)[1]
		1961	**(59,163)**	**(74,743)**	**(73,539)**	**(6,718)**	**(20,808)**	**(16,336)**	**(43,578)**	**(57,564)**	**(63,159)**	**(109,110)**	**(104,881)**	**(164,040)**	**(793,639)**
	Totals, gas	1960	7,474,043	7,024,835	7,401,394	7,230,439	7,111,417	6,943,702	6,822,818	6,843,897	6,777,496	7,101,395	7,364,366	8,280,525	86,376,327
		1961	**8,594.664**	**8,432,881**	**9,653,539**	**9,030,742**	**8.687,791**	**7.717,250**	**7,705,297**	**7,958,700**	**8.194,922**	**8,471.268**	**9,082.581**	**10,386.793**	**103,916,428**

1 Amended.

Table 16.—Monthly Natural-gas Liquids and Sulphur Production, 1960 and 1961

	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Condensate/pentanes plus (bbl.)	1960	72,578	56,328	65,751	62,714	65,916	61,774	53,448	59,053	62,942	64,701	60,054	65,589	750,848
	1961	**71,682**	**68,680**	**79,077**	**67,604**	**73,736**	**67,956**	**68,643**	**70,583**	**65,548**	**66,790**	**50,886**	**62,539**	**813,724**
Butane (bbl.)—														
Natural-gas liquids	1960	29,287	26,626	26,031	20,026	19,945	19,845	23,126	24,223	24,757	28,606	30,126	30,589	303,187
Liquefied refinery gases[1]	1960	....	....	....	....	....	....	....	....	....	539	450	671	1,660
Natural-gas liquids	**1961**	**32,360**	**30,169**	**29,271**	**25,687**	**25,459**	**24,383**	**24,467**	**24,415**	**27,385**	**27,912**	**11,905**	**35,818**	**319,231**
Liquefied refinery gases[1]	**1961**	**677**	**368**	**293**	**55**	**62**	**358**	**259**	**163**	**43**	**167**	**30**	....	**2,475**
Propane (bbl.)—														
Natural-gas liquids	1960	10,623	5,807	7,018	7,215	9,149	8,260	10,391	11,380	10,804	13,632	15,298	15,789	125,366
Liquefied refinery gases[1]	1960	....	....	....	....	....	....	....	....	....	500	854	917	2,271
Natural-gas liquids	**1961**	**17,166**	**15,733**	**14,448**	**10,428**	**10,985**	**11,542**	**8,946**	**10,133**	**12,615**	**13,478**	**7,330**	**21,913**	**154,717**
Liquefied refinery gases[1]	**1961**	**789**	**1,057**	**1,044**	**233**	**105**	**873**	**742**	**765**	**1,230**	**1,524**	....	....	**8,362**
Sulphur (short tons)	1960	5,420	5,007	5,194	5,152	5,262	4,803	4,597	4,823	4,937	4,699	5,090	5,470	60,454
	1961	**5,685**	**5,295**	**5,895**	**5,230**	**4,580**	**4,315**	**4,020**	**4,362**	**2,484**	**3,545**	**4,918**	**5,326**	**55,655**

[1] Recovered at Pacific Petroleums Ltd. refinery, Taylor. Not shown in totals of Table 5.

TABLE 17.—MONTHLY CRUDE-OIL DISPOSITION, 1960 AND 1961

(Quantities in barrels.)

Month	Year	Field							Transporters								
												Deliveries					
												B.C. Refineries					
		Production	Opening Inventory	Receipts	Transfers	Losses and Adjustments	Total Sales	Closing Inventory	Receipts	Line Fill	Line Loss	North-east	Interior	Lower Mainland	Miscellaneous	Total
January	1960	89,713	14,441	1,047	1,512	1,277	85,221	17,101	85,221	....	....	79,594	....	....	5,627	85,221
	1961	**65,541**	**33,150**	**1,264**	**2,544**	**756**	**71,359**	**25,296**	**71,359**	**2,786**	**90**	**62,908**	....	....	**5,575**	**68,483**
February	1960	77,255	17,191	1,525	2,385	181	73,495	19,910	73,495	....	....	63,401	....	....	10,094	73,495
	1961	**87,443**	**25,296**	**627**	**2,184**	**366**	**83,395**	**27,421**	**83,395**	**17,449**	**80**	**60,867**	....	....	**4,999**	**65,866**
March	1960	81,446	19,910	1,370	4,225	3	78,441	20,057	78,441	....	....	67,291	....	....	11,150	78,441
	1961	**102,645**	**27,421**	**161**	**1,677**	**247**	**101,801**	**26,502**	**101,801**	**10,569**	**213**	**87,428**	....	....	**3,591**	**91,019**
April	1960	26,036	20,057	65	74	760	24,926	20,398	24,926	....	....	24,447	....	....	479	24,926
	1961	**2,748**	**26,502**	**672**	....	**20**	**148**	**29,754**	**148**	**—1,574**	....	**1,574**	....	....	**148**	**1,722**
May	1960	56,276	20,398	....	202	....	52,802	23,670	52,802	....	....	52,802	....	....	....	52,802
	1961	**40,028**	**29,754**	**160**	**744**	**25**	**44,279**	**24,894**	**44,279**	....	**213**	**44,066**	....	....	....	**44,066**
June	1960	74,464	23,670	109	657	29	79,757	17,800	79,757	....	....	78,299	....	....	1,458	79,757
	1961	**25,562**	**24,894**	**698**	**2,074**	**45**	**24,536**	**24,499**	**24,536**	....	**116**	**24,382**	....	....	**38**	**24,420**
July	1960	105,097	17,800	379	253	....	101,951	21,072	101,951	....	....	100,378	....	....	1,573	101,951
	1961	**50,800**	**24,499**	....	**938**	....	**49,990**	**24,371**	**49,990**	....	**243**	**49,707**	....	....	**40**	**49,747**
August	1960	87,407	21,072	234	814	....	79,571	28,328	79,571	....	....	78,383	....	....	1,188	79,571
	1961	**51,926**	**24,371**	**592**	**1,349**	**450**	**45,348**	**29,742**	**45,348**	....	....	**44,930**	....	....	**418**	**45,348**
September	1960	88,627	28,328	943	308	343	94,825	22,422	94,825	....	....	94,606	....	....	219	94,825
	1961	**88,657**	**29,742**	**3,278**	**7,116**	**155**	**89,044**	**25,362**	**89,044**	....	....	**79,967**	....	....	**9,077**	**89,044**
October	1960	74,904	22,422	688	494	174	70,487	26,859	70,487	....	....	69,835	....	....	652	70,487
	1961	**144,092**	**25,362**	**4,666**	**9,928**	....	**132,242**	**31,950**	**132,242**	....	....	**116,321**	....	....	**15,921**	**132,242**
November	1960	26,757	26,859	368	1,805	533	23,890	27,756	23,890	....	....	20,328	....	....	3,562	23,890
	1961	**140,712**	**31,950**	**8,133**	**6,765**	**413**	**143,595**	**30,022**	**143,585**	**—15,372**	**259**	**122,606**	....	**25,654**	**10,448**	**158,708**
December	1960	79,103[1]	27,756	758	811	396	73,260[1]	33,150	73,260	....	....	69,186[1]	....	....	4,074	73,260[1]
	1961	**217,672**	**30,022**	**6,897**	**6,660**	**318**	**211,523**	**36,090**	**211,523**	**—1,591**	**8,876**	....	**9,715**	**181,288**	**13,295**	**204,238**
Totals	1960	867,085[1]	14,441	7,486	13,540	3,696	838,626[1]	33,150	838,626	....	....	798,550[1]	....	....	40,076	838,626[1]
	1961	**1,017,826**	**33,150**	**27,148**	**41,978**	**2,795**	**997,260**	**36,090**	**997,260**	**12,267**	**10,090**	**694,756**	**9,715**	**206,942**	**63,490**	**911,413**

[1] Amended.

TABLE 18.—MONTHLY NATURAL-GAS DISPOSITION, 1960 AND 1961

(Quantities in M s.c.f.)

Month	Year	Field: Total B.C. Production: Wet Gas	Field: Total B.C. Production: Dry Gas	Field: Total B.C. Production: Solution Gas	Field: Flared	Field: Lease Fuel	Field: Delivered to G.G.S.	Gas-gathering System: Received from B.C. Producers
January	1960	7,025,039	362,593	86,411	86,411	51,616	7,336,016	7,336,016
	1961	**8,239,087**	**296,414**	**59,163**	**59,163**	**43,152**	**8,492,349**	**8,492,349**
February	1960	6,563,732	378,952	82,151	82,151	40,117	6,902,567	6,902,567
	1961	**8,082,229**	**275,909**	**74,743**	**74,743**	**40,075**	**8,318,063**	**8,318,063**
March	1960	7,012,192	315,513	73,689	73,689	41,542	7,286,163	7,286,163
	1961	**9,278,016**	**301,984**	**73,539**	**73,539**	**46,103**	**9,533,897**	**9,533,897**
April	1960	6,795,827	404,004	30,608	30,608	79,198	7,120,633	7,120,633
	1961	**8,777,569**	**246,455**	**6,718**	**6,718**	**41,879**	**8,982,145**	**8,982,145**
May	1960	6,977,261	90,129	44,027	44,027	38,484	7,028,906	7,028,906
	1961	**8,373,056**	**293,927**	**20,808**	**20,808**	**39,786**	**8,627,197**	**8,627,197**
June	1960	6,655,965	222,865	64,872	64,872	41,215	6,837,615	6,837,615
	1961	**7,429,631**	**271,283**	**16,336**	**16,336**	**66,726**	**7,634,188**	**7,634,188**
July	1960	6,476,252	270,706	75,860	75,860	77,438	6,669,520	6,669,520
	1961	**7,390,311**	**271,408**	**43,578**	**43,578**	**40,289**	**7,621,430**	**7,621,430**
August	1960	6,503,504	267,495	72,898	72,898	56,566	6,714,433	6,714,433
	1961	**7,671,651**	**229,485**	**57,564**	**57,564**	**37,318**	**7,863,818**	**7,863,818**
September	1960	6,438,836	257,410	81,250	82,601	42,677	6,652,218	6,652,218
	1961	**7,873,307**	**258,456**	**63,159**	**63,159**	**37,815**	**8,093,948**	**8,093,948**
October	1960	6,776,066[2]	250,314	75,015[2]	75,015	46,841	6,979,539	6,979,539
	1961	**8,051,878**	**310,280**	**109,110**	**109,110**	**64,929**	**8,297,229**	**8,297,229**
November	1960	7,062,025[2]	267,166	35,175[2]	35,175	213,010	7,116,181	7,116,181
	1961	**8,683,809**	**293,891**	**104,881**	**115,282**	**89,470**	**8,877,829**	**8,877,829**
December	1960	8,002,664[2]	216,080	61,781[2]	60,854	42,375	8,177,296	8,177,296
	1961	**9,902,670**	**320,083**	**164,040**	**257,440**	**114,514**	**10,014,839**	**10,014,839**
Totals	1960	82,289,363[2]	3,303,227	783,737[2]	784,161	771,079	84,821,087	84,821,087
	1961	**99,753,214**	**3,369,575**	**793,639**	**897,440**	**662,056**	**102,356,932**	**102,356,932**

Month	Year	Gas-gathering System: Line Loss and Metering Difference[1]	Gas-gathering System: Delivered to—Westcoast Transmission (Dry Gas)	Gas-gathering System: Delivered to—Gas Plant (Wet Gas)	Gas Plant: B.C. Wet Gas Received from G.G.S.	Gas Plant: Plant Fuel	Gas Plant: Processing Shrinkage	Gas Plant: Plant Waste and Metering Difference	Gas Plant: Marketable Residual Gas
January	1960	—162,131	360,758	7,137,389	7,137,389	278,320	385,192	—37,979	6,511,856
	1961	**—79,995**	**295,249**	**8,277,095**	**8,277,095**	**275,776**	**448,061**	**—115,878**	**7,669,136**
February	1960	—133,276	377,030	6,658,813	6,658,813	239,901	359,521	—20,914	6,080,305
	1961	**—27,901**	**274,417**	**8,071,547**	**8,071,547**	**265,112**	**424,553**	**—137,037**	**7,518,919**
March	1960	—165,438	314,790	7,136,811	7,136,811	226,415	370,142	—67,622	6,607,876
	1961	**—142,725**	**301,516**	**9,375,106**	**9,375,106**	**278,917**	**465,395**	**—53,679**	**8,684,473**
April	1960	—153,797	402,769	6,871,661	6,871,661	205,139	348,198	—34,429	6,352,753
	1961	**—117,292**	**245,529**	**8,853,908**	**8,853,908**	**243,490**	**410,789**	**—20,836**	**8,220,465**
May	1960	—161,405	92,694	7,097,617	7,097,617	205,649	365,481	—51,485	6,577,972
	1961	**—98,905**	**295,379**	**8,430,723**	**8,430,723**	**231,315**	**399,690**	**—49,005**	**7,848,723**
June	1960	—133,886	222,480	6,749,021	6,749,021	213,722	347,352	—76,277	6,264,224
	1961	**—121,739**	**271,360**	**7,484,567**	**7,484,567**	**229,509**	**365,068**	**—44,428**	**6,934,418**
July	1960	—122,979	270,432	6,522,067	6,522,067	213,995	342,668	—69,614	6,035,018
	1961	**—156,913**	**272,016**	**7,506,327**	**7,506,327**	**231,545**	**366,596**	**—43,810**	**6,951,996**
August	1960	—223,091	265,977	6,671,547	6,671,547	246,763	359,771	—53,535	6,118,548
	1961	**—197,270**	**228,698**	**7,832,390**	**7,832,390**	**269,099**	**379,285**	**—30,527**	**7,214,533**
September	1960	—167,617	255,477	6,564,358	6,564,358	225,644	387,064	—146,380	6,098,030
	1961	**—155,439**	**258,596**	**7,990,791**	**7,990,791**	**282,138**	**287,532**	**59,703**	**7,361,418**
October	1960	—222,662	249,561	6,952,640	6,952,640	281,349	408,608	—113,560	6,376,243
	1961	**—66,234**	**309,440**	**8,054,023**	**8,054,023**	**168,825**	**350,447**	**157,666**	**7,377,085**
November	1960	—203,046	267,841	7,051,386	7,051,386	283,463	402,144	—7,289	6,373,068
	1961	**—80,353**	**293,931**	**8,664,251**	**8,664,251**	**178,311**	**350,346**	**163,047**	**7,972,547**
December	1960	—72,869	216,637	8,033,528	8,033,528	301,805	440,470	—131,807	7,423,060
	1961	**—1,616**	**322,930**	**9,693,525**	**9,693,525**	**167,805**	**456,393**	**224,991**	**8,844,336**
Totals	1960	—1,922,197	3,296,446	83,446,838	83,446,838	2,922,165	4,516,611	—810,891	76,818,953
	1961	**—1,246,382**	**3,369,061**	**100,234,253**	**100,234,253**	**2,821,842**	**4,704,155**	**110,207**	**92,598,049**

Month	Year	Transporters: Receipts: Marketable Residual Gas from Plant	Transporters: Receipts: B.C. Dry Gas from Plant	Transporters: Receipts: Alberta Dry Gas Imports	Transporters: Line Loss and Metering Difference[1]	Sales to Purchasers and Distributors: British Columbia: North-east	Sales to Purchasers and Distributors: British Columbia: Interior	Sales to Purchasers and Distributors: British Columbia: Lower Mainland	Sales to Purchasers and Distributors: United States	Total Sales
January	1960	6,511,856	360,758	2,926,141	231,847[2]	193,412[2]	612,302	2,064,077	6,697,117	9,566,908[1]
	1961	**7,669,136**	**295,249**	**2,427,406**	**194,566**	**217,387**	**858,941**	**2,157,413**	**6,963,484**	**10,197,225**
February	1960	6,080,305	377,030	2,647,499	61,836[2]	162,936[2]	503,859	1,866,257	6,509,946	9,042,998[1]
	1961	**7,518,919**	**274,417**	**2,140,860**	**260,773**	**192,193**	**691,841**	**1,893,712**	**6,895,677**	**9,673,423**
March	1960	6,607,876	314,790	2,747,590	236,919	173,252	569,836	1,899,016	6,791,233	9,433,337
	1961	**8,684,473**	**301,516**	**2,158,669**	**410,804**	**197,835**	**715,823**	**1,899,677**	**7,920,519**	**10,733,854**
April	1960	6,352,753	402,769	2,515,534	196,188	97,109	450,208	1,404,944	7,122,607	9,074,868
	1961	**8,220,465**	**245,529**	**1,505,891**	**260,839**	**144,377**	**599,124**	**1,672,521**	**7,295,024**	**9,711,046**
May	1960	6,577,972	92,694	2,492,742	162,344	94,676	406,937	1,262,444	7,237,007	9,001,064
	1961	**7,848,723**	**295,379**	**1,516,319**	**4,784**	**102,522**	**510,345**	**1,367,717**	**7,675,053**	**9,655,637**
June	1960	6,264,224	222,480	2,291,943	146,996	78,664	337,473	969,045	7,246,469	8,631,651
	1961	**6,934,418**	**271,360**	**1,401,804**	**101,434**	**73,001**	**462,490**	**962,993**	**7,007,664**	**8,506,148**
July	1960	6,035,018	270,432	2,351,786	207,787	61,373	328,179	791,704	7,268,193	8,499,449
	1961	**6,951,996**	**272,016**	**1,276,710**	**193,960**	**68,682**	**445,883**	**884,239**	**6,907,958**	**8,306,762**
August	1960	6,118,548	265,977	2,452,888	122,278	69,361	372,378	902,214	7,371,182	8,715,135
	1961	**7,214,533**	**228,698**	**1,079,657**	**129,676**	**68,788**	**457,476**	**894,812**	**6,972,136**	**8,393,212**
September	1960	6,098,030	255,477	2,007,115	218,960	87,310	408,538	1,092,490	6,553,324	8,141,662
	1961	**7,361,418**	**258,596**	**1,458,961**	**68,027**	**107,516**	**505,599**	**1,257,991**	**7,139,842**	**9,010,948**
October	1960	6,376,243	249,561	2,446,452	52,501	126,019	493,275	1,489,952	6,910,509	9,019,755
	1961	**7,377,085**	**309,440**	**1,982,879**	**79,916**	**153,403**	**645,364**	**1,843,517**	**6,947,204**	**9,589,488**
November	1960	6,373,068	267,841	2,524,124	223,397	170,551	753,164	2,058,396	5,959,525	8,941,636
	1961	**7,972,547**	**293,931**	**1,944,489**	**344,344**	**214,211**	**798,671**	**2,380,230**	**6,473,511**	**9,866,623**
December	1960	7,423,060	216,637	2,545,752	263,436	192,533	872,850	2,319,578	6,537,052	9,922,013
	1961	**8,844,336**	**322,930**	**2,423,831**	**396,123**	**250,718**	**895,323**	**2,759,347**	**7,289,586**	**11,194,974**
Totals	1960	76,818,953	3,296,446	29,949,566	2,124,489[2]	1,507,196[2]	6,108,999	18,120,117	82,204,164	107,940,476[1]
	1961	**92,598,049**	**3,369,061**	**21,317,476**	**2,445,246**	**1,790,633**	**7,586,880**	**19,974,169**	**85,487,658**	**114,839,340**

1 Differences in metered volumes necessitate adjustments between metering stations. The total of metering difference and line loss (or plant waste) is subtracted algebraically from the appropriate total; thus a minus figure represents an actual gain.
2 Amended.
1960: Volumes in M c.f. at 14.4 psia. and 60° F.
1961: Volumes in M c.f. at 14.65 psia. and 60° F.

TABLE 19.—MONTHLY NATURAL-GAS LIQUIDS AND SULPHUR DISPOSITION, 1960 AND 1961

	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Condensate/pentanes plus (bbl.)—														
Production	1960	72,578	56,328	65,751	62,714	65,916	61,774	53,448	59,053	62,942	64,701	60,054	65,589	750,848
	1961	**71,682**	**68,680**	**79,077**	**67,604**	**73,736**	**67,956**	**68,643**	**70,583**	**65,548**	**66,790**	**50,886**	**62,539**	**813,724**
Opening inventory	1960	....	....	....	....	....	....	....	....	....	....	....	19,634	....
	1961	***18,286***	***35,472***	***42,909***	***5,723***	***49,309***	***32,534***	***38,176***	***89,782***	***8,119***	***30,344***	***83,147***	***34,810***	***18,286***
Losses and adjustments	1960	28,900	25,400	32,488	20,631	26,316	36,433	26,850	15,023	31,720	18,233	....	....	261,994
	1961	....	....	....	....	....	....	....	....	....	....	....	....	....
Sales—														
British Columbia—														
Northeast British Columbia refineries	1960	43,678	30,928	33,263	42,083	39,600	25,341	26,958	44,030	31,222	46,468	40,420	66,937	470,568
	1961	**54,496**	**23,113**	**31,476**	**21,218**	**27,911**	**10,550**	**10,837**	**73,549**	**43,323**	**13,987**	**23,166**	**50,265**	**383,891**
Other British Columbia refineries	1960	....	....	....	....	....	....	....	....	....	....	....	....	....
	1961	....	....	....	**2,800**	**6,600**	**5,600**	**6,200**	....	....	....	....	....	**21,200**
Other	1960	....	....	....	....	....	....	....	....	....	....	....	....	....
	1961	....	....	....	....	....	....	....	....	....	....	....	**108**	**108**
Alberta	1960	....	....	....	....	....	....	....	....	....	....	....	....	....
	1961	....	**38,130**	**84,787**	....	**56,000**	**46,164**	....	....	....	....	**76,057**	....	**301,138**
Export	1960	....	....	....	....	....	....	....	....	....	....	....	....	....
	1961	....	....	....	....	....	....	....	**78,697**	....	....	....	....	**78,697**
Closing inventory	1960	....	....	....	....	....	....	....	....	....	....	19,634	18,286	18,286
	1961	**35,472**	**42,909**	**5,723**	**49,309**	**32,534**	**38,176**	**89,782**	**8,119**	**30,344**	**83,147**	**34,810**	**46,976**	**46,976**
Butane (bbl.)—[1]														
Production	1960	29,287	26,626	26,031	20,026	19,945	19,845	23,126	24,223	24,757	29,145	30,576	31,260	304,847
	1961	**33,037**	**30,537**	**29,564**	**25,742**	**25,521**	**24,741**	**24,726**	**24,578**	**27,428**	**28,079**	**11,935**	**35,818**	**321,706**
Opening inventory	1960	5,434	5,664	2,838	2,289	2,418	1,766	1,756	1,476	1,310	1,509	2,260	2,727	5,434
	1961	**1,210**	**2,569**	**1,663**	**1,822**	**2,460**	**1,833**	**1,601**	**3,217**	**1,037**	**1,933**	**83**	**1,817**	**1,210**
Receipts	1960	....	....	....	....	....	....	....	....	....	....	....	....	....
	1961	....	....	....	....	....	....	....	....	....	....	**2,064**	....	**2,064**
Losses, transferred, consumed	1960	9,493	3,854	13,125	16,410	15,787	14,494	15,756	7,997	8,475	9,630	12,061	14,326	141,408
	1961	**17,160**	**13,568**	**13,771**	**20,174**	**20,987**	**23,990**	**20,130**	**21,010**	**20,737**	**15,784**	**9,734**	**18,518**	**215,563**
Sales—														
British Columbia	1960	19,564	25,598	....	....	....	81	2,349	11,709	4,121	9,021	....	....	72,443
	1961	....	....	....	....	**22**	....	**499**	**3,717**	**3,895**	**7,522**	**1,528**	**7,780**	**24,958**
Alberta	1960	....	....	....	....	....	....	....	....	....	....	970	425	1,395
	1961	***1,319***	***726***	***583***	....	....	....	....	....	***898***	***324***	....	***811***	***4,761***
Export	1960	....	....	13,455	3,487	4,810	5,280	5,301	4,683	11,962	9,743	17,078	18,026	93,825
	1961	**13,199**	**17,149**	**15,051**	**4,930**	**5,139**	**983**	**2,481**	**2,031**	**1,002**	**6,299**	**1,008**	**7,044**	**76,316**
Closing inventory	1960	5,664	2,838	2,289	2,418	1,766	1,756	1,476	1,310	1,509	2,260	2,727	1,210	1,210
	1961	**2,569**	**1,663**	**1,822**	**2,460**	**1,833**	**1,601**	**3,217**	**1,037**	**1,933**	**83**	**1,817**	**3,382**	**3,382**
Propane (bbl.)—[1]														
Production	1960	10,623	5,807	7,018	7,215	9,149	8,260	10,391	11,380	10,804	14,132	16,152	16,706	127,637
	1961	**17,955**	**16,790**	**15,492**	**10,661**	**11,090**	**12,415**	**9,688**	**10,898**	**13,845**	**15,002**	**7,330**	**21,913**	**163,079**
Opening inventory	1960	1,336	2,726	1,762	2,628	1,118	2,669	426	1,318	1,808	452	2,102	809	1,336
	1961	**1,835**	**1,040**	**2,198**	**2,152**	**2,616**	**1,767**	**1,423**	**1,680**	**831**	**679**	**770**	**1,428**	**1,835**
Losses, transferred, consumed	1960	....	763	....	....	....	1,063	107	....	....	....	....	....	1,933
	1961	....	....	....	**5**	**445**	....	....	**—24**	**—11**	....	....	....	**415**
Sales—														
British Columbia	1960	9,233	6,008	5,975	8,725	7,598	9,440	8,482	9,938	11,278	11,415	15,931	14,259	118,282
	1961	**16,762**	**8,995**	**7,460**	**2,583**	**7,310**	**6,851**	**5,399**	**5,824**	**9,255**	**12,146**	**5,092**	**16,190**	**103,867**

[1] Includes butane and propane recovered from refinery gases. *See* Table 16 for amounts.

TABLE 19.—MONTHLY NATURAL-GAS LIQUIDS AND SULPHUR DISPOSITION, 1960 AND 1961—*Continued*

	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Propane—*Continued*														
Sales *Continued*														
Alberta	1960	......	......	......	......	......	......	......	......	......	......	......	100	100
	1961	......	**4,057**	**4,644**	**5,869**	**2,873**	**3,627**	**2,339**	**3,674**	**2,423**	**798**	**715**	**2,447**	**33,466**
Northwest Territories	1960	......	......	......	......	......	......	......	......	......	......	......	......	......
	1961	......	**281**	**191**	......	**92**	**515**	**89**	**268**	**94**	**282**	......	**984**	**2,796**
Yukon	1960	......	......	......	......	......	......	......	......	......	......	......	......	......
	1961	......	**377**	**1,193**	**684**	**511**	**689**	**688**	**857**	**886**	**723**	**377**	**380**	**7,365**
Export	1960	......	......	177	......	......	......	910	952	882	1,067	1,514	1,321	6,823
	1961	**1,988**	**1,922**	**2,050**	**1,056**	**708**	**1,077**	**916**	**1,148**	**1,350**	**962**	**488**	**781**	**14,446**
Closing inventory	1960	2,726	1,762	2,628	1,118	2,669	426	1,318	1,808	452	2,102	809	1,835	1,835
	1961	**1,040**	**2,198**	**2,152**	**2,616**	**1,767**	**1,423**	**1,680**	**831**	**679**	**770**	**1,428**	**2,559**	**2,559**
Sulphur (short tons)—														
Production	1960	5,420	5,007	5,194	5,152	5,262	4,803	4,597	4,823	4,937	4,699	5,090	5,470	60,454
	1961	**5,685**	**5,295**	**5,895**	**5,230**	**4,580**	**4,315**	**4,020**	**4,362**	**2,484**	**3,545**	**4,918**	**5,326**	**55,655**
Opening inventory	1960	74,734	76,958	78,637	81,039	82,552	84,502	86,738	88,683	90,934	92,494	94,359	95,070	74,734
	1961	**97,802**	**98,798**	**98,680**	**99,464**	**99,754**	**99,640**	**100,552**	**99,777**	**101,026**	**100,820**	**99,232**	**99,082**	**97,802**
Losses and adjustments	1960	......	......	......	......	......	......	......	—334	......	......	......	......	—334
	1961	......	......	......	......	......	......	......	......	......	......	......	......	......
Sales—														
British Columbia	1960	1,811	2,087	2,043	2,565	2,211	1,982	2,089	2,465	2,123	2,470	2,378	396	22,245
	1961	**1,982**	**1,879**	**2,554**	**1,950**	**1,667**	**1,669**	**2,754**	**1,691**	**1,039**	**2,591**	**2,075**	**1,128**	**22,979**
Export	1960	1,385	1,241	749	1,074	1,101	585	563	441	1,254	364	2,001	2,342	15,475
	1961	**2,707**	**3,534**	**2,557**	**2,990**	**3,027**	**1,734**	**2,041**	**1,422**	**1,651**	**2,542**	**2,993**	**2,127**	**29,325**
Closing inventory	1960	76,958	78,637	81,039	82,552	84,502	86,738	88,683	90,934	92,494	94,359	95,070	97,802	97,802
	1961	**98,798**	**98,680**	**99,464**	**99,754**	**99,640**	**100,552**	**99,777**	**101,026**	**100,820**	**99,232**	**99,082**	**101,153**	**101,153**

TABLE 20.—MONTHLY VALUE OF CRUDE OIL, NATURAL GAS, NATURAL-GAS LIQUIDS, AND SULPHUR TO PRODUCER, 1960 AND 1961

(Dollars.)

	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Crude oil	1960	152,245	128,406	137,596	48,259	97,742	147,277	185,802	146,919	174,807	129,345	44,588	138,063	1,531,049
	1961	**135,497**	**158,708**	**191,395**	**296**	**84,411**	**46,785**	**95,737**	**89,353**	**172,065**	**255,363**	**275,918**	**394,873**	**1,900,401**
Natural gas	1960	609,272	572,457	613,051	598,892	591,368	575,060	558,991	566,051	563,254	587,393	588,743	677,417	7,101,949
	1961	**724,287**	**713,506**	**823,696**	**778,916**	**750,405**	**666,353**	**665,945**	**685,495**	**702,201**	**708,167**	**757,984**	**841,936**	**8,818,891**
Natural-gas liquids	1960	54,878	38,159	36,521	44,729	42,352	27,555	29,409	56,342	41,198	60,726	77,652	84,127	593,648
	1961	**86,316**	**79,189**	**88,220**	**72,018**	**77,580**	**74,393**	**74,008**	**74,693**	**70,080**	**73,103**	**54,078**	**69,214**	**892,892**
Sulphur	1960	6,110	5,438	5,114	4,457	4,701	4,431	3,958	4,747	4,996	5,677	5,517	6,029	61,175
	1961	**5,962**	**5,351**	**5,861**	**4,233**	**3,990**	**4,054**	**3,642**	**4,002**	**2,150**	**3,289**	**4,665**	**4,936**	**52,135**
Totals	1960	822,505	744,460	792,282	696,337	736,163	754,323	778,160	774,059	784,255	783,141	716,500	905,636	9,287,821
	1961	**952,062**	**956,754**	**1,109,172**	**855,463**	**916,386**	**791,585**	**839,332**	**853,543**	**946,496**	**1,039,922**	**1,092,645**	**1,310,959**	**11,664,319**

NATURAL-GAS TRANSMISSION, GATHERING, AND DISTRIBUTION PIPE-LINES

Company	Source of Natural Gas	Size and Mileage of Transmission-lines		Compressor Stations		Present Daily Capacity (M S.C.F.)	Size and Mileage of Gathering and Distribution Lines		Areas Served by Distributors
		Size	Mileage	Number	Horsepower		Size	Mileage	
British Columbia Electric Co. Ltd.	Westcoast Transmission Co. Ltd.	12" 18" 20" 24" 30"	25.0 36.0 13.6 12.0 18.0	*Nil*	—	185,000	(1)	2,333.0	Lower Mainland.
Gas Trunk Line of British Columbia Ltd.	Fields	—	—	2	7,980	355,500			
	Beg	—	—	—	—	—	16"	27.4	
	North Beg	—	—	—	—	—	6.625"	3.2	
	Boundary Lake	—	—	—	—	—	16"	31.4	
	Jedney and Bubbles	—	—	—	—	—	10.75" 12.75"	7.04 17.8	
	North Jedney	—	—	—	—	—	12.75"	13.7	
	Laprise	—	—	—	—	—	12.75"	23.8	
	Nig Creek	—	—	—	—	—	16"	28.3	
Inland Natural Gas Co. Ltd.	Westcoast Transmission Co. Ltd.	0–2.9" 3–5.9" 6–8.9" 9–12.9"	4.7 70.2 46.9 268.8	*Nil*	—	50,000	(2)	663.0	Interior.
Northland Utilities (B.C.) Ltd.	Peace River Transmission	2" 4"	3.6 2.2	*Nil*	—	(3)	(2)	44.6	Dawson Creek.
Plains Western Gas & Electric Co. Ltd.	McMahon Plant	2" 3" 4" 6"	0.3 3.4 10.8 0.3	*Nil*	—	5,500	(2)	21.0	Fort St. John.
Westcoast Transmission Co. Ltd.	McMahon Plant and 26" line from Alberta	30"	646.6	4	55,690	450,000	—	—	
	Alberta	26"	32.5	*Nil*	—	215,000	—	—	
	British Columbia—								
	Alaska Highway system	—	—	—	—	—	26"	37.5	
	Alaska Highway system	—	—	—	—	—	20"	18.1	
	Alaska Highway system	—	—	—	—	—	20"	1.2	
	Alaska Highway system	—	—	—	—	—	18"	17.9	
	Alaska Highway system	—	—	—	—	—	12.75"	9.9	
	Blueberry West field	—	—	—	—	—	8.625"	6.7	
	Boundary Lake South field	—	—	—	—	—	16"	0.5	
	Buick Creek field	—	—	—	—	—	10.75"	5.6	
	Buick Creek West field	—	—	—	—	—	20"	16.2	
	Dawson Creek field	—	—	—	—	355,500[4]	8.625"	5.4	

	Fort St. John field	—	—	—	—	—	18"	7.8	
	Fort St. John field	—	—	—	—	—	10.75"	0.9	
	Fort St. John field	—	—	—	—	—	8.625"	0.7	
	Fort St. John Southeast field	—	—	—	—	—	12.75"	4.0	
	Gundy Creek field	—	—	—	—	—	10.75"	6.1	
	Kobes System, Kobes-Townsend field	—	—	—	—	—	12.75"	18.9	
	Montney field	—	—	—	—	—	4.5"	7.4	
	Parkland field	—	—	—	—	—	8.625"	6.6	
	Red Creek field	—	—	—	—	—	4.5"	2.9	
	Stoddart field	—	—	—	—	—	8.625"	6.3	
	Townsend system, Kobes-Townsend field	—	—	—	—	—	8.625"	5.5	

[1] Urban and suburban distribution. [2] Distribution. [3] Not available. [4] British Columbia gathering capacity.

CRUDE-OIL PIPE-LINES

Company	Fields Served	Size and Mileage of Main and Lateral Lines		Pumping Stations		Present Capacity (Bbl./Day)	Gathering Mileage	Throughput (Bbl./Day)	Storage Capacity (Bbl.)
		Size	Mileage	Number	Capacity (Bbl./Day)				
B.C. Oil Transmission Co. Ltd. (Blueberry field to Taylor)	Blueberry	4½" 8⅝" 12¾"	16.0 63.0 2.0	1	12,000	6,000	([1])	2,000	54,800
Trans-Prairie Pipelines (B.C.) Ltd. (terminal at Taylor)	Beatton River, Beatton River West, Boundary Lake, Milligan Creek, Peejay, Wildmint	4½" 6⅝" 8⅝"	8.6 24.3 76.0	6	29,330	29,330	37.9	19,300	60,000
Western Pacific Products and Crude Oil Pipelines Ltd. (Taylor to Kamloops)		12"	505.0	4	27,500	27,500	*Nil*	18,000	220,000

[1] Not available.

GAS-PROCESSING PLANTS, 1961

Operator	Location	Fields Served	Plant Type	Date on Stream	Plant Capacity (Thousand M S.C.F./Day)		Natural-gas Liquids	Residual Gas Sales to—	Remarks
					In	Out			
Pacific Petroleums Ltd.	Taylor	Beg, Blueberry, Blueberry West, *Boundary Lake, Bubbles*, Buick Creek, Buick Creek West, Fort St. John, Fort St. John Southeast, Gundy Creek, Halfway, Highway, Jedney, Kobes-Townsend, Laprise Creek, Laprise Creek East, Montney, Nig Creek, Red Creek, Snyder Creek, Stoddart	Amine treating, *oil absorption*	1957	330	300	Condensate/pen-*tanes plus*	Westcoast Transmission Co. Ltd. and *Plains* Western Gas & Electric Co. Ltd.	Began operation in November, *1957*.

SULPHUR PLANTS, 1961

Name	Location	Raw Material	Principal Product	Tonnage/Day (Short Tons)	Remarks
Jefferson Lake Petrochemicals of Canada, Ltd.	Taylor	Hydrogen sulphide	Sulphur	150	Began operation in November, 1957.

CRUDE-OIL REFINERIES, 1961

Name	Location of Refinery	Type of Refinery	Date of First Operation	Source of Crude	Crude-oil Capacity (Bbl./Day)	Storage Capacity (Bbl.)	Cracking Plant Units	Cracking Capacity (Bbl./Day)	Other Units
The British American Oil Co. Ltd.	Port Moody	Comp.	1958	Alberta	18,000	1,500,000	Catalytic-fluid	8,480	Catalytic reformer, distillate desulphurization, alkylation-sulphuric acid.
Imperial Oil Ltd.	Ioco (Vancouver)	S.C.A.	1915	Alberta	32,000	2,700,000	Catalytic-fluid	9,000	Catalytic polymerization, powerformer.
Royalite Oil Co. Ltd.	Kamloops	S.C.A.	1954	Alberta	5,000	400,000	Catalytic-fluid	1,400	Catalytic polymerization, platformer.
Shell Oil Co. of Canada Ltd.	Shellburn	Comp.	1932	Alberta	21,000	2,455,300	Catalytic-fluid	6,000	Catalytic polymerization, platformer.
							Thermal-visbreaking	3,000	Vacuum flashing, solvent fractionation, distillate hydrotreater.
Standard Oil Co. of British Columbia Ltd.	North Burnaby	Comp.	1936	Alberta	18,000	1,534,000	Catalytic-fluid	8,100	Catalytic polymerization, catalytic reformer, lube-oil blending plant, asphalt.
Pacific Petroleums Ltd.	Taylor	Comp.	1957, 1961	N.E. B.C.	3,800	400,000	Catalytic-fluid	2,000	Alkylation, asphalt depropanizer, pentane splitter.

Refinery symbols: S.—skimming; S.C.—skimming and cracking; S.C.A.—skimming, cracking, and asphalt; Comp.—complete.

Inspection of Lode Mines, Placer Mines, and Quarries

By J. W. Peck, Chief Inspector of Mines

CONTENTS

PRODUCTION

The output of metal mines for 1961 was 8,392,161 tons. This tonnage was produced from fifty-nine mines, of which thirty-nine produced 100 tons or more.

FATAL ACCIDENTS

During 1961 there were six fatal accidents connected with lode mines, placer mines, and quarries. This was six less than in 1960.

Tonnage mined per fatal accident during the last ten-year period was 907,800 tons.

The following table shows the mines at which fatal accidents occurred during 1961, with comparative figures for 1960:—

Mine	Mining Division	Number of Fatal Accidents 1961	Number of Fatal Accidents 1960
Bralorne	Lillooet	1	2
Britannia	Vancouver	....	1
Canam	New Westminster	....	1
Cassiar	Liard	....	1
Duncan	Slocan	....	1
Highland-Bell	Greenwood	....	1
Iron Mask	Kamloops	1	....
Keller P.M.L.	Fort Steele	1	....
Mastodon	Revelstoke	....	1
Mother Lode	Greenwood	2	....
Paradise	Golden	....	1
Reeves MacDonald	Nelson	....	2
Routledge Gravel Quarry	Vancouver	....	1
Sunro	Victoria	1	....
Totals		6	12

The following table classifies fatal accidents as to cause and location:—

Cause	Number	Location
Falls of person	1	Underground.
Vehicles	2	Surface.
Asphyxiation	2	Underground.
Conveyor belt	1	Surface.
Total	6	

A description of all fatal accidents follows.

Nels Raymond Johnson, aged 38, married, with four children, and employed as a truck-driver by Ernie's Transfer of Greenwood, was fatally injured at 8 p.m. on February 17th at the Mother Lode mine of Consolidated Woodgreen Mines Limited when the front-end tractor loader he was operating rolled over an embankment at the crushing plant.

The embankment is a rock-filled ramp which enables trucks, loaded with copper ore from the open-pit mine, to be dumped into the coarse-ore bin. A stockpile of ore is kept near the bin, and it was Johnson's job to operate the loader to transfer the ore from the stockpile to the bin. The loader would dig into the load, load bucket, turn toward bin, travel, dump, reverse to point of loading, turn into ore, and load. The ramp area is about 18 feet wide and the distance the loader travelled varied from 20 to 250 feet. The deceased had made several trips when it would appear that after loading the bucket he backed too far onto one edge of the ramp, and in turning to go to the bin the loader became overbalanced and upset over the edge. It rolled over one and a half times to the bottom of the slope, a distance of 40 feet. The accident was not observed, but Johnson was found shortly after, lying beside the loader. The doctor was immediately summoned, but death must have occurred quickly as there were crushing internal injuries, multiple rib fractures, and a broken spine.

The inquest into the death attached no blame to anyone. The jury recommended that a safely guard be secured along the embankment edges of the loading-ramp and that a protecting canopy be secured over the operator's area on the tractor.

The first part of the jury's recommendation was put into effect shortly after the accident.

Charles Edward Leathwood, aged 34, married, with two children, and employed as a miner at the Sunro mine of Cowichan Copper Co. Ltd., was killed when he fell about 240 feet in a vertical raise about 7 a.m. on May 13th.

The raise was being driven with the assistance of an Alimak raise platform, which operates on a monorail bolted to one wall. An Alicab servicing skip was used on the same monorail and was used between the raise platform and the bottom of the raise. On the day of the accident, near the end of the shift, Leathwood and his partner had completed drilling the round and the raise platform was in position at the top of the raise. Immediately prior to the accident Leathwood brought up explosives in the Alicab skip and transferred them to the Alimak control cage and then up to the top platform, where his partner was working. At this time the partner requested Leathwood to raise the Alimak to facilitate the loading of the drilled holes. Immediately after, the partner felt the Alimak platform move slightly and at the same time heard a peculiar noise. On calling Leathwood and getting no response, he investigated and found both Leathwood and the Alicab skip gone. He then lowered the Alimak platform to the bottom of the raise, where he noted the Alicab skip was damaged but still on the track. Leath-

Gear box in Alicab raise machine after fatal accident at Sunro mine.

wood was at the bottom of the raise, lying on some of the trailing hose of the Alicab machine. No sign of life was evident, and Leathwood was pronounced dead by the attending doctor who examined him after he was removed from the raise.

Subsequent examination disclosed Leathwood sustained multiple lacerations and abrasions about the face, neck, and wrists, fractures of the wrists, four ribs, and right ankle, hæmorrhages of the lungs, upper chest, and abdominal cavity. Death was believed due to multiple traumatic injuries resulting in massive hæmorrhage and shock.

External examination of the Alicab skip showed the driving mechanism to have failed but the brake mechanism to have been in good working order. On dismantling the drive it was noted the operating action was as follows: A chain drive connects the air motor to a sprocket on one end of a shaft having a worm screw thread part way along the shaft. The worm screw drives a bronze gear internally attached to a cast steel hub. The hub is attached by a countersunk key on a second shaft having a climbing sprocket on its outer end. The worm-screw bronze-gear assembly is known as an irreversible gear; that is, the screw can turn the gear but the gear cannot turn the screw.

On examination, the cast hub was found to be split into two pieces diagonally, the key unseated from the keyway, the bronze gear ruptured with an approximate gap of an inch and one-half between ends, and the gear separated from the hub. It was believed this damage could have developed during operations as a result of any or all of the following conditions: (1) Improper initial assembly, (2) faulty hub casting and (or) bronze gear, (3) the Alicab skip having been raised or lowered by some external agency when the power was off the skip. This would tend to force the drive to work in opposition to the irreversible gear.

As the hoist was assembled prior to delivery, the operating crew had no knowledge of the construction or assembly. It was reported that on a number of occasions the brake had jammed and the Alimak had been used to raise the Alicab. The driving mechanism could have been damaged at this time and finally failed at the time of the accident. The failure would have rendered braking impossible by the air motor but should not have influenced the manual or gravity operated brake. It was reported common practice to wire up this hand-brake as the Alicab skip approached the Alimak platform. This was done in order to free one hand to clear a passage through the Alimak air hoses while the other hand operated the motor controls. It was believed the brake handle was held up in some manner at the time of the accident as otherwise it would have functioned. After the accident the brake handle was examined, but nothing was present or attached to the cab which could have been used to tie back the handle.

The Coroner's jury returned a verdict of accidental death with no blame attached to anyone, but recommended (1) that the brass ring gear and cast hub be examined for metal fatigue, etc.; (2) that the brake system be revised so that the brake lever should not have to be wired in off position when moving Alicab; (3) that a telephone system be installed underground connecting with the surface.

Further to the jury's recommendations, the broken gear was given a metallographic examination by the British Columbia Research Council. The findings were that the casting was normal.

No permits are now in use for the Alicab in British Columbia. Discussion has taken place with the company's representative with respect to a redesign of the gear arrangement as well as an improvement of the braking system.

Fred Alex Derhousoff, aged 38, married, with four children, and employed as a crusher operator at Consolidated Woodgreen Mines Limited, was fatally injured by a conveyor belt at about 2.25 p.m. on August 2nd.

The site of the accident was the tail pulley of the No. 1 conveyor belt in the primary crushing plant. This pulley is located in a concrete well about 6 feet deep. Access is by steep concrete steps which lead to the back of the conveyor pulley. There is 6 inches clearance on either side between the pulley and the concrete walls. A chute feeds ore to the top of the belt near the pulley and a skirting or scraper board is fastened to the bottom of the chute in a position about 1 inch above the belt. There was no handrail alongside the stairway.

There were no witnesses to the accident. Another crusher operator was in the crushing plant prior to the accident, and he was aware that Derhousoff was going to enter the tail-pulley well, apparently to fix the skirting board. Derhousoff had shut off the conveyor to do this. The first-aid attendant, who was operating the weighing-scales outside the crushing plant, received a signal at the door of the plant that Derhousoff was going to turn on the conveyor, and it was about five minutes later that he went to look for Derhousoff. He found him lying on the steps of the concrete well with the clothes torn off his back and legs. The conveyor belt was running. He removed Derhousoff from the well and noted he was in severe shock and could not talk. Medical help was obtained, but the deceased died at about 3.20 p.m. while being transported from Greenwood to the Grand Forks hospital. Cause of death was massive rupture of the liver and the piercing of the lung by fracture of the fourth rib on the right-hand side.

It could not be determined whether the deceased tripped on the stairs and fell on the belt so that he was pulled up against the skirting board or whether his clothes were caught between the belt and pulley. It was standard procedure to shut off the belt before going into the well and it is not known why Derhousoff went down with the belt running.

At the inquest the verdict was that death was accidental, with no blame attached to anyone. It was recommended that "some form of guard be placed over the belt so that it is not possible for an operator to fall against the belt while in operation." The District Inspector required that this recommendation be carried out. He further ordered that handrails be installed on both sides of the stairway and a notice posted prohibiting the entering of the well while the belt is in motion.

Carl Bruhaug, aged 52, married, was asphyxiated in a placer mine he was working in partnership with another man on the Keller placer-mining lease on Moyie River near Cranbrook at approximately 5.30 p.m. on August 19th.

The fatality took place in a shaft 36 feet deep which was being sunk through gravel to reach bedrock. It is 6 feet 5 inches by 3 feet 2 inches in cross-sectional area and partitioned into two compartments. It was ventilated by a small fan, and normally dewatered by a small reciprocating type of deep-well pump, both of which were operated by gasoline motors located on the surface near the collar of the shaft.

On the day of the accident the two men had difficulty in operating the regular pump and decided to use a portable gasoline pump until the trouble could be located in the regular pump. This portable pump also did not appear to be working properly, and Bruhaug's partner ascended the shaft to check the outflow. On reaching the surface he noticed the ventilation fan had stopped, so he returned down the shaft to warn his partner. He met Bruhaug coming up on the second ladder and preceded back ahead of him. After climbing a short distance he thought he heard a thud and on investigating he found Bruhaug had collapsed and was hanging on the ladder by one leg. He was unconscious and groaning. The partner was not able to lift Bruhaug but managed to place him in a more comfortable position to assure that he would not fall down the shaft. He then went back up the shaft and on reaching the top collapsed. Recovering some time later he managed to crawl around the top of the shaft and cut the ropes on which the portable pump was hanging in the shaft, so that it would fall into the water and stop operating. He then returned down the shaft on several occasions after this, waving a cloth to try to circulate the air, but each time on returning to the surface he collapsed. It is understood that during this period that Bruhaug's wife, who was staying nearby, also came to investigate and went down the shaft herself but could find no sign of life in her husband. She did not collapse when in the shaft but complained of pains in her throat and chest. Eventually the two decided to fetch help, and after driving about half a mile down the road met two placer-miners who were working another placer operation a few miles down the river. These two placer-miners were experienced mine-rescue men and were able to effect a rescue, although not without some difficulty as ventilation had to be restored first. The body was recovered at 9.30 p.m. Artificial respiration was applied until the arrival of the doctor at 10.05 p.m., when death was pronounced.

An inquest was held on September 6th. Death was determined due to carbon monoxide poisoning as the result of the operation of a gasoline engine in the shaft. No blame was attached to anyone, but the jury "felt there was a certain amount of human error involved." *See* Prosecutions.

Robert Kenneth Gerlib, aged 24, single, and employed as a geologist at the Iron Mask mine of Kamloops Copper Company Ltd. near Kamloops, was asphyxiated some time between 11 a.m. and 2 p.m. on November 25th, when he entered old mine workings which had been abandoned for many years.

The Iron Mask workings are shaft workings, the deepest being about 750 feet below the surface. The Iron Mask shaft has been caved for several years and is inaccessible, but the mine can be entered by means of another shaft. The last work done in the mine was about thirty years ago. Recently a consulting firm, H. Hill & L. Starck & Associates Ltd., of Vancouver, had been engaged to examine the mine. On the day of the accident, Gerlib was accompanying Mr. Starck and the senior geologist in an exploration survey of the lower or 750 level. They had reached a point where further progress was impeded by water, and at this point Gerlib was ordered by Starck to remain until the other two returned in order that he could summon help if any trouble developed. When the two men returned to the point where Gerlib had been stationed, he was not in sight, and they proceeded out of the mine on the assumption that Gerlib had done likewise. However, Gerlib was not outside the mine, and thus a search was instituted. He was found some time later in sublevel workings, 35 feet above the 750 level. There was no sign of life. The search party of two which located Gerlib suffered dizziness but were able to remove the body to the 750 level. Artificial respiration was applied until 3.30 p.m., when the doctor arrived and pronounced death. There is natural ventilation on the 750 level, but none in the workings where Gerlib was found. On November 26th the workings were inspected by the District Inspector of Mines, and at that time the safety lamp went out at the raise entrance heading to the sublevel workings. An air sample was taken, which was shown by a later analysis to contain: Carbon dioxide, 0.65 per cent; oxygen, 14.08 per cent; combustibles, 0.11 per cent; carbon monoxide, trace; nitrogen, 85.16 per cent.

At the inquest the pathologist who performed the autopsy stated that there were no fractures or external injuries. The internal examination revealed findings similar to cases of asphyxiation. The jury brought in a verdict of accidental death with no recommendations.

Melville Carrington Waddell, aged 67, married, and employed as a tractor operator by Bralorne Pioneer Mines Limited, was fatally injured on December 23rd at approximately 6.10 p.m., when the Hough Payloader which he was driving slipped and went over the bank on the highway immediately east of Bralorne. He had been engaged in snow-ploughing in the Company townsite at Pioneer, 2 miles east of Bralorne, and at the time of the accident was returning to Bralorne, having completed his job. Apparently just previous to the accident he had driven the machine onto the snow-bank on the right-hand side of the road. In order to correct this situation, it would appear from the tire marks that he had backed out and then attempted to go forward. At this moment it would seem that his machine skidded on the icy surface of the road and then went over the bank on the left side of the road. The vehicle rolled to the bottom of the 25-foot bank. A witness, aged 16, was immediately on the scene. He found the deceased near the vehicle, covered him with his coat, and went for help. The local doctor was on the scene by 6.20 p.m., and found that Waddell was dead. A later autopsy disclosed that death was due to a crushing injury of the posterior chest wall, causing rupture of the lung, spleen, and kidney, with severe internal bleeding. There was no indication of a heart attack or other seizure. A blood sample submitted to the Vancouver City analyst was found to have an alcohol content of 0.28 per cent.

The deceased was a tractor operator of generally acknowledged experience and ability. He had been employed by Bralorne Pioneer Mines Limited, and by the former Bralorne Mines Limited, since 1934. For some days prior to the accident he had been assigned to snow-ploughing in the Bralorne Pioneer camp. Immediately previous to the day of the accident there had been a heavy snowfall, and on the days of the accident it had rained hard, making road conditions hazardous in places. The Hough Payloader was equipped with a blade for snow-ploughing. It carried skid chains on all four wheels. Waddell was last seen by his supervisor at 3.30 p.m., and at that time he appeared to be in normal health and condition. Examination of the vehicle after the accident indicated it had been in normal condition, but that the blade had been raised 6 to 8 inches above road level. It is thought that an operator of Waddell's experience should have had the presence of mind to drop the blade, which would probably have prevented the skid.

At the inquest the jury brought in its findings as follows: "We find that his death was accidental, and that no blame is attached to any person or persons. However, we, the jury, believe that the hazardous condition of the road, and the influence of alcohol a contributing factor."

The following recommendations were made by the jury:—

(1) "As medical advice on the man's reaction time, and complete medical factors relating to fatigue were not available (as yearly medical exams are not given to surface personnel), we therefore recommend yearly medical exams for all vehicle operators.

(2) "We recommend that any attachments to vehicles be tested by qualified persons as to:—

"(*a*) Stability.

"(*b*) Visibility.

"(*c*) Roadworthiness.

"(*d*) Any other factors which will contribute to the safety of the operator."

FATAL ACCIDENTS AND ACCIDENTS INVOLVING LOSS OF TIME

Six fatal accidents and 196 accidents involving a loss of time of over three days were reported to the Department. These were investigated and reported on by the Inspectors of Mines.

The following three tables classify these accidents as to cause, occupation, and as to the parts of the body injured. The fourth table lists all fatal and compensable accidents which occurred in lode mines over a ten-year period and relates these accidents to the number of persons employed and tons mined.

Accidents Causing Death or Injury Classified as to Cause

Cause	Number of Accidents	Percentage of Total
Explosives	4	2.0
Falls of ground	31	15.8
Falls of persons	33	16.8
Lifting and handling material	24	12.3
Machinery and tools	62	31.6
Transportation	18	9.2
Flames, heat, chemicals, etc.	6	3.1
Bins, chutes	1	0.5
Miscellaneous	17	8.7
Totals	196	100.0

Accidents Causing Death or Injury Classified as to the Occupation of Those Injured

Occupation	Number of Accidents	Percentage of Total
Underground—		
Chutemen	3	1.5
Haulagemen	12	6.2
Miners	73	37.2
Helpers	11	5.7
Timbermen	2	1.0
Mechanics, electricians, etc.	21	10.7
Miscellaneous	8	4.1
Surface—		
Shops	7	3.6
Mill	14	7.1
Quarries	11	5.6
Surface, general	34	17.3
Totals	196	100.0

Accidents Causing Death or Injury Classified as to Parts of the Body Injured

Location	Number of Accidents	Percentage of Total
Head and neck	18	9.2
Eyes	8	4.1
Trunk	57	29.1
Upper extremities	53	27.0
Lower extremities	50	25.5
General	10	5.1
Totals	196	100.0

Compensable Fatal Accidents Related to Tons Mined and Men Employed

Year	Number of Accidents	Number of Persons Employed	Frequency per 1,000 Persons	Tons Mined	Tons Mined per Accident
1952	1,327	9,610	139	9,174,617	6,910
1953	899	7,105	125	9,660,281	11,750
1954	718	6,293	114	8,513,865	11,850
1955	679	6,208	109	9,126,902	13,450
1956	615	6,507	94	8,827,037	14,350
1957	535	5,678	94	7,282,436	13,600
1958	396	4,353	91	6,402,198	16,200
1959	310	4,316	72	6,990,985	22,550
1960	394	4,389	90	8,242,703	20,920
1961	338	3,993	85	8,392,161	24,830

DANGEROUS OCCURRENCES

Twenty-two dangerous occurrences were reported as required by section 9 of the *Metalliferous Mines Regulation Act* and were investigated by the Inspectors of Mines. This compares with twenty-four reported for 1960.

Of these occurrences, five were connected with hoisting; three with haulage; four with subsidence or cave-ins; two with explosives; two with fires; two with flood water or muck; two with machinery; one with gas; and one with electricity.

On January 5, 1961, at the Texada iron mine, a slowly moving subsidence occurred on the main haulage road between the open pits and mill, necessitating suspension of travel over the affected section of the road. The road was built over glacial till with a thickness ranging from 55 feet to 95 feet, and it is believed the cause of the slide was the exceptionally heavy rainfall combined with the superimposed load of a waste dump located immediately above. In about a month's period the ground moved as much as 5 feet vertically and 20 feet horizontally.

On January 7, 1961, at Bralorne, a surge of water and fine muck spilled into the Crown shaft when the lower waste pocket was being drawn. The shaft sump was partially filled, and there was considerable damage to the loading mechanism. Precautions had been taken in the event of such an incident, and thus there were no injuries to personnel.

On January 15, 1961, at Britannia, an inrush of water occurred in the Victoria mine. This was caused by the blockage of a drainage system near a surface glory-hole.

On February 11, 1961, at Britannia, the hoisting-rope in No. 8 shaft was kinked and a set of guides was damaged when the shaft conveyance was lowered onto the spill pocket doors below a loading-pocket. The hoistman apparently failed to heed a red-light signal which warns when these doors are covering the shaft.

On February 19, 1961, at Britannia, in the No. 8 mine, a large cave occurred in two empty stopes, affecting an area from the 4300 level to above the 4200 level. No harm was done other than a break-through to a ventilation raise.

On March 21, 1961, at the Sullivan mine, a miner was slightly injured by a blast when he returned too soon to the scene of his blasting operation. The miner mistook the sound of a nearby blast for his own.

On March 28, 1961, at Britannia, considerable damage was done to the skip and shaft guides in the No. 8 shaft when the hoistman inadvertently raised the skip above the limit of the dumping range.

On April 6, 1961, at the Canam mine, a fire of undetermined origin destroyed the building containing the dry-house, power-house, and machine-shop.

On May 5, 1961, at the Jersey mine, a wedge-shaped slab weighing about 400 tons, 20 to 40 feet wide, 80 feet long, and one-half foot to 5 feet thick, peeled to a slip in the back of a stope. Two miners were in the stope at the time, but no one was injured.

On May 25, 1961, at the Merry Widow open-pit mine, two cracks developed about 30 feet back from the brow of the headwall, which was approximately 225 feet high. A 6-inch gap developed at a rate of movement of one-half inch in twenty-four hours. It was estimated 100,000 tons of rock was involved in the movement. Large bulldoze blasts involving up to 600 cases of explosives were detonated along the cracks, and when these were not successful in bringing down the headwall, it was removed by conventional mining methods.

On June 2, 1961, at Bralorne, two skip-tenders were injured slightly when a drill rod in the cage caught the shaft timbers as the cage was being hoisted. The load consisted of ninety 10-foot diamond-drill rods, and although they had been wedged in position, they had not been chained.

On June 2, 1961, at the Craigmont mine, a diesel locomotive, pulling eight loaded mine cars from underground en route to the dump, could not be braked to a stop and was carried under momentum to the end of the dump and onto the top of the ore-bin which was then under construction. The permanent stop-block had been removed while the rails were to be extended to the top of the ore-bin. No persons were injured.

On June 10, 1961, at the Bluebell mine, a miner guarding a blast underground was struck by a small piece of fly rock which punctured his leg to cause a compound multiple fracture of the tibia. The rock would have had to ricochet several times to reach the miner.

On June 14, 1961, at Bralorne, a fire occurred in an underground mechanics' shop in a container of oily rags. The smoke was so dense that the area had to be sealed off and a mine-rescue team used to extinguish the fire.

On June 30, 1961, at the Reeves MacDonald mine, a loaded muck skip fell about 200 feet and crashed through a sinking bulkhead when the brakes failed on the hoist. The skip stopped six shaft sets below the bulkhead. The shaft-sinking crew, who were farther below, escaped injury. The brakes were found in normal condition after the accident, but the hoist drum concerned was unclutched at the time for hoisting out-of-balance. A positive interlocking device was later installed which prevents a hoist drum from moving if there is brake failure when the drum is unclutched.

On July 2, 1961, at Cassiar, a truck was backed over an ore bench in the open pit and came to rest upside down on a bench 30 feet below. The driver remained with the vehicle and suffered minor injuries.

On July 7, 1961, at Britannia, the passenger train was derailed 2,800 feet from the portal in the lower adit. Minor injuries were received by one man. The cause of the derailment was worn mountings on the locomotive as well as some poor track.

On July 29, 1961, at the Giant Nickel mine, a hoisting-rope was damaged by electricity as the skip containing men was being hoisted past a level station. The cage struck the shaft gate, which had been knocked into the shaft by a nearby blast. This collision knocked out the post supporting the shaft signals and the cutout switch for the trolley feeder-line. The troller feeder-line was damaged, and the resultant sparking affected the hoisting-rope. A new hoisting-rope had to be installed.

On August 3, 1961, at Bralorne, an emission of methane occurred after completion of the drilling of a lifter hole at the face of a drift on the 77 vein on No. 38 level. The gas was ignited by one of the crew and burned for a short time. The crew was withdrawn by the shiftboss, but no sign of methane could be found a few hours later, and no further emissions of methane were reported.

On September 12, 1961, at the Texada iron mine, one man was burned and a multi-meter destroyed while he and another man were testing the low-voltage side of the potential transformer in the main switch cubicle of the mill. Apparently the meter test prods which one man was using came in contact with the 2,300-volt circuit.

On September 23, 1961, at Cassiar, four workmen were injured during the installation of a new haulage cable on the aerial tram-line. The end of the new cable had been spliced to an end of the used cable and was being drawn out by a tractor with the tram-line driving mechanism in the neutral position and the brake off. The used cable was rewound on a reel. The operation proceeded satisfactorily until an overload, presumably due to the brake being applied to the tram-line, caused the grab-hook on the tractor towing chain to spread apart. The cable was released and free haul-back of the line resulted. The reel upon which the cable was being wound moved forward suddenly to strike one of the workmen while the released cable struck three other men.

On October 7, 1961, at Cassiar, a bulldozer left the mine road and rolled down a gulley. The operator jumped clear and was not injured.

On December 22, 1961, at the Sullivan mine, a train comprising two explosive cars, with locomotive at rear, collided with a number of flat cars which had been left unattended in a drift. The front ends of both explosive cars were damaged, and two cartons containing explosives were damaged in the first car.

PROSECUTIONS

One prosecution was instituted under the *Metalliferous Mines Regulation Act,* as follows:—

A miner, and part owner of the Keller placer operation on the Moyie River, was charged under section 21, General Rule 21 (*a*), for using a portable gasoline pump to dewater a shaft on the property on August 19, 1961. The hearing was held at Cranbrook on September 19, 1961, and the miner pleaded guilty. He was fined $25 and $3.50 costs.

BLASTING CERTIFICATE SUSPENSIONS

There were violations of the provisions of the *Metalliferous Mines Regulation Act* in regard to the use of explosives and blasting procedure, but such violations were less than in former years. One miner had his blasting certificate suspended for one month for failing to properly guard a blast. Another miner had his certificate suspended for two weeks for using a bootleg hole to fasten an eyebolt.

EXPLOSIVES USED IN MINES

The table below shows the quantities of explosives and blasting accessories used in metal mines and quarries in British Columbia in 1957, 1958, 1959, 1960, and 1961:—

	1957 Total	1958 Total	1959 Total	1960 Total	1961 Total	1961	
						Mines	Quarries
High explosives (lb.)	7,103,000	5,485,000	6,319,000	7,188,000	7,280,000	6,784,000	496,000
Blasting-caps	1,676,000	1,244,000	1,587,000	1,320,000	1,719,000	1,612,000	107,000
Electric blasting-caps	64,000	84,000	46,000	124,000	145,000	135,000	10,000
Delay electric blasting-caps (short period)	160,000	129,000	157,000	146,000	154,000	143,000	11,000
Delay electric blasting-caps (L.P.V. delays)	127,000	128,000	153,000	146,000	170,000	170,000	
Primacord (ft.)	261,000	574,000	592,000	1,690,000	3,120,000	2,300,000	820,000
B-line detonating fuse (ft.)	2,049,000	2,197,000	1,972,000	2,311,000	3,199,000	2,412,000	787,000
Safety fuse (ft.)	13,367,000	11,272,000	11,411,000	10,288,000	11,244,000	10,990,000	254,000
Ignitercord (ft.)	639,000	469,000	775,000	555,000	881,000	881,000	
Ignitercord connectors	750,000	610,000	865,000	623,000	975,000	975,000	
Ammonium nitrate	5,000	190,000	872,000	1,641,000	2,647,000	1,972,000	675,000
"Hydromex"			325,000	862,000	2,116,000	1,782,000	334,000
"Amex"			20,000		169,000	169,000	
"Nitrone" S-1				6,000			
"Nitrone" S-1 primers				1,150			

The quantity of high explosives used in mines in 1961 increased 8 per cent over 1960, but that used in quarries decreased 50 per cent. This follows the trend established in former years for ammonium nitrate explosives to be accepted into nearly every surface blasting operation. Use of the slurry type of explosive, Hydromex (ammonium nitrate, T.N.T., and water), increased in 1961 to 250 per cent of that in 1960. The do-it-yourself explosive of ammonium nitrate and fuel oil (AN/FO) also continued its spectacular rise in annual consumption. During 1961 an innovation in its use was the introduction of compressed-air loading-machines which allowed the AN/FO to be blown into horizontal or " up " holes. The commercial form, Amex II, was allowed underground and rapidly became popular. This type of explosive has good safety features in that it cannot be detonated by ordinary impact, but there is a danger that its fume characteristics will change under certain conditions. Thus its use is contingent on a permit being obtained from the Chief Inspector of Mines, Victoria. For those operators who wish to blend their own ammonium nitrate and fuel oil, written permission must be obtained from the Chief Inspector of Explosives, Ottawa.

DUST CONTROL AND VENTILATION

Problems in dust control and ventilation have continued to receive the attention of mine operators and Government departments. Dust counts and ventilation surveys were made by the staff of the Chief Inspector, Silicosis Branch of the Workmen's Compensation Board, and the results of these surveys made available to the Inspectors of Mines. The following information is taken from his report, " Summary of Dust Conditions at British Columbia Metalliferous Mines during the Year 1961 ":—

" 1. Eighty-two surveys on dust control were made at fifty-seven metalliferous mines during 1961.

" 2. The main object in this inspection work is to determine the concentrations of dust present in the atmospheres and where necessary, give recommendations to apply measures for dust control which will lower the amount of dust to which the workmen are subjected.

"3. It is not known what concentration of silica dust is considered safe to breathe without producing silicosis. Other factors besides the dust concentration must be taken into consideration. The figure of 300 particles per c.c. of air has been chosen as an objective to work towards. When this figure is attained, it indicates a very great improvement over conditions existing several years ago.

" 4. Stoper drilling operations underground consistently produce the highest concentrations of dust during the time men are working. The dust counts at these operations used to be 2000 or more particles per c.c. of air. Sixty-two per cent of the surveys made in 1961 gave averages of less than 1000 particles.

" 5. At leyner, jackleg, and plugger drilling operations underground the dust concentrations are lower than at stoper drilling operations. Sixty-six per cent of the surveys gave averages of less than 500 particles per c.c. of air.

" 6. The averages for all other underground locations are quite satisfactory. Eighty-two per cent of the surveys made in 1961 gave averages of less than 300 particles. This condition is particularly satisfactory when considering the fact that the great majority of the men work in atmospheres containing this lower dust concentration. The percentage of mines having less than 300 particles has remained fairly constant during the past eleven years, varying between seventy-six per cent and ninety-three per cent.

" 7. Some other operations underground produce denser dust concentrations than the operations mentioned above. One of these is blasting operations, but the workmen are generally not subject to this dust or subjected to it for short periods of time only. Most of the blasting operations can be arranged to occur at the ends of the shifts and allow sufficient time for ventilation to remove the dust from the workings before the following shift goes to work. A certain amount of these operations, such as blasting in chutes, may be considered necessary so that the production of ore is not interfered with but this should be reduced to the very minimum. If such operations are carried on during the shift, the dust produced is sampled in our routine surveys and included in our averages.

" 8. Drilling in open pit mining operations give average dust concentrations that are very similar to those obtained at underground leyner drilling operations. Also the average of the dust counts obtained at all other operations in the open pit are similar to those obtained underground.

" 9. The averages at some of the crushing plants were not as satisfactory as that during the five years previous to 1960. Forty-nine per cent of the surveys in 1961 gave averages of 300 or less particles. This was a slight improvement over 1960.

" 10. Sixty-nine per cent of the surveys made in assay grinding rooms gave averages of less than 300 particles. This compares quite similarly with results obtained during immediate past years.

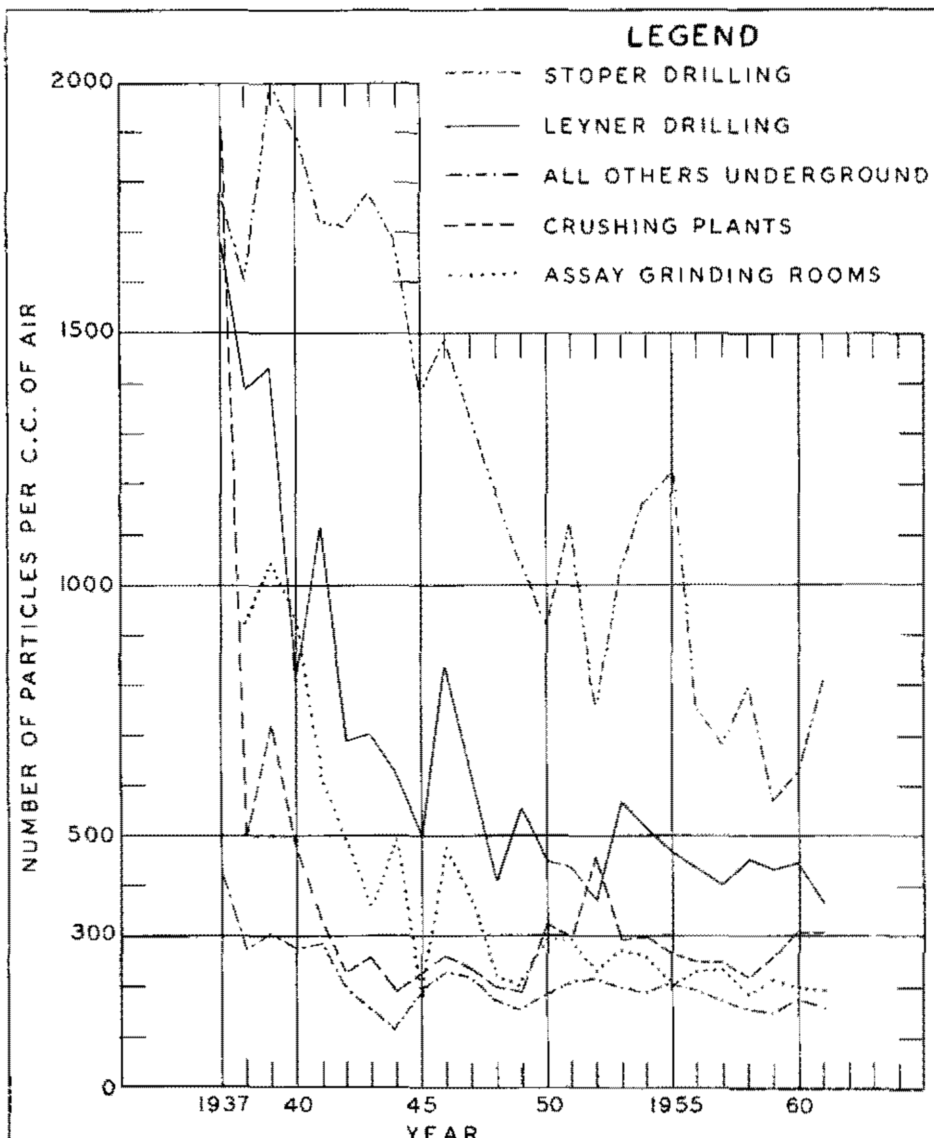


Figure 22. Average dust counts obtained each year since 1937.

"11. The percentage of certificates of fitness in good standing held by the employers for their workmen who require medical examination was more than ninety-six per cent. Considering the difficulties inherent in this work, the results are quite satisfactory.

"12. Aluminum powder prophylaxis treatments for the prevention of silicosis were given at three mines during the year. No aluminum powder therapy treatments were given at the Rehabilitation Clinic of the Workmen's Compensation Board in Vancouver, to men who have silicosis.

"13. The main measures for dust prevention, suppression, and elimination are receiving good attention at the metalliferous mines. The more important of these measures are: good ventilation; thorough wetting of the rock before it is handled in any manner; not subjecting the workmen to dust, fume and gases from blasting operations; using good exhaust systems in crushing plants, assay grinding rooms, etc. Full application of all measures at all times have not been obtained but the results have been quite satisfactory in most cases.

"14. Figure 22 is a graph showing the median of all the averages in various operations in the metalliferous mines, obtained each year since 1937."

SHIFTBOSS CERTIFICATES

The *Metalliferous Mines Regulation Act,* as amended in March, 1960, requires that every person employed underground be under the daily supervision of an official who is the holder of a shiftboss certificate issued under this Act. A Board of Examiners was appointed in May, 1960, and this consisted of R. B. Bonar, Deputy Chief Inspector of Mines, chairman, A. R. C. James, member; and J. E. Merrett, member.

An applicant for a shiftboss certificate is required to pass an examination on the *Metalliferous Mines Regulation Act* and general safe working practices. He must have three years' practical experience or one year plus a degree in mining engineering. He must also be the holder of a mine-rescue certificate and a first-aid certificate. A fee of $5 is charged for the examination.

The Board may grant provisional certificates under such conditions as the Board considers advisable. During 1960 and 1961 respectively, 243 and sixty-eight provisional certificates were issued, each good for two years from date of issue. The first examination for permanent certificates was held at Vancouver on November 21, 1960, and since then at various places throughout the Province. By December 31, 1961, 138 men had received their certificates, as follows:—

Certificate No.	Name	Date	Certificate No.	Name	Date
1	Albert Malvern Heath	21–11–60	20	Frank Wallace Griswold	4–3–61
2	Herbert R. Shuttleworth	23–11–60	21	Edwin Peterson	4–3–61
3	Gordon M. Begon	23–11–60	22	Thomas Daniel Boone	4–3–61
4	Luke Thompson Kirby	23–11–60	23	William Albert G. Yerbury	4–3–61
5	Albert R. Wells	23–11–60	24	Garnet Coulter	4–3–61
6	John Arthur Dyck	23–11–60	25	Stanley Hodgson	4–3–61
7	James C. MacCullock	23–11–60	26	William Jones	4–3–61
9	Leslie R. Archibald	23–11–60	27	John Oakley Trinder	4–3–61
10	John Welter	23–11–60	28	Carl Hjemaas Olson	4–3–61
11	Robert Elmer Oakes	23–11–60	29	John Peter Rokosh	4–3–61
12	Alexander Pirie Mill	23–11–60	30	Harold Dean Johnson	4–3–61
13	James G. Scott	4–3–61	31	George Angus Derry	4–3–61
14	John K. Walsh	4–3–61	32	Roland Trevor Trenaman	4–3–61
15	William Cairns	4–3–61	33	William Arthur Cavan Jeffery	4–3–61
16	Myles Norman Anderson	4–3–61	34	Victor Albert Marunchak	4–3–61
17	George Bruce Crowe	4–3–61	35	Erick Walter Ekskog	4–3–61
18	William Leslie Pratt	4–3–61	36	Bernard Joseph N. Malchelasse	4–3–61
19	Percy Moody	4–3–61	37	Peter Richard Kotush	4–3–61

Certificate No.	Name	Date	Certificate No.	Name	Date
38	Albert Dellert	4-3-61	89	Walter Thiessen	13-5-61
39	William Ralph Robertson	4-3-61	90	George James Lee	13-5-61
40	Gordon Russel Edmonds	4-3-61	91	Earl Fred Menhinick	13-5-61
41	William Harvey Webber	4-3-61	92	Adam Okrainec	13-5-61
42	Thomas Victor Mawson	4-3-61	93	George Vooro	13-5-61
43	William Muir, Jr.	4-3-61	94	Thomas William Illidge	13-5-61
44	John Helmer Ekskog	4-3-61	95	Edward Partridge	21-11-60
45	James Dixon	4-3-61	96	Bernard Winston Bradford	13-5-61
46	Lloyd George Coulter	4-3-61	97	Terrance Bunka	23-5-61
47	George Wilkie McFarlane	4-3-61	98	William Edwin Hyde	13-5-61
48	Francis Cornelius Lowes	4-3-61	99	John Francis Ablett	13-5-61
49	John Walter Jewitt	4-3-61	100	Donald P. Cripps	23-11-60
50	William Cox	4-3-61	101	Donald C. Shavela	23-11-60
51	Reginald Walter Hoiditch	4-3-61	102	Herbert L. Fuerst	9-9-61
52	*John Joseph McKay*	*4-3-61*	*103*	*Robert J. Brown*	*9-9-61*
53	Terrant Ogden Bloomer	4-3-61	104	Peter Badyk	9-9-61
54	James Allen Byrne	4-3-61	105	Brian Buckley	9-9-61
55	William Edward Walsh	4-3-61	106	William H. Childress	9-9-61
56	Harvey Donald J. McDonald	4-3-61	107	Clarence L. Fiedler	9-9-61
57	Brian T. Stephens	24-3-61	108	Robert G. Weber	9-9-61
58	William Muir, Sr.	22-4-61	109	Erling R. Mathisen	9-9-61
59	*Hans Oslie*	*22-4-61*	*110*	*Kenneth Munro*	*9-9-61*
60	John A. McSporran	22-4-61	111	Harold E. Wright	9-9-61
61	Leslie McCarson	22-4-61	112	George Stregger	9-9-61
62	Edmund H. Nagle	22-4-61	113	George Friesen	22-9-61
63	James S. Riddell	22-4-61	114	Harvie M. Ingram	22-9-61
64	George William Law	13-5-61	115	Albe Sevigny	22-9-61
65	Alexander John Richardson	13-5-61	116	Charles McNeil	20-9-61
66	*Alvin Ronald Peterson*	*13-5-61*	*117*	*George A. Peebles*	*20-9-61*
67	Ralph Giffin Peitzsche	13-5-61	118	Alexander H. J. MacCullock	20-9-61
68	Donald C. Plecash	13-5-61	119	Gordon Wyse	20-9-61
69	Carman McInnis	13-5-61	120	Archibald H. White	20-9-61
70	Ronald Louis Turner	13-5-61	121	Sydney W. Allen	20-9-61
71	Roy G. McLeish	13-5-61	122	Marcel Guiguet	20-9-61
72	William Hugh Peter	13-5-61	123	John Johnson	22-9-61
73	George A. Sutherland	13-5-61	124	James B. Magee	24-11-61
74	John William Robinson	13-5-61	125	Joseph U. Blais	24-11-61
75	John Donald McDonald	13-5-61	126	Gunter Polivka	24-11-61
76	Peter Rollick	13-5-61	127	Bertram A. McConachie	24-11-61
77	Norman Idwal Poole	13-5-61	128	Daryl G. McSpadden	24-11-61
78	Charles Stanley Comfort	13-5-61	129	William W. Cummings	24-11-61
79	George Walter Steacy	13-5-61	130	Donald M. Edwards	24-11-61
80	Francis H. T. Webster	13-5-61	131	Leonard E. Cox	25-11-61
81	Sebastian Flegel	13-5-61	132	J. P. Duval	25-11-61
82	Edward C. Ingham	13-5-61	133	Roy R. McMichael	25-11-61
83	Bruce Glover Hawkins	13-5-61	134	Robert L. Ralph	25-11-61
84	Philip E. Rowan	13-5-61	135	Angus McIntyre Scott	25-11-61
85	Gerald A. Rose	13-5-61	136	John W. Rogers	25-11-61
86	Fred Menhinick	13-5-61	137	John E. Merrett	11-12-61
87	Robert Richardson	13-5-61	138	James N. McMorrow	9-9-61
88	Allan W. Poole	13-5-61	139	Norman C. Hilborn	13-5-61

MINE RESCUE, SAFETY, AND FIRST AID

The promotion of mine rescue and first aid continued at a high level throughout 1961. Three mine-rescue stations were fully maintained and another on a part-time basis. An instructor qualified in mine rescue and first aid was available at each station. Each station is equipped with sufficient self-contained oxygen breathing apparatus to maintain two mine-rescue teams of six men each should any emergency in nearby mines arise. There are also sets of mine-rescue equipment maintained at various mines, either on loan from the Government or owned by the mine. In 1961 Government-owned equipment totalled forty-seven McCaa two-hour apparatus and forty-eight Chemox three-quarter-hour apparatus, while that owned by mining companies totalled thirty-seven McCaa's and forty-seven Chemox's. Each station also has auxiliary equipment such as all-service masks, self-rescuers, gas detectors, inhalators, and a complete set of first-aid equipment. The district instructor makes a periodic check of mine-rescue and first-aid equipment at mines in his district.

The station at Cumberland was maintained to serve the Tsable River coal mine, with an instructor hired on a part-time basis. There was an emergency call for the equipment in December when an underground fire broke out at the mine. Most of the rescue equipment was moved to the mine for use during the inspection and control of the fire. The only other call for equipment was for oxygen to be supplied to the local fire department. A truck is kept at the station for emergency purposes.

The Princeton station, which was opened in 1931, was closed in August, 1961, and the office of the instructor moved to Kamloops. A mobile unit has been used since 1957 to give service over a wider area. Mine-rescue and first-aid training were given at Cassiar, Texada, Britannia, Giant Nickel, Phoenix, Woodgreen, Canam, Ideal Cement, Imperial Limestone, Gypsum Lime and Alabastine, McKinney, and Craigmont mines. Forty-one persons received mine-rescue certificates, fourteen received industrial first-aid certificates, and 154 received St. John Ambulance certificates. Travelling during 1961 amounted to 11,862 miles.

The East and West Kootenay areas have been serviced since 1950 by a mobile mine-rescue unit stationed at Nelson. Mine-rescue courses were held at the Bluebell, Jersey, H.B., Reeves MacDonald, and Mineral King mines. First-aid classes were given at the larger mines or at nearby villages to a total of 147 St. John Ambulance and twenty industrial first-aid candidates. Help was given to the Nelson, Salmo, and New Denver fire departments in the use and care of oxygen breathing apparatus and gas masks. A course in life-saving was given to a class of thirty-five at Procter. One new McCaa two-hour apparatus was added to the equipment.

The mine-rescue station at Fernie is maintained principally to serve the coal mines in the area, but assistance in mine-rescue training is also given to personnel of the Sullivan and Mineral King mines. Thirty new candidates took the mine-rescue course and were awarded certificates. First-aid classes were fairly well attended, and twenty-two persons completed the course and received awards. There were no emergency calls for the equipment during 1961.

A certificate of competency in mine-rescue work is granted to each man who takes the training course and passes the examination set by the Department of Mines and Petroleum Resources. During 1961, in addition to the regular teams in training, eighty-six men took the course and were granted certificates, as follows:—

Certificate No.	Name	Where Trained	Certificate No.	Name	Where Trained
3255	William Francis Black	Bralorne.	3278	Robert Armour Mitchell	Cassiar.
3256	Victor Zaporoyan	Bralorne.	3279	Rupert Lynn McKenzie	Cassiar.
3257	William Muir, Sr.	Kimberley.	3280	Donato Demitri	Cassiar.
3258	S. Vander Maaten	Kimberley.	3281	James R. Murdoch	Cassiar.
3259	Arthur Lewis Burrows	Kimberley.	3282	Kenneth R. Maver	Grand Forks.
3260	James Riddle Buchanan	Kimberley.	3283	Douglas Fraser Irving	Grand Forks.
3261	Norman C. Knippleberg	Kimberley.	3284	Newman Glen Cornish	Grand Forks.
3262	Dugal Roy McMillan	Kimberley.	3285	Howard Harry Engel	Greenwood.
3263	Robert James McSporran	Kimberley.	3286	Ralph Andrew Andersen	Greenwood.
3264	Leonard Nelson	Kimberley.	3287	Leslie Lewis	Cumberland.
3265	John Clayton Hart	Kimberley.	3288	Thomas P. Shilton	Cumberland.
3266	Stanley Hodgson	Kimberley.	3289	William Webb Cummings	Toby Creek.
3267	Terrance William Johnson	Kimberley.	3290	Lloyd Walter Smith	Toby Creek.
3268	Ambrose Joseph Kennedy	Kimberley.	3291	Ralph Paton Wismer	Toby Creek.
3269	Hugh Joseph Chesser	Kimberley.	3292	Uldege Joseph Blais	Toby Creek.
3270	Nicholas Kostuik	Kimberley.	3293	Reino Olavi Lehtonen	Toby Creek.
3271	Thomas Pierre Huppie	Kimberley.	3294	Peter Jacob Jantz	Toby Creek.
3272	Albert Tindale Richardson	Kimberley.	3295	Daryl George McSpadden	Toby Creek.
3273	George Trowsdale	Cassiar.	3296	William Emil Stark	Toby Creek.
3274	Frank Clarke	Cassiar.	3297	Harry Burgoyne	Toby Creek.
3275	Cyril F. Dopson	Cassiar.	3298	Konrad Butler	Toby Creek.
3276	Heinz Beyer	Cassiar.	3299	Gunther Poliva	Toby Creek.
3277	Don Ritchat	Cassiar.	3300	Kenneth Slobodian	Toby Creek.

Certificate No.	Name	Where Trained	Certificate No.	Name	Where Trained
3301	Dieter R. G. Millahn	Toby Creek.	3321	John A. McKinley	Riondel.
3302	Ubaldo Minelli	Toby Creek.	3322	Dennis G. Bouillet	Riondel.
3303	Robert Joseph Brown	Salmo.	3323	Stanton R. Foster	Riondel.
3304	Michael Karwtski	Britannia Beach.	3324	Anthony J. Petrina	Merritt.
3305	Donald Lindley	Britannia Beach.	3325	Bruno Batschies	Merritt.
3306	William J. Marsh	Britannia Beach.	3326	Derek H. Channon	Merritt.
3307	Ronald D. Harrison	Britannia Beach.	3327	Murray Zulps	Merritt.
3308	Ugo Peressini	Britannia Beach.	3328	Robert A. Baase	Merritt.
3309	Marcel Guillemette	Britannia Beach.	3329	Anthonic Luteyn	Merritt.
3310	John Johnson	Britannia Beach.	3330	Michael N. Osoki	Merritt.
3311	William Stewart	Salmo.	3331	George C. Sharpe	Merritt.
3312	Cory V. Sibbald	Salmo.	3332	Thomas M. Waterland	Merritt.
3313	Harold G. Copley	Salmo.	3333	John B. Evans	Merritt.
3314	Alastair H. Summers	Salmo.	3334	Charles J. Mountain	Merritt.
3315	John Sutherland	Salmo.	3335	Roger Pegoraro	Remac.
3316	Oliver D. Johnson	Kaslo.	3336	Anthony John Poloskas	Remac.
3317	Karl Borowski	Riondel.	3337	James N. McMorrow	Remac.
3318	Richard C. Wills	Riondel.	3338	William Oliver Pollock	Remac.
3319	Leonard Brown	Riondel.	3339	Larry Jacobsen	Remac.
3320	Archibald F. Buie	Riondel.	3340	Norman Hilborn	Remac.

The mine safety associations in different centres of the Province, sponsored by the Department of Mines and Petroleum Resources and aided by company officials, safety supervisors, Inspectors of Mines, and mine-rescue instructors, continued to promote mine-rescue, first-aid, and safety education in their respective districts.

The Vancouver Island Mine Safety Association held its forty-seventh annual competition in Cumberland on May 27, 1961. Three teams competed in the mine-rescue event—two from the Tsable River mine and a visiting team from Britannia. The winning team was from the Tsable River mine and was captained by W. High.

The East Kootenay Mine Safety Association held its annual competition at Fernie on June 3, 1961. Five teams took part in the mine-rescue competition—two from Kimberley, and one each from Fernie, Michel, and Toby Creek. First place was won by a Kimberley team captained by J. K. Walsh.

The Central British Columbia Mine Safety Association held its thirteenth annual competition at Kamloops on June 10, 1961. Four teams took part in the mine-rescue competition—two from Britannia and one each from Bralorne and Cariboo Gold Quartz mines. A Britannia team captained by L. Kirby took first place.

The West Kootenay Mine Safety Association held its fifteenth annual competition at Nelson on June 17, 1961. Five teams took part in the mine-rescue event—two from Bluebell mine and one each from the Canadian Exploration, H.B., and Reeves MacDonald mines. A Bluebell team, captained by B. Ramage, took first place.

At all meets, competitions were held in first-aid as well as mine-rescue work. In these competitions, events were held for women and juniors. There were entries in these competitions from industries and organizations not necessarily connected with mining.

The Bridge River Valley Mine Safety Association held its annual competition at Bralorne on October 21, 1961. This was a first-aid meet with events for juniors and seniors. The senior event was quite spectacular in that simulated casualties were used to show what could happen on the fringe area of an atomic bomb burst. The winning team for this event was captained by M. Mitchell.

The sixth Provincial mine-rescue competition was held at Nanaimo on June 24, 1961. The winning teams from the Cumberland, Fernie, Nelson, and Kamloops events competed for a trophy and silver trays. The event was won by the Sullivan mine team captained by J. K. Walsh. The team also won a silver cup which has been donated by the International Union of Mine, Mill and Smelter Workers for annual competition for mine-rescue teams from metalliferous mines. In conjunction with this competition, the Workmen's Compensation Board sponsored the fifth Provincial men's first-aid competition and St. John Ambulance sponsored the third Provincial ladies' first-aid competition. Teams competed which had won local events at Victoria, Kitimat, Vancouver, Fernie, Kamloops, Cumberland, and Nelson. The men's winning team was the Metropolitan Ambulance Services team captained by Ben Pietz. The ladies' winning team was the First-aid Patrol team from Vancouver captained by Carol Bradshaw.

JOHN T. RYAN TROPHY

The John T. Ryan Regional Safety Award for the metal mine with the lowest accident frequency record for 1961 was won by the H.B. mine of The Consolidated Mining and Smelting Company of Canada, Limited, at Salmo. To win this trophy the mine completed the year without a single compensable accident. The record also won the Dominion Ryan Trophy for metal mines for the third time, an outstanding record in the history of the competition. The company's safety organization, officials, and employees are entitled to high praise for this accomplishment.

The 1961 Regional Safety award for coal mines was won by the Tsable River mine of the Comox Mining Company Limited. Only five compensable accidents occurred at this mine during 1961. This excellent record won the Dominion Ryan Trophy for coal mines. The record is particularly enviable when it is considered that this is the first time the Dominion Trophy has been won by a coal mine in British Columbia.

WEST KOOTENAY MINE SAFETY ASSOCIATION TROPHY

The West Kootenay Mine Safety Association in 1951 donated a safety trophy for annual competition in order to encourage and promote safety in small mines not eligible for the John T. Ryan awards. At first the trophy was restricted to mines in the West Kootenay area, but in 1956 this restriction was removed.

The award is made to the mine having the lowest accident rate and working a total of from 2,500 to 30,000 shifts per year, one-third of these having been worked underground. An accident is taken as one which involved more than three days' loss of time.

In 1961 the award was won jointly by the Benson Lake mine of The Consolidated Mining and Smelting Company of Canada, Limited, and the Violamac mine of Violamac Mines Limited. Both mines completed the year without a single compensable accident. This is a most commendable record—for Benson Lake because it was in the throes of development and for Violamac because this was the fifth time this mine had won or shared first-place honours.

SAFETY COMPETITION, OPEN-PIT MINES AND QUARRIES

The open-pit or quarry industry has become increasingly important to the economy of British Columbia, but while its safety record has compared favourably with the rest of the mining industry, there has been little recognition of this fact. In 1961 the Department of Mines and Petroleum Resources instituted a safety competition for this industry and put up awards and a trophy for annual competition.

The trophy is awarded to the operation having worked a minimum of 75,000 man-hours in the year and having the lowest number of compensable injuries per million man-hours of exposure. For those operations which amass over 15,000 man-hours per year, certificates of achievement are given when no compensable accidents occur during the year.

In 1961 the trophy was won by the Phoenix Copper Company Limited with an injury frequency rate of 7.31. Four quarries received Certificates of Achievement, as follows: British Columbia Cement Company Limited, at Cobble Hill; Dominion Tar & Chemical Company Limited, at Blubber Bay; Ideal Cement Company Ltd., at Vananda; Evans, Coleman and Evans Limited, Producers Sand & Gravel Division at Royal Roads.

BRITISH COLUMBIA MINING ASSOCIATION, SAFETY DIVISION

This division continued to foster and encourage safe working practices to prevent accidents and injuries, and to supervise a safety-training programme in the mining industry. The lost-time injury frequency of the reporting lode-mining companies was reduced from twenty-eight in 1960 to twenty-one lost-time injuries for each million man-hours of exposure in 1961. This decrease is the greatest average yearly decrease since inauguration of the programme in 1955.

Injury statistics for 1961 are based on reports from twenty-four lode-mining companies and one coal-mining company, while in 1960 only twenty-one lode companies reported.

With the expanding interest in safety, with the evolution of safer work procedures and methods, and with additional training in safety, progress is being made in the difficult task of injury prevention.

AWARDS FOR BRAVERY

The following is taken from the Dangerous Occurrence section, page 206, of the Annual Report for 1960: " On October 21st, 1960, at Britannia, a miner was trapped for eight hours in a cave caused by a rock-burst. His left forearm was removed during the rescue operation."

In October, 1961, Her Majesty Queen Elizabeth bestowed honours for heroism performed in the rescue involved in the above incident. John Johnson received the Queen's Commendation for Brave Conduct for his work as leader of the rescue team. George J. Priessler received the George Medal for his work on the rescue team, being the first man to reach the trapped miner. Dr. B. Flather received the award of Member of the Order of the British Empire for performing the difficult surgical amputation that was necessary to release the trapped miner.

Coal

By Robert B. Bonar, Deputy Chief Inspector of Mines

CONTENTS

PRODUCTION

The gross output in short tons of the coal mines of the Province for 1961 was 1,018,832 tons, an increase of 174,332 tons or 20.6 per cent over 1960. A total of 141,747 tons came from strip mines at Michel and Tent Mountain.

The Vancouver Island District produced 78,310 tons, a decrease of 13,094 tons or 14.3 per cent from 1960.

The Northern District production was 7,826 tons, an increase of 116 tons or 1.5 per cent over 1960.

The Nicola-Princeton District production was 505 tons, a decrease of 900 tons or 63.9 per cent from 1960.

The East Kootenay District production was 932,191 tons, an increase of 188,212 tons or 25.3 per cent over 1960.

Output and per Capita Production, 1961

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)
Tsable River Mine, Comox Mining Co. Ltd.	75,324	234	105	3.06	717	95	3.38	793
Midan Mine (Chambers No. 5 mine)	853	228	2	1.87	426	2	1.87	426
Loudon No. 6 mine	353	85	3	1.38	118	2	1.38	118
Lewis mine (Timberlands)	681	176	3	1.28	227	3	1.28	227
Carruthers & Wakelem No. 3 mine	223	103	1	2.16	223	1	2.16	223
Stronach mine	243	105	2	1.15	121	2	1.15	121
Undun No. 3 mine	633	182	2	1.73	316	2	1.73	316
Princeton Blue Flame No. 3 mine	346	64	2	2.70	173	2	2.70	173
Coldwater mine	159	100	2	0.80	80	2	0.80	80
Bulkley Valley Collieries	5,764	138	16	2.61	360	11	3.79	524
Gething No. 3 mine	2,062	206	7	1.43	295	5	2.00	412
Michel Colliery (underground)	790,444	237	771	4.32	1,025	578	5.76	1,367
Michel Colliery (strip)	87,620	237	13	28.40	6,740	—	—	—
Coleman Collieries (strip)	54,127	216	13	19.36	4,163	—	—	—

NOTE.—The Reschke mine did not operate during 1961.

District Output and per Capita Production, Underground Mines, 1961

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	78,310	118	664	107	732
Nicola-Princeton	505	4	126	4	126
Northern	7,826	23	340	16	489
East Kootenay	790,444	771	1,025	578	1,367
Whole Province	877,085	916	957	705	1,244

Output per Man-shift, Underground Mines, 1952–61

Year	Man-shifts[1]	Tonnage	Average per Man-shift (Tons)
1952	383,422	1,388,732	3.62
1953	333,922	1,171,932	3.51
1954	280,353	1,064,023	3.79
1955	304,139	1,157,813	3.86
1956	307,821	1,100,434	3.57
1957	226,536	945,848	4.17
1958	204,148	728,722	3.56
1959	171,608	646,788	3.77
1960	210,254	766,581	3.66
1961	213,962	877,085	4.10

[1] Includes both surface and underground workers.

Collieries of British Columbia, 1961—Production and Distribution, by Collieries and by Districts (in Short Tons)

Mine	Gross Output	Washery Refuse	Net Output	Used Under Companies' Boilers, etc.	Used in Making Coke	Stocks				Sales				Total Coal Sold and Used[1]
						On Hand First of Year	On Hand Last of Year	Added To	Taken From	In Canada	In U.S.A.	Elsewhere	Total Sales	
Vancouver Island District														
Comox Mining Company Ltd.—Tsable River Colliery	75,324	......	75,324	......	......	9,152	11,453	2,301	......	73,023	......	......	73,023	73,023
Midan mine (Chambers No. 5)	853	......	853	......	......	......	......	......	......	853	......	......	853	853
Loudon No. 6 mine	353	......	353	......	......	......	......	......	......	353	......	......	353	353
Lewis mine (Timberlands)	681	......	681	......	......	......	......	......	......	681	......	......	681	681
Carruthers & Wakelem No. 3 mine	223	......	223	......	......	......	......	......	......	223	......	......	223	223
Stronach mine	243	......	243	......	......	......	......	......	......	243	......	......	243	243
Undun No. 3 mine	633	......	633	......	......	......	......	......	......	633	......	......	633	633
Totals, Vancouver Island District	78,310	......	78,310	......	......	9,152	11,453	2,301	......	76,009	......	......	76,009	76,009
Nicola-Princeton District														
Princeton Blue Flame No. 3 mine	346	......	346	......	......	......	......	......	......	346	......	......	346	346
Coldwater mine	159	......	159	......	......	......	......	......	......	159	......	......	159	159
Totals, Nicola-Princeton District	505	......	505	......	......	......	......	......	......	505	......	......	505	505
Northern District														
Bulkley Valley Collieries	5,764	......	5,764	......	......	306	220	......	86	5,850	......	......	5,850	5,850
Gething No. 3 mine	2,062	......	2,062	......	......	......	......	......	......	2,062	......	......	2,062	2,062
Totals, Northern District	7,826	......	7,826	......	......	306	220	......	86	7,912	......	......	7,912	7,912
East Kootenay District														
The Crow's Nest Pass Coal Co. Ltd.—Michel Colliery (underground and strip)	878,064	86,014	792,050	14,698	200,190	14,760	20,932	6,172	......	186,462	9,041	375,487	570,990	785,878
Coleman Collieries (strip)	54,127	5,289[2]	48,838	......	......	......	......	......	......	48,838	......	......	48,838	48,838
Totals, East Kootenay District	932,191	91,303	840,888	14,698	200,190	14,760	20,932	6,172	......	235,300	9,041	375,487	619,828	834,716
Coal														
Grand totals for Province	1,018,832	91,303	927,529	14,698	200,190	24,218	32,605	8,473	86	319,726	9,041	375,487	704,254	919,142
Coke														
The Crow's Nest Pass Coal Co. Ltd.—Michel Colliery	156,151	......	156,151	......	......	35,945	31,393	4,552	......	89,034	71,669	......	160,703	......

[1] Includes coal used in making coke and coal used under company stationary and locomotive boilers, etc. [2] Estimated.

COLLIERIES OF BRITISH COLUMBIA, 1961—MEN EMPLOYED, DISTRIBUTION BY COLLIERIES AND BY DISTRICTS

Mine	Supervision and Clerical			Miners			Helpers			Labourers			Mechanics and Skilled Labour			Total Men Employed		
	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.
Vancouver Island District																		
Comox Mining Company Ltd.—Tsable River Colliery	9	2	11	58	......	58	......	......	......	25	4	29	3	4	7	95	10	105
Midan mine (Chambers No. 5 mine)	1	......	1	1	......	1	......	......	......	......	......	......	......	......	......	2	......	2
Loudon No. 6 mine	1	......	1	1	......	1	......	......	......	......	1	1	......	......	......	2	1	3
Lewis mine (Timberlands)	1	......	1	2	......	2	......	......	......	......	......	......	......	......	......	3	......	3
Carruthers & Wakelem No. 3 mine	......	......	......	1	......	1	......	......	......	......	......	......	......	......	......	1	......	1
Stronach mine	1	......	1	1	......	1	......	......	......	......	......	......	......	......	......	2	......	2
Undun No. 3 mine	1	......	1	1	......	1	......	......	......	......	......	......	......	......	......	2	......	2
Totals, Vancouver Island District	14	2	16	65	......	65	......	......	......	25	5	30	3	4	7	107	11	118
Nicola-Princeton District																		
Princeton Blue Flame No. 3 mine	1	......	1	1	......	1	......	......	......	......	......	......	......	......	......	2	......	2
Coldwater mine	1	......	1	1	......	1	......	......	......	......	......	......	......	......	......	2	......	2
Totals, Nicola-Princeton District	2	......	2	2	......	2	......	......	......	......	......	......	......	......	......	4	......	4
Northern District																		
Bulkley Valley Collieries	2	2	4	4	......	4	4	......	4	1	1	2	......	2	2	11	5	16
Gething No. 3 mine	1	......	1	2	......	2	1	......	1	1	2	3	......	......	......	5	2	7
Totals, Northern District	3	2	5	6	......	6	5	......	5	2	3	5	......	2	2	16	7	23
East Kootenay District																		
The Crow's Nest Pass Coal Co. Ltd.—																		
Michel Colliery (underground)	37	22	59	283	......	283	117	......	117	57	48	105	84	123	207	578	193	771
Michel Colliery (strip)	......	1	1	......	......	......	......	......	......	......	......	......	......	12	12	......	13	13
Coleman Collieries (strip)	......	1	1	......	......	......	......	......	......	......	......	......	......	12	12	......	13	13
Totals, East Kootenay District	37	24	61	283	......	283	117	......	117	57	48	105	84	147	231	578	219	797
Grand totals for Province	56	28	84	356	......	356	122	......	122	84	56	140	87	153	240	705	237	942

NOTE.—U.=underground; A.=above ground; T.=total.

Coal-preparation Plants

The construction of an additional cleaning plant to use feldspar as a medium was started at Michel Colliery, The Crow's Nest Pass Coal Company Limited, Fernie, in July, 1961. It is estimated to cost three-quarters of a million dollars and will be capable of cleaning 150 tons of minus ¼-inch or ½-inch coal per hour. Provisions have been made so that capacity may be increased to 180 tons per hour when necessary. Part of the old briquetting plant was incorporated in the new building. This construction is part of the company's modernization programme and is expected to be completed early in 1962.

Coke-making

Coke is made at only one plant in the Province, that of the Michel Colliery, The Crow's Nest Pass Coal Company Limited, Fernie.

LABOUR AND EMPLOYMENT

In 1961, 942 persons were employed in and about the coal mines of the Province, a decrease of 240 from 1960. Because of the five-day week in force throughout the Province at the larger mines and the legal holidays, the maximum number of working-days was 241. In the Vancouver Island District the one large mine, the Tsable River mine, worked 234 days. In the East Kootenay District the Michel Colliery worked 237 days.

COMPETITION FROM COAL PRODUCED OUTSIDE OF BRITISH COLUMBIA

In 1961 the shipment of Alberta coal and briquettes to British Columbia totalled 321,909 and 8,726 tons respectively.

The following table shows the amount of Alberta coal brought into British Columbia during the past ten years:—

Year	Short Tons	Year	Short Tons
1952	1,021,484	1957	672,527
1953	859,385	1958	532,911
1954	891,194	1959	437,118
1955	932,764	1960	379,668
1956	860,329	1961	321,909

Of the 704,254 tons of British Columbia coal marketed, 160,666 tons was sold for domestic and industrial use in Alberta, Saskatchewan, Manitoba, and Ontario; 2,099 tons was sold for railroad use in Canada; 9,041 tons was exported to the United States; and 375,487 tons was exported to Japan.

The amount sold for domestic and industrial use in the Province was 156,961 tons.

ACCIDENTS IN AND AROUND COAL MINES

In 1961 there were six fatal accidents, as compared with none in 1960. The number of fatal accidents per 1,000 persons (underground and strip-mine personnel) employed was 6.37, compared with 0.00 in 1960, 1.89 in 1959, 0.00 in 1958, 1.45 in 1957, 4.39 in 1956, 3.38 in 1955, 0.69 in 1954, 3.22 in 1953, and 1.78 in 1952.

The number of fatal accidents per 1,000,000 gross tons of coal (underground and strip-mine coal) produced was 5.88, compared with 0.00 in 1960.

The following table shows comparative figures for fatal accidents for 1960 and 1961:—

Company	Colliery	1961	1960
The Crow's Nest Pass Coal Co. Ltd.	Michel	6	—
Total		6	—

The following table classifies the fatal accidents in coal mines as to cause:—

FATAL ACCIDENTS CLASSIFIED AS TO CAUSE

Cause	1961		1960	
	Number	Per Cent	Number	Per Cent
Runaway trip	2	33.3	—	—
Fall of roof rock	1	16.7	—	—
Struck by runaway plank in raise	1	16.7	—	—
Fall of coal	2	33.3	—	—
Totals	6	100.0	—	—

In 1961 there were six fatal accidents at the mines in the Province, all of which occurred underground.

Juczas Serksnas, aged 51, single, and employed as a miner in "A" West mine, Michel Colliery, was fatally injured when he was buried under a large cave of coal at about 11.25 a.m. on May 3, 1961.

The accident occurred near the entrance to No. 1 split, No. 5 room off No. 4 raise, No. 2 left belt-road section. The deceased and his partner were engaged in retimbering a portion of caved coal roof near the entrance to No. 1 split when six of seven sets of timber collapsed, allowing about 125 tons of top coal to drop and completely fill the roadway. Serksnas was buried by the coal, but his partner escaped with minor injuries. There was no warning of the impending cave. The sets of timber had been reinforced by reliners and were double centre-posted.

Edward Sweeney, aged 35, married, and employed as a miner in "A" North mine, Michel Colliery, was fatally injured when he was partially buried under a cave of rock at about 10.20 a.m. on May 24, 1961.

Sweeney, with the assistance of two other men of the " Borecut " crew, were engaged in placing a centre post under a cracked stringer outby the mining-machine when two other stringers broke, allowing about ten cars of rock to fall and partly bury the deceased. All of the timber sets had been braced, but they were not centre-posted, in order to allow the mining-machine to manœuvre.

Joseph Jarolim, aged 61, married, and employed as a conveyor attendant in "A" West mine, Michel Colliery, was fatally injured when he was struck by a runaway trip of empty cars and timber-trucks at about 9.30 a.m. on June 2, 1961.

The haulage crew on No. 4 incline was lowering the trip, consisting of sixteen mine cars and timber-trucks, when the first ten cars and trucks became disengaged from the trip and travelled a distance of about 1,000 feet before being derailed near the bottom of the incline. The deceased had been working near where the runaway trip derailed and was fatally injured by same. He had been warned of the lowering of the empty trip.

The dropping-out of a coupling pin was the apparent cause of the trip separating. The pin was not found.

Stanley Kabat, aged 60, married, and employed as a miner in "A" West mine, Michel Colliery, was fatally injured when he was struck by a runaway trip of two loaded coal-cars at about 3 a.m. on June 6, 1961.

The deceased and partner were engaged in timbering on No. 2 belt supply road when the accident occurred. Two other miners were timbering inby on the same road, which inclines rather steeply toward the face. These miners loaded two cars of coal and then proceeded to lower them by tugger hoist down the incline to where a sprag post was set from floor to roof. This portion of the roadway is comparatively flat. The cars were usually lowered to the sprag, which held them while the tugger rope was replaced by a rope from a bigger hoist, which then was used to lower the trip down to the belt-road parting.

At the time of the accident the two cars stalled on the flat section of the roadway before it reached the sprag. The two miners started to push the cars when they appeared to run away. The tugger hoistman had left his post when the cars stalled, and proceeded down the roadway to find out the trouble. On noticing the rope moving he ran back to the tugger and applied the brakes and also put the hoist into reverse. This action apparently broke the rope, which allowed the trip to run away freely. The trip broke the sprag post and continued on down the roadway to where Kabat and partner were working. The trip derailed at this point and knocked out some timber sets. The falling timber apparently fatally injured Kabat. The rope in question was old and was apparently not in good condition. The tugger hoistman did not have too much experience in operating the hoist.

John Rastocnik, aged 40, married, and employed as a miner in "A" South mine, Michel Colliery, was fatally injured when struck by a runaway plank in a raise at about 7.40 p.m. on December 5, 1961.

Rastocnik was one of a crew who were building a chute in No. 2½ raise. Two members of the crew had gone to the top of the chute at the surface, 170 feet away, to lower a large plank. The plank was being lowered by a hemp rope and secured by a half-hitch when somehow the plank slipped out of the hitch and slid down the raise. The plank struck a pile of other planks that were held in the chute by a plank barricade. The impact broke the barricade and allowed the planks to slide down the chute to the point where Rastocnik was working. One of the planks struck Rastocnik on the face and pushed his head against a steel rail battery, thus inflicting fatal injuries.

The slippage of the plank from the rope was apparently due to the icy condition of the plank and rope and to carelessness in attaching the rope to the plank.

Ronald Saad, aged 36, married, and employed as a fireboss in "A" South mine, Michel Colliery, was fatally injured when he was partially buried by a fall of coal and timber at about 3.20 a.m. on December 11, 1961.

The deceased was coupling two shots in the rib at the face of a retreating pillar-extraction room, preparatory to blasting, when a large rock fell from the roof in the gob ahead that dislodged the front set of timber under which he was standing. A quantity of top coal that fell when the set was dislodged partially buried Saad. He was recovered very soon after the accident but was found to be dead from shock and asphyxiation. The fall of rock gave no warning.

Including the foregoing fatal accidents, 219 accidents involving loss of four days' work or more were reported to the Department by the management of the various mines.

The following tables classify the accidents in coal mines in 1961:—

Accidents Classified as to Occupation

Occupation	Number of Accidents	Percentage of Accidents
Underground—		
Miners	110	50.22
Drillers and facemen	......	......
Haulage and conveyor men	35	15.98
Trackmen and mechanics	14	6.39
Supervisors	8	3.66
Timbermen	7	3.20
Coal-cutters	......	......
Miscellaneous	18	8.22
Surface—		
Shops	4	1.83
Surface	3	1.36
Preparation and coke-ovens	16	7.31
Miscellaneous	4	1.83
Totals	219	100.00

Accidents Classified as to Cause

Cause	Number of Accidents	Percentage of Accidents
Fall of ground	55	25.11
Fall of material and flying material	17	7.76
Lifting and handling equipment and material	62	28.31
Machinery and tools	40	18.27
Slipped and tripped	33	15.07
Falling off staging and platforms	2	0.91
Miscellaneous	10	4.57
Totals	219	100.00

Accidents Classified as to Injury

Injury	Number of Accidents	Percentage of Accidents
Head and neck	17	7.76
Eyes	2	0.91
Trunk	52	23.74
Back	16	7.31
Arms	8	3.66
Hands and fingers	55	25.11
Legs	49	22.38
Feet	18	8.22
Toes	2	0.91
Totals	219	100.00

Compensable[1] Accidents, Including Fatal Accidents Related to Tons Mined and Men Employed in and about Coal Mines

Year	Number of Accidents	Number of Persons Employed	Frequency per 1,000 Persons	Tons Mined (Gross)	Tons Mined per Accident
1952	636	1,681	378	1,650,619	2,595
1953	557	1,550	359	1,576,105	2,829
1954	360	1,434	251	1,447,608	4,021
1955	372	1,478	252	1,484,066	3,989
1956	385	1,366	282	1,589,398	4,129
1957	340	1,380	246	1,221,766	3,593
1958	214	1,086	197	882,962	4,126
1959	189	1,056	179	757,628	4,009
1960	235	1,182	198	844,500	3,593
1961	219	942	232	1,018,832	4,652

[1] Compensable accident means an injury causing a loss of four days' work or more.

EXPLOSIVES

The following table shows the quantity of explosives used in underground coal mines in 1961, 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 rock in coal mines):—

Vancouver Island District

Colliery	Quantity of Explosives Used (Pounds)	Coal Mined (Tons)	Total Number of Shots	Average Tons per Pound of Explosives Used	Average Pounds of Explosives per Shot Fired
Tsable River Colliery (Comox Mining Company Ltd.)	27,835	75,324	59,000	2.71	0.47
Midan Mine (Chambers No. 5)	300	853	400	2.84	0.75
Loudon No. 6 mine	650	353	900	0.54	0.72
Lewis mine (Timberlands)	850	681	1,100	0.80	0.77
Carruthers & Wakelem No. 3 mine	350	223	420	0.63	0.83
Stronach mine	200	243	260	1.21	0.77
Undun No. 3 mine	400	633	600	1.58	0.67
Totals for district	29,985	78,310	62,680	2.61	0.48

Nicola-Princeton District

Colliery	Quantity of Explosives Used (Pounds)	Coal Mined (Tons)	Total Number of Shots	Average Tons per Pound of Explosives Used	Average Pounds of Explosives per Shot Fired
Princeton Blue Flame No. 3 mine	180	346	320	1.92	0.56
Coldwater mine	100	159	200	1.59	0.50
Totals for district	280	505	520	1.80	0.53

Northern District

Colliery	Quantity of Explosives Used (Pounds)	Coal Mined (Tons)	Total Number of Shots	Average Tons per Pound of Explosives Used	Average Pounds of Explosives per Shot Fired
Bulkley Valley Collieries	6,300	5,764	7,280	0.91	0.86
Gething No. 3 mine	1,900	2,062	2,000	1.08	0.95
Totals for district	8,200	7,826	9,280	0.95	0.88

East Kootenay District

Colliery	Quantity of Explosives Used (Pounds)	Coal Mined (Tons)	Total Number of Shots	Average Tons per Pound of Explosives Used	Average Pounds of Explosives per Shot Fired
Michel Colliery (underground)	157,833	790,444	136,957	5.01	1.15

Province

Colliery	Quantity of Explosives Used (Pounds)	Coal Mined (Tons)	Total Number of Shots	Average Tons per Pound of Explosives Used	Average Pounds of Explosives per Shot Fired
Totals for Province	196,298	877,085	209,437	4.47	0.94

QUANTITY OF DIFFERENT EXPLOSIVES USED

	Lb.
Monobel of different grades	193,499
Permissible rock powder	2,799
Total	196,298

MACHINE-MINED COAL

In 1961, mining-machines produced approximately 96,754 tons or 11.3 per cent of the total output from underground mining. A total of 141,747 tons of strip-mined coal was removed by mechanical means.

SAFETY LAMPS

There were 1,042 safety lamps in use in the mines of the Province. Of this number, 955 were approved electric lamps, mostly of the Edison type.

APPPROVED 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) under 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. model pneumatic electric lamp.

ELECTRICITY

Electricity is used for various purposes on the surface and underground at three collieries. A total of 11,267 horsepower was used in and about these mines. Detailed information as to how and where this power was used is given in the report of the Senior Electrical Inspector of Mines.

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 report are sent to the Inspectors 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, sides, and floor of mine roadways and analysed. The reports of the analyses are forwarded to the District Inspector each month.

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.

MILLISECOND 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. For further details *see* 1954 Annual Report.

DANGEROUS OCCURRENCES

On February 27, 1961, a small fire was found burning in a wood stopping outside a sealed fired area, on the No. 9 belt-road counter level, "A" West mine, Michel Colliery. The fire apparently originated from the fire zone, and had crept past a number of seals and rock-dust barrier erected in 1960. The fire was extinguished and the stopping repaired.

On March 6, 1961, a miner was partially buried and entombed by a fall of coal at the face of a pillar extraction in the No. 3 left belt-road section, "A" West mine, Michel Colliery. Rescue operations were started immediately, and two and one-half hours later the miner was released. He suffered only minor injuries.

On May 21, 1961, an inrush of water entered the workings of "A" West mine, Michel Colliery, following the undermining of a surface creek by a cave in the gob workings in the No. 4 left belt-road section. The water caused several caves on the roadways by undermining the timbers, and washed approximately 200 tons of coal down to the main west level. The creek was relocated around the caved area on the surface and the cavity filled with gravel.

On July 18, 1961, traces of carbon monoxide gas ranging up to 0.01 per cent were found issuing from an abandoned area of gob workings in the No. 2 left belt-road section, "A" West mine, Michel Colliery. There were no indications of smoke, odour, or increase in temperature, but as it was suspected that heating was taking place in the gob the area was sealed off.

On August 16, 1961, a gas explosion occurred in the coke breeze drier at the by-product plant, Michel Colliery. Several air ducts were distorted, and the exhaust stack on the roof of the building was damaged. One workman's eyebrow was slightly singed. The incident was attributed to a defective valve on the gas-line feeding the burners on the drier.

On August 16, 1961, the 100-horsepower electric motor operating the main surface fan ventilating the " B " Seam mine, Michel Colliery, was damaged during a severe electrical storm. Several coils on the stator were extensively burnt, and the motor had to be replaced. The mine was idle at the time of the incident.

On August 25, 1961, a fire was found burning in a seal at No. 6 Right crosscut, No. 9 belt-road section, "A" West mine, Michel Colliery. The fire was extinguished and the seal repaired. Since that time concrete seals have been erected on the three main inclines, thus sealing off the district completely.

On October 31, 1961, an electric trailing cable used for operating a shuttle car in the No. 102 slope district, "A" East mine, Michel Colliery, was damaged. There was a flash but no one was injured. The protective equipment functioned immediately the incident occurred, thus cutting off the power to the machine.

Subsequent investigation revealed that the reel for coiling the cable on the car had ceased to function momentarily and the cable looped beneath the machine, where it was damaged by the undercarriage of the conveyor used for unloading the car.

On December 18, 1961, slight smoke was discovered issuing from the Nos. 6 Right and 8 Right level abandoned gob areas, where extensive pillar extraction had taken place.

A search to discover the seat of the fire by mine-rescue crews equipped with self-breathing apparatus proved futile because of the almost total caving brought about by the pillar extraction. On consultation with officials of the Department, the management of the mine decided to seal off the entire area. In all, twenty-eight seals were erected in two days, requiring the services of the whole mine crew of about 100 men to complete.

To date the atmosphere within the sealed-off area has proved to be extinctive, but a small percentage of carbon monoxide is still detectable.

It is thought that the fire is the direct result of the breakdown of the main fan late in 1961. The small auxiliary fan used while the main fan was being repaired was unable to ventilate the gob areas as well as the active mine workings.

PROSECUTIONS

There were no prosecutions instituted at the various mines during the year.

SUPERVISION OF COAL MINES

During 1961 twelve companies operated seventeen mines, employing 705 men underground. In the supervision of underground employees, there were three managers, nine overmen, two shiftbosses, and forty-five firebosses, or approximately one official for every twelve men.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS

First-, Second-, and Third-class Certificates and Mine Surveyors' Certificates

The Board of Examiners, formed on July 10, 1919, consists at present of R. B. Bonar, Deputy Chief Inspector of Mines, chairman and secretary; A. R. C. James, Inspector of Mines, member; and D. R. Morgan, Inspector of Mines, member.

The examinations are held at least once a year and more often if necessary. Examinations were held at the Fernie centre in 1961 on May 17th, 18th, and 19th.

The total number of candidates at these examinations were as follows: Third-class certificates, six (passed); second class, one (passed); mine surveyor's certificate, one (failed).

The following were the successful candidates: Third-class—Philias J. Gauthier, Henry G. Beard, Gerhard F. Nowotny, Spencer Morgan, Jr., Nillo Quarin, Michael Mihalynuk; second class—Henry R. Eberts.

All officials, before engaging in multiple blasting with millisecond delay detonators, are required to obtain a permit to do so from the Board of Examiners (Coal-mine Officials). This permit is issued only after the applicant has successfully passed oral and practical examinations in such work.

In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act provides that every coal-miner shall be the holder of a certificate of competency as such. Examinations are held as circumstances warrant in 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 1961 fifty-one candidates were successful in obtaining coal-miners' certificates. In addition to the certificates granted above, substitute certificates were issued to those who had lost their original certificates.

The Board of Examiners desires to thank the different coal-mining companies for use of their premises for the holding of examinations where necessary.

NOTES ON COAL MINES

VANCOUVER ISLAND INSPECTION DISTRICT

By R. B. Bonar

The gross output of coal from the Vancouver Island Inspection District was 78,310 tons, a decrease of 13,094 tons or 14.3 per cent from the 1960 output. Only one large coal mine, the Tsable River mine, is now in production on the Island. Operations in the once important Nanaimo coalfield are now restricted to six very small mines, providing employment for no more than thirteen men. These mines operate in outcrop, pillars, and barriers left during earlier working.

The Island coal-mining industry has suffered a rapid decline in the past few years. Production has declined over 85 per cent since 1951. This condition has resulted from loss of markets due to competition from other fuels, high cost of production, and from the depletion of economic reserves in the Nanaimo coalfield.

In 1961 there were six accidents reported and investigated. There were no fatal accidents.

The annual mine-rescue and first-aid meet organized by the Vancouver Island Mine Safety Association was held at Cumberland on Saturday, May 27th. Two teams from the Tsable River mine and a visiting team from Britannia mine participated in the mine-rescue competition, and a very high standard of performance was maintained. The winning team was the Tsable River Team No. 2, captained by William High.

Nanaimo (49° 123° S.W.)

Midan Mine

This mine, formerly known as Chambers No. 5 mine, is in Section 14, Range 7, in the Douglas district, near Extension. It is now operated by the Midan brothers; A. Midan, fireboss. The present workings consist of a 600-foot slope driven in a section of the Wellington seam in the vicinity of the old Vancouver slope workings. The slope pillars and the pillars between the rooms driven to the right off the slope are being mined on the retreat.

The coal is mined by picking out the middle band of carbonaceous shale with hand-picks. It is then blasted and hand-loaded into cars which are hauled to the tipple by a gasoline-driven hoist. A small shaker screen sorts the coal into 2-inch, 1- to 2-inch, and under 1-inch sizes.

Total production in 1961 was 853 tons over a working period of 228 days with a crew of two men. Working conditions were found to be satisfactory in the course of inspections. No accidents were reported.

Lewis Mine

Glyn Lewis, operator and fireboss. The property comprises two small mines 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 on the side of a ridge parallel to and immediately south of the Nanaimo River valley at an elevation of 540 feet above sea-level. The coal measures dip southward at 8 degrees. The two mines are one-third of a mile apart.

The new mine, which commenced production in May, 1951, is in Range 1, Section 2, of the Cranberry district. It operates in an area of coal outcrop about 1 acre in extent, which is bounded on the west by a thrust fault that also formed the western boundary of the old No. 8 mine. The seam is 6 feet thick, including two thin rock bands.

The coal is blasted off the solid and hand-loaded into cars which are hauled to the surface up the slope by a small hoist driven by a gasoline-operated engine. A shaker screen sorts the coal into lump, nut, and pea sizes. Total production in 1961 was 681 tons over a working period of 176 days, with a crew of three men. Working conditions were found to be satisfactory, and no accidents were reported.

Undun No. 3 Mine

J. Unsworth and A. Dunn, operators; A. Dunn, fireboss. This mine was brought into production in September, 1960, and is located near the No. 3 slope, old Extension Colliery. A long outcrop pillar of fairly thick coal was encountered, which was skipped on the inside for several hundred feet to form a level haulage road. This pillar is now being mined on the retreat.

Production was 633 tons over a period of 182 days with a crew of two men.

Conditions as found during inspections were satisfactory, and no accidents were reported.

NORTH WELLINGTON (49° 124° S.E.)

Loudon No. 6 Mine

William Loudon, operator and fireboss. This mine is about 1 mile southeast of Wellington and has been opened up by a flat-dipping slope driven in a small area of outcrop coal in the No. 2 Upper Wellington seam adjacent to the old No. 9 workings. The top portion of the seam, varying from 2 to 3 feet and consisting of carbonaceous shale, is blasted off the solid and stowed. The bottom 20 inches to 2 feet of coal is broken up with light shots and hand-loaded into cars which are hauled to the surface by a small gasoline-powered hoist. Production in 1961 amounted to 353 tons over a working period of eighty-five days with a crew of three men. Working conditions were found to be satisfactory during the course of inspections, and no accidents were reported.

Carruthers and Wakelem No. 3 Mine

R. B. Carruthers, operator and fireboss. This mine, near the Loudon mine, is also in the No. 2 or Upper Wellington seam adjacent to the abandoned workings of the old No. 9 mine. Production in 1961 amounted to 223 tons over a working period of 103 days with a crew of one man. Working conditions were found to be satisfactory in the course of inspections, and no accidents were reported.

Stronach No. 2 Mine

Charles Stronach, operator; H. Gilmour, fireboss. This mine is a section of the No. 2 or Upper Wellington seam adjacent to the old No. 9 mine. All the output comes from the mining of pillars and small areas of coal left in the early workings. Production in 1961 amounted to 245 tons over a period of 105 days with a crew of two men. Working conditions were found to be satisfactory in the course of inspections. No accidents were reported.

COMOX (49° 124° N.W.)

Comox Mining Company Limited.—S. J. Lawrence, president; G. Dutfield, vice-president; P. F. Grundy, secretary. Head office address, P.O. Box 4, Union Bay, B.C.

Tsable River Mine.—S. J. Lawrence, manager; James Cochrane, overman; A. Somerville, M. Frobisher, J. Thomson, A. Cullen, L. Cooper, and W. High, firebosses.

On April 14, 1960, Canadian Collieries Resources Limited ceased operations at the Tsable River mine.

On May 9, 1960, the mine was again brought into production by the newly formed company, Comox Mining Company Limited. The company leases the property from Canadian Collieries Resources Limited and payment is made on a royalty per ton of coal produced.

Mining has been concentrated in the northeast section, where previously developed pillars are being extracted by the use of shaker-conveyors, Joy loaders, and hand-loading. Electrical multiple blasting with millisecond delay detonators is used throughout the mine.

Production in 1961 amounted to 75,324 tons over a working period of 234 days with a crew averaging 105 men.

Considerable production was lost during August and early September due to total restriction of travel during the fire closure imposed by the Forest Service and to the breakdown of the main ventilating fan.

First-aid arrangements were maintained at a satisfactory standard. A suitably equipped first-aid room was provided on the surface, and an ambulance was held in readiness for emergencies. Two mine-rescue teams of six men each were maintained, and these attended periodic practices at the Cumberland mine-rescue station.

Conditions at the mine were usually found to be satisfactory in the course of inspections.

The safety record at this mine during 1961 has been exceptional. Only five accidents of six days and over were recorded. This record is recognized, and the mine has been awarded the Regional and Dominion Ryan awards for having the lowest accident rate in Canada for 1961 for coal mines.

NICOLA-PRINCETON INSPECTION DISTRICT

By David Smith

Coal production in 1961 in the Nicola-Princeton district was 505 tons. Production was obtained from two small mines. A small amount of exploration work was carried out on the property known as the Fairley Prospect.

No accidents were reported by the coal mines in 1961, nor were there any prosecutions under the *Coal Mines Regulation Act*.

Merritt (50° 120° S.W.)

Coldwater Mine

This property, 1 mile south of Merritt, is operated by the owners, S. Gerrard and partners. Mining of coal has been confined to the recovery of pillars in the abandoned workings of the old Middlesboro No. 5 mine. Total production in 1961 was 159 tons, sold locally. A crew of two men was employed. Working conditions were satisfactory, and no methane was detected in the course of inspections.

Princeton (49° 120° S.W.)

Blue Flame Colliery

This mine is about 10 miles by road south of Princeton and about half a mile west of the Hope–Princeton highway. T. Bryden, fireboss, and a partner work the mine on a lease basis. Total production for 1961 was 346 tons. Working conditions were satisfactory, and no methane was detected in the course of inspections. This mine has now been closed, all possible coal having been recovered.

Fairley Prospect

J. Fairley and partners carried out underground exploration on a lease on the west bank of the Similkameen River, about 10 miles south of Princeton. One hundred feet of tunnelling and some raising did not indicate a workable deposit. Work by a crew of two men was discontinued.

EAST KOOTENAY INSPECTION DISTRICT

By D. R. Morgan

The production of coal from the East Kootenay Inspection District during 1961 was 932,191 tons, an increase of 188,212 tons, or 25.3 per cent more than was produced in 1960. Most of the production was obtained by The Crow's Nest Pass Coal Company Limited, whose operations were confined to the Michel Colliery. The colliery produced 878,064 tons, an increase of 146,683 tons, or 20 per cent more than in 1960. The remainder of the production was obtained from a large strip mine operated by Coleman Collieries Limited on Tent Mountain, near Corbin. These workings are on both sides of the British Columbia-Alberta border, and are operated from the Alberta side. The production from the British Columbia side during 1961 was 54,127 tons, an increase of 41,529 tons, or 330 per cent more than was produced in 1960.

Accident statistics at the Michel Colliery during 1961 showed an increase in both frequency and severity, and recorded a high fatality rate. Six fatal accidents were reported, all of which occurred underground. Three were caused by falls of roof, two involved haulage, and one the handling of supplies. The accidents were fully investigated and the safety programme was intensified. Accidents of a lesser nature but classified as serious totalled six, four of which were caused by falls of roof, one involved haulage, and one transportation. This was an increase of seven above the total number of serious accidents reported in 1960, which was a year free of fatalities. Minor accidents resulting in the loss of one or more working-days totalled 214, of which 181 occurred underground and thirty-three on the surface, an increase of eight accidents. Ten dangerous occurrences were investigated at Michel Colliery. They are reported more fully in another part of this report under the heading "Dangerous Occurrences." There were no accidents or dangerous occurrences reported from the British Columbia side of the stripping operation on Tent Mountain.

The East Kootenay Mine Safety Association held its fortieth annual mine-rescue and first-aid competitions at Fernie on June 3rd, and the various contests were well attended. Five teams from Fernie, Michel, Kimberley, and the Mineral King mine at Toby Creek entered the mine-rescue competition, and the Department of Mines and Petroleum Resources shield was won by the Sullivan mine team from Kimberley, captained by J. K. Walsh. In the first-aid events the Men's Open competition was won by the Sullivan concentrator team, captained by Art Nixon, and the Men's Novice competition by the Crow's Nest Pass Coal Company mill team from Michel, captained by M. Slavens. The winners of both the mine-rescue and first-aid open competitions represented the East Kootenay district at the Provincial competitions held at Nanaimo on June 24th. The Sullivan mine-rescue team was successful in winning the Provincial championship.

The Crow's Nest Pass Coal Company Limited

T. G. Ewart, president, Fernie; Thomas F. Gleed, vice-president, 2000 Washington Building, Seattle, Wash.; W. R. Prentice, secretary, Fernie; J. F. Cleeve, treasurer, Fernie; J. E. Morris, superintendent of operations, Fernie. This company has conducted large-scale mining operations in the Crowsnest Pass area of the East Kootenay district since 1897. Present activities are confined to the Michel Colliery, and they include both underground and open-cast operations. The production is mainly sold on the industrial market and a large quantity is exported to the Japanese market. Operations are directed from a head office in Fernie.

MICHEL COLLIERY.—(49° 114° N.W.) J. E. Morris, manager; Irving Morgan, senior overman; Walter McKay, safety supervisor; William Gregory, afternoon-shift overman.

The colliery is located at Michel, 24 miles east of Fernie, and is on the Crowsnest Pass branch of the Canadian Pacific Railway. It is a large colliery and has been in operation since 1899. The present operations include the working of six mines (underground), two stripping operations, and a modern by-product plant which is located on the colliery-site. The mines are operated on both sides of the valley and, with the exception of one, are named according to the seam worked and the direction of development. Four of the mines have been developed from a pair of long rock tunnels which have been driven across the synclinal structure of the coal measures on the south side of the valley, and the other two, Balmer and "A" North, are being developed from the outcrops of the seams on each side of the valley. The mines are worked by the room-and-pillar system, and the pillars in general are extracted on the retreat. The mines are fully mechanized, and both electricity and compressed air are largely used. The electrical equipment is of the flame-proof type and has been approved for use in coal mines. Transportation in the rock tunnels and most of the entry levels to the mines is by means of compressed-air locomotives, and battery locomotives are used at the Balmer and "A" North mines.

The production of coal from all the mines is cleaned and treated at a modern preparation plant located near the entrances to the rock tunnels. It has been in operation since 1938, and a description has been given in past reports. An additional plant has been in course of construction since July, 1961, and is expected to be completed in the early part of 1962, at an estimated cost of three-quarters of a million dollars. The new plant is being built for cleaning fines, and will be capable of cleaning and treating 120 tons of minus ¼-inch or ½-inch coal per hour. It embodies the very latest in coal-cleaning equipment, and provisions have been made whereby its capacity can be increased to 180 tons per hour. The plant is located on the colliery-site adjoining the remainder of the preparation plant. It is part of the company's current modernization programme.

The underground operations are under the direct supervision of five overmen and twenty-eight firebosses. A brief description of the mines follows.

"A" East Mine.—Harry Corrigan, overman; Frank McVeigh, Harry Sanders, Roger Pasiaud, James Walsh, and Henry Eberts, firebosses.

The mine is operated in the "A" seam. It is on the eastern limb of the Michel syncline, and all the workings are on the left side of the rock tunnels. The coal is 10 to 12 feet thick, dips at an angle of 20 degrees, and is overlain by a shale roof which is heavily fractured, and requires close timbering for its support. The mine has been in operation for many years, and present activities are confined to a number of dip workings which are near the outer end of the main east levels and are rapidly approaching the rock tunnels. The method of working is by the room-and-pillar system, and a description of the workings has been given in past Annual Reports.

Most of the activities during 1961 were directed to the extraction of pillars. There were two districts in operation, and the mine produced a daily average of 925 tons with a crew of 114 men. Most of the production was obtained by the operation of a new Joy continuous miner extracting a small section of pillars in the No. 102 Slope district. The unit was installed in May, 1961, and its operation to date has been satisfactory. Systematic timbering was rigidly carried out, and a strong current of ventilation was maintained at the faces of the pillar extractions to contend with the rapid advancement of the mining unit. The coal from the unit was loaded by shuttle car and fast-moving belts, and loaded into cars at a large loading point on the main east level. The remainder of the production from the mine was obtained from the No. 1 Slope district, which is operated by conventional mining methods. Conditions in general were found to be satisfactory during the course of inspections, with the exception of restricted clearance on some of the roadways in the No. 1 Slope district due to the convergence of extensive pillar extraction on the roadways.

The mine is ventilated by an electrically driven aerodyne fan which delivered 108,850 cubic feet of air per minute to the workings at a 4.2-inch water-gauge. This quantity was found to be sufficient for the normal requirements of the workings.

"A" West Mine.—Daniel Chester, overman; Reginald Taylor, Robert Taylor, Thomas Krall, William Cytko, Stanley Menduk, Herbert Parsons, Arnold Webster, Benjamin Volpatti, Andrew Davey, and Albert Littler, firebosses.

This mine has been developed in the "A" seam, and the workings are on both the eastern and western limbs of the Michel syncline. It is entered on the right side of the rock tunnels, and all the workings are toward the outcrop. The seam is 12 to 28 feet thick, dips at an angle of 20 to 35 degrees, and is overlain by a moderately strong shale roof. The mine is operated by the room-and-pillar system, and the workings are arranged so that most of the extraction is carried out on the strike of the seam.

The mine produced 972 tons per day during 1961 with a crew of 163 men. Most of the output was obtained from the lower part of the mine, where the coal is 28 feet thick and the pillars are extracted by the caving system. The workings in this area of the mine are partitioned into panels, and all the roadways are driven on the footwall of the seam and the top coal is supported by timber sets. The rooms are driven at 45-foot centres, and the coal is mined by shortwall coal-cutters or is blasted from the solid by the use of millisecond delay detonators. During extraction of pillars, the timber supports are withdrawn and the top coal is allowed to fall or is blasted into the roadways. The coal is loaded by duckbill conveyors which extend beyond the timber supports, thus preventing the workmen from being exposed to the caved areas. All the coal is loaded onto conveyors and is transferred to a central loading point on the main west level, where it is loaded into large trips of cars which are taken from the mine by compressed-air locomotives.

The mine maintained a high production rate during 1961, but the size of the operation was considerably reduced owing to a number of heatings and fires that are reported more fully under the heading of " Dangerous Occurrences." All the workings in the No. 4 left belt-road panel were abandoned when the upper part of the mine was sealed following the ignition of two fires in the fire seals in the No. 9 right belt-road section. Six working-places were also abandoned in the No. 2 left belt-road panel when that area was sealed following the suspected heating in the old gob workings. These resulted in the complete abandonment of all the workings in the upper part of the mine and restricted the present operations to three comparatively small panels of workings in the lower part of the mine. Another panel was in an early stage of development at the end of the year. This panel will be located near the main west level, and will complete the extraction of coal from the mine.

The mine is ventilated by an electrically driven axivane fan which delivers 87,450 cubic feet of air per minute to the mine workings at a 2.5-inch water-gauge. The ventilation system was reorganized following the sealing of the upper part of the mine, and the present intake airway is via the No. 1 entry in the old No. 4 right belt-road section which is connected to the surface outcrop. The change-over proved to be successful, and the quantity was sufficient for the requirements of the workings.

Upper "A" South Mine.—James E. Anderson, overman; Michael Tymchuk, William Verkerk, Joseph Serek, Paul Kusnir, Chester Plonka, and Harvey Travis, firebosses.

The mine was opened in 1956 and is being worked to develop a large area of virgin coal left in the "A" seam between the old "A" South mine and the outcrop of the seam. The workings are on the western limb of the Michel syncline and are entered by two inclines which have been driven in the underlying seam and later connected to the "A" seam by two rock raises. The seam was entered in 1958, and since that time most of the activities have been directed to the driving of three inclines to the surface outcrop and the development of workings on each side of the main inclines. The seam is 26 feet thick, of good quality, and pitches at an angle of 35 degrees in a westerly direction. The roadways, with the exception of the inclines, are driven on the footwall of the seam, and the pillars are extracted by the caving system.

The mine averaged a daily output of 680 tons during 1961 with a crew of 110 men. Most of the output was obtained by the extraction of pillars in the No. 1 North level district. The district was developed in 1960 and was described in that Annual Report. Other activities were directed to the driving of the three main inclines and further development work. Two of the inclines were connected to the surface outcrop during the early part of 1961 and have since been used for ventilating the mine by the installation of a fan at one of the portals. Other development included the driving of a new level, No. 2 North, in the upper part of the workings and further development of a number of roadways in the No. 1 South level section. The coal at the faces is usually mined with pneumatic picks or is blasted from the solid by the use of millisecond delay detonators. It is loaded into chutes or conveyors and transferred to a central loading point on the main rock tunnels. All the production from the mine is loaded at this point. Production from the pillar extractions in the No. 1 North level district was loaded into 10-ton-capacity bottom-dumping cars and transported to a large bin on the main inclines by compressed-air locomotive. Most of the equipment is operated by electricity.

The mine is ventilated by an aerodyne fan which delivers 66,250 cubic feet of air per minute to the workings at a 1.3-inch water-gauge. The fan was installed following the connection of the main inclines to the surface. Conditions in general were found to be satisfactory during the course of inspections.

"A" North Mine. — John Whittaker, overman; Thomas Slee and Sidney Hughes, firebosses.

This mine is operated in the "A" seam on the north side of the Michel Valley, approximately half a mile east of the colliery preparation plant. It was opened in 1951 and is being developed by means of four levels which follow the strike of the seam from the outcrop. The levels have been driven over 5,000 feet, but most of the development from the levels to date has been restricted to suit the coal market. The mine will eventually become a large operation.

The seam is very irregular and faulty but is 12 feet thick where normal and dips at an angle of 15 to 20 degrees in a southerly direction. Most of the coal at the working-places is mined with pneumatic picks or is blasted from the solid by the use of millisecond delay detonators. It is loaded by hand onto shaker and chain conveyors and transferred by a series of conveyors to various loading points on the main levels, where it is loaded into 10-ton-capacity bottom-dumping cars and taken from the mine by battery locomotives. The two bottom levels are more highly mechanized and are advanced by continuous miners, which mine and load the coal in one operation. Nearly all the equipment is operated by electricity, and compressed air, which is used mainly for operating pneumatic picks, is supplied by three portable electric compressors located on the main levels inside the mine. All the production is taken to the preparation plant by truck from bins at two of the portals of the mine.

The mine averaged a daily output of 185 tons during 1961 with a crew of thirty-two men. The operations were considerably restricted owing to the coal market, and activities were mainly directed to the extraction of pillars in the No. 4 incline district, which is located above the No. 2 level. Extraction was confined to the left side of the panel, and most of the pillars were extracted by a " Borecut " continuous miner which was formerly operated in the lower levels. The " Borecut " operated in a satisfactory manner but encountered difficulties in several instances owing to poor roof conditions. Other pillar extractions in the district were carried out by conventional mining methods. No further progress was made at the faces of the four main levels, but it is expected operations will be resumed at the faces of the two lower levels in the near future.

The mine is ventilated by an electrically driven axivane fan which delivers 65,000 cubic feet of air to the mine workings at a 1.5-inch water-gauge. Small auxiliary fans, capable of producing 5,000 cubic feet of air per minute, are also used for ventilating the faces of the levels and headings beyond the last crosscuts. These quantities were found to be sufficient to meet the requirements of the mine.

" B " South Mine.—William Davey, overman; John Krall, Robert Doratty, and Kenneth Kniert, firebosses.

This mine is operated in the " B " seam. The workings are on the western limb of the Michel syncline and are on the left side of the rock tunnels. The seam is 5½ feet thick, dips at an angle of 30 degrees in an easterly direction, and is overlain by a hard sandstone roof. The coal is of excellent coking quality, friable, and gassy. It is mined by pneumatic picks, and no shot-firing is allowed. The mine has been a major producer for many years, but extensive pillar extractions have reduced its size considerably, and it is rapidly nearing completion. Present activities are restricted to the extraction of a limited number of pillars left alongside the main roadways from former workings. The mine is operated by the room-and-pillar system, and a description of the workings has been given in past Annual Reports.

The mine averaged a daily output of 207 tons of coal during 1961 with a crew of forty-six men. Most of the production was obtained from the extraction of pillars alongside the old No. 3 incline, and the remainder alongside the outer end of the main south levels. The conditions in general were found to be satisfactory, but a great deal of difficulty was experienced in maintaining sufficient clearance on some of the roadways.

The mine is ventilated by an electrically driven axivane fan which delivers 50,000 cubic feet of air per minute to the workings at a 3.3-inch water-gauge. This quantity was found to be sufficient for the normal requirements of the workings.

Balmer (No. 10) Mine.—William Davey, overman; John McInnes and Thomas Taylor, firebosses.

This operation was started in September, 1960, and is being worked to develop a large area of virgin coal in the No. 10 seam on the south side of the valley. The workings are located 1 mile west of the preparation plant and will be developed by three main levels which are being driven from the outcrop of the seam near creek elevation. The seam is 40 feet thick, of good coking quality, and pitches at an angle of 30 degrees in an easterly direction. The levels are driven in close contact with the hangingwall and follow the strike of the seam.

Most of the activities during 1961 were directed to the driving of the three levels. Total advancement was 1,870 feet. The coal at the faces was mined with pneumatic picks or blasted from the solid. It was loaded by hand onto conveyors and transported to a central loading point on the lower level, where it was loaded into 10-ton capacity bottom-dumping cars and taken from the mine by battery locomotive. Transportation from the surface to the preparation plant was by truck. Surface activities during 1961 included the completion of the portal of the main haulage level and the grading of an area of ground for a large timber-yard and locomotive-shed. Preparations were also being made for the construction of a 200-ton steel bin to facilitate the transportation of the coal to the preparation plant. The conditions in general were found to be satisfactory during the course of inspections. The workings at present are ventilated by natural means, which is boosted by an auxiliary fan in the upper part of the mine.

During 1961, 155,184 pounds of Monobel No. 4, 2,649 pounds of CXL-ite, and 136,917 electric detonators were used at the colliery for coal and rock blasting. No misfired shots were reported.

Three hundred and twenty-five tons of limestone dust was used for application on roadways at the various mines to minimize the coal-dust hazard and for tamping shots. Monthly mine-dust samples were regularly taken at all the mines and analysed. All the samples were found to be above the minimum requirements of incombustible content.

Regular monthly examinations were made at all the mines by the miners' inspection committees, and a meeting was held at the colliery office each month by the pit committee. All the report books kept at the mines in accordance with the *Coal Mines Regulation Act* were examined periodically and found to be in order.

Baldy Mountain Strip Mine.—J. E. Morris, manager; George Lancaster, foreman. This operation is on Baldy Mountain, 4 miles east of Michel. It is at an elevation of 5,000 feet and is reached by means of a private road leading from the colliery preparation plant. The operation has been active since 1948, and a description of the property has been given in past Annual Reports.

The operation produced 87,620 tons during 1961 with a crew of one power-shovel operator for loading and three truck-drivers for transporting the coal to the preparation plant. Most of the activities were directed to the No. 4B pit, where a large area of overburden was removed in 1960 and the spring of 1961. The pit is adjacent to the old No. 4A pit, which was operated in 1959, and the coal is a continuation of the outcrop of the same seam. The coal is 45 feet thick, of fairly good quality, but certain sections of the seam possess inferior coking properties. Stripping operations were carried out by Emil Anderson Construction Company. It is estimated that over 300,000 cubic yards of overburden was removed during the stripping operations and 200,000 tons of coal exposed. Most of the activities in 1961 were confined to the loading of coal, and these were restricted to a single-shift basis.

"A" South Strip Mine.—J. E. Morris, manager, George Lancaster, foreman. This is a new operation that was started in August, 1961, with the intention of stripping a large quantity of "A" seam coal outcropping on the mountainside, 2 miles west of the colliery preparation plant. The operation is at an elevation of 5,500 feet and is located above the underground workings of the Upper "A" South mine. It can be reached via the underground workings or by means of an old mining-road leading from the No. 3 highway east of Michel. The coal is 30 feet thick, is of good quality, and dips at an angle of 35 degrees in a westerly direction. The stripping operations were contracted to Emil Anderson Construction Company, and the intention is to remove 200,000 cubic yards of overburden to expose 120,000 tons of coal.

Most of the activities in 1961 were directed to the removal of overburden. Sufficient work was completed to enable the commencement of production, and since that time both operations have been carried out. The coal is transported to the preparation plant via the underground workings in the Upper "A" South mine. A total of fifteen men was employed on the coal and rock work.

By-product Plant.—George Lancaster, superintendent. The plant is adjacent to the preparation plant at Michel Colliery, and a description has been included in past Annual Reports. Conditions in general were found to be satisfactory, with the exception of one minor explosion in the breeze drier, which is reported more fully under "Dangerous Occurrences."

Briquette Plant.—No briquettes were produced at Michel Colliery during 1961. The plant was dismantled in September, and since that time the buildings have been used for the construction of the new fine-coal cleaning plant.

Columbia Iron Mining Company

Company office, 120 Montgomery Street, San Francisco 6, Calif. R. C. Talbott, manager, Land and Exploration; S. G. Sargis, assistant manager, Exploration; J. K. Hayes, supervisor, Field Exploration; M. D. Okerlund, project manager, Fernie. This company, a wholly owned subsidiary of United States Steel Corporation, obtained an option in May, 1960, to explore and investigate all the coal properties of The Crow's Nest Pass Coal Company Limited with a view to purchasing all or part of the property if a sufficient quantity of suitable coal was found. The option covers a period of four years and includes an intensive exploration programme. The following, prepared by the management, is a synopsis of the work completed in 1961:—

"A total working force of 52 men, including 13 geologists, 9 miners, and 30 laborers, were used to continue the investigation of the Fernie Coal Basin, begun in 1960. Field operations started the last week of May and continued at full strength until mid-September, when a portion of the crew returned to school. Sampling operations were terminated in November and diamond drilling operations continued until December 18th, when all active field work was stopped.

" One to three drilling rigs were operated throughout the field season and approximately 10,000 lineal feet drilled in seven holes. The upper portion of some holes was drilled by non-coring methods, using air as a circulation medium. The balance of the drilling was diamond coring.

" Trenching crews exposed coal beds at 30 locations on the west rim of the coal basin, and the beds were described and sampled by geologists. Twenty-four adit tunnels, totalling 1,772 feet, were driven in selected coal seams to obtain four-ton samples for washability and coking tests.

"About 24 miles of roads were constructed for access to drill sites, adit locations, and outcrop trenches. One helicopter and fifteen four-wheel-drive vehicles provided transportation for field crews."

Coleman Collieries Limited

(49° 114° N.W.) D. B. Young, general manager, Coleman, Alta.; John C. Shearer, strip-mine manager. Coal-mining activities of this company in the East Kootenay District are confined to a large stripping operation on the interprovincial boundary on Tent Mountain, near Corbin. Most of the operation is on the Alberta side, but large quantities of coal have been produced from the British Columbia side during the past ten years. Access to the property is by means of a private road leading from the No. 3 highway at Crowsnest Lake. The road is on the Alberta side, and all the production from the mine is taken to the company's preparation plant at Coleman, Alta.

Most of the activities on the British Columbia side during 1961 were confined to the No. 2 pit, which is at an elevation of 7,200 feet, and has been in operation since 1954. The coal is in the form of a synclinal basin and is over 100 feet thick in parts. The overburden has been removed in past working, and present activities are confined to the removal of coal which is loaded by power-shovel and transported to the preparation plant by truck. The operation had a greater output than in 1960 but was considerably restricted owing to the shortage of markets for the coal, and the mine was idle for several periods. Conditions in general were found to be satisfactory during the course of inspections.

NORTHERN INSPECTION DISTRICT

By David Smith

The coal mines of the Northern District produced a total of 7,826 tons of coal in 1961. The output is sold entirely on the domestic market, which limits all operations to seasonal work.

One accident and no dangerous occurrences were reported from the mines of this district in 1961.

Telkwa (54° 127° N.E.)

Bulkley Valley Collieries Limited

Company office, Telkwa. F. M. Dockrill, president; F. Bond and L. Gething, firebosses. This property is on Goat Creek, a tributary of Telkwa River, about 7 miles southeast of Telkwa. Total production in 1961 was 5,764 tons. The mine closed at the end of March and resumed operations in September. An average crew of eighteen men was employed.

Conditions in the mine were found to be satisfactory in the course of inspections, and no methane was detected. No accidents were reported.

PEACE RIVER (56° 122° S.E.)

King Gething Mines

This property is on Lot 1039, 12 miles by road from Hudson Hope, and is owned and operated by Q. F. (King) Gething. A. Rapp is fireboss. Total production for 1961 was 2,062 tons. A crew of six men was employed. Conditions in the mine were found to be satisfactory in the course of inspections, and no methane was detected. One accident was reported.

Inspection of Electrical Equipment and Installations at Mines, Quarries, and Well Drilling Rigs

By L. Wardman, Senior Electrical Inspector

ELECTRIC POWER

In 1961 electric power was used by thirty-eight mining companies in operations at thirty-five lode mines, three placer mines, and three collieries. Twenty-four metallurgical mills were operated during the year. Twenty-five structural-material and industrial-mineral mines and quarries used electric power during the year. Fifty-four drilling rigs drilled during the year on 237 well locations. One hundred and fifty-one wells were completed either as gas or oil wells, fifty-five were abandoned, and thirty were drilling at the end of the year. In addition to the above, one well was completed for eventual fluid injection.

Lode-metal Mines

At eight properties the installation of completely new electrical systems was commenced. Two of these installations were completed, but the others will not be completed until sometime in 1962. Operations at four properties using electric power were terminated for an indefinite period, and two were not operated from the beginning of the year. Five properties were reopened.

The kilovolt-ampere generating capacity of mining-company-owned plants which operated in 1961 and type of prime mover is given below:—

Prime Mover	Generator Kva. Capacity
Diesel engines	10,921
Water-wheels	10,300
Steam turbines	1,800
Total	23,021

The electric power produced during 1961 was approximately 52,885,606 kilowatt-hours. The power purchased from public utilities and from the generating division of The Consolidated Mining and Smelting Company of Canada, Limited, amounted to 202,757,672 kilowatt-hours. The total amount of power consumed for mining and concentrating of lode mines was 255,643,278 kilowatt-hours.

A general breakdown of the connected electrical load was as follows:—

Equipment	Horsepower
Hoists (incline and shaft)	5,472
Hoists (scrapers)	6,427
Fans (mine ventilating)	4,638
Pumps (mine unwatering)	6,594
Rectifiers and M.G. sets	6,961
Air compressors (supplying mining equipment)	15,450
Crushing	9,785
Sink float	1,750
Grinding	19,671
Concentrating	12,763
Pumps	8,548

Equipment	Horsepower
Workshops	1,982
Miscellaneous	4,771
Shovels and rotary drills	3,075
Total	107,887

In addition to electrically powered equipment, there was in use approximately 7,790 horsepower of prime movers driving direct-connected or belt-connected equipment as tabulated below:—

Prime Mover	Horsepower
Diesel engines	5,930
Water-wheels	1,800
Gasoline engines	60
Total	7,790

On the haulage systems there were in use eighty-eight battery locomotives, eighty-eight trolley locomotives, and eighteen diesel locomotives.

Structural-material and Industrial-mineral Mines and Quarries

Electric power was used at twenty-three structural-material and industrial-mineral mines and quarries. Electric power is purchased from public utilities for these operations, with the exception of those in remote areas which, of necessity, must produce their own power. The capacity of company-owned plants was approximately 3,490 kilovolt-amperes.

Approximately 12,104,265 kilowatt-hours of power was generated and 990,802 kilowatt-hours was purchased, making a total of 13,095,147 kilowatt-hours of power consumed.

The distribution of the connected load was approximately as follows:—

Equipment	Horsepower
Hoists (incline)	244
Hoists (scraper)	505
Fans (ventilating and dust-collecting)	101
Pumps	809
Rectifiers and M.G. sets	37
Air compressors	603
Electric drills and electric shovels	210
Crushing (includes drying)	4,639
Conveyors	2,659
Screens	895
Milling	2,369
Workshops	34
Miscellaneous	1,620
Total	14,725

At these properties there was also direct-driven equipment totalling 4,760 horsepower.

One battery locomotive was used for underground haulage.

Coal Mines

There was no change in the number of collieries using electrical power. The distribution of connected load was as follows:—

	Horsepower	
Surface—		
Compressors	3,940	
Ventilation	580	
Hoisting	545	
Haulage	15	
Coal washing and screening	2,041	
Pumping	215	
Coke	1,180	
Miscellaneous	175	
Total		8,691
Underground—		
Ventilation	250	
Hoisting	160	
Haulage	105	
Coal-loaders	84	
Coal-cutters	100	
Borecut	75	
Continuous miners	260	
Conveyors	1,007	
Pumping	325	
Compressed air	200	
Miscellaneous	10	
Total		2,576
Total for surface and underground		11,267

Three battery locomotives and two diesel locomotives were in use for haulage below and above ground.

A total of 26,484,610 kilowatt-hours of electric power was used for mining and coal processing.

ELECTRICAL INSTALLATIONS

LODE MINES

Moresby Island (52° 131° S.E.)

Jedway (Jedway Iron Ore Limited) A camp-site was prepared and the following buildings were built: A fifty-room bunk-house, a cook-house of 120-place capacity, an office, store, school, change-house, staff-house, and ten residences. Plans are being prepared for a mill, which it is expected will be built in 1962.

Lillooet

Bridge River (50° 122° N.W.)

Bralorne Pioneer Mines Limited A new mill consisting of a grinding section and a cyanide section was built. The grinding equipment will consist of two ball mills driven by two 200-horsepower, 2,300-volt motors. Other equipment consists of feeders, jigs, pumps, cyanide tanks, filters, and amalgam barrels. The total connected load for the grinding and cyanide section is 670 horsepower.

New distribution equipment was added to the 460-volt bus in the power-house to supply shops, crushing plant, townsite, and cyanide mill. Also a new distribution panel consisting of fused 2,300-volt disconnecting switches was installed for the compressor motors.

A second fan driven by a 150-horsepower motor was installed on the mine ventilating system.

Kamloops

Iron Mask (Kamloops Copper Company Ltd.).—(50° 120° N.W.) A transformer station was built near the shaft and ten pumps driven by 8-horsepower motors were installed for unwatering the mine.

Highland Valley

Bethlehem Copper Corporation Ltd. — (50° 120° S.W.) A 5,000-volt power-line 37,700 feet long was built from the camp power plant to the lake to supply two 75-horsepower pump motors when required. A machine-shop, office, and assay office were built and wired.

Merritt

Craigmont Mines Limited (50° 120° S.W.) In 1961 complete equipment for mining and concentrating 4,000 tons of ore per day was installed. The orebody in the open pit is drilled by rotary electric drills, blasted, and then loaded onto trucks by means of electric shovels. The total connected load of the shovels and drills is 1,325 horsepower, supplied at 4,160 volts.

A primary crushing plant was built at the open pit on the 3700 level. The crusher is driven by a 350-horsepower 4,160-volt motor. From the primary crusher to the secondary crusher at the mill the ore is carried on a retarding belt controlled by a 350-horsepower 4,160-volt motor. The total connected load of both crushing plants is 1,642 horsepower. This includes auxiliary equipment.

The main units in the grinding circuit are two 11- by 14-foot ball mills driven by two 900-horsepower, 4,160-volt synchronous motors and two 9-foot 6-inch by 12-foot rod mills driven by two 600-horsepower 4,160-volt synchronous motors. Feeder motors, conveyor motors, etc., make the connected load of the grinding circuit 3,395 horsepower.

The concentrating section consists of ninety flotation cells and thirty cleaner cells driven by sixty 15-horsepower motors. These units, together with filtering and pumping units, make a connected load of 1,575 horsepower for this section.

Two pumping stations were built to pump water from the Nicola River. A 4,160-volt power-line 21,000 feet long was built to supply power to the pump motors. The connected pump load is 375 horsepower.

An auxiliary 1,000-kw. diesel-driven electric plant was installed to take care of the fluctuating load. The main power supply is obtained from the British Columbia Hydro and Power Authority.

Beaverdell

Highland-Bell (Mastodon-Highland Bell Mines Limited).—(49° 119° S.E.) The 50-horsepower ball-mill motor was replaced with a 75-horsepower motor, and a new dust-collecting system was installed in the crusher-room. Further rewiring in the mill was done to replace wiring which had deteriorated.

Aspen Creek

H.B. (The Consolidated Mining and Smelting Company of Canada, Limited).—(49° 117° S.E.) A 30-horsepower scraper hoist was added to the mining equipment and the load centre formerly on the 3300 level was installed on the 3000 level.

Iron Mountain

Jersey (Canadian Exploration Limited).—(49° 117° S.E.) The major electrical work on this property consisted of relocating equipment to accommodate the changing mine load.

Nelway

Reeves MacDonald Mines Limited

(49° 117° S.E.) A cone crusher driven by a 125-horsepower motor was installed in the crushing plant. A third pump driven by a 75-horsepower motor was installed in the river pumping plant. The No. 1 hoist was moved from the 2650 level to the 1100 level. Improvements made in the ventilating system added 10 horsepower to the fan-motor load.

North Kootenay Lake

Riondel (49° 116° N.W.)

Bluebell (The Consolidated Mining and Smelting Company of Canada, Limited).—A 30-kw. 550-volt three-phase heater and two pumps driven by two 7½-horsepower 550-volt motors were installed in the mill. Five 10-kw. three-phase 550-volt hot-water heaters were installed in the main dry; also installed was a battery charger for miners' lamps. Two airfoil fans driven by two 30-horsepower 550-volt motors were installed at the Kootenay Chief mine. In the mine a 40-horsepower motor on a Jeffery fan was replaced with a 60-horsepower motor.

Kimberley

Sullivan (The Consolidated Mining and Smelting Company of Canada, Limited)

(49° 115° N.W.) Three 1,000-kva. single-phase transformers were moved from the hillside, adjacent to the compressor-room, to the transformer station serving the electric boiler. A 300-kva. transformer was installed on the 2500 level at No. 1 shaft station for the 2500 level crusher. A 200-horsepower man hoist was installed on the 3900 level at the 3932 shaft to replace the 150-horsepower man hoist which was formerly located on the 4500 level. The 3500 level crusher was moved to the new 2500 level crushing chamber. At the mill the old wiring and switchgear is gradually being replaced with new. During 1961 the following work was done:—

In the tin-plant section forty-two circuit lighting panels and 25-kva. transformers were installed. Solenoids and wiring for the tables were also installed.

The obsolete lighting panels in the sink-float building, in the tripper section, and in the rod-mill sections of the concentrator were replaced with no-fuse panels.

Mercury vapour lighting units were installed in the retreatment section and in the mill yard.

Fluorescent lighting units were installed in the engineering, warehouse, and maintenance offices.

The fire hall, salvage shed, zinc scale-house, tank-house, and creosote building were rewired.

An annunciator system wired in with seven-conductor Pyrotenax cable was installed for the copper sulphate and lime distribution systems.

Eight motors were installed, as follows: Four ¼-horsepower on the fire sprinkler system, a 5-horsepower on the high-pressure water system, a 10-horsepower on the spare lime pump, a 25-horsepower on the rod-mill discharge pump, a 30-horsepower for the water-booster pump in the Turbo building.

A remote-control circuit was installed for the fire-pumps, and the substation general alarm circuit was extended to the fire hall.

A 1,000-kva. 66,000–550-volt transformer was installed in the remodelled transformer yard at the mill.

The 550-volt switchboards in the iron filter building, the No. 650 conveyor, the retreatment floor, and assay office furnace laboratory were remodelled.

Obsolete oil switches were replaced with magnetic starters on four 40-horsepower, five 50-horsepower, and two 75-horsepower motor circuits.

Obsolete fused line switches were replaced with 400-ampere De-ion air circuit-breakers on three 300-horsepower ball-mill motor circuits.

Windermere

Toby Creek (50° 116° S.E.)

Mineral King (Sheep Creek Mines Limited)

A Miulees type TLS6 diesel driving a 350-kva. three-phase 60-cycle 600-r.p.m. a.c. generator was installed in the power-house. A 100-lamp electronic battery charger was installed in the dry for charging the Wheat cap-lamp batteries. The primary distribution voltage for the townsite voltage was raised from 440 to 2,300 volts. The coal-stoker-fed boiler furnace was converted to oil feed with automatic controls. A duplex dwelling and a teacherage were built and wired, and one room was added to the school.

At the Jumbo mine a 20- by 40-foot power-house was built to house a 50-kva. portable diesel generating unit and a compressor. A 10-horsepower rectifier and a 10-horsepower fan were installed at the mine.

Skagit River

A.M. (Canam Copper Company Ltd.).—(49° 121° S.E.) On April 6, 1961, the power-house was destroyed by fire. Two Cummings diesels driving 75-kw. a.c. generators were installed to replace the units destroyed. Later in the year, operations were suspended for an indefinite period.

Hope

Pride of Emory (Giant Mascot Mines Limited)

(49° 121° S.W.) A transformer was installed on the 3400 level, consisting of six 37½-kva. 2,300–440-volt transformers connected in delta-delta and paralleled. This station supplies power to one 100-horsepower and two 50-horsepower slusher motors. A three-conductor No. 2 A.W.G. rubber-insulated armoured cable 1,000 feet long was installed in the main shaft from the 2600 level to supply the new 3400 level substation. Trolley conductors were installed on the 3250 level.

Howe Sound

Britannia (Howe Sound Company (Britannia Division)) (49° 123° N.E.) A dry grinding plant was installed in the old car-shop. It consists of the following units: A ball mill driven by a 100-horsepower motor, a classifier driven by a 60-horsepower motor, a jaw crusher driven by a 20-horsepower motor, a cone crusher driven by a 25-horsepower motor, an elevator driven by a 10-horsepower motor, and feeders and conveyors driven by one 5-, four 3-, and five 2-horsepower motors.

A 333-kva. transformer station was installed in the 4850 level of No. 8 mine, and the 3500 level transformer station was relocated.

Texada Island

Texada Mines Ltd. (49° 124° N.W.) The dry mill crushing plant was rewired with neoprene-jacketed armoured cable. A rod mill driven by a 500-horsepower motor with control gear and switchgear was installed in the wet mill. Several smaller motors were installed for auxiliary equipment in this mill. The 12,000-volt 2,250-kva. substation was moved from the power-house site to a location adjacent to the wet mill, and the 12,000-volt line was extended to this location. For further information on the electrical installations *see* Annual Reports for 1952, 1956, and 1958.

Vancouver Island

Benson Lake (50° 127° S.E.)

Benson Lake (Empire Development Company Limited).—A new crushing plant was set up for use when the underground operation commenced. It is complete with power unit.

Old Sport (Coast Copper Company Limited).—A temporary camp, four bunk-houses, cafeteria, and office-warehouse were built during the year. Construction work was started on a 2,400-horsepower hydro-electric plant, a 700-horsepower diesel-driven electric stand-by plant, a 6,900-volt power-line, a crushing plant, a concentrator, and shops.

Zeballos (50° 126° S.W.)

F.L. (Zeballos Iron Mines Limited) The installation of a mill at this property was commenced in the summer. The crushing plant will contain two crushers—one a 30- by 42-inch jaw crusher driven by a 150-horsepower motor, the other a 10- by 42-inch jaw crusher driven by a 60-horsepower motor. Screens, conveyors, and feeders will make the connected load of the crushing plant 270 horsepower.

The mill will contain the following equipment: A 36- by 60-inch vibrating feeder requiring 2 kw.; two 24-inch conveyors driven by a 5- and a 15-horsepower motor respectively; a conveyor slewing drive driven by a 5-horsepower motor; two 24- by 48-inch vibrating feeders requiring 1½ kw.; an 18-inch conveyor driven by a 30-horsepower motor; two cobbling belts each driven by 5-horsepower motors; two magnetic pulleys requiring 3 kw.; a 24- by 42-inch vibrating feeder requiring 3 kw.; a magnetic wet separator requiring 16 kw. and drive for same requiring 4 horsepower; a concentrate classifier and a waste classifier each driven by 5-horsepower motors; four 18-inch conveyors driven by a 15-horsepower motor, two 3-horsepower motors and a 7½-horsepower motor respectively; three 36- by 60-inch vibrating screens requiring 18 kw. each; a conveyor requiring 15 horsepower; a water pump requiring 10 horsepower; and two vibrating feeders.

Jordan River (48° 124° S.E.)

Sunloch and Gabbro (Sunro Mines Limited)

Excavations for an underground mill were made, and installation of the machinery was commenced. By the end of the year the following work had been done: A 12,000-volt power-line 2,000 feet long was built to the upper adit of the mine; a 12,000–440-volt transformer station was built to supply two air compressors; a compressor-house was built and two air compressors were installed. The connected load of these two compressors is 500 horsepower.

Four banks of transformers were installed in the underground transformer station, as follows: Three 200-kva. 12,000–2,300 volts connected delta-delta, three 333-kva. 12,000–2,300 volts connected delta-delta, three 150-kva. 6,900–460 volts connected wye-delta, and three 250-kva. 12,000–460 volts connected delta-delta.

An armoured cable connects the surface power-line with the underground power transformer station.

A 2,300-volt power-line 1,000 feet long was built to the mine portal.

PLACER MINES

Lightning Creek (53° 121° S.W.)

Wingdam (Wingdam & Lightning Creek Mining Co. Ltd.)

Electrical equipment was installed for unwatering the mine and bringing it into production. In the old power-house two 200-kva. Westinghouse generators driven by 170-horsepower diesels and a 250-kva. generator driven by a Caterpillar diesel were installed. Also installed was an Ingersoll Rand compressor, size H.R. 315. In the hoist-house a double-drum hoist driven by a 75-horsepower motor was installed. In the shaft-house two Flygtt deep-well pumps driven by 65-horsepower motors were installed.

A cook-house, office building, dry, hoist-house, and trailer bunk-houses were also built.

Bridge River (50° 122° N.W.)

B.C. Placer Mining & Refining Ltd.—Four small single-phase 220-volt motors were installed to operate two pumps, a vibrating screen, and a Wilfley table.

STRUCTURAL-MATERIAL AND INDUSTRIAL-MINERAL MINES AND QUARRIES

McDame

Cassiar Asbestos Corporation Limited.—(59° 129° S.W.) Some new equipment was added to the system and some old equipment was taken out of service, making the connected load at the end of 1961 as follows:—

	Load Added	Load Removed	Final Load
Crushing and drying	22.5	......	477.75
Mill	367.5	11.5	2,369.25
Rock reject plant	140.0	......	335.5
Mine crusher	24.0	......	119.5
Mine garage	......	......	20.0
Tram-line	18.0	......	244.0
Townsite	183.5	......	1,153.0
Workshops	......	......	200.0
Totals	755.5	11.5	4,919.0

To accommodate the increased load, an additional unit was added to the power plant, which increased the capacity by 818 kva. to 3,376 kva.

Coquitlam

Pipe Line Road Gravel Pit (Deeks-McBride Ltd.).—(49° 122° S.W.) A new electrically driven sand and gravel plant was installed. The crushing part of the plant requires 150 horsepower, conveyors require 140 horsepower, screens require 55 horsepower, workshops require 20 horsepower, the water-pump requires 75 horsepower, miscellaneous equipment requires 120 horsepower, making a total load of 560 horsepower.

Spillimacheen

Baroid of Canada Ltd.—(50° 116° N.E.) Some of the equipment at the Silver Giant property was returned to service for recovering barite. A tabling beneficiation plant requiring 30 horsepower was installed.

Windermere

Western Gypsum Products Limited.—(50° 115° S.W.) A crushing and screening plant was built at Athalmer in 1960 and was put into service in 1961. The equipment was taken mainly from the crushing plant at the mine. Several new units were added, bringing the total connected load to 260 horsepower.

Texada Island

Ideal Cement Company Ltd.—(49° 124° N.E.) A washing system was installed requiring two 7-horsepower and one 5-horsepower motors. A secondary crusher system requiring 125 horsepower was installed. The lighting facilities were improved and the power factor was improved by the installation of capacitors.

Cassidy

Cassidy Gravel Pit (Evans, Coleman and Evans Limited).—(49° 123° S.W.) A secondary crusher driven by a 50-horsepower motor and a bucket elevator driven by a 3-horsepower motor were installed.

Metchosin

Metchosin Gravel Pit (Evans, Coleman and Evans Limited).—(48° 123° S.W.) The crusher, driven by a 50-horsepower motor, was changed for a larger one driven by a 75-horsepower motor.

COAL MINES

Comox

Tsable River Mine.—(49° 124° N.W.) The electrical installation at this mine has not been changed since it was taken over by the Comox Mining Company Limited, except that the 50-horsepower pump motor on the lower level has been replaced by a 75-horsepower motor.

EAST KOOTENAY

Michel Colliery (The Crow's Nest Pass Coal Company Limited)

(49° 114° S.W.) In "A" East mine, mining efficiency was improved by the installation of the following equipment: One Joy continuous miner, Model 1 JCM; one Joy shuttle car, Model 10 S.C.; One Joy 30-inch by 700-foot-long extensible belt rated at 200 tons per hour; two standard 30-inch belts rated at 200 tons per hour. This was put into service with a crew of six men, including a fireboss. A 14-B.U. loader was added in November, and peak performance then rose to 526 tons of coal per day.

On the surface above Upper "A" South mine a Joy Axivane fan rated at 100,000 cubic feet per minute capacity was installed for ventilation of the mine. It is driven by a 350-horsepower 550-volt motor.

A second oil circuit-breaker was installed at the portal of the main rock tunnel to control power to the continuous miner.

Also on the surface at Upper "A" South, the installation of a hoist driven by a 254-horsepower motor was commenced. The hoist will move men and material in the No. 2 raise.

The main power-line from Michel No. 1 substation to Sparwood Ridge was converted from 2,200 to 6,600 volts and a 500-kva. 6,600–2,200-volt transformer was installed to supply two fans driven by two 100-horsepower motors. The voltage for these motors was stepped down to 550 volts by means of two banks of 2,200–550-volt transformers. A third 100-horsepower fan was in use in the " B " seam but was closed in February, 1962. Three 150-kva. 6,600–550-volt transformers were installed to supply the 350-horsepower hoist. The electrical equipment in Upper "A" South will be supplied from the 6,600-volt line through a 6,600-volt oil circuit-breaker. Underground 6,600–550-volt transformers will step down the voltage for the equipment.

For power-supply to the Balmer mine, a 500-kva. 2,300–6,600-volt transformer and switchgear was installed at the Natal substation. Three thousand feet of 6,600-volt power-line was built from the substation to the Balmer portal.

The construction of a small coal-cleaning plant was commenced, and it is expected that it will be completed in May, 1962. Approximately 500 horsepower will be required. Six 200-kva. transformers have been installed to supply this power from the mine distribution system.

Three 75-kva. transformers were installed in a new concrete substation to supply the by-product plant tipple and the breeze drying plant.

Lode-metal Deposits Referred to in the 1961 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 1961:—

Northern British Columbia.—Atlin, Liard.

Central British Columbia.—Cariboo, Clinton, Omineca.

Coast and Islands.—Alberni, Nanaimo, New Westminster, Skeena, Vancouver, Victoria.

South Central British Columbia.—Greenwood, Kamloops, Lillooet, Nicola, Osoyoos, Similkameen, Vernon.

Southeastern British Columbia.—Fort Steele, Golden, Nelson, Revelstoke, Slocan, Trail Creek.

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Uranium	Chromium	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Cobalt	Page
Northern British Columbia																					
Galore Creek	Liard	57° 131° S.E.			3																7
Hab	Liard	57° 131° S.E.			3																8
Hanna Gold	Liard	59° 129° S.W.	3																		6
Lamb Mountain	Liard	59° 129° S.W.														3					6
Lang Creek	Liard	59° 129° S.W.			3																7
Lark	Liard	59° 129° S.W.			3																7
Silver Tip Group	Liard	59° 130° N.E.		3		3															6
Central British Columbia																					
Aurum, Cariboo Gold Quartz	Cariboo	53° 121° S.W.	1	2																	19, A46
Boss Mountain	Cariboo	52° 120° S.W.														3					21
Copper Nos. 1 to 4	Clinton	51° 122° S.W.			3																23
Cronin Babine	Omineca	54° 126° N.W.	2	1		1	1		2												19, A46
Fish Lake	Clinton	51° 123° S.W.			3																24
Glacier Gulch	Omineca	54° 127° N.E.														3					19
Stella	Omineca	54° 125° S.E.														3					19
Stock	Omineca	54° 127° N.E.			3																18
Coast and Islands																					
A.M.	N. West'r.	49° 121° S.E.			3																85
Alice	Skeena	55° 129° S.E.														3					10
Alpha, Beta	Victoria	48° 124° N.E.			3																111
Anyox	Skeena	55° 129° S.W.			3																10
Apex, Morning	Alberni	49° 125° S.E.	3																		103
Britannia	Vancouver	49° 123° N.E.	2	2	1	2	1														89, A47
Berton Gold Mines	Alberni	49° 125° S.W.	3																		101
Cambrian Chieftain	Vancouver	49° 123° N.W.	2	2	1																89, A47
Catface	Alberni	49° 125° S.W.			3																101
Colossus	Vancouver	50° 125° N.E.			3																90
Copper King	Nanaimo	50° 124° S.W.			3					3											90
Copper Road	Nanaimo	50° 125° S.E.		2	1																91, A46
Dolly Varden	Skeena	55° 129° N.W.		3																	10
Domineer	Nanaimo	49° 125° N.W.	1	1	2																102, A47
Empire Development	Nanaimo	50° 127° S.E.								1											95, A46
F.L.	Nanaimo	50° 126° S.W.								3											101
Gold Coin	N. West'r.	49° 121° S.E.			3	3	3														86
Granduc	Skeena	56° 130° S.E.			3					3											8
Harriet Harbour	Skeena	52° 131° S.E.								3											13
Hesquiat	Alberni	49° 126° S.E.			3					3											101
Iron Duke	Skeena	52° 131° N.W.								3											17
Iron Mike	Nanaimo	50° 125° S.W.								3											91

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 the shipment. Production for 1961 is listed in Table XIV.

Non-shipping Mines.—(3) Metal present, indicated by assay or mineralogical determination.

LODE-METAL DEPOSITS REFERRED TO IN THE 1961 ANNUAL REPORT—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Uranium	Chromium	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Cobalt	Page
Coast and Islands—Continued																					
Kennedy Lake	Alberni	49° 125° S.E.								3											104
Lake, Don, Ken	Skeena	56° 130° N.E.			3																8
Little Lake Group	Alberni	50° 127° S.E.								3											100
Loughborough Gold	Vancouver	50° 125° N.W.	3																		90
Lucky Jim	N. West'r.	49° 121° S.W.	3		3		3														88
Lynx, Paramount, Price	Alberni	49° 125° N.W.	3	3	3	3	3														103
Musketeer	Alberni	49° 125° S.W.	1	2	2	2															102, A46
Nimpkish, Klaanch	Nanaimo	50° 126° S.W.								1											93, A47
Old Sport	Nanaimo	50° 127° S.E.			3																97
Pride of Emory	N. West'r.	49° 121° S.W.			1										2						86, A47
Privateer	Alberni	50° 126° S.W.	3		3																100
Sarita River	Alberni	48° 125° N.E.								1											111
Silbak Premier	Skeena	56° 130° S.E.	1	1		2	2														9, A47
Skookum	Vancouver	49° 123° N.W.	3																		89
Sunloch, Gabbro	Victoria	48° 124° S.E.			3																113
Tassoo	Skeena	52° 132° N.E.			3					3											11
Texada (Prescott, Paxton, Yellow Kid, Yellow Jacket)	Nanaimo	49° 124° N.W.	2	2	1					1											90, A47
Tofino Inlet	Alberni	49° 125° S.W.	3		3					3											104
Tofino Mines Ltd.	Alberni	49° 125° S.W.	3																		103
Tzartus Island	Alberni	48° 125° N.E.								3											111
Valley View	N. West'r.	49° 121° S.W.		2	1																88, A47
Wedeene Iron	Skeena	54° 128° S.W.								3											17
Willoron	Victoria	49° 123° N.W.								3											112
South Central British Columbia																					
Ace	Lillooet	50° 122° N.W.	3																		25
Ajax and Monte Carlo	Kamloops	50° 120° N.E.			3																48
Anarchist Chrome	Greenw'd.	49° 119° S.E.											3								61
B.R.	Lillooet	50° 122° N.W.			3																25
Bethlehem	Kamloops	50° 120° S.W.			3																30
Betty Lou and Lou	Nicola	50° 120° S.W.			3																41
Bounty Fraction	Greenw'd.	49° 119° S.E.		1		2	1														A47
Bralorne	Lillooet	50° 122° N.W.	1	2																	26, A48
Bridge River	Lillooet	50° 122° N.W.	3																		27
Canford Explorations	Nicola	50° 120° S.W.			3																42
Cariboo-Amelia	Greenw'd.	49° 119° S.E.	1	2		2	2														63, A47
Consolidated Standard	Nicola	50° 120° S.W.			3																40
Copper Soo	Nicola	50° 120° S.W.			3					3											43
Copperado	Nicola	50° 120° S.W.			3																45
Craigmont	Nicola	50° 120° S.W.		2	1																31, A48
Deep Gulch	Similk'n	49° 120° S.W.			3																56
Dora Kay	Kamloops	50° 121° S.E.			3																29
Fairview	Osoyoos	49° 119° S.W.	2														1				61, A48
French	Osoyoos	49° 120° S.E.	1	2																	58, A48
Friday Creek	Similk'n	49° 120° S.W.			3																56
Friday Mines	Nicola	50° 120° S.W.			3																38
Galaxy Minerals	Kamloops	50° 120° N.E.			3																46
Golden Contact	Lillooet	50° 122° N.E.	3																		28
Good Hope and Nighthawk	Similk'n	49° 120° S.E.	3																		56
Highland-Bell	Greenw'd.	49° 119° S.E.	2	1		2	2		2												63, A47
Highvale Copper	Nicola	50° 120° S.W.			3																40
Huestis Mining Corporation	Kamloops	51° 119° S.W.				3	3														53
Iron Mask	Kamloops	50° 120° N.E.			3																47
Jericho	Kamloops	50° 120° S.W.			3																30
Judy Group	Nicola	50° 120° S.W.			3																43
Makaoo Development	Kamloops	50° 120° N.E.			3																46
Matt	Greenw'd.	49° 119° S.E.		3		3	3														63
Mid-West Copper & Uranium	Nicola	50° 120° S.W.			3																41
Mother Lode	Greenw'd.	49° 118° S.W.	1	2	1																64, A47

LODE-METAL DEPOSITS REFERRED TO IN THE 1961 ANNUAL REPORT—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Uranium	Chromium	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Cobalt	Page
*South Central British Columbia—*Continued																					
Nickel Plate	Osoyoos	49° 120° S.E.	1	2																	A48
Norex	Osoyoos	49° 119° S.W.	1	2		2	2														A48
Olalla Manganese	Osoyoos	49° 119° S.W.									3										59
P.C.M., Cap, Domino, Hank, Freda	Nicola	50° 120° S.W.			3																41
Peel Resources	Nicola	50° 120° S.W.			3																37
Phelps Dodge	Lillooet	50° 122° N.W.			3																29
Phoenix	Greenw'd	49° 118° S.W.	2	2	1																65, A47
Pioneer	Lillooet	50° 122° N.W.	1																		A48
Providence	Greenw'd	49° 118° S.W.	1	1		2	2														A47
Quilchena	Nicola	50° 120° S.W.			3																46
Rainbow	Kamloops	50° 120° N.E.			3																48
Renning No. 1, LT	Kamloops	51° 119° S.W.				3	3														48
Rose Group	Kamloops	51° 119° S.W.					3														56
Royal Canadian Ventures	Kamloops	50° 121° S.E.			3																29
Ruby Mac	Greenw'd	49° 118° S.W.	3	3	3																65
Salal	Lillooet	50° 123° N.E.			3																28
Sands Creek	Kamloops	51° 120° N.E.														3					51
Skeena Silver	Nicola	50° 121° S.E.			3																43
Standard	Osoyoos	49° 119° S.W.	3																		61
Stemwinder	Osoyoos	49° 119° S.W.	3														3				61
Stump Lake	Nicola	50° 120° S.E.	1	1		1	1														A48
Sunrise, Golconda, Copper King	Osoyoos	49° 119° S.W.	3		3																59
Tintlhohtan Lake	Kamloops	51° 120° N.E.														3					49
Tormont	Nicola	50° 120° S.W.			3																39
Torwest Resources	Nicola	50° 120° S.W.			3																39
Trojan Consolidated	Kamloops	50° 120° N.W.			3																30
Viking	Nicola	50° 120° S.W.			3																31
Wade	Nicola	50° 120° S.W.			3																41
Wen Group	Similk'n	49° 120° N.W.			3																46
Windpass	Kamloops	51° 119° S.W.	3																		49
Southeastern British Columbia																					
Anna	Slocan	49° 117° N.E.		3																	78
Arlington	Nelson	49° 117° N.E.		3																	78
Bess	Slocan	49° 117° N.E.		1		1	2														A49
Black Fox	Slocan	49° 117° N.E.		1		1	1		2												74, A49
Bluebell	Slocan	49° 116° N.W.		2	2	1	1		2												72, A49
Caledonia	Slocan	50° 117° S.E.	2	1		1	1		2												75, A49
Carnation	Slocan	49° 117° N.E.		3		3	3														76
Duncan	Slocan	50° 116° S.W.				3	3														79
Empire	Slocan	49° 117° N.E.		3		3	3														75
Galena Farm	Slocan	49° 117° N.E.	2	1		1	1		1												78, A49
Giant Western	Slocan	49° 117° N.E.		1		2	2														A50
Gold Belt	Nelson	49° 117° S.E.	1	2		2	2														A49
H.B.	Nelson	49° 117° S.E.		2		1	1		1												68, A49
Hewitt	Slocan	49° 117° N.E.	2	1		1	1		1												78, A50
Highlander	Slocan	49° 116° N.W.		2		1	1		2												74, A50
It and In	Revelstoke	51° 118° N.W.				3	3														84
Jersey	Nelson	49° 117° S.E.		2		1	1		2												69, A49
Kootenay Belle	Nelson	49° 117° N.E.	1	2		1	1														68, A49
Liz B	Nelson	49° 116° S.E.				3	3														80
London-Panama	Slocan	50° 117° S.E.		3		3															76
Lone Bachelor	Slocan	49° 117° N.E.	2	1		1	1		2												77, A50
Lucky Jim	Golden	50° 116° N.E.		1		1	2														A49
Lucky Strike	Nelson	49° 117° S.E.	1	1		2	2														A49
Mammoth	Slocan	49° 117° N.E.	2	1		1	1		2												77, A50
Mineral King	Golden	50° 116° S.E.		2	2	1	1		2												82, A49
Nadeco	Slocan	50° 117° N.W.			3																79
New Arlington	Nelson	49° 117° S.E.	1	2		1	1														68, A49
New Springfield	Slocan	49° 117° N.E.		3		3	3														77
New Zone Copper	Slocan	50° 117° N.E.			3																79

Lode-metal Deposits Referred to in the 1961 Annual Report—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Uranium	Chromium	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Cobalt	Page
Nugget	Nelson	49° 117° S.E.	3																		68
Ottawa	Slocan	49° 117° N.E.	2	1		2	2														78, A50
Queen	Nelson	49° 117° S.E.	1	2		2	2														68, A49
Queen Victoria	Nelson	49° 117° S.E.		2	1																66, A49
Red Bird	Nelson	49° 117° S.E.				3	3														72
Reeves MacDonald	Nelson	49° 117° S.W.		2		1	1		2												71, A49
Richmond-Eureka	Slocan	49° 117° N.E.	2	1		1	1		2												A50
Rossland Mines	Trail Cr'k	49° 117° S.W.	3		3																66
Scranton	Slocan	49° 117° N.E.	3	3		3	3														74
Silversmith, Richmond-Eureka	Slocan	49° 117° N.E.		3		3	3														76
St. Andrew Mining	Golden	50° 116° S.E.			3																83
Sal	Slocan	50° 116° S.W.				3	3														80
Slocan Base Metals	Slocan	49° 117° N.E.		3		3	3														77
Slocan Prince	Slocan	49° 117° N.E.		1		2	1														A50
Sullivan	Ft. Steele	49° 115° N.W.	2	2	2	1	1														80, A49
Tam O'Shanter	Slocan	49° 116° N.W.		3		3	3														74
Texas, Fourth of July	Slocan	50° 117° S.E.		3		3	3														76
Utica	Slocan	49° 117° N.E.	2	1		1	1		2												75, A50
Velvet	Trail Cr'k	49° 117° S.W.	1	2	1																65, A50
Victor	Slocan	49° 117° N.E.	2	1		1	1		2												77, A50
W.D.	Trail Cr'k	49° 117° S.W.	3																		66
Waterbed	Nelson	49° 117° S.E.	1	2		1	1														A49
Welcome, Enterprise	Ft. Steele	49° 116° N.W.			3																82
Western Exploration	Ft. Steele	49° 115° N.W.				3	3														82
White	Nelson	49° 117° S.E.	1	2		2	2														67, A49
Wigwam	Revelstoke	51° 118° S.E.				3	3														84
Yale	Slocan	49° 116° N.W.	2	2		1	1		2												A50
Yankee Dundee	Nelson	49° 117° S.E.	3																		67

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