CANADA

DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH

BUREAU OF GEOLOGY AND TOPOGRAPHY

GEOLOGICAL SURVEY

MEMOIR 230

# MINERAL INDUSTRY OF THE NORTHWEST TERRITORIES

BY

C. S. Lord



OTTAWA
EDMOND CLOUTIER
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1941

No. 2462

*Price, 50 cents*

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# Mineral Industry of the Northwest Territories

## CHAPTER I

## INTRODUCTION

### GENERAL STATEMENT

This report deals with the mineral industry of that part of Northwest Territories bounded by latitudes 60 and 68 degrees and longitudes 109 and 126 degrees, except that part lying west and south of Mackenzie River. The district lies north of Alberta and British Columbia, includes Great Slave and Great Bear Lakes, and extends north of the Arctic Circle. It is the only part of Northwest Territories from which minerals are produced and is one of Canada's youngest mineral-producing districts. In 1939 the district produced gold, silver, copper, natural gas, and petroleum valued at $2,072,920 and radium-uranium concentrates valued at $2,391,325. Most mining and prospecting has been confined to areas near the east end of Great Bear Lake, near Indin (Wray) Lake and Snare River, and north of Great Slave Lake near Yellowknife Bay, Beaulieu River, and Gordon Lake. Gold deposits are most numerous, but deposits of many other minerals are known. During the summer of 1938 the area north of Great Slave Lake was probably the most actively prospected district in Canada.

Most of the active mines and prospects in the district were visited in 1939 and this report deals with these and other deposits known to the Geological Survey, and describes location, history, geology, development, mining, and milling, and, where available, gives general operating data. It also includes information on some general and economic features of the district that may prove useful to prospectors, operators, investors, and others interested in mining and exploration in this part of Northwest Territories.

The report was made possible through the co-operation of officials and staffs of mining, exploration, and transportation companies, of prospectors, and of others interested in Northwest Territories, and the writer gratefully acknowledges his indebtedness to all. K. W. B. Moodie acted as field assistant.

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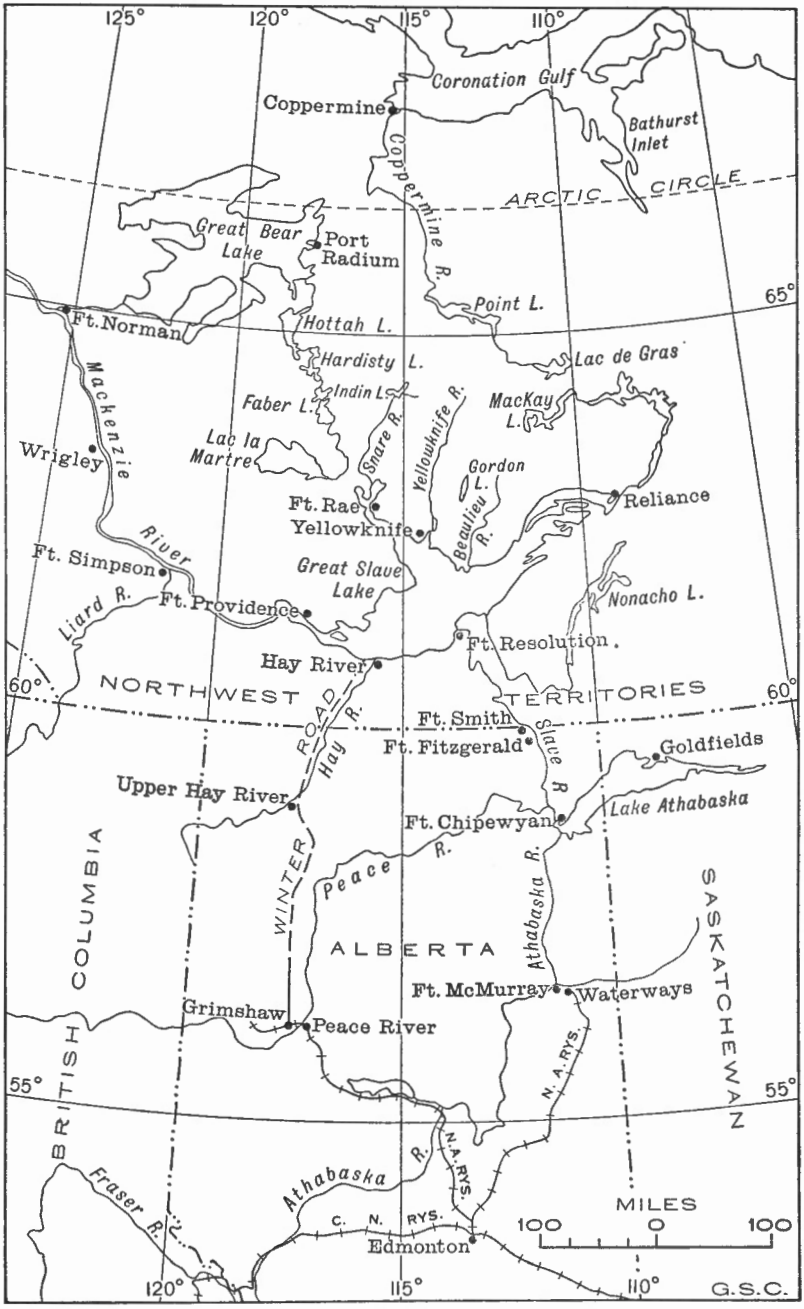


**Figure 1. Part of District of Mackenzie, Northwest Territories, and adjacent provinces.**

## GEOGRAPHY AND TOPOGRAPHY

The part of Northwest Territories described in this report is drained by Mackenzie and Coppermine Rivers, both flowing to the Arctic Ocean. Great Bear Lake, in the northwest part of the area, has an area of 11,660 square miles and is the largest body of fresh water lying entirely within Canada; part of it lies north of the Arctic Circle. Camsell River enters it from the southeast and Dease and Sloan Rivers from the northeast. Great Bear River drains the lake westerly to Mackenzie River at Fort Norman. Great Slave Lake lies about 210 miles southeast of Great Bear Lake and is the second largest lake in Canada, with an area of 11,170 square miles. Some of the rivers entering the lake are: on the south, Hay, Slave, and Taltson; on the east, Lockhart; and on the north, Beaulieu, Yellowknife, Snare, and Marian. Mackenzie River flows from the west end of the lake northwesterly for over 1,000 miles to the Arctic Ocean. Coppermine River flows northwesterly from Lac de Gras and Point Lake to Coronation Gulf.

The southwestern boundary of the Canadian Shield crosses the territory through Fort Smith, Slave River, northwest arm of Great Slave Lake, through Marian, Faber, Hardisty, and Hottah lakes, and through the southern bay of McTavish Arm on Great Bear Lake. The Canadian Shield part of the region when viewed from the air appears nearly flat and is dotted with innumerable lakes of all sizes and shapes, many of which are studded with islands. The relief is probably over 1,500 feet. Great Slave Lake has an elevation of 495 feet and Nonacho Lake, to the south, has an elevation of 1,160 feet. Great Bear Lake has an elevation of 391 feet and Mazenod and Mackay Lakes, near the watershed between Great Slave Lake to the south and Great Bear Lake and Arctic Ocean to the north, are 765 and 1,415 feet, respectively, above sea-level. In detail most of the area is one of low relief, and in many places rocky hills and ridges rise abruptly 50 to 150 feet above intervening rock bound lakes and swampy areas called muskegs. The maximum relief near the mouth of Snare River is about 150 feet, but the country becomes increasingly rugged towards the north. Along the east side of Great Bear Lake it is deeply dissected and in places rises 1,100 feet above the lake. Rock exposures are numerous in this part of the Territories; perhaps they are most numerous near Yellowknife Bay, Beaulieu River, and Gordon Lake, where outcrops occupy more than half the areas between the lakes.

Southwest of the Canadian Shield the country is heavily wooded, gently rolling, and underlain in most places by nearly flat-lying sediments. This area extends across Mackenzie River westward to Mackenzie Mountains. In many places the northeast border of this gently rolling area is marked by easterly facing scarps and in others by low, drift-covered belts several miles wide. The scarps range in height from a few feet to about 250 feet. Lakes and rivers are less numerous than in the Canadian Shield, and in most places solid rock is hidden by soil, moss, or swamp. Although, generally, the relief is low, a few hills and mountain ranges rise to heights varying from a few hundred feet to about 4,000 feet. Such ranges are: Horn Mountain, northwest of Providence; Franklin Mountains, between Mackenzie River and Great Bear Lake; and Grizzly Bear Mountain and Scented Grass Hills, on the south and west shores of Great Bear Lake.

## CLIMATE

The climate is one of long, cold winters, short, moderately warm summers, and light precipitation. The season of open water on Great Bear Lake lasts from about July 15 to October 15, and on Great Slave Lake from about June 15 to October 15. The season of open water on the smaller, inland lakes begins and ends from 1 to 3 weeks sooner than on Great Bear and Great Slave Lakes. All lakes and rivers in the district are frozen for the remainder of the year, except a few weeks during the spring break-up and autumn freeze-up. The mean annual temperature on the east shore of Great Bear Lake is about 12 degrees F., but this may be about the coldest part of the district. Winter temperatures as low as —72 degrees F. have been recorded at Great Bear Lake, but the mean temperature for the coldest month (January or February) throughout the district is about —20 degrees F. During the latter part of December the sun shines for a few hours daily south of Great Slave Lake, but does not rise above the horizon on parts of Great Bear Lake. The annual snowfall ranges from 3 to 5 feet, but there is rarely more than 2 feet of snow on the ground and in some years there is less. The summers, although short, are pleasantly warm, with long periods of continuously fine weather. Temperatures above 85 degrees F. are not uncommon for short periods, but the mean temperature throughout the district for the warmest month (July) is about 60 degrees F. June and most of July are months of continuous daylight, and for a few days during the latter part of June the sun does not set on parts of Great Bear Lake or on points north. Annual precipitation is about 12 inches, of which about 7 inches is in the form of rain. Much of the rain comes in brief showers. Strong winds are common throughout the year, and are particularly common beyond the northern limit of trees where they sometimes reach the velocity of gales. A few weeks of fine, moderately warm weather are common just before spring break-up, and this period is often used by prospectors and others wishing to extend the summer season. During the summer the ground thaws to a depth ranging from a few inches to about 2 feet, but ground for many feet below this depth is permanently frozen. At Eldorado mine, on Great Bear Lake, the lower limit of this permanently frozen ground is about 345 feet below the surface, and at Negus mine, near Yellowknife, is at a depth of about 175 feet.

## POPULATION AND SETTLEMENTS

Probably most of the white people of the district are employed by the mineral industry or are in part dependent on it; others are engaged in trapping and trading, transportation, administration, or missionary work. Natives are engaged mainly in trapping and hunting and take no part in mining or prospecting. The census of 1931 gave the population as: White, 676; Indian, 2,549. The present white population is not known, but is considerably greater.

Settlements north of Edmonton, Alberta, and most important to the mineral industry of Northwest Territories, are Waterways and McMurray, in Alberta, and Fort Smith, Yellowknife, Port Radium, and Fort Norman, in Northwest Territories. Waterways, near the mouth of

Clearwater River, is 304 miles by Northern Alberta Railways north of Edmonton and is the northern rail terminus for almost all freight entering District of Mackenzie. McMurray is about 3 miles from Waterways; all facilities for handling water-borne freight are at Waterways and aeroplane bases are at McMurray. Fort Smith is the administrative headquarters for Mackenzie District, and offices of the District Agent, Department of Mines and Resources, are located there. The settlement is on Slave River a few miles north of the Alberta-Northwest Territories boundary and 450 miles north of Edmonton. It is at the north end of a 16-mile portage from Fitzgerald, Alberta. A Mounted Police detachment, wireless station, missions, hospital, school, and hotel are located there. Yellowknife, on Yellowknife Bay on the north shore of Great Slave Lake, is 610 miles north of Edmonton, and has risen from a few buildings in 1936 to probably the most active and modern community in Northwest Territories. On October 1, 1939, it became the centre of an administrative district of 38½ square miles governed by a board of five members, of which two are elected and three appointed by the Commissioner of Northwest Territories. A townsite of about 250 lots has been surveyed and about 100 of these have been leased for 5 years. Two and a half miles of road have been built and a summer water system installed. Businesses are licensed. The town has five general stores, several restaurants and cafes, a thirty-room hotel, a billiard hall, theatre, drug stores, bakeries, bank, three air transport agencies, four water transport agencies, three wireless stations, dentist, doctor, lawyers, magistrate, a detachment of the Royal Canadian Mounted Police, sub-recorders office, liquor store, lumber yards, two oil agencies, cold storage plant (at Con mine), a post office with air mail service from Edmonton three times a week, and other facilities. The post office serves about 850 persons (summer, 1939). Port Radium, on Echo Bay, on the east shore of Great Bear Lake, was formerly called Cameron Bay. It is 30 miles south of the Arctic Circle and 870 miles north of Edmonton. The post office serves about 160 people (June 1939); most of these live at Eldorado mine, 5 miles west; about 15 live in the settlement. A Royal Canadian Mounted Police detachment, wireless station, Hudson's Bay store, and two establishments providing meals and accommodation are located there. Fort Norman, on Mackenzie River at the mouth of Great Bear River, is 230 miles west of Port Radium and 880 miles northwesterly from Edmonton. Trading posts, wireless station, Mounted Police detachment, mission, and school are at the settlement, and oil wells are 50 miles downstream on Mackenzie River.

## VEGETATION

The northern limit of trees is a poorly defined zone passing westerly through Artillery Lake to a point between Mackay and Great Slave Lakes, and thence northwesterly to a point 75 miles southwest of Point Lake, thence north to the Arctic Circle at Coppermine River, then northwesterly to a point 15 miles north of the northern arm of Great Bear Lake, and finally northwesterly towards Mackenzie River delta.

Barren grounds or tundra lie north of the timbered area. In most places the drift and rock is partly covered with lichen, moss, or grass. Willows, alders, ground birch, and berry bushes and heather grow in some

sheltered places. The ground is entirely free of snow in the summer. Low bushes provide limited fuel, but the plentiful resinous white heather is probably the best natural fuel available. Most white men in the barren grounds use gasoline, kerosene, or alcohol for fuel.

That part of the district lying northeast of a line through Fort Smith, northwest arm of Great Slave Lake, and the southern tip of McTavish Arm on Great Bear Lake, and southwest of the northern limit of trees, is sparsely timbered with stunted coniferous trees. Black and white spruce, paper birch, and tamarack are the most common varieties, but there is some Banksian pine, aspen, and balsam poplar. White spruce is by far the most suitable wood for lumber and construction timbers and occurs in isolated stands from south of Great Slave Lake to north of Great Bear Lake. White spruce trees with butts up to 30 inches in diameter grow near the mouth of Slave River; trees with butts 24 inches in diameter were seen between Faber and Marian Lakes, and white spruce logs cut for a sawmill at Eldorado mine on Great Bear Lake have a minimum diameter of about 10 inches. Most of this sparsely timbered area has been burnt over during the past 40 years, and fires have been particularly numerous within a radius of 100 miles of Yellowknife during the past few years.

That part of the district lying south of Great Bear Lake and southwest of a line through Fort Smith, northwest arm of Great Slave Lake, and the southern tip of McTavish Arm on Great Bear Lake is thickly wooded in most places and is the most important forest area of the region. White spruce is probably the dominant species, but there is some aspen, balsam poplar, white birch, Banksian pine, black spruce, and tamarack. Sawmills on Slave River cut mostly white spruce and supply much of the lumber and construction timbers used near and south of Great Slave lake.

About[1] twenty varieties of edible roots, greens, and berries are known in the region. No poisonous mushrooms, toadstools, or berries are known in Northwest Territories. The lichens are the most nourishing and plentiful edible plants.

Small quantities of vegetables are grown at various points along the main waterways as far north as Great Bear Lake, but the district is not well suited to agriculture.

## WILD LIFE

Caribou and fish are the only forms of wild life that can be relied upon to provide much food for men or dogs; there are a few moose and black bear. Caribou are abundant at some seasons of the year on the barren grounds and in the wooded areas bordering the barren grounds. Small fur-bearing animals are plentiful in parts of the district. Ducks and geese frequent the basin of Mackenzie River during the summer months, and several varieties of grouse remain in the district throughout the year. Fish are abundant in many of the lakes and rivers: whitefish, lake trout, and pike are the most common varieties and most widely distributed; grayling and pickerel occur in some places; herring are abundant in Great Bear Lake and inconnu are plentiful in Great Slave Lake.

[1] Porsild, A. E.: Edible roots and Berries of Northern Canada; National Museum, Canada.

Parts of the district north and south of Great Slave Lake lie within the Yellowknife and Slave River game preserves. White men are not allowed to hunt or trap within these preserves.

## HISTORY OF MINING

A little prospecting was done along the Mackenzie River system by prospectors en route to Yukon after the discovery of gold on the Klondike in 1896. Several well-known Canadian mining companies prospected near Great Slave and Great Bear Lakes in 1928-29 without much success. In 1930 silver and pitchblende were discovered by Gilbert LaBine on the east shore of Great Bear Lake. In 1932 there were between 200 and 300 men[1] in Great Bear Lake area and many of these were prospectors. Between 2,500 and 3,000 claims were recorded up to the end of the year. Considerable prospecting was done near Great Bear Lake in 1933, but between 1936 and 1939 most prospecting was done between Great Slave Lake and Indin Lake, and very little prospecting was done near Great Bear Lake. In 1938 about 3,500 claims were recorded between Indin Lake and Great Slave Lake and probably there were between 300 and 400 prospectors in the region during the summer. In 1939 about 1,400 claims were recorded in the area and about 125 men prospected during the summer. At the end of 1939 there were about 7,700 claims in good standing in Northwest Territories and about 5,000 of these were between Great Slave and Indin Lakes. Gold was discovered at Indin Lake by prospectors of Territories Exploration Company, Limited, in the summer and autumn of 1938 and one of these discoveries contained abundant visible gold. They became generally known in Yellowknife by about October and resulted in a rush to stake claims near Indin Lake during the winter of 1938-39. Some prospecting was done in the area in the spring and early summer of 1939, but very little during the latter part of the summer. Most prospecting during the summer of 1939 was done within an area extending 70 miles east of Yellowknife and from Great Slave Lake to an east-west line 35 miles north of Yellowknife, and probably most activity within this area was between Desperation and Hearne Lakes. Some prospecting was done northwest of Yellowknife near Russell and Slemon Lakes and near Snare and Emile Rivers. Most prospectors searched for gold deposits.

First important mineral production in Northwest Territories came from near Fort Norman. Oil was encountered in a well there in 1920, but steady production of oil did not start until 1932. The first metal mine entered production late in 1933 when the concentrator was started at the pitchblende-silver deposit of Eldorado Gold Mines, Limited, on the east shore of Great Bear Lake. Silver concentrates were produced near Eldorado mine by Bear Exploration and Radium, Limited, between 1936 and 1939. In September 1938 first gold was produced in Northwest Territories at the Con mine on Yellowknife Bay on Great Slave Lake. In February 1939 first gold was produced at Negus mine, about one-half mile from Con mine. Eldorado, Con, Negus, and Rycon mines are the only producing metal mines in Northwest Territories (1939).

[1] Kidd, D. F.: Great Bear Lake Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, p. 1.

## MINERAL PRODUCTION

Mineral production of Northwest Territories to the end of 1939 is shown in Table I. Almost no minerals were produced before 1932, and in that year mineral production was valued at $9,251. In 1939 the mineral production, except uranium salts and radium, was valued at $2,072,920; this was 0·44 per cent of the value of minerals produced in Canada in 1939, and was exceeded by Yukon and all provinces except Prince Edward Island. Gold produced in Northwest Territories in 1939 was valued at $1,821,615, and most of it came from Con and Negus mines. Reserves of gold ore were increased throughout the year at properties operated by Ptarmigan Mines, Limited, 6 miles northeast of Yellowknife, and by Thompson-Lundmark Gold Mines, Limited, 30 miles east-northeast of Yellowknife, and these companies considered the advisability of erecting mills.

## TABLE I

*Mineral Production in Northwest Territories, 1932-39*

| Year | Gold (b) | | Silver (b) | | Copper (b) | | Radium (c) | | Uranium salts (c) | | Natural gas(b) | | Petroleum (b) | | Total annual value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fine ounces | Value | Fine ounces | Value | Pounds | Value | Grams | Value | Pounds | Value | M cu. ft. | Value | Barrels | Value | |
| | | $ | | $ | | $ | | $ | | $ | | $ | | $ | $ |
| 1932 | ..... | ..... | (a) | (a) | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 910 | 9,251 | 9,251 |
| 1933 | ..... | ..... | (a) | (a) | ..... | ..... | 3·021 | 176,300 | 34,940 | 71,600 | ..... | ..... | 4,608 | 23,037 | 270,937 |
| 1934 | ..... | ..... | (a) | (a) | ..... | ..... | 2·820 | 112,800 | 27,748 | 46,600 | ..... | ..... | 4,438 | 22,188 | 181,588 |
| 1935 | ..... | ..... | 146,506 | 94,921 | ..... | ..... | 8·486 | 305,500 | 73,089 | 108,200 | ..... | ..... | 5,115 | 25,575 | 534,196 |
| 1936 | ..... | ..... | 317,014 | 143,059 | ..... | ..... | 15·613 | 405,900 | 160,662 | 208,900 | 1,100 | 246 | 5,399 | 26,995 | 785,100 |
| 1937 | ..... | ..... | 135,442 | 60,788 | ..... | ..... | 23·868 | 525,100 | 211,857 | 271,200 | 1,500 | 335 | 11,371 | 56,855 | 914,278 |
| 1938 (f) | 6,794 | 238,979 | 564,146 | 245,274 | (a) | (a) | (a) | (a) | (a) | (a) | 2,500 | 550 | 22,854 | 114,270 | 599,073(d) |
| 1939 (f) | 50,403 | 1,821,615 | 483,515 | 195,765 | 42,382 | 4,277 | (a) | (a) | (a) | (a) | 1,000 | 224 | 17,013 | 51,039 | 2,072,920(d) |
| Totals | 57,197 | 2,060,594 | 1,646,623 | 739,807 | 42,382 | 4,277 | 53·808 | 1,525,600 | 508,296 | 706,500 | 6,100 | 1,355 | 71,708 | 329,210 | 5,367,343(e) |

(a) Data not available.
(b) From reports by Dominion Bureau of Statistics.
(c) From the Mineral Industry During 1937, McGraw-Hill Book Company, 1938, p. 533.
(d) Does not include value of radium, and uranium salts.
(e) Does not include value of radium, and uranium salts, produced in 1938 and 1939.
(f) Data subject to revision.

# CHAPTER II

## SOME ECONOMIC FACTORS AFFECTING MINING

### TRANSPORTATION AND COMMUNICATION

Nearly all heavy freight for the district is shipped by train from Edmonton to Waterways and thence by boat via Athabaska River, Lake Athabaska, and Slave River to Great Slave Lake, or beyond via Mackenzie and Great Bear Rivers to Great Bear Lake; many passengers follow the same route. Edmonton to Waterways, by rail, is 304 miles, and Waterways to Fitzgerald, by water, is 290 miles. All freight and passengers are portaged from Fitzgerald to Fort Smith, a distance of 16 miles. Yellowknife and Port Radium are 300 and 1,050 miles, respectively, beyond Fort Smith. Most heavy freight on Great Bear River is portaged 14 miles around a series of rapids. The season for water transportation at Great Bear Lake is from July 15 to October 15 and at Great Slave Lake from June 15 to October 15; unusual seasons may alter these dates by as much as 3 weeks. Mackenzie River Transport and Northern Transportation Company, Limited, carry most water-borne freight and passengers. These companies operate about twenty-five powered boats and about fifty barges. Many of the powered boats carry passengers. Most boats are diesel powered and four are stern-wheel, wood-burning steamers. The capacity of the barges ranges from 60 to 600 tons and some have refrigeration facilities. The total capacity of the barge fleet is about 8,000 tons. The cost of freight from Edmonton to Waterways, according to class, ranges from $1.70 to $0.38 a hundred pounds. Special rates are available for carload lots. Freight from Waterways to Yellowknife costs $2.25 a hundred pounds or, for larger shipments, $37.50 a ton. Freight from Waterways to Eldorado mine on Great Bear Lake costs $8.50 a hundred pounds, or, for larger shipments, $110 a ton. The cost to each passenger by train and boat from Edmonton to Yellowknife, including berth, meals, and probably hotel accommodation, is about $90. Under normal conditions passengers and express require about 8 days to reach Yellowknife from Edmonton by this route; freight requires 15 days or more. Northbound vessels connect with weekly trains at Waterways.

Freight[1] carried by Mackenzie River Transport and Northern Transportation Company, Limited, in 1939 is shown below, and much of this freight was a result of the mineral industry.

| | Tons freight |
|---|---|
| [1]Total north-bound | 15,657 |
| Total south-bound | 2,806 |
| North-bound from Fort Smith | 6,976 |
| To Yellowknife | 5,600 |
| To Eldorado mine, Great Bear Lake | 1,900 |
| From Eldorado mine, Great Bear Lake | 1,100 |

[1] Includes freight for points between Waterways, Alta., and Fitzgerald, Alta., including Goldfields, Sask.; also freight for points on Mackenzie River below Fort Norman.

[1] Compiled from data supplied by Mackenzie River Transport and Northern Transportation Company, Limited.

Aeroplanes carry all mail, many passengers, and important quantities of freight and express into and within Northwest Territories. Regular schedules are maintained between Edmonton and practically all settlements in the district. Planes are available for charter from air bases at Fort Smith and Yellowknife. During the summer, planes make scheduled flights to most prospecting camps at least once a week. Planes operate throughout the year, except for a few weeks during freeze-up and break-up. Seaplanes are used in the summer and skiplanes in the winter. In normal seasons seaplanes can operate between Eldorado mine or Yellowknife and Edmonton or Waterways from about June 1 until about October 15, and skiplanes from about December 1 until about April 15. Three air companies operate in the district: Canadian Airways, Limited, and Mackenzie Air Service, Limited, from Edmonton, and Peace River Airways from Peace River. The first two companies operated about twelve planes in the district during the summer of 1939, and from June to September, inclusive, their planes operating from Yellowknife, which was the most active air base, carried[1] 1,284 passengers, 562,890 pounds of express, and 16,915 pounds of mail. All planes are equipped with wireless and the largest carry twelve passengers or 3,500 pounds of freight. Passenger fares from Edmonton to Yellowknife and Eldorado mine are $110 and $175, respectively; air express to Yellowknife and Eldorado mine costs 50 cents and 85 cents a pound, respectively. Planes with a payload of about 1,900 pounds may be chartered from Yellowknife for 65 cents a mile. Special prices were quoted for large quantities of air freight; the rate quoted for one air freight contract between Yellowknife and a point 29 miles away was 1·7 cents a pound or $1.17 a ton-mile. During the summer planes flew daily between Edmonton and Yellowknife and twice weekly between Edmonton and Eldorado mine.

During the winter of 1938-39 a 400-mile winter tractor road was constructed between Grimshaw, on the Peace River line of Northern Alberta Railways, and Hay River, on Great Slave Lake. This road is the only winter route for hauling heavy freight from the railroad to Great Slave Lake. About 70 tons of freight was taken from Grimshaw to Yellowknife in March 1939 by Yellowknife Transport Company, and the freight rate charged was $150 a ton or about 30 cents a ton-mile.

Heavy freight is usually hauled from the nearest docking point to a mine or prospect by tractor over a winter road. About 65 miles of such road was constructed from Yellowknife Bay in 1937 at a cost of about $140 a mile, and the cost of hauling freight over it was about 45 cents a ton-mile.

Because of the high cost of sending freight into the district from rail head at Waterways by tractor or aeroplane, mine operators in the district endeavour to anticipate most freight requirements nearly one year in advance and have it shipped by boat. This factor becomes particularly important when a mining property nears the stage when installation of a mill is justified.

Government wireless stations are located at Fort Smith, Yellowknife, Port Radium, Fort Norman, Fort Simpson, Fort Resolution, Fort Chipewyan, Coppermine, and Edmonton. Wireless stations operated by aeroplane

[1] Compiled from data supplied by Canadian Airways, Limited, and Mackenzie Air Service, Limited.

or mining companies are located at Yellowknife, Con mine in Yellowknife Bay, and Eldorado mine on Great Bear Lake. Traffic over Government wireless stations is exchanged with land lines of Canadian National and Canadian Pacific Telegraphs at Edmonton.

All mail is carried by Mackenzie Air Service planes. Yellowknife received mail three times a week and Port Radium once a week during the summer of 1939.

## LABOUR

Six mining companies near Great Bear and Great Slave Lakes employed about 460 men during the summer of 1939, and the aggregate monthly payroll was about $69,000. These men were employed at Eldorado, Con, Rycon, and Negus mines, and at the properties of Ptarmigan Mines, Limited, Thompson-Lundmark Gold Mines, Limited, and Giant Yellowknife Gold Mines, Limited. Daily wages paid at these properties ranged as follows: miner, $5 to $7.50; mucker, $4.50 to $6; labourer, $4 to $5; mill worker, $4.75 to $5.60. One dollar is deducted from these maximum and minimum wages for board. Some miners and muckers receive bonuses in addition to their wages. Prospectors are paid $125 to $175 a month; board, and in many cases transportation to and from place of residence, is provided. A few experienced miners are nearly always available at Yellowknife, but idle men are not often available at Great Bear Lake. Indians and Eskimos are not employed at mines or by prospecting companies. Annual labour turnover at the mines probably ranges from 25 per cent to nearly 100 per cent. Accommodation, recreation, and medical facilities compare favourably with those at other new mining camps in Canada. There is no Workmen's Compensation Board for Northwest Territories, but the principal mining companies provide for compensation either through suitable insurance policies or company funds. Labour unions are not represented in Northwest Territories.

## POWER AND FUEL

Most of the mines and prospects use diesel engines for power; there is not enough wood to furnish fuel for large steam plants, and although suitable sites for hydro-electric plants are known, none has been built but one is planned.

The cost of generating power by diesel engines is three to six times that at many mining camps in northern Ontario, mainly because of the higher cost of oil in Northwest Territories. Diesel oil at the wells at Fort Norman costs 13 cents a gallon and at Waterways, from Turner Valley, 15·9 cents a gallon. Oils may be purchased in drums from either of two oil companies at Yellowknife at the following prices per gallon: gasoline, 45·2 cents; lighting naphtha, 54·3 cents; aviation gasoline, 51·2 to 53·2 cents; diesel fuel oil, 38·9 cents; and kerosene, 50·3 cents. Diesel fuel in larger quantities, as purchased by the mines, costs about 30 cents a gallon at Eldorado mine on the east side of Great Bear Lake and about 23 cents a gallon at Yellowknife Bay, on Great Slave Lake. A 1,234-horsepower plant at Eldorado mine generates power at a cost of $175 a horsepower-year; a plant of similar power at Con mine on Yellowknife Bay generates power at a cost of 2½ cents a Kilowatt-hour.

Some of the possible sites for hydro-electric plants near the north shore of Great Slave Lake were examined[1] in 1937. This work, supplemented by further data on stream flow, suggests: first, that the total power available during the low water season from six sites, three on the lower 30 miles of Yellowknife River and three on the lower 25 miles of its tributary, Cameron River, is 15,300 horse-power; and second, that the total power available during the low water season at four sites on the lower 45 miles of Beaulieu River is 4,750 horse-power. About 9,750 horse-power can be generated during the low water season from two sites on Yellowknife River, 8 and 15 miles from Yellowknife townsite; this is about five times the power generated by diesel engines near Yellowknife Bay in 1939. Consolidated Mining and Smelting Company of Canada, Limited, state that they have let a contract for the erection of a 4,700-horsepower hydro-electric plant at a site on Yellowknife River about 15 miles north of Yellowknife townsite. This plant would supply power to Con and Ptarmigan mines on Yellowknife Bay, and possibly to other properties.

## COST OF SUPPLIES

Supplies in quantities suitable for prospecting operations or domestic use may be purchased at Yellowknife as follows: drill steel ($\frac{7}{8}$-inch octagonal), 30 cents a pound; powder (Polar Forceite, 40 per cent), $13.95 a case; gasoline (in 8-gallon case), $5.32 a case; dimension lumber, $50 to $55 M ft. board measure; wood, $8 to $10 a cord. Beef by the quarter is 30 cents a pound, creamery butter 40 cents a pound, and eggs 35 cents a dozen. The price of general groceries in Yellowknife is about 40 per cent higher than in Edmonton, or about 20 per cent higher than the wholesale price in Edmonton plus cost of freight from Edmonton to Yellowknife.

Charges for meals in restaurants and hotels at Fort Smith, Yellowknife, and Port Radium are 75 cents, $1, and $1.50 each, respectively. Meals served by a mining company near Yellowknife cost that company about 50 cents each.

## PROSPECTING COSTS

Some prospecting operations in Northwest Territories, which employed about ten men for a summer, cost between $400 and $500 a man each month. This cost included wages, supplies, assays, miners' licences, recording fees, transportation to and from the district, aeroplane transportation within the district, and supervision, but did not include erection of frame buildings, diamond drilling, or other underground work. If about ten men are employed by a single organization in widely separated parts of the district much flying will be required for moving men and for supervision, but in most cases it will be cheaper for such an organization to charter aeroplanes as required than to operate its own aeroplane.

[1] Wood, G. H .:Water and Power Bureau, Department of Mines and Resources, Ottawa.

## OPERATING COSTS

Data on the cost of operating mines in Northwest Territories is based on the experience of three mines: Eldorado mine on Great Bear Lake, and Con and Negus mines on Great Slave Lake. Two of these mines have entered production since the summer of 1938. These properties treat from 70 to 110 tons of ore a day, use diesel engines for power, and bring supplies by boat and barge. Direct operating costs at these properties range from about $13.43 to $17.15 a ton of ore milled. The cost for at least one mine may be somewhat less in the future because that mine commenced production with comparatively small ore reserves and the operating cost to date has included a large expenditure for development work necessary to increase these reserves. Power in Northwest Territories costs much more than in many mining districts in Canada, but this cost may be reduced if hydro-electric power becomes available. Transportation costs at properties situated far from the shores of Great Bear or Great Slave Lake would be much higher than at the above mines.

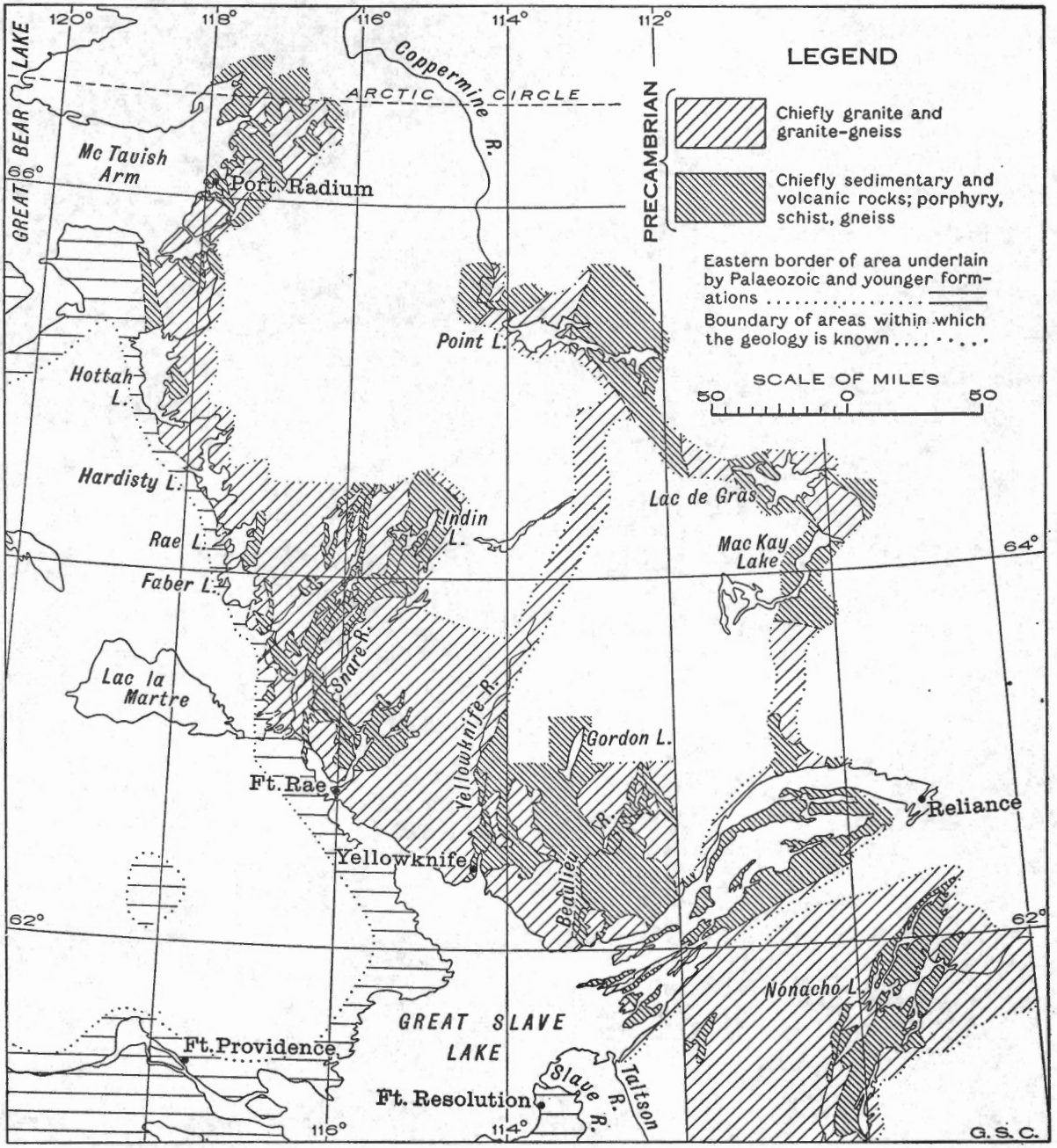


Figure 2. Geology of part of District of Mackenzie, Northwest Territories.

# CHAPTER III

## GEOLOGY

## GENERAL GEOLOGY

### GENERAL STATEMENT

The district is underlain by Precambrian rocks east of a line through Fort Smith, north arm of Great Slave Lake, and the southern tip of McTavish Arm on Great Bear Lake; west of this line it is underlain by sedimentary rocks of Palæozoic and later ages (*See* Figure 2). Only parts of the district have been mapped. Correlation of groups and series of Precambrian sedimentary and volcanic rocks of one part of the district with those of other parts is difficult because in many places the areas of sedimentary and volcanic rocks are separated by granitic rocks of at least two ages and these granites have been subdivided in only a few places. Because the division of Precambrian time into Archæan and Proterozoic eras is based on rock formations in eastern Canada, it is difficult in parts of Northwest Territories to say to which of these two eras certain rocks should be assigned.

*Formations in Part of District of Mackenzie, Northwest Territories*

| Era | Period | [1]Formation | Locality | Lithology |
|---|---|---|---|---|
| Tertiary | | | Mouth of Great Bear River | Sand, clay, gravel |
| Mesozoic | Cretaceous | | North and west sides of Great Bear Lake; Great Bear River; Mackenzie River between Fort Norman and Wrigley; 100 miles northwest of Providence; near latitude 60 degrees; south of Providence and Fort Simpson | Sandstone, shale |
| Palæozoic | Devonian | | West side of Slave River; west side of Great Slave Lake and thence down Mackenzie River to a point midway between Wrigley and Fort Norman | Shale, limestone |
| | Silurian | | West side of Slave River; west side of north arm of Great Slave Lake; some places along Mackenzie and Great Bear Rivers | Dolomite, limestone, gypsum, anhydrite |

*Formations in Part of District of Mackenzie, Northwest Territories—Con.*

| Era | Period | [1]Formation | Locality | Lithology |
|---|---|---|---|---|
| | Ordovician | | West side of north arm of Great Slave Lake | Sandstone, shale, limestone, dolomite, gypsum |
| | Cambrian | | Franklin Mountains (east of Mackenzie River from Fort Norman to Wrigley) | Shale, salt, gypsum |
| | Proterozoic | Coppermine River series | Lower Coppermine River and Arctic Coast | Basalt, sandstone, shale |
| | | Hornby Bay series | McTavish Arm, Great Bear Lake | Conglomerate, sandstone, quartzite |
| | | Et-then series | East arm of Great Slave Lake | Conglomerate, sandstone, quartzite |
| | | Intrusive rocks | | Granite, granodiorite, diorite, etc. |
| | | Epworth dolomite | Coppermine River and Arctic Coast | Dolomite |
| | | Snare group | Emile and Snare Rivers | Conglomerate, arkose, quartzite, shale, argillite, slate, limestone, dolomite, andesite |
| | | Great Slave group | East arm of Great Slave Lake | Upper part: sandstone, shale, argillite, limestone, dolomite, andesite, basalt, trachyte. Lower part: conglomerate, sandstone, quartzite, shale, slate, argillite, iron formation, limestone, dolomite, andesite, tuff, breccia, agglomerate |
| | | Nonacho | Taltson River | Conglomerate, arkose, quartzite, slate, greywacke |
| Precambrian | | Intrusive rocks | | Granite, granodiorite, diorite, etc. |
| | | Cameron Bay group | East side of Great Bear Lake | Conglomerate, sandstone, argillite, tuff |
| | | Echo Bay group | East side of Great Bear Lake | Porphyry, argillite, chert, tuff, quartzite, conglomerate, limestone |
| | | Marian group | Marian River | Quartzite, greywacke, chert, argillite, arkose, iron formation, phyllite, limestone, agglomerate |

*Formations in Part of District of Mackenzie, Northwest Territories—Conc.*

| Era | Period | [1]Formation | Locality | Lithology |
|---|---|---|---|---|
| | Archæan | Yellowknife group | North shore of Great Slave Lake thence to near Indin Lake | Upper part: greywacke, arkose, quartzite, slate, conglomerate, knotted quartz-mica schist, hornfels, quartz-mica gneiss. Lower part: basalt, andesite, dacite, rhyolite, tuff, agglomerate |
| | | Point Lake-Wilson Island group | | |
| | | Wilson Island phase | East arm of Great Slave Lake | Rhyolite, trachyte, conglomerate, arkose, quartzite, iron formation, dolomite, phyllite, sedimentary gneiss, and schist |
| | | Point Lake phase | North shore of Great Slave Lake and thence to Point Lake | Sedimentary gneiss and schist |
| | | Tazin series | Tazin and Taltson Rivers | Slate, quartzite, conglomerate, rhyolite, andesite, dacite, tuff |

[1] The relative ages of the formations within each of the main subdivisions of the Precambrian are, for the most part, unknown.

## DESCRIPTION OF FORMATIONS

The oldest known rocks in the district were formed in Archæan (early Precambrian) time; most of them are sediments, but some are volcanic rocks. Rocks probably of Archæan age have been given the following names in various areas; Tazin series, Point Lake-Wilson Island group, Marian group, Yellowknife group, Echo Bay group, and Cameron Bay group. Rocks of the Tazin series occupy a few small areas within granitic rocks near Tazin and Taltson Rivers and include slate, quartzite, conglomerate, schist, rhyolite, andesite, dacite, and tuff. Rocks of the Yellowknife group and of the Point Lake phase of the Point Lake-Wilson Island group underlie large areas near Beaulieu River, Gordon Lake, Yellowknife Bay, Snare River, Indin Lake, Mackay Lake, Lac de Gras, Point Lake, and elsewhere; they are mostly sediments, but include some volcanic rocks. The oldest exposed members of the groups in some places are volcanic rocks that include basalt, andesite, dacite, rhyolite, tuff, and agglomerate, and the largest known areas of these rocks occur near Yellowknife Bay, upper Beaulieu River, Gordon Lake, Indin Lake, and Snare River. The volcanic rocks are overlain by greywacke, arkose, quartzite, and conglomerate, and over wide areas these rocks have been altered to knotted quartz-mica schist and hornfels, and quartz-mica gneiss. Rocks of the Wilson Island phase of the Point Lake-Wilson Island group outcrop on

islands in the east arm of Great Slave Lake and include rhyolite, trachyte, conglomerate, arkose, quartzite, iron formation, dolomite, phyllite, sedimentary gneiss, and schist. Their age relative to nearby rocks of the Point Lake phase and Yellowknife group is not known; all are cut by granitic rocks. Near Marian River rocks assigned to the Marian group occur as narrow bands within granitic rocks and are associated with feldspar porphyry. The Marian rocks include quartzite, greywacke, chert, argillite, iron formation, phyllite, limestone, and agglomerate, and are cut by granitic rocks; they may be of Archæan age or they may be younger. A sedimentary and volcanic complex that is cut by granitic rocks occurs east of Great Bear Lake and has been subdivided near Echo Bay into Echo Bay and Cameron Bay groups. Rocks of the Echo Bay group comprise intrusive and extrusive porphyry, banded chert, and argillite, and some tuff, quartzite, conglomerate, and limestone, whereas those of the Cameron Bay group include conglomerate and sandstone and some tuff and argillite. Rocks of the Cameron Bay group probably overlie unconformably those of the Echo Bay group. Rocks assigned to these groups may be of Archæan or Proterozoic age, or both. In Archæan time granite, granodiorite, diorite, and related rocks intruded the sediments and volcanic rocks, and in many places altered them to schists and gneisses that in some places are intimately mixed with granitic rock.

Early Proterozoic rocks, mostly sediments, unconformably overlie the Archæan rocks in many places, and may include the following groups: Nonacho series, Great Slave group, Snare group, and Epworth dolomite. Rocks of the Nonacho series occupy northeasterly trending basins for over 100 miles near Thekulthili and Nonacho Lakes on upper Taltson River and include conglomerate, arkose, quartzite, slate, and greywacke. Rocks of the Great Slave group occur in a complex syncline about 150 miles long in the east arm of Great Slave Lake. The lower part of the group includes conglomerate, sandstone, quartzite, shale, slate, argillite, iron formation, dolomite, limestone, andesite, tuff, breccia, and agglomerate, and the upper part comprises sandstone, shale, argillite, limestone, dolomite, andesite, basalt, and trachyte; the upper and lower parts may be separated by an unconformity. The Snare group of rocks occurs along and near Emile River for a distance of over 70 miles, and occupies narrow basins that trend about north; the rocks include conglomerate, arkose, quartzite, shale, argillite, slate, limestone, dolomite, and a little andesite. Epworth dolomite outcrops near Coppermine River about 50 miles from its mouth and on the Arctic coast 80 miles and 145 miles east of the mouth of Coppermine River. In many places early Proterozoic rocks have been intruded by granitic rocks. In only a few places have the granitic rocks of Proterozoic age been mapped separately from those probably of Archæan age.

Rocks that probably are late Proterozoic are grouped under the terms Et-then series, Hornby Bay series, and Coppermine River series, and are not known to be cut by granitic rocks but are cut by diabase at many places. The Et-then series of conglomerate, sandstone, and quartzite occurs in parts of the east arm of Great Slave Lake. Hornby Bay conglomerate, sandstone, and quartzite outcrop on the north and south shores of McTavish Arm at the east end of Great Bear Lake. Rocks of the Coppermine River series occur for about 80 miles east and west of the mouth of

Coppermine River and along the river to a point about 50 miles from its mouth. The lower part of the series is mainly amygdaloidal basaltic lava and the upper part is interbedded sandstone and shale.

Palæozoic sedimentary rocks outcrop west of Slave River, around the west end of Great Slave Lake, and west of a line of lakes extending from the north arm of Great Slave Lake to McTavish Arm on Great Bear Lake; they also occur on the south shore of Great Bear Lake and at many places along Mackenzie River between Fort Norman and Great Slave Lake. In places these rocks have been seen to rest unconformably on Precambrian rocks. The precise age of all the Palæozoic rocks that have been examined is not known, but in most places where it is known the rocks belong to the Silurian and Devonian and in a few places to the Ordovician and Cambrian. Middle and Lower Cambrian rocks are exposed in Franklin Mountains, which lie east of Mackenzie River from Fort Norman to Franklin and are mostly shale but include a little salt and gypsum. They rest on clastic beds that may be of late Precambrian age. Lithologically similar rocks, as determined by deep borings, are known to underlie Silurian strata near Great Slave Lake. Ordovician beds, in part of Richmond age, have been recognized only on the west side of the north arm of Great Slave Lake, and north of the north arm west of Marian River. Ordovician rocks include sandstone, shale, limestone, dolomite, and gypsum, and rest unconformably on Precambrian rocks in places. Silurian dolomite and limestone with gypsum and anhydrite occur along Slave River, on the west shore of Great Slave Lake, and in places along Mackenzie and Great Bear Rivers. Most rocks near the west end of Great Slave Lake and thence down Mackenzie River to a point about midway between Fort Norman and Wrigley are of Middle and Upper Devonian age and are separated from older rocks by an unconformity; the Middle Devonian rocks are mostly limestone and the Upper Devonian rocks mostly shale.

Mesozoic sandstones and shales of Cretaceous age, with some coal seams, rest on an erosion surface developed on Devonian and older rocks. The Cretaceous beds outcrop south of Fort Simpson and Fort Providence near latitude 60 degrees, about 100 miles northwest of Fort Providence, around the north and west sides of Great Bear Lake, along Great Bear River, and along Mackenzie River from Fort Norman to a point about midway between Fort Norman and Wrigley.

Tertiary beds, probably of Eocene age, rest on Cretaceous and older rocks near the mouth of Great Bear River and comprise partly consolidated, crossbedded sand, clay, and gravel, and some lignite.

## STRUCTURAL GEOLOGY

Archæan sedimentary and volcanic rocks occupy basins within granitic rocks and trend in all directions; they dip at angles steeper than 65 degrees in most places, and in many places are nearly vertical or are overturned. Over wide areas they have been altered to schist and gneiss. The average dip of rocks of the Marian group is less than 65 degrees and is some places 15 degrees. In many places the dips of Cameron Bay and Echo Bay rocks are less than 45 degrees. Sediments of the Yellowknife group are intricately crumpled in many places, but the lavas of this group perhaps form more open and regular folds.

Early Proterozoic rocks occur in elongated basins within older rocks, and in most places strike about parallel to the borders of these basins. In some places they are horizontal and in other places are vertical, but in many places dip at angles of less than 45 degrees; in most places they dip more gently than underlying sedimentary and volcanic rocks. They are much fresher than the older rocks and have not been altered to schist and gneiss.

Late Proterozoic sediments and lavas dip at angles ranging up to 15 degrees in most places, but in some places they dip as steeply as 70 degrees. They are cut by tabular bodies of diabase, many of which are parallel to the bedding.

The Precambrian rocks are broken by many faults. Some of these faults occur near where the Precambrian rocks are overlain by Palæozoic rocks, but the faults are not known to cut the Palæozoic rocks. Most of the faults have steep dips and some have been traced for many miles and have displaced adjacent rocks from 1 to 5 miles or more. Such faults in the east arm of Great Slave Lake strike about north 30 degrees east; near Yellowknife Bay they strike about north; near Snare and Emile Rivers most of them strike northerly or northeasterly; near Indin Lake many trend northerly or northwesterly; and on the east side of Great Bear Lake most of them strike northeasterly. Along many northerly trending faults the east side is displaced north relative to the west side; on many northeasterly trending faults the northwest side is displaced towards the northeast and on many northwesterly trending faults the northeast side is displaced towards the northwest. Large quartz veins or diabase dykes occupy some of the faults.

Palæozoic and younger rocks in most places between Mackenzie Mountains on the west and the Precambrian area on the east are nearly horizontal or dip at angles of only a few degrees. East of Mackenzie River between Fort Norman and Wrigley several close folds, which lie *en échelon*, form Franklin Mountains and involve Cretaceous and older rocks, but Tertiary beds nearby are nearly horizontal.

# CHAPTER IV

# ECONOMIC GEOLOGY

## GENERAL STATEMENT

In 1939 Northwest Territories produced gold, silver, copper, natural gas, and petroleum valued at $2,072,920 and radium-uranium (pitchblende) concentrates valued at $2,391,325. These products came from three gold mines on Great Slave Lake (Con, Rycon, and Negus mines), a radium-uranium mine on Great Bear Lake (Eldorado mine), a silver mine near Great Bear Lake (Bear Exploration and Radium, Limited), and oil wells near Fort Norman (Imperial Oil, Limited). Nearly all mining effort in recent years has been directed toward a search for gold mines, although deposits of many other minerals are known. The eastern part of the district is underlain by Precambrian rocks and contains deposits of gold, radium, uranium, silver, copper, lead, zinc, tungsten, iron, and other metals. Only a very little of this part of the district has been thoroughly prospected and probably many more deposits will be found. The western part of the district is underlain by Palæozoic and younger sedimentary rocks and contains petroleum and natural gas, coal, gypsum, and salt, but only a few known deposits of metallic minerals. No placer deposits of commercial importance are known east of Mackenzie River and probably none exists.

## MINERAL DEPOSITS

Many of the known mineral deposits, including those on which most work has been done and those from which metals have been produced, can be classified as follows:

### *Deposits of Metallic Minerals*

(1) Gold

(a) Gold-quartz veins in volcanic rocks of the Yellowknife group.
Examples: Dingo group (23)[1]; Pa group (24); Ann group (26); Giant Yellowknife Gold Mines, Limited (59); Con and Rycon mines (63); Negus mine (64).

(b) Gold-quartz veins in sedimentary rocks of the Yellowknife group.
Examples: Au group (28); Try Me group (33); Pan group (35); Camlaren Mines, Limited (37); Mon group (39); S.D.C. group (41); Harry A. Ingraham Trust (42); Thompson-Lundmark Gold Mines, Limited (48); Ptarmigan Mines, Limited (58); June group (66).

(c) Gold-tungsten replacement deposits.
Example: Slave Lake Gold Mines, Limited (73).

(2) Pitchblende (radium, uranium) and silver.

(a) Pitchblende deposits, some of which contain silver.
Examples: Workman Island (8); Eldorado mine (11); Thompson group (16); WLO and WK claims (20); Tatee and Bee claims (21).

(b) Silver deposits, some of which contain pitchblende.
Examples: Echo Bay group (12); Bonanza group (14); Bear Exploration and Radium, Limited (15); How group (17); Otter group (18); Elite group (19).

[1] This number appears on Figure 3 and indicates the approximate location of the property.

(3) Copper.
  (a) Copper sulphides in large ("giant") quartz veins.
    Examples: B group (3); Polaris, Vega, and Star claims (6); Consolidated Mining and Smelting Company group, Hunter Bay (7).
  (b) Native copper or copper sulphides in volcanic rocks of the Coppermine River series.
    Examples: A group (4); D group (5).
(4) Copper, lead, and zinc replacement deposits.
    Example: XL group (44).
(5) Lead and zinc replacement deposits in dolomite.
    Example: Pine Point (75).
(6) Sedimentary iron deposits.
    Examples: Iron Islands (74); Utsingi Point (71).

*Deposits of Non-metallic Minerals*

(1) Petroleum and natural gas.
    Example: Imperial Oil, Limited (22).
(2) Coal.
    Example: Etacho Point (9).

GOLD

Deposits of gold-bearing quartz are far more numerous than known deposits of other metals in the area covered by this report. Most of the known gold deposits occur north of Great Slave Lake in the Yellowknife Bay-Beaulieu River area; others occur in Snare River and Indin Lake areas, and a few are reported from Great Bear Lake area. Almost all known gold occurs in quartz and almost all known deposits of gold-bearing quartz occur within rocks of the Yellowknife group. Probably most known deposits occur within the sediments of this group, but many occur within the volcanic rocks: sediments occupy greater known areas than the volcanic rocks. Ore-bodies occur in quartz in sediments and volcanic rocks, but probably most of the known ore-bodies occur in the volcanic rocks.

The three producing gold mines, Con, Rycon, and Negus, are in andesitic volcanic rocks (greenstones). The gold at these mines occurs in quartz veins in steeply dipping, strong, rusty-weathering, carbonatized shear zones, some of which are more than 1,200 feet long. The quartz veins contain a wide variety of metallic minerals, but these minerals are sparsely disseminated and aggregate not more than a few per cent of the volume of the veins; pyrite is the most plentiful metallic mineral. The longest known ore shoot is 287 feet long and averages 3·8 feet wide. Many ore shoots are less than 3½ feet wide. The widest known ore shoot averages 17 feet wide and is 100 feet long. The veins at Con and Rycon mines have been explored to a depth of 500 feet and gold-bearing quartz occurs on the lowest levels of both mines. Ore has been mined to a depth of 250 feet at Con and Rycon mines and 300 feet at Negus mine. In 1939 these properties produced about 49,745 fine ounces of gold from 58,163 tons of ore. At the end of 1939 their ore reserves totalled 66,620 tons and contained about 57,600 fine ounces of gold.

Deposits of gold-bearing quartz so far found in the sediments are about equally distributed between comparatively fresh greywackes and slates (locally known as "cold" sediments) and the more highly altered, knotted quartz-mica schists (locally known as "hot" sediments). Most

known gold occurs in fairly regular veins of nearly pure quartz, but gold is abundant in parts of many stockworks and irregular bodies of quartz. Nearly all quartz bodies dip steeper than 45 degrees. In many places the walls of quartz bodies in the sediments are tight, but in some places the rock next the quartz is slightly fractured or sheared. Most gold-bearing quartz contains very small amounts of some of the following minerals: pyrite, arsenopyrite, chalcopyrite, pyrrhotite, galena, sphalerite, carbonate, feldspar, and tourmaline. In many places the gold is coarse and readily visible. Many deposits of gold-bearing quartz belong to one of the following types, and some quartz in each of the first three types is ore or nearly ore.

(1) Veins of nearly pure quartz parallel to the bedding of the sediments. Examples: Fraser, Kim, B, and Island veins of Thompson-Lundmark Gold Mines; and H vein, Camlaren Mines.
(2) Veins of nearly pure quartz that cross the bedding of the sediments. Examples: Ptarmigan Mines and Au group.
(3) Quartz introduced along the axial planes of tight folds. In most places the quartz occurs as irregular lenses and stringers, as on the Pan group and in the "31" vein of Camlaren Mines. In the Hump vein of Camlaren Mines it forms a saddle reef on the crest of an anticline.
(4) Quartz introduced as irregular bodies along drag-folds. Examples: S.D.C. group and Mon group.
(5) Quartz introduced as irregular lenses and stockworks within weak, slaty rocks between stronger, massive greywackes or altered greywackes. Example: Vic 5 claim, Harry A. Ingraham Trust.

Veins of nearly pure quartz parallel to the bedding of the sediments are not common, but some of them contain ore or quartz that is nearly ore. Most of them occur as single veins without much included rock and have regular walls. They dip between 45 degrees and vertical. The Fraser vein on the property of Thompson-Lundmark Gold Mines, Limited, is a single vein of nearly pure quartz and is at least 540 feet long at the surface, where it averages 2½ feet wide. The walls are tight and regular in most places. It dips 47 degrees and is explored to a vertical depth of 230 feet, and an ore shoot that occurs on all levels averages 313 feet long, 2·3 feet wide, and contains 18,600 tons of ore, which averages 0·83 ounce of gold a ton. The quartz contains a little tourmaline, galena, pyrite, and visible gold. The Kim "vein" on the same property is at least 1,750 feet long and dips 50 degrees. Fifteen hundred feet at the surface averages 6½ feet wide and contains about 25 per cent quartz, and in most places this quartz occurs in three veins each of which is nearly free of included rock. The rock near the quartz is sheeted and slightly sheared. Quartz that is almost ore grade occurs in the vein from the surface to the lowest level, at a vertical depth of 230 feet. The quartz contains tourmaline, pyrite, galena, sphalerite, chalcopyrite, and visible gold.

Veins of nearly pure quartz that cross the bedding of the sediments are not common, but one of them contains ore and is being explored by Ptarmigan Mines, Limited. It is exposed for 1,300 feet at the surface where it averages 12 feet wide. The vein strikes north 65 degrees west and is nearly vertical, and the adjacent beds strike north 10 degrees west and dip 45 to 80 degrees east. In some places the walls are sharp and tight, but sinuous, and in other places they are irregular or the quartz grades into the adjacent rock through several feet of quartz and rock. In some places the vein splits and includes lenses of country rock. By August 1939

it had been explored to a depth of 300 feet and contained ore on all levels; it is reported to contain ore at a depth of 450 feet. The tonnage and gold content of the ore is not known. The quartz contains a little pyrite, sphalerite, galena, arsenopyrite, chalcopyrite, pyrrhotite, tourmaline, feldspar, and visible gold.

An irregular body of quartz has been introduced along a faulted drag-fold on the S.D.C. group and contains considerable gold, but is not ore. It outcrops over a length of about 200 feet and has a maximum width of about 40 feet. The central part is entirely quartz, but at either end and along the margins it contains a large proportion of country rock. The quartz contains arsenopyrite, pyrrhotite, galena, pyrite, chalcopyrite, and sphalerite, and in places these minerals are abundant. It also contains a little feldspar and visible gold.

Quartz occurs in slaty rocks between massive greywacke or altered greywacke at many places, but none is known to constitute ore although some contains gold. In places the quartz is in a single slaty bed and at other places it is in bands up to 65 feet wide of many slaty beds. The weak slaty rocks have been squeezed between the stronger massive greywackes and have in part been crumpled and mashed, and the quartz entered along the resultant channelways and formed irregular lenses and stockworks of veinlets.

Gold and ferberite (a tungsten mineral) occur together on the property of Slave Lake Gold Mines, Limited, in Great Slave Lake area. Mineralized bodies on the property are the result of replacement of fractured zones in quartz-mica schist by quartz and chalcopyrite with which are associated a little gold, ferberite, and other minerals. It is reported that one zone, to a depth of 425 feet, contains 17,308 tons of mineralized rock with an average gold content of 0·5 ounce a ton. The same zone is reported to contain considerable tungsten-bearing rock, some of which occurs 425 feet below the surface.

### PITCHBLENDE AND SILVER

Deposits of pitchblende or silver or of both minerals occur in Great Bear Lake area near Echo Bay on the east shore of the lake; near the mouth of Camsell River 35 miles south of Echo Bay; and near Beaverlodge and Hottah Lakes 90 miles south of Echo Bay. They contain a wide variety of minerals, of which the following are most common: quartz, hematite, pitchblende, cobalt-nickel minerals, chalcopyrite, pyrite, galena, sphalerite, bismuth minerals, dolomite, rhodocrosite, other carbonates, and silver. The deposits at Eldorado mine on Labine Point and at the mine of Bear Exploration and Radium, Limited, at Contact Lake are of this type and are the only deposits of known economic importance in Great Bear Lake area. Most other deposits of this type, so far as known, are very small. The deposit at Eldorado mine is a pitchblende deposit and contains only a little silver. The pitchblende is associated with brownish quartz in steeply dipping shear zones in highly altered siliceous sediments and feldspar porphyries of the Echo Bay group. The zone that contained most pitchblende is more than 2,100 feet long and averages about 5 feet wide. It has been explored to 800 feet below lake-level and ore was found on all levels. On each of two levels 750 feet of drift encountered drift-

lengths of ore totalling about 500 feet. Most ore shoots are less than 3½ feet wide. Probably most ore at the mine occurs where the shear zones cut altered sediments. About 126,370 tons of ore were milled from 1934 to 1939 and the estimated value of the concentrates recovered is $7,639,764. Ore reserves are reported (December 1939) ample for the operation of the present mill for 4 years. The deposit of Bear Exploration and Radium, Limited, was a silver deposit, but contained a little pitchblende; the mine was closed in 1939. Veins of quartz and carbonate occur in a steep, fractured and sheared zone in massive grandiorite and some of the veins contained abundant native silver. The zone is more than 870 feet long and comprises a series of narrow fractures that branch and join, are distributed over widths up to 40 feet, and are separated by massive granodiorite. Veins occur in some of the fractures and range in width from thin seams to over 2 feet. The zone was explored to a depth of 190 feet and ore occurred on all levels. Four ore shoots on one level ranged from 30 to 74 feet long, the average width ranged from 1¼ to 5 feet, and the silver content ranged from 72 to 261 ounces a ton. About 10,080 tons of ore were milled and 348,250 ounces of silver recovered, from 1934 to 1939. Only a little known ore is left in the mine.

### COPPER

Copper deposits occur in Great Bear Lake area near Hunter Bay, and in Coppermine River-Arctic Coast area near Coppermine River and Dismal Lakes and on Bathurst Inlet. Only a little work has been done on them and none is known to be of commercial value. Deposits of bornite, chalcopyrite, and chalcocite occur in large ("giant") quartz veins near Hunter Bay and Dismal Lakes. The copper deposits near Coppermine River and Dismal Lakes and on Bathurst Inlet occur in rocks of the Coppermine River series, and include deposits of: (1) native copper in minute flakes in massive basalt; (2) native copper in the amygdaloidal tops of some flows; (3) native copper as sheets, in some places ⅛ inch thick, in cracks in the basalt; and (4) bornite, chalcocite, covellite, and chalcopyrite, with quartz and carbonate minerals, in shear and fracture zones or veins that traverse the basalt.

### COPPER, LEAD, AND ZINC

Copper, lead, and zinc sulphides have selectively replaced altered beds of the Yellowknife group near granite at Turnback Lake in the Beaulieu River area. Deposits occur here and there over a length of 1,900 feet, but are not known to be of commercial value.

### LEAD AND ZINC

Lead and zinc replacement deposits occur in Devonian dolomite near Pine Point on Great Slave Lake, and considerable work has been done on them. The dolomite is flat or dips at angles up to 10 degrees, and contains pores and cavities. The principal metallic minerals are galena, sphalerite, and pyrite, and the silver content is negligible. The minerals occur as horizontal impregnations along favourable beds, along vertical or inclined joints, and they also cement fragments of dolomite to form a breccia.

### IRON

Sedimentary iron deposits containing specularite and oolitic hematite occur on islands in Great Slave Lake. A bed of hematite[1] 20 feet thick occurs in Silurian rocks about 20 miles east of Wrigley on Mackenzie River. None of the deposits is of commercial value.

### PETROLEUM AND NATURAL GAS

Petroleum and natural gas are produced from two wells in Upper Devonian rocks 50 miles northwest of Norman. Other unsuccessful wells have been drilled nearby. From what is known the prospects for a large production of oil from this area are not very favourable. Oil seepages are known near the west end of Great Slave Lake from Middle Devonian rocks. Wells were drilled in this area near Windy Point and Hay River, but no oil was found.

### COAL

Coal (lignite) outcrops at intervals for 1½ miles near Etacho point on the west shore of Great Bear Lake.

## SUGGESTIONS TO PROSPECTORS

Before going too far afield prospectors should carefully consider all areas near Great Slave and Great Bear Lakes. Operating costs at properties far inland will be considerably higher than at those near the lakes and, therefore, the chances of finding a deposit that can be worked at a profit in the more remote inland areas are correspondingly decreased. Although most prospecting during the past few years has been done within 60 miles of the north shore of Great Slave Lake, the possibilities of this area have not been exhausted. Most gold discoveries during 1939 were made in this area, including a vein on the property of Thompson-Lundmark Gold Mines, Limited, 30 miles east of Yellowknife, in which a body containing 18,600 tons of high-grade gold ore was developed by March 1940. In almost all cases prospecting should be confined to areas for which good topographic maps (*See* Appendix and Figure 9) are available, as even experienced prospecting companies have found exploration beyond mapped areas to be difficult and expensive. Prospectors without previous experience in the district should confine their efforts to areas covered by geological maps (*See* Figure 2). Gold was found at many new places in 1939 and almost all these places are within areas mapped by the Geological Survey.

Suggestions for prospecting within these areas will be found in the reports accompanying the geological maps (*See* Appendix). Most metalliferous mineral discoveries made to date are gold deposits and most known gold deposits occur near the north shore of Great Slave Lake in the Yellowknife Bay-Beaulieu River area (*See* Figure 3), and some occur in the Snare River and Indin Lake areas. Nearly all known gold deposits are in quartz veins within greenstones, knotted schists, and fresh greywackes

[1] Kindle, E. M.: Notes on the Iron Ores of the Mackenzie River Valley; Geol. Surv., Canada, Sum. Rept. 1919, pt. C, pp. 1-2.

and slates of the Yellowknife group. Prospectors should, therefore, pay particular attention to rocks of the Yellowknife group and should examine them regardless of their composition or degree of metamorphism. About 6,500 square miles of Yellowknife rocks have been mapped. All quartz bodies in these rocks should be carefully examined, irrespective of their colour, texture, form, or mineral content. Bodies of gold-bearing quartz should be searched for along faults, shear zones, drag-folds, crests and troughs of tight folds, or in weak slaty bands that have been squeezed between strong beds of massive greywacke. Contacts between unlike rocks, as greenstone and sediments, should be examined for shear zones and quartz.

Prospecting conditions during the summer are excellent in many parts of the district near Great Slave and Great Bear Lakes. The country is well suited to travel by canoe, as lakes and rivers are numerous, vegetation is sparse, and portages are made with minimum labour. Detailed topographic maps are available for more than 100,000 square miles of territory underlain by Precambrian rocks. Long periods of continuously fine weather are common and daylight is continuous for about 2 months of the summer. Ample aeroplane service is available at Yellowknife and other places and aeroplanes can land on many of the numerous lakes throughout the Precambrian area. Rock exposures are numerous in many places. Aerial photographs (*See* Appendix and Figure 9) are available for all mapped areas. These may be of considerable use to the prospector when his work is confined to a limited area, such as a group of claims. With a little experience, and where rock is well exposed, many geological features can be seen on the photographs, including contacts, faults, folds, dykes, and quartz veins. The photographs are almost essential for detailed prospecting in areas that are not geologically mapped, but they are also useful in areas for which geological maps are available because they may show details not shown on the geological maps.

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# CHAPTER V

## DESCRIPTIONS OF PROPERTIES

## COPPERMINE AREA-ARCTIC COAST AREA

### Galena Deposit on Bathurst Inlet (1)[1]

A galena deposit on Galena Point 10 miles southeast of Cape Barrow on the west side of the entrance to Bathurst inlet was described by O'Neill.[2]

"At Galena point, in Bathurst inlet, granite outcrops and is much weathered and has disintegrated to a depth of a few inches. Near the middle of the point, about 200 yards back from the beach, galena occurs in three places. At one place a small pocket of pegmatite, 6 inches in length, contains white feldspar, quartz, some muscovite, and on one side, 2 inches of galena. The two other occurrences are lenticular veins 9 and 20 feet in length respectively, and about 3 inches in width, composed of milky quartz carrying a little galena. No more galena was seen in the northern part of the point although narrow veins of quartz are numerous."

### Copper Deposits on Bathurst Inlet (2)

These deposits were described by O'Neill[3] and his description was summarized by Stockwell and Kidd[4].

The latter description follows:

"The copper-bearing rocks in Bathurst inlet apparently occupy an area separate from Coppermine River area. The part of the Bathurst Inlet area examined is oval-shaped, extends about 50 miles northwest-southeast, and has a maximum width of about 25 miles, and a total area of about 1,000 square miles. This area includes more than one hundred and fifty islands of various sizes in Bathurst inlet, Banks peninsula, the western mainland, and a strip 5 or 6 miles wide extending along the coast from Arctic sound to Moore bay. The thickest section seen consists of about 9,500 feet of basaltic amygdaloids.

"The copper-bearing formation belongs to the Coppermine River series, and is a series of basic lava flows with a few thin beds of tuffaceous conglomerate and ash. The beds dip in various directions at an average angle of about 6 degrees, forming a shallow basin, or basins.

"Native copper was seen on almost every island in the area, as well as on the mainland. The distribution of the metal is remarkably uniform throughout any single flow. A rock section over 450 feet thick, on Banks peninsula, showed copper through about 350 feet of the total thickness.

"The native copper occurs in three forms. (1) As minute flakes scattered throughout the dense groundmass of the basalts. This copper occurs over the whole area of more than 1,000 square miles and practically through the whole exposed thickness of the formation. Analyses of forty-five

[1] This number appears on Figure 3 and indicates the approximate location of the deposit.

[2] O'Neill, J. J.: Report of the Canadian Arctic Expedition, 1913–18; vol. XI, Geology and Geography, pt. A, p. 47.

[3] O'Neill, J. J.: Report of the Canadian Arctic Expedition, 1913–18; vol. XI, Geology and Geography, pt. A.

[4] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 82–83 (out of print).


Figure 3. Index map of part of District of Mackenzie, Northwest Territories, showing position of properties described. 1, Galena deposit on Bathurst Inlet; 2, Copper deposits on Bathurst Inlet; 3, B group; 4, A group; 5, D group; 6, Polaris, Vega, and Star claims; 7, Consolidated Mining and Smelting Company group, Hunter Bay; 8, Workman Island pitchblende deposit; 9, Etacho Point coal deposits; 10, Oro group; 11, Eldorado Gold Mines, Limited; 12, Echo Bay group; 13, Bud group; 14, Bonanza group; 15, Bear Exploration and Radium, Limited; 16, Thompson group; 17, How group; 18, Otter group (White Eagle Silver Mines, Limited); 19, Elite group; 20, W L O and W K claims; 21, Tatee and Bee claims; 22, Imperial Oil, Limited; 23, Dingo group; 24, Pa group; 25, Ma group; 26, Ann group; 27, Deloro group; 28, Au group; 29, Corinne group; 30, Keno vein; 31, Galloway Gordon Lake Mines, Limited; 32, Ardogo group; 33, Try Me group; 34, Territories Exploration Company, Limited; 35, Pan group; 36, Sentinel Mines, Limited; 37, Camlaren Mines, Limited; 38, E.P. group; 39, Mon group; 40, Lil and Lilex groups; 41, S.D.C. group; 42, Harry A. Ingraham Trust; 43, Kal group; 44, XL group; 45, Ruth group; 46, Irma group; 47, Bobjo group; 48, Thompson-Lundmark Gold Mines, Limited; 49, Walsh Lake group; 50, Homer group; 51, Arseno group; 52, Nib group; 53, Fox claim; 54, A E S group; 55, Gold group; 56, Murphy-Bell group; 57, Star group; 58, Ptarmigan Mines, Limited; 59, Giant Yellowknife Gold Mines, Limited; 60, Aye group; 61, Duck Lake group; 62, Rich group; 63, Con and Rycon mines; 64, Negus Mines, Limited; 65, Baltic group; 66, June group; 67, July group; 68, P. L. D. group; 69, Ena group; 70, Niccolite veins; 71, Iron deposits; 72, Gold-quartz veins; 73, Slave Lake Gold Mines, Limited; 74, Iron deposits; 75, Lead and zinc deposits.

representative samples show that the values range between $\frac{1}{100}$ and $\frac{1}{4}$ of 1 per cent. (2) As irregular grains and small masses filling, or partly filling, the branching gas cavities near the surface of the basalt flows. The amygdaloidal portions of the flows range from a few inches to several feet in thickness and in places contain several per cent of copper, whereas in other places the amygdules are filled with other minerals. The amygdaloidal portions are commonly exposed only along cliffs, which, however, are in many places screened by talus. Under these conditions it was not possible when merely conducting a reconnaissance, to judge of the relative extent and importance of the amygdaloidal copper. (3) In fissures and shatter planes not confined to any particular horizon in the basalt flows. This mode of occurrence is important in some areas where the basalts have been considerably shattered and are now traversed by a network of thin fissures occupied by plates of native copper or by vein material containing a small amount of native copper.

" In addition to native copper, sulphides of copper occur in the district and appear to be worthy of investigation. Chalcocite and covellite have been found replacing dolomite which underlies the copper-bearing rocks. Besides the sulphides which replace the dolomites, there is a considerable amount of chalcopyrite and some chalcocite, disseminated through some of the large sills or dykes of diabase that traverse the region. A grab sample of one such occurrence was found by analysis to contain 1·18 per cent of copper."

## B Group[1] (3)

" These claims are 19 miles north of the narrows between Dismal lakes and approximately 45 miles west-southwest of the mouth of Coppermine river. A lake about 4,000 feet long at an elevation of between 700 and 1,000 feet above sea-level is used as an aircraft base.

" The hills at this place rise to 700 feet above the adjacent valleys and have steep southwest slopes and moderate northeast slopes. Outcrops are numerous in the hills, but relatively scarce in the intervening valleys.

" The discoveries on these claims are along the northeast slope of one of these hills and overlook a broad valley. This hill is composed of basaltic flows of the Coppermine River series, the northeast slope being almost a dip slope. On the southwest slope, where the flows can be seen in cross-section, they are 25 to 100 feet thick, fine-grained at the top and bottom, and somewhat coarser grained in the middle. The tops of the flows, and in places other parts, are vesicular or amygdaloidal. The amygdules decrease in size and increase in numbers from the middle to the tops of the flows. They contain several minerals, among which are quartz, epidote, and orthoclase.

" A linear depression striking 295 degrees (magnetic) and in places 50 feet wide, has been traced for 3,000 feet along the north baes of the hill described. It is largely drift filled, but in a few places a quartz-carbonate vein with a visible width of 25 feet is exposed. Ten test pits have been sunk in this draw; some of them expose a quartz vein with bornite-chalcopyrite mineralization; the others show nothing, having never reached bedrock or being now caved. The basaltic flows that form the wall-rocks

[1] Kidd, D. F.: Great Bear Lake–Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 59–60 (out of print).

on the northeast side of the vein are, for a width of as much as 50 feet, fractured and in places cut by small quartz veins that apparently branch at slight angles from the main vein or zone.

"The mineralization in the vein is dominantly massive bornite with, in places, chalcopyrite and covellite, and the gangue is quartz and a yellow carbonate mineral. The quartz frequently exhibits crustiform and banded structures with alternate milky and glassy bands. The quartz is probably of more than one age, as it is found veining bornite and also containing bornite seams. Bornite mineralization has been found in the following pits, commencing with the most westerly. The assay values have been kindly furnished by Northern Aerial Minerals Exploration, Limited.

Pit No. 8A: In the west end of this trench, a 15-inch vein of quartz, buff carbonate, and abundant bornite, strikes diagonally away from the main zone and narrows sharply.

Pit No. 8: This is 300 feet south of pit 8A. Some fragments of bornite lie on the dump. The only exposures are of the east part of a vein of massive quartz.

Pit No. 7: This is 95 feet south of pit No. 8. A breadth of 11·5 feet of the east part of a vein was exposed, displaying abundant bornite with some chalcopyrite; the western part was buried under muck. The company reports that a cross-section of 14 feet 11 inches along the north side of the trench averaged 47·13 per cent copper, and one of 12 feet along the south side averaged 46·99 per cent copper.

Pit No. 6: This pit is 40 feet south of pit No. 7. On the north and south walls a band of nearly solid bornite varying from 3 to 4 feet in width and dipping steeply to the west is exposed.

Pit No. 5: This is 40 feet south of pit No. 6. One foot 6 inches of abundant bornite mineralization, bounded for a short width on the east by quartz, is exposed. The walls of the remainder of the pit have slumped. The company reports an average of 44·65 per cent copper across a width of 9 feet 11 inches.

Pit No. 4: This is 90 feet south of pit No. 5. No exposures. The company reports 35·04 per cent copper across a width of 2 feet and in another band, 7 feet east 25·57 per cent copper over a width of 4 feet 2 inches.

"It is stated that bornite float has been found at several places in and near the linear depression in a length of 2,000 feet."

## A Group[1] (4)

The A group is about 20 miles north of the narrows between Dismal Lakes and about 46 miles west-southwest of the mouth of Coppermine River. A deposit on these claims 1¼ miles northwest of the workings on the adjacent B group was described by Kidd[2].

"..... four trenches have been dug in a small, rocky and grassy flat in which chalcocite-bornite float is present. In the two central pits, 25 feet apart, a nearly pure mixture of chalcocite and bornite in interlocking fragments almost in place is present over a width of 3 feet. In the end trenches the mineralization is less abundant. The gangue is quartz and a white carbonate mineral. One thousand feet to the south in the nearest exposures along the apparent strike, no signs of shearing or veins were seen.

"Two thousand feet northwest of this working a small pit has been sunk in the middle of an area 50 by 20 feet in which chalcocite-bornite float is abundant. None of it can be seen in place in the pit."

[1] Reverted to the Crown.
[2] Kidd, D. F.: Great Bear Lake–Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, p. 60 (out of print).

### D Group[1] [2] (5)

"These claims are situated on the hills at the west end of Burnt Creek valley and are estimated to be 8 miles west of the junction of Burnt creek with Coppermine river. The claims were staked for Northern Aerial Minerals Exploration, Limited.

"The rocks in the vicinity are the basaltic flows of the Coppermine River series. They are cut by a zone of fracturing which where exposed is as much as 8 feet wide and strikes in its southern part approximately north but swings somewhat to the west in its northern part. The zone of fracturing is exposed in a cliff 20 feet high, overlooking the valley of Burnt creek. It is a breccia of basaltic fragments cemented by a white carbonate, which in places carries abundant chalcocite. The walls of the zone are vertical and sharp and the fragments are abundant. G. G. Duncan reports that an average of four channel samples across a width of 8 feet gave 9·96 per cent copper.[3] Approximately 650 feet south along the strike of the zone, across a drift-covered flat, a small trench exposes a width of 7 feet of lower-grade mineralization; and 150 farther south, a trench exposes a width of 8 feet of mineralization similar in grade to that of the exposures in the cliff. In the other direction mineralized float can be traced for 450 feet, and at a distance of 800 feet a narrow depression extending several hundred feet farther along the strike probably indicates the extension of the zone. Mineralized float is reported to have been found in two small pits sunk in the middle of this depression at a distance of 1,200 feet north of the cliff exposure."

## GREAT BEAR LAKE AREA

### Polaris, Vega, and Star Claims (6)

These claims are on the north shore of Hunter Bay 2 miles west of the mouth of Sloan River. The following description is taken from a report by Kidd.[4]

"The claims are crossed diagonally by a large quartz vein known as the Sloan dyke. This vein has a general strike of 50 degrees and is nearly vertical. It has been traced from the lake shore northeast for 7 miles. The width in places is several hundred feet. Two other veins, converging somewhat to the south, lie 600 and 1,500 feet, respectively, northwest of the "Sloan dyke". The Sloan vein is bordered on the west by red granite and on the east by massive, fine-grained, brown to purple rocks of the complex, and carries numerous scattered grains of feldspar, quartz, epidote, and other minerals. Along both borders of the vein the rocks are considerably altered for as much as 100 feet in places. There are shattered zones in the vein itself.

"A mineralized band in the vein has been found in an isolated outcrop near the lake shore and has been traced by four pits to within 200 feet of the shore. Further work here has been prevented by the deep over-

[1] Reverted to the Crown.
[2] Kidd, D. F.: Great Bear Lake–Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 60–61 (out of print).
[3] Duncan, G. G.: Exploration in Coppermine River Area, Northwest Territories; Can. Inst. Min. and Met., Bull. No. 227 (March 1931).
[4] Kidd, D. F.: Great Bear Lake–Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 56–58 (out of print).

burden. The three northern pits show a band of chalcopyrite-bornite mineralization, bordered on the west by altered and chloritized granite and on the east by intensely altered rocks of the complex. The chalcopyrite tends to be more abundant in the western part of the vein and the bornite in the eastern part. The mineralization in the different pits is as follows, the pits being numbered from northeast to southwest:

Pit No. 1: A few specks of chalcopyrite at one place.

Pit No. 2: 15 feet with occasional specks of bornite and chalcopyrite, followed to the east by 14 feet with scattered blebs and areas, some ½ inch wide, of bornite and chalcopyrite.

Pit No. 3: Little material exactly in place is visible, but some fragments as much as 2 feet wide contain abundant bornite.

Pit No. 4: Caved; there are no exposures."

Pits 1 and 4 are about 150 feet apart. A diamond drill hole, located 350 feet southwest of pit 4 was directed at right angles to the strike of the vein and inclined at 60 degrees to the horizontal; the hole intersected disseminated chalcopyrite and bornite for a length of 96 feet beginning 141 feet from the collar. The true width of this mineralized material is not known.

## Consolidated Mining and Smelting Company Group, Hunter Bay[1] (7)

"This group of claims lies 5 miles northeast of the settlement at Hunter bay.[2] It is reached by ascending Sloan river for 5 miles to a small basin at the foot of several miles of rapids. Two small rapids are portaged in making this ascent, the lower one, on the north bank, the upper one on the south. From the basin at the foot of the long series of rapids a rough foot trail leads northeasterly for 1½ miles to a small pond on the claims, along the west shore of which some pits have been sunk.

"Near the pond the prevailing rock is a medium-grained, red granite. This is cut by a large quartz vein which crosses diagonally a small bay at the south end of the pond, and strikes 35 degrees. A cross-section of the vein at this place shows, from west to east: 325 feet of a network of small quartz veins in granite; 360 feet of nearly solid quartz; 310 feet concealed under drift and the pond; and on the far shore outcrops of granite with small quartz veins. Due to the great size and irregular edges of the quartz veins its dip has not been determined.

"Copper mineralization has been found in the outcrops of the vein near the pond. The mineralization consists of bornite and chalcocite with subordinate amounts of chalcopyrite, famatinite, hematite, and siderite. In August, 1931, four pits had been sunk at intervals along a distance of 420 feet north and south (magnetic). The mineralization exposed in the different pits, commencing with the northernmost, is as follows:

Pit No. 1: 2 feet sparsely mineralized with chalcocite and bornite.

Pit No. 2: 2 feet abundantly mineralized with chalcocite, bornite, and famatinite.

Pit No. 3: 34 feet of chalcocite and bornite in scattered blebs.

Pit No. 4: 6 inches of chalcocite and bornite at one place, and smaller amounts at two other places.

[1] Kidd, D. F.: Great Bear Lake–Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada Sum. Rept. 1931, pt. C, p. 56 (out of print).

[2] Thirty miles north-northeast from Port Radium.

"In a small pit 1,300 feet to the north of No. 1 pit, sunk in the vein near its southeast edge, a fracture zone a few feet wide and striking with the vein is exposed. At this point a width of 6 feet across the strike of the zone is very sparingly mineralized with chalcocite and bornite. The mineralization rapidly becomes less to the north. At a distance of 1,500-2,000 feet south of the pits, near the shore of the pond, a pit has been dug in the side of a rusty knob on the vein. In it abundant chalcopyrite is exposed across a width of 5 feet."

### Workman Island Pitchblende Deposit[1] (8)

"The pitchblende deposit exposed at Workman island is of no economic importance, but its genesis is of significance. The occurrence, which is on Maple No. 1 claim, is in a giant quartz vein on the east side of Workman island just south of the narrows in McAlpine channel. The vein cuts granite which it has altered extensively to chlorite. Including stockworks it is 300 feet wide, of which 120 feet is solid quartz. It is cut by a 15-foot diabase dyke. Some distance south of the dyke a little pitchblende was found in a stockwork of the vein at the junction of two chloritic shear zones, 1 to 6 inches wide. In 1934 only a few yellow uranium and green copper stains were to be seen in the bottom of a pit, a foot deep. Quartz of the second generation associated with a little hematite occurs where the stockwork is sheared."

### Etacho Point Coal Deposits (9)

Coal deposits at Etacho Point were examined by Kidd in 1932 and the following account is a summary of his report.[2]

Etacho Point lies between Keith and Smith Arms on the west side of Great Bear Lake, and is formed by the east end of Scented Grass Hills. Coal seams occur on the west side of Douglas Bay, which is on the north side of the point 9 miles from the end. The seams strike about north 30 degrees west, nearly parallel to the shore; they dip 25 degrees to 50 degrees west, or inland. Most of the bluffs along the shore are covered with drift or vegetation and outcrops are scarce. The age of the coal is not known, but it is probably Cretaceous or Tertiary. The coal seams outcrop in the bluffs along the shore at intervals for 1½ miles. In most places there are several seams of coal separated by a few feet of clay, sand, or silt. What may be one seam is exposed in four places over a distance of about 7,000 feet and the exposed width ranges from 12 feet to 17½ feet. Six channel samples were taken from coal seams along the shore and were cut across widths ranging from 2 feet to 13 feet. These

[1] Kidd, D. F.: Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, pp. 40-41 (1936).

[2] Kidd, D. F.: Great Bear Lake Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, pp. 33-36 (out of print).

were analysed in the Fuel Testing Laboratories, Mines Branch, Department of Mines, Ottawa, and the following table gives the average of these analyses:

| | | |
|---|---|---|
| Moisture, per cent | R | 45·9 |
| | D | – |
| Ash, per cent | R | 10·3 |
| | D | 18·4 |
| Volatile matter, per cent | R | 21·8 |
| | D | 40·5 |
| Fixed carbon (by difference), per cent | R | 22·0 |
| | D | 41·0 |
| Sulphur, per cent | R | 0·3 |
| | D | 0·5 |
| Calories per gram gross | R | 2,754 |
| | D | 5,144 |
| B.T.U. per lb. gross | R | 4,953 |
| | D | 9,262 |
| Fuel ratio | | 1·05 |

R=coal as received; D=dried.

The coal is lignite. So far as is known none has been used as fuel. The coal may be frozen to a depth of several hundred feet, which would affect mining.

## Oro Group [1] [2] (10)

"These claims are situated on and near the shore of Great Bear Lake 3 miles north of Labine Point. In the late summer of 1932 visible gold was reported to have been discovered by prospectors of Great Bear Lake Mines, Limited.

"The discovery lies approximately 1,000 feet inland from a point on the mainland shore southeast of the south end of a prominent, narrow island formed of a vein of quartz. It is west of a narrow, northeast-trending lake locally called Explorer's Lake. The place is close to the contact of quartz-mica diorite with older rocks of the complex to the south. On the edges of a drift-filled gully the borders of a band a few feet wide, of pinkish brown, fine-grained rock with scattered pink feldspar and glassy quartz grains up to one-quarter inch across, are exposed. On each side of the band is massive, medium-grained, brown and grey diorite or granodiorite. On the northwest side a 1 to 2-inch quartz vein cuts the diorite and can be traced 75 feet to where the fissure narrows to a tight crack. It is stated grains of gold as large as a grain of wheat were found in this vein. The quartz is milky, white to brown in colour, and contains pyrite and chalcopyrite. No gold was seen. In the northeast-trending gully three other veins, the largest one foot wide, are visible. It is stated gold can be panned from one of them."

[1] Reverted to the Crown.
[2] Kidd, D. F.: Great Bear Lake Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, p. 31 (out of print).

## Eldorado Gold Mines, Limited (11)

(*See* Figure 4)

*References:*

Kidd, D. F.: Great Bear Lake-Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 47-69.

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*Introduction.* Eldorado Gold Mines, Limited, owns the Cobalt, Cobalt Extension, Ray, and Bonanza groups, which comprise fifty-eight claims. Most of these claims are at Labine Point, which is on the northeast shore of Great Bear Lake 4 miles west of Port Radium and 29 miles south of the Arctic Circle. Radium ore (pitchblende) is mined and concentrated at the Eldorado mine, which is the most northerly lode mine in North America and Canada's only producer of radium ore. It is one of two principal sources of radium in the world. The mine is reached from Edmonton or Yellowknife by aeroplane or from the railroad at Waterways, Alberta, by boat. Concentrated ore is shipped from the mine to a refinery at Port Hope, Ontario, where the following substances are recovered: radium bromide and sulphate, yellow and orange sodium uranate, black uranium oxide, small amounts of other uranium salts, silver sulphide, and chloride and oxide of radio-lead. The mine was visited in July 1939. E. J. Walli was superintendent.

*History, Production, and Ore Reserves.* The pitchblende deposit was staked by G. A. LaBine and Charles St. Paul in May 1930. In 1930 and 1931 ore was sent to the Mines Branch, Ottawa, where a method was found for extracting radium. Diesel power was installed at the property in 1932 and underground work started. A plant designed to concentrate 25 tons of ore a day started operation in December 1933. The mine and mill have operated almost continuously since that time, and the present mill has a daily capacity of about 100 tons of ore a day.

Concentrates and crude ore produced at Eldorado mine from 1934 to 1939, inclusive, are valued at $7,639,764, as follows[1]:

| Year | Ore milled | Pitchblende-silver concentrates | | Copper-silver concentrates | | Cobalt ore, crude | | Total value |
|---|---|---|---|---|---|---|---|---|
| | Tons | Pounds | Value[1] $ | Pounds | Value[1] $ | Pounds | Value[1] $ | $ |
| 1934 | 4,042 | 134,437 | 203,509 | 38,099 | 4,382 | ..... | ..... | 207,891 |
| 1935 | 14,402 | 525,880 | 796,077 | 66,305 | 7,625 | ..... | ..... | 803,702 |
| 1936 | 22,946 | 785,269 | 1,188,739 | 17,768 | 2,043 | ..... | ..... | 1,190,782 |
| 1937 | 23,838 | 950,586 | 1,438,997 | 386,703 | 44,471 | 11,851 | 16,591 | 1,500,059 |
| 1938 | 27,770 | 1,338,000 | ..... | 149,400 | ..... | 28,000 | ..... | 1,546,005 |
| 1939 | 33,373 | ..... | ..... | ..... | ..... | ..... | ..... | 2,391,325 |
| Total | 126,371 | ..... | ..... | ..... | ..... | ..... | ..... | 7,639,764 |

[1] Pitchblende-silver concentrate, copper-silver concentrate, and crude cobalt given nominal values of $1.51, $0.115, and $1.40 a pound, respectively.

From 1933 to 1937, inclusive, the refinery at Port Hope produced 53·808 grams of radium valued at $1,525,600 and 508,296 pounds of uranium salts valued at $706,500, as follows[1]:

| Year | Radium | | Uranium salts | |
|---|---|---|---|---|
| | Grams | Value $ | Pounds | Value $ |
| 1933 | 3·021 | 176,300 | 34,940 | 71,600 |
| 1934 | 2·820 | 112,800 | 27,748 | 46,600 |
| 1935 | 8·486 | 305,500 | 73,089 | 108,200 |
| 1936 | 15·613 | 405,900 | 160,662 | 208,900 |
| 1937 | 23·868 | 525,100 | 211,857 | 271,200 |
| 1938 | ..... | Not available for publication | | ..... |
| 1939 | ..... | Not available for publication | | ..... |
| Total | 53·808 | 1,525,600 | 508,296 | 706,500 |

The refinery is reported to be capable of producing about 8 grams of radium a month.

The company reports that ore reserves in the mine at December 31, 1937, and December 31, 1938, were valued at about $5,946,482 and $8,886,386, respectively. At the end of 1939 it was stated that ore reserves

[1] Spence, H. S.: in The Mineral Industry During 1937; McGraw-Hill Book Company, pp. 533. Eldorado Gold Mines, Limited, Annual Reports for 1938 and 1939.

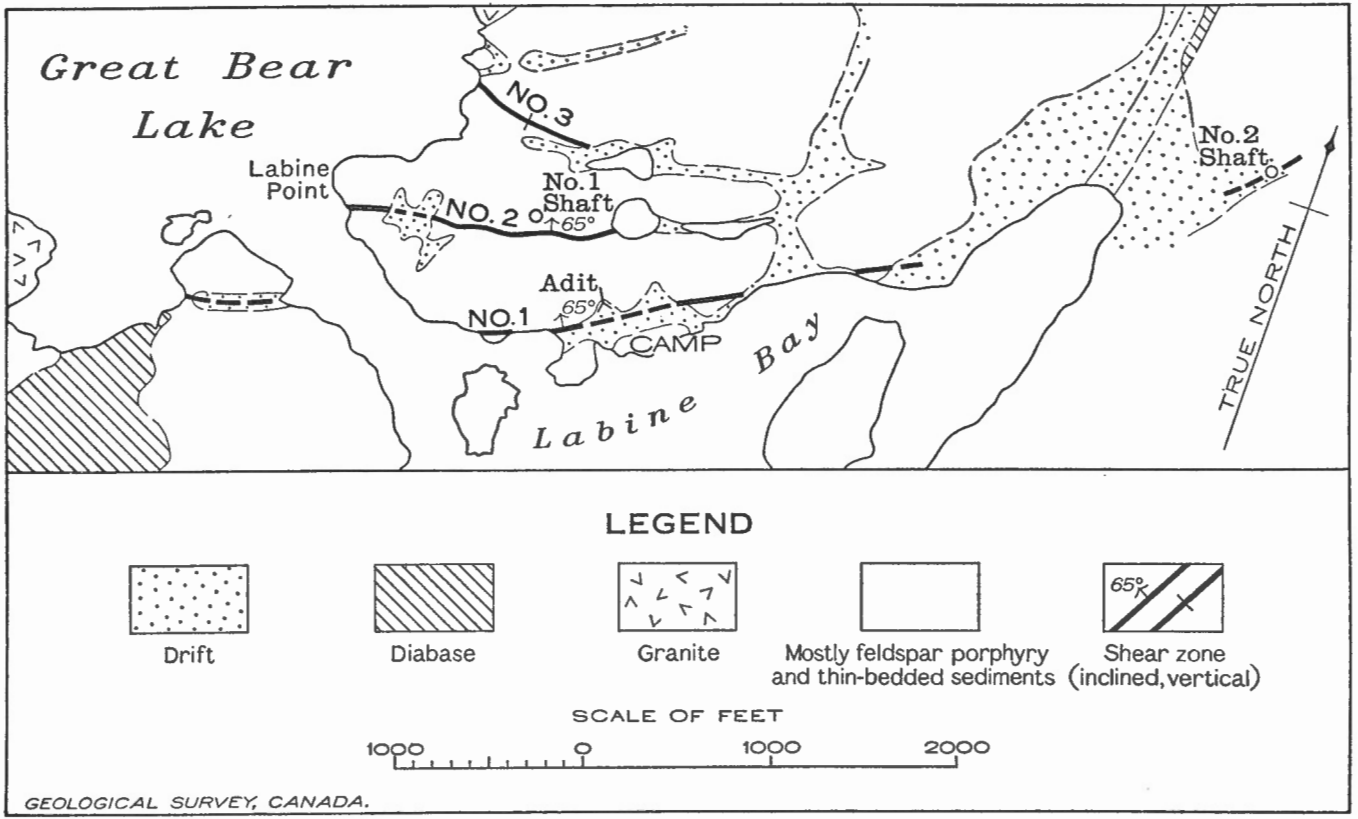


Figure 4. Eldorado mine, Labine Point, Great Bear Lake. From survey by Eldorado Gold Mines, Limited.

were ample for the operation of the present mill for 4 years. Due to the increased efficiency of the concentrator in recent years part of the tailings may be considered as ore reserves.

*Development.* Camp, mining, and milling plant are located on a rocky shelf about 800 feet by 300 feet on the southeast side of Labine Point on the shore of Labine Bay. Camp buildings include a two-story bunkhouse, a two-story building for cookery, dining rooms, and staff quarters, a combined commissary and recreation hall, and superintendent's residence. Other buildings include mill, power-house, "dry," blacksmith shop, assay office, storehouses, and office. A ship yard and sawmill are located about ½ mile from the camp. A radio station at the camp maintains two-way communication with the station operated by Royal Canadian Corps of Signals at Port Radium and thence with other points. Buildings are of frame construction, well insulated, and supplied with running water and electric light. Steam for heating is supplied by a 60-horsepower, wood-fired boiler. Steam and water pipes between buildings are insulated with sawdust enclosed in wood boxes and are above ground. Diesel engines supply 1,234 horse-power. A 177-horsepower Ruston and Hornsby engine operates an angle compound Ingersoll Rand compressor, which supplies 900 cubic feet of free air a minute. Two Ruston and Hornsby and two Belliss and Morcom engines operate English Electric generators, which provide 550-volt, 60-cycle, 3-phase alternating current. The main shaft (No. 1) is equipped with a 75-horsepower, two-drum electric hoist.

Most development work has been done on three shear zones that strike about east to northeast. No. 1 shear zone outcrops at the camp at lake-level and No. 2 and No. 3 shear zones outcrop about 550 and 1,100 feet, respectively, north of it and in places these outcrops are about 100 feet above the lake. Access to the mine is provided by a crosscut adit that extends 390 feet northwest from the portal to a drift on No. 2 shear zone a little above lake-level. A three-compartment vertical shaft (No. 1 shaft) is connected to this drift 275 feet west of the adit and provides entry to all other openings on shear zones 1, 2, and 3. The shaft is 90 feet north of the outcrop of No. 2 shear zone and extends 800 feet below the adit level where the hoist is located. Stations in the shaft are at adit level and 125, 250, 375, 500, 650, and 800 feet below adit level. Crosscuts from the shaft extend about north and south to shear zones 1, 2, and 3. Crosscuts and drifts served by the adit and shaft total more than 16,500 feet. No. 1 shear zone is explored on the 250-, 375-, 500-, and 800-foot levels and drifts on these levels total about 3,400 feet. No. 2 shear zone is opened on all levels from the adit level down to and including the 800-foot level, and drifts on these levels total about 7,200 feet. No. 3 shear zone is opened on the 250-, 500-, and 650-foot levels and drifts on these levels total about 2,000 feet. No. 2 shaft, about 3,900 feet east-northeast of No. 1 shaft, is not used. It is reported that the shaft is 125 feet deep and that about 130 feet of crosscut and 570 feet of drifts were opened at that level.

In July 1939 drifts were being extended east on No. 2 shear zone on the 500- and 800-foot levels and no other drifting was in progress.

*Geology.* Probably all rocks near the Eldorado mine are of Precambrian age. Most of them belong to the Echo Bay group and are thin-

bedded sediments and feldspar porphyry, but in many places rocks of this group are so highly altered that their original character is not known. The least altered sediments are mostly thin-bedded, pink, green, and grey, cherty rocks with some thin-bedded limestone. The freshest porphyry is grey, massive, andesitic rock that weathers buff to reddish brown and contains phenocrysts of altered feldspar in a very fine-grained groundmass. In most places the porphyry is not known to intrude the sediments, but it may do so in some places. Locally the sediments and porphyry are separated by a sharp contact, but in many places the rocks are altered and the contact is gradational. Over wide areas rock of uncertain origin exhibits no recognizable banding and is now a mottled, reddish brown, pink, and greenish grey, jasper-like rock that is very hard, dense, and massive, and contains quartz, feldspar, carbonate, chlorite, magnetite, garnet, biotite, white mica, pyrite, actinolite, epidote, and other minerals. A stock of granodiorite, about 100 feet in diameter, intrudes the Echo Bay rocks on the east side of Labine Bay, and larger bodies of similar rock intrude Echo Bay rocks at many places within 6 miles of Eldorado mine. Granite that intrudes adjacent sediments, outcrops at many points along the east shore of Great Bear Lake and intrudes Echo Bay rocks about 1,100 feet northwest of No. 1 shaft of Eldorado mine. Aplite dykes occur on Labine Point and are probably related to this granite. A gently dipping, fresh diabase dyke from 50 to 100 feet thick outcrops at the head of and along the east side of Labine Bay and on an island 2,400 feet southwest of No. 1 shaft and is probably the youngest consolidated rock near the mine.

Banded rocks of the Echo Bay group strike about north in most places at the mine, but in some places they are crumpled and strike in other directions. Probably they dip east in most places, but in some places they dip west. Dips range from 10 degrees to vertical, but in most places are between 35 and 75 degrees.

*Shear Zones and Ore-bodies.* Known ore-bodies at Eldorado mine occur in three shear or fracture zones designated, from south to north, as Nos. 1, 2, and 3. The zones strike from north 65 degrees east to south 80 degrees east and dip from 55 degrees north to vertical. The width of the zones ranges up to 30 feet and may average 6 feet. No. 1 zone is most strongly sheared, is widest, and may be more than 6,000 feet long, but is not exposed continuously for that distance. Most ore has been drawn from No. 2 zone, which is followed for 2,100 feet on the 375-foot level. The zones outcrop in well-defined depressions or along the bases of abrupt cliffs, and probably all are faults. They cross sediments and feldspar porphyry and in some places appear to offset the contacts between these rocks. On the 500-foot level No. 2 zone passes through an aplite dyke and the dyke on the north side of the zone is about 25 feet west of the dyke on the south side of the zone. No transverse faults are known to offset the zones sufficiently to affect mining operations.

In many places the rock in the zones is cut by veinlets of quartz or of carbonate, or both, and the result is a stockwork or breccia wherein much of the rock has been altered and is fine-grained, hard, and red. This altered rock contains quartz and feldspar and the red colour is probably due to finely disseminated hematite. In some places the shear zones are

bounded by sharp walls or by seams of gouge and in other places they grade into unsheared rock. The zones branch in some places, which makes them difficult to follow underground. Pitchblende is the principal ore mineral. Native silver was abundant in one ore shoot, which outcropped in No. 2 zone, but ore now being mined contains very little silver. Only a little known ore occurs where the zones pass through comparatively unaltered feldspar porphyry; much of the known ore occurs where the zones pass through rocks that are probably sediments and wherein the bedding is partly obliterated, but it may be that most ore occurs[1] where the bedding is best preserved. In most places the shear zones are fairly straight, but west of No. 1 shaft the strike of No. 2 zone is irregular and much of the ore mined at the property comes from near this part of No. 2 zone. Most ore shoots plunge west. No ore has been mined from the 650- or 800-foot levels (July 1939). Ore shoots consist of one or more seams or lenses of pitchblende that parallel the walls of the zone in which they occur and are accompanied by fine-grained, hard, red rock, brown quartz, and a great variety of other metallic and non-metallic minerals. Most ore shoots are less than 3½ feet wide. Bodies of nearly solid pitchblende range up to 21 inches wide and 40 feet long, but most of them are much smaller. Metallic minerals may constitute about 5 per cent of the ore; pitchblende and chalcopyrite are probably the most plentiful. The following metallic minerals have been identified in polished sections[2]: pitchblende, magnetite, hematite, "limonite", arsenopyrite, pyrite, smaltite-chloanthite, safflorite-rammelsbergite, skutterudite, nickel-skutterudite, cobaltite, gersdorffite, glaucodot, nickeliferous löllingite, niccolite, polydymite, molybdenite, native bismuth, bornite, chalcopyrite, chalmersite, tetrahedrite, freibergite, chalcocite, covellite, sphalerite, galena, stromeyerite, jalpite, argentite, hessite, native silver, pyrolusite, psilomelane, and polianite (?). Non-metallic minerals include quartz, dolomite, manganiferous carbonate, barite, and, possibly, witherite. According to Kidd and Haycock[3], pitchblende and quartz were the first minerals deposited and were followed by cobalt and nickel minerals and more quartz. Dolomite and lead, zinc, and copper sulphides were deposited next, and the last group to be deposited included ferruginous rhodochrosite, copper and silver sulphides, and native silver. Surface alteration products include yellow and orange alteration products of pitchblende, azurite, malachite, erythrite (cobalt bloom), annabergite (?) (nickel bloom), and sooty and clinkery manganese minerals. Pitchblende mineralization at Eldorado mine is post-aplite in age; its age relative to the diabase is not known.

A more detailed description of individual shear zones and ore-bodies follows.

*No. 1 Shear Zone* is exposed in several places over a length of 1,400 feet near the shore on the southeast side of Labine Point and passes under the lake at each end. It is more than 1,550 feet long on the 500-foot level. It strikes about north 65 degrees east and dips 65 degrees north. What may be the westerly extension of this zone outcrops on an island about

[1] Walli, E. J.: Superintendent, personal communication.

[2] Kidd, D. F., and Haycock, M. H.: Mineragraphy of the Ores of Great Bear Lake; Bull. Geol. Soc., Am., vol. 46, p. 895.

[3] Op. cit.

1,600 feet south 80 degrees west of the outcrop. Probable easterly extensions of the zone outcrop about north 60 degrees east of the outcrop at 700 feet and at 2,900 feet where No. 2 shaft is sunk in a deep valley; the zone continues for an unknown distance beyond No. 2 shaft and probably follows the valley. The width of the zone ranges from 5 to 30 feet and may average 8 feet. Where seen on the surface the zone is a stockwork of white quartz veinlets in red, jasper-like rock, and in some places quartz constitutes 25 per cent of the zone. The quartz is coarse-grained, white, banded, and contains many crystal-lined cavities and occurs as veinlets that trend in all directions and range in width from less than an inch to one foot. Underground the zone is very strongly sheared and in places there is a few inches of gouge on the walls. Parts of the zone contain only a very little quartz, but in other parts quartz and country rock occur in about equal proportions and fragments of dense red to grey rock are cemented by quartz to form breccia. Three stopes have been opened in the zone: they are on the 250-, 375-, and 500-foot levels, range in length from 80 to 150 feet, and are about 700 feet west of the adit portal and below the point at which No. 1 zone passes under Great Bear Lake. The relative positions of the stopes indicate that they may be on an ore shoot that plunges about 65 degrees west. A little pitchblende is reported to occur on the 125-foot level near No. 2 shaft.

*No. 2 Shear Zone* outcrops nearly continuously for 1,350 feet. The west end passes under Great Bear Lake and the east end passes under two small lakes in a drift-filled depression. The zone is more than 2,100 feet long on the 375-foot level. It strikes about north 70 degrees east and dips about 65 and 55 degrees north on the surface and 650-foot levels, respectively. The width of the zone ranges from 1 to 30 feet and may average 5 feet, and in some places a few inches of gouge occurs at the walls. In many places the zone is a quartz-vein stockwork, but at the surface at the northeast end of the outcrop the veins of the stockwork are carbonate and quartz is absent. No. 2 zone cuts sedimentary rocks and porphyry and probably most of the known ore shoots occur where it cuts the sediments. One ore shoot contained plentiful native silver, but pitchblende is the main ore mineral in all other ore shoots. Pitchblende occurred throughout about 1,200 feet of the outcrop as seams and lenses near the northwest wall, and the largest single lens is reported to have been 40 feet long and to have had a maximum width of 20 inches. This lens was about 140 feet west of No. 1 shaft. Pitchblende occurs with fine-grained, brown quartz except at the northeast end of the outcrop where it occurs with carbonate. Native silver occurred abundantly near the northeast end of the outcrop and accompanied pink, manganiferous carbonate; this ore shoot has been removed by mining. Most of the ore mined at the property came from No. 2 zone and most ore from this zone came from parts of the zone near and west of No. 1 shaft and between the 500-foot level and the surface. On both the adit and 250-foot levels, drift lengths of stopes total about 500 feet in 750-foot lengths of drifts; on the 500-foot level drift lengths of stopes total about 220 feet in a 300-foot length of drift. In one place stopes are continuous from the 500-foot level to the surface. The relative positions of this group of stopes suggest that the group of ore shoots they contained plunged about 60 degrees west. These ore shoots are reported[1]

[1] Walli, E. J.: Superintendent, personal communication.

to occur within No. 2 zone where it cuts altered sedimentary rocks that occur as a U-shaped basin within feldspar porphyry, and the bottom of this basin is probably near the 650-foot level. Most of the ore shoots may terminate beyond this basin where the zone cuts the porphyry. Near the southwest end of this group of ore shoots the strike of the zone changes from about south 70 degrees west to about north 75 degrees west and, as the zone passes beyond the ore shoots, the strike again becomes about south 70 degrees west. Thus the formation of this group of ore shoots may have been influenced by the character of the wall-rock or by the change of strike of the shear zone or by both factors. An ore shoot is reported to occur about 1,000 feet east of No. 1 shaft on the 375-, 500-, and 800-foot levels, and the country rock at these points is probably sediment. The plunge of this ore shoot is not known. The shoot is reported to be 325 feet long at one place.

*No. 3 Shear Zone* is 700 feet long at the outcrop and extends an unknown distance under Great Bear Lake to the west and under a drift-filled depression to the east. The zone strikes about south 80 degrees east and dips nearly vertical. The width of the zone ranges from 1 to 12 feet and may average 3 feet. It is best exposed at the west end, where it is about 3 feet wide and consists of fragments of reddened country rock cemented by white, vuggy quartz. In some places at the surface the south wall of this breccia zone is sheared and contains a little pitchblende and brown quartz. The zone is not well defined underground and is difficult to follow. There are two stopes in this zone and they are about 200 feet east of the west end of the outcrop; one stope is on the 250-foot level and the drift length is 200 feet; the other is on the 500-foot level and the drift length is 90 feet.

*Mining, Milling, and Other Operating Data.* Direct mining and milling costs were about $14.50 a ton in 1939. In January 1938 direct milling costs were $3.98 a ton. Drifting, crosscutting, and raising cost about $17.50, $18.45, and $28.29 a foot, respectively.

Most freight between Waterways, Alberta, and Eldorado mine is carried by water by Northern Transportation Company, Limited, a subsidiary of Eldorado Gold Mines, Limited. In 1939 the freight carried to and from the mine by this company amounted to 1,900 and 1,100 tons, respectively. The freight rate from Waterways to the mine is $110 a ton. The company formerly owned and operated an aeroplane, and during 1938 this craft carried 68,570 pounds of freight. This aeroplane was sold early in 1939 and a contract for air transportation given to Canadian Airways, Limited. Passengers, mail, express, meat, fresh vegetables, and some light freight are flown to the mine. A few tons of concentrate were flown to Waterways during the winter 1938-39. Air rates from Edmonton to the mine in 1939 were: passenger, $175; express, $0.87 a pound.

About 100 men are employed at the mine and the monthly payroll is about $15,000. A recreation hall with two billiard tables is provided for employees. The staff includes a doctor. It is stated[1] that, in so far as

[1] Dr. Lozier, resident M.D.: Personal communication.

is known, employees suffer no ill effects due to the radioactive ore. Dust is kept at a minimum in the mine by wet drilling and spraying. Many employees work at the mine about one year.

Cost of developing one horse-power for one year by diesel engines is about $175. Fuel oil costs about 30 cents a gallon at the mine and comes from wells of Imperial Oil Company located about 50 miles northwest of Fort Norman on Mackenzie River. It is transported by tank barges from the wells to the rapids on Great Bear River, pumped around the rapids through 8½ miles of pipe, and then taken by barge to storage tanks at Fort Franklin on Great Bear Lake. From there, a barge with a capacity of 60,000 gallons takes the oil to tanks at the mine, which hold 250,000 gallons.

Local timber is used at the mine and grows fairly abundantly in some of the sheltered valleys tributary to the lake; most of it is white spruce. Logs with a minimum top diameter of about 10 inches are sawn at the property.

Ore is mined in shrinkage stopes, and ore and rock are hoisted in No. 1 shaft in cars of 1 ton capacity to the adit level and then trammed via the adit crosscut to the mill or to the waste dump. In most places the zones are well defined and readily followed underground, but in some places the walls are indistinct or the zones branch where the strike changes and zones or ore shoots in the zones must be followed carefully. No. 1 zone is so strongly sheared that in some places it was necessary to drift beside the zone rather than in the strongly sheared rock. Most ore-bodies are narrower than the minimum stope width, which is 3½ to 4 feet, and mining requires careful supervision to minimize dilution. Because pitchblende is friable it is sorted and sacked in stopes wherever practicable and drill holes are placed so that a minimum of pitchblende will be shattered by blasting. Permanent frost extends about 345 feet below surface. Above this depth hot water or salt water was used in drills to prevent freezing, and broken ore in stopes sometimes froze and had to be re-blasted; considerable labour was required to keep haulageways and ditches clear of ice. Most underground openings, except those on No. 1 zone, require no timber support; local round timber is used where supports are required. About 300 gallons of water is pumped from the mine each minute. Drift faces are sampled after each round is blasted and the uranium oxide content of the sample measured by an electrometer. Silver content of samples is not determined. Close sampling is not necessary in stopes as pitchblende can be readily seen and borders of the ore shoot estimated. Ore-bodies cannot be satisfactorily sampled with a diamond drill because of abnormal core losses in the friable pitchblende and fractured rock, but some diamond drilling is done to determine the location of shear zones and the character of country rock.

As no method of floating pitchblende is known, it is concentrated at Eldorado mine by gravity. The mill has a daily capacity of about 100 tons. Ore is passed over a ¾-inch grizzly and the oversize from the grizzly passes through a water spray and over a sorting table where waste, cobbed pitchblende, and cobbed cobalt minerals are removed. Ore passing over the table joins the undersize from the grizzly and after suitable crushing passes over a magnetic pulley, which removes magnetite. Material

removed on the sorting table and by the magnetic pulley is about 7 per cent of the material entering the mill. Pitchblende concentrates are recovered from the remaining ore by jigs and tables. Concentrates are dried and are packed in paper-lined burlap bags, holding about 120 pounds, for shipment to Port Hope. Cobbed cobalt is stored at the mine. Ratio of concentration ranges from about 20:1 to 45:1 and averages about 37:1. In January 1938[1] mill heads contained 25·99 ounces of silver a ton and 1·064 per cent $U_3O_8$; 54·549 per cent of the above silver and 73·617 per cent of the above $U_3O_8$ were recovered. Previous recovery of pitchblende was lower than the above figure, so some tailings contain pitchblende that could be recovered in the present mill. Neither average pitchblende content of mill heads in 1939 nor percentage of this pitchblende recovered is available for publication; silver content[2] of mill heads in 1939 ranged up to about 5 ounces. Some factors contributing to pitchblende losses are: (1) high ratio of concentration required for economical shipment to, and treatment at, the refinery at Port Hope; (2) some pitchblende is so finely shattered in crushing and grinding machines that it cannot be recovered by gravity methods; and (3) pitchblende is not readily separated by gravity methods from some associated metallic minerals that have nearly the same specific gravity as pitchblende.

## Echo Bay Group (12)

The Echo Bay group of ten claims lies one mile northeast of the head of a small bay on the east side of Labine Point and 400 to 650 feet above Great Bear Lake. The following account is a summary of reports by Kidd[3].

The claims were staked for Consolidated Mining and Smelting Company of Canada, Limited, in 1930, and some diamond drilling was done in 1932. An adit was started in 1934, but the amount or results of underground work is not known.

The rocks are tuff, dacite, feldspar porphyry, and fine-grained, banded sediments, and all belong to the Echo Bay group. All are altered and contain pyrite, chlorite, magnetite, biotite, actinolite, and tourmaline. Six steeply dipping shear and fracture zones, five of which trend northeast, occur in an area 2,000 feet long and 600 feet wide that extends northeasterly across the crest of a prominent hill. The exposed length of the zones ranges from 50 to 800 feet, but their widths are not known. The zones are belts of intense fracturing that in places near the middle contain up to 1 foot of gouge-like material. The fracturing dies out away from the central zone of shearing. In most places the fractures are coated with supergene manganese minerals, and in many places the rock adjacent to them contains disseminated chalcopyrite or galena. Metallic minerals in the zones are in part disseminated throughout the fractured rock and in

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1 Smith, D. A. G.: Milling Pitchblende-Silver Ores at Eldorado Plant; Eng. and Min. Jour., vol. 139, No. 4, April 1938, p. 38.

2 Walli, E. J.: Superintendent, personal communication.

3 Kidd, D. F.: Great Bear Lake-Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 66-67 (out of print).

Great Bear Lake Area, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, pp. 21-24 (out of print).

Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, p. 37 (1936).

part occur in veins or stockworks of manganiferous carbonate or quartz. Those seen are pyrite, magnetite, arsenopyrite, pitchblende, chalcopyrite, sphalerite, marcasite, galena, bornite, rammelsbergite, unidentified minerals containing cobalt or nickel or both metals, niccolite, stromeyerite, argentite (?), native silver, covellite, and surface alteration products of manganese, copper, iron, and cobalt minerals. Neither the proportion of vein filling to rock in the zones nor the proportion of metallic to non-metallic minerals in the vein filling is known. One quartz vein is 2 feet wide in one place. Silver-bearing minerals occur in places in most of the zones and a little pitchblende occurs in one zone.

### Bud Group (13)

The Bud group consists of twenty-two claims and has been described by Kidd[1].

"These claims are 6 miles northeast of Labine point and are on the east side of a lake locally known as Sparkplug lake. The showings are on the northeast corner of Bud No. 5 claim, approximately one-quarter mile southeast of the east bay of Sparkplug lake. A series of pits and drill holes have been placed to explore a mineralized zone of fracturing reported to be auriferous.

"The country rocks are brown argillite and fine-grained, impure quartzite. Near the fracture zone they contain chlorite and some serpentine. The zone is cemented by quartz veinlets and they as well as the wall-rock contain pyrite, chalcopyrite, pyrrhotite, and hematite. Native gold as a single, minute speck in pyrite was seen under high magnification. Some white carbonate occurs with the quartz. The zone has been found at intervals for 250 feet and is up to several feet wide; it is irregularly, but on the whole sparsely, mineralized. Erratic, at places high, values in gold are reported. The occurrence is of interest on this account and because of the presence of the mineral pyrrhotite which is not known to the writer to occur elsewhere in this district. The deposit may be associated with the granodiorite and unrelated to the silver deposits, but at present this is only speculation."

### Bonanza Group (14)

The Bonanza group is on Dowdell Point, the south point of Echo Bay, 6 miles south of Labine Point. The claims were staked in May 1931 by G. A. LaBine, E. C. St. Paul, and others, for Eldorado Gold Mines, Limited. Two silver deposits occur one-half mile apart and about 2 miles east-southeast from the end of Dowdell Point. El-Bonanza Mining Corporation, Limited, was incorporated in January 1934 to develop the eastern deposit, and did some surface and underground work on it in 1934 and 1935, shipping 6,506 pounds of high-grade silver ore to Trail, B.C., in 1935. So far as known no work has been done on the deposit since 1936. The western deposit was explored underground by Eldorado Gold Mines, Limited, in 1938 and no work has been done since about the end of 1938. No detailed

[1] Kidd, D.F.: Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, p. 40 (1936).

description of the underground openings on either deposit on Bonanza group is available. Some silver ore from the Bonanza group was treated at the mill of Eldorado Gold Mines, Limited, on Labine Point.

The surface geology of the deposits has been described by Kidd[1] and is summarized below.

The western deposit is in a band of sediments that ranges up to 300 feet wide and trends about west. Granite lies on the south side of the band and a dioritic rock lies on the north side. The sediments are mostly well-banded, hard, fine-grained, grey and pink, highly altered rocks and strike west-northwest and dip nearly vertical. A fractured zone, with an exposed width up to 30 feet, has been traced for 300 feet and strikes northwest; part and perhaps all of the exposed zone is in the altered sediments. Some of the fractures are occupied by veinlets of manganiferous carbonate, native silver, chalcopyrite, and at least two, unidentified, soft, grey, metallic minerals. A stripped part of the zone, measuring 30 feet by 12 feet, contains eight silver-bearing areas, which range in size from 1 inch by 12 inches to 8 inches by 30 inches; these areas contain silver wires in carbonate and the silver content may range from 5 per cent to 50 per cent. Eight areas of similar size contain silver and occur in another stripped part of the zone that measures 54 feet by 16 feet.

At the eastern deposit silver occurs in two zones. One sheared and fractured zone has been traced 300 feet, strikes about west-northwest, dips nearly vertical, and is 6 feet wide in places. It cuts siliceous volcanic rocks and lies 300 feet north of their contact with granite. The zone contains disseminated chalcopyrite, bornite, and galena, as well as native silver associated with calcite. At one place calcite for a length of 16 feet and an average width of 1 inch contained 35 per cent silver. Another sheared zone lies in altered rocks about 500 feet southwest of the first zone, strikes about northwest, and contains abundant silver in several places over areas ranging up to 2 inches by 3 feet. It also contains calcite, bornite, chalcopyrite, covellite, sphalerite, tetrahedrite, and malachite. The length and width of the zone are not known.

## Bear Exploration and Radium, Limited (15)

(*See* Figure 5)

*References:*

Furnival, G. M.: Geology of the Area North of Contact Lake, N.W.T., Canada; Am. Jour. Sci., vol. 237, July 1939, pp. 476-499.

A Silver-pitchblende Deposit at Contact Lake, Great Bear Lake Area, Canada; Ec. Geol., vol. XXXIV, No. 7, November 1939, pp. 739-776.

Kidd, D. F.: Great Bear Lake Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, pp. 1-36.

Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187 (1936).

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[1] Kidd, D. F.: Great Bear Lake-Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 67-68 (out of print).

Great Bear Lake Area, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, pp. 26-28 (out of print).

Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, pp. 39-40 (1936).

*Introduction.* Bear Exploration and Radium, Limited, owns M1, M2, and S groups, comprising about sixty-one claims, on the north shore of Contact Lake. The property is near the east short of Great Bear Lake, 5 miles south-southeast of Port Radium and 9 miles southeast of Eldorado mine on Labine Point. The topography is rugged and the relief may be 1,000 feet. Bare rock is exposed over wide areas. Silver-pitchblende ore was mined and concentrated at the Contact Lake mine on claims M1 and M2 and concentrates shipped to Trail, B.C., for treatment, but operations were suspended in July 1939. The mine is accessible by aeroplane from Edmonton or Yellowknife, or by boats of Northern Transportation Company, Limited, from Waterways, Alberta. D. A. G. Smith was superintendent. The property was visited late in July 1939, but a proper examination of the veins was impossible because most known ore had been removed from the mine and the stopes were empty and inaccessible.

*History, Production, and Ore Reserves.* The claims were staked in the summer of 1931 for Northern Aerial Minerals Exploration, Limited, by Tom Creighton and others. The property was acquired by Bear Exploration and Radium, Limited, in June 1932. A mill with a daily capacity of about 25 tons operated intermittently from late in 1936 to early in 1938 and operated continuously from July 1, 1938, to June 30, 1939, when all work at the property stopped.

Production[1] at the Contact Lake mine is tabulated below. The quantity of $U_3O_8$ recovered before July 1, 1938, is not known.

| — | Ore milled Tons | Concentrate produced Pounds | Content of concentrate | |
|---|---|---|---|---|
| | | | Silver Ounces | $U_3O_8$ Pounds |
| 1934 | ..... | ..... | 14,330[1] | ..... |
| 1935 | ..... | ..... | ..... | ..... |
| 1936 | 948 | 13,936 | 33,341 | ..... |
| 1937 | 1,299 | 28,880 | 70,546 | ..... |
| Jan. 1 to June 30, 1938 | 1,174 | 23,704 | 34,700 | ..... |
| July 1, 1938, to June 30, 1939 | 6,658 | 198,265 | 195,333 | 6,933 |
| Total | 10,079 | 264,785 | 348,250 | 6,933 |

[1] From crude ore.

Ore reserves are estimated by the company to be 3,403 tons containing 68,060 ounces of silver capable of recovery with existing mill. Tailings are estimated to contain 292,833 ounces of silver and 16,933 pounds of pitchblende.

*Development and Prospecting.* The camp is on the northeast shore of Contact Lake and the shaft and mining and milling plant are about 1,600 feet east of the camp, about 100 feet above it, and at the foot of an

[1] Data supplied by C. L. Harshman, General Manager, Bear Exploration and Radium, Limited.

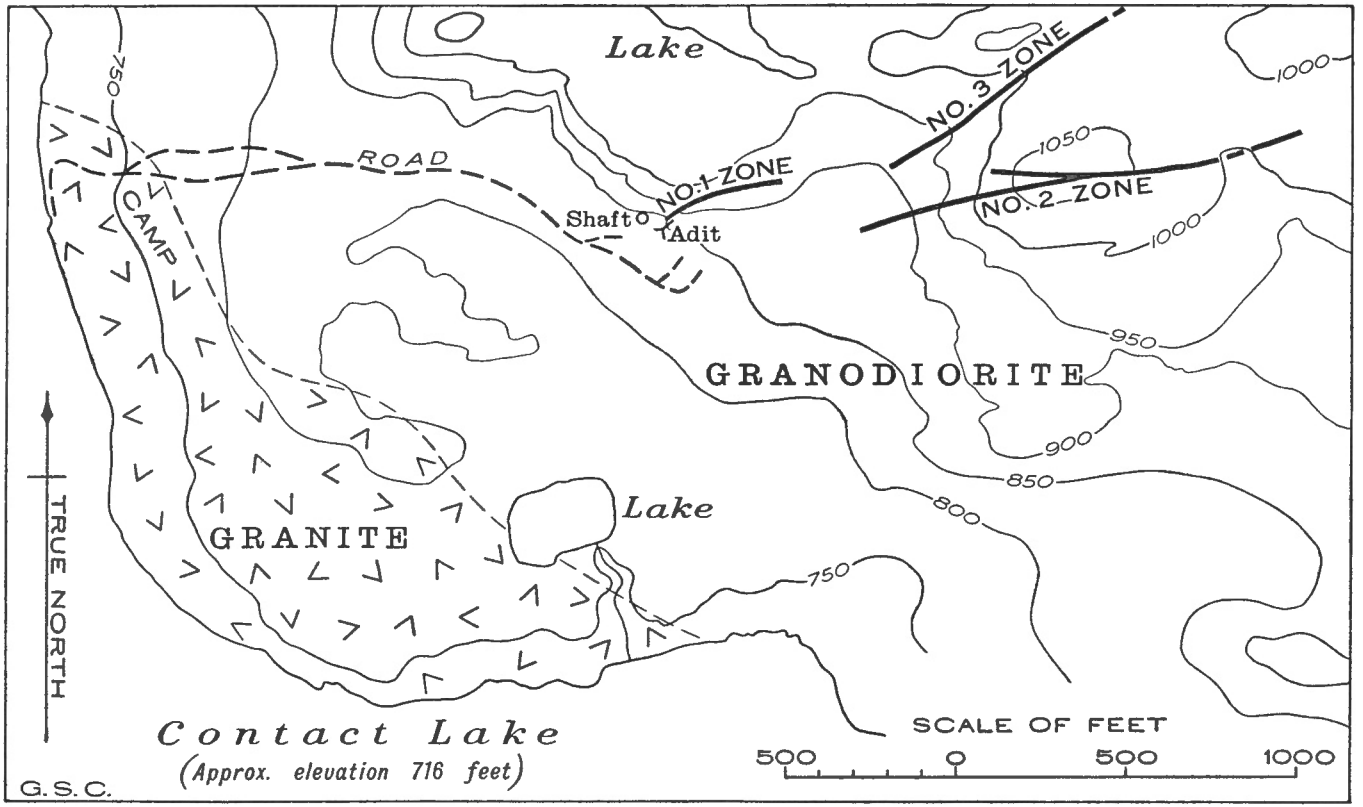


Figure 5. Contact Lake mine, Bear Exploration and Radium, Limited, Great Bear Lake area. From survey by Bear Exploration and Radium, Limited.

abrupt hill. All buildings are of temporary construction. A radio station provided two-way communication with the station operated by Royal Canadian Corps of Signals at Port Radium, and thence with other points.

A little trenching and stripping was done on zones 1, 2, and 3, but in many places they outcropped or were covered with only a little drift. Zones 1 and 2 strike a little north of east and the west ends of their outcrops are about 70 and 650 feet, respectively, east of the shaft. No. 3 zone strikes about northeast and the west end of its outcrop is about 800 feet east-northeast of the shaft.

All underground work is on and near No. 1 zone, which is explored by drifts on three levels. The drift on the first level is an adit that enters a hill at the outcrop of the zone and is 133 feet above Contact Lake, runs north 73 degrees east, and is 450 feet long. A two-compartment, vertical shaft is 70 feet west of the adit portal and about 210 feet deep. The shaft provides access to the second and third levels, which are about parallel to the adit (first) level and 90 and 190 feet below it, respectively. Horizontal openings on the second and third levels total about 1,200 and 640 feet, respectively, and are east of the shaft. A winze connects the adit level to the second level.

During the summer of 1939 an instrument designed to detect the presence of radioactive elements was used to explore the surface of the property in a search for pitchblende deposits. No pitchblende was found, but the work is said[1] to indicate that it may occur in zones 1 and 2, and in one other zone.

*Geology.* Probably all rocks near the mine are of Precambrian age. The mine is in the southeast end of a granodiorite mass that is about 5 miles long and 1½ miles wide. The granodiorite is a massive, medium-grained, brown rock composed of feldspar, hornblende, biotite, and about 20 per cent quartz. About 950 feet southwest of the shaft fresh, pink, biotite granite is in contact with the granodiorite and in places contains 1-inch feldspar phenocrysts. The granite probably intruded the granodiorite. In a few places the contact between the two rocks is sharp, but in many places no sharp contact was found. Granite dykes cut the granodiorite. A few pink aplite dykes occur in the granodiorite and granite and may be related to the granite.

The granodiorite near the mine is cut by many fractured and sheared zones and most of them strike about northeast or north 75 degrees east; a few strike about east.

*Veins and Ore-bodies.* Veins of quartz and carbonate occur in some of the fractured and sheared zones in the granodiorite. Bodies of silver ore with some pitchblende were found in No. 1 zone and all ore mined came from this zone. Veins in No. 1 zone that contain silver and pitchblende cut aplite dykes that are probably related to the pink biotite granite, and no rocks younger than the aplite dykes have been found at the mine. The silver and pitchblende on the Thompson group (*See* page 55) about 3 miles west of the Contact Lake mine were introduced considerably later than the pink biotite granite, and the silver and pitchblende mineralization at the Contact Lake mine may be of about the same age as that on the Thompson group.

[1] Ridland, C.: Geologist, Bear Exploration and Radium, Limited, personal communication.

Detailed descriptions of indidvidual zones and accompanying veins are given below.

*No. 1 Zone* outcrops for 370 feet and passes under drift at each end; the average strike is about north 70 degrees east and the average dip is about vertical. The greatest distance it has been traced underground is 870 feet on the second level; it ends against No. 3 zone at the east end and continues beyond the west end of the drift. The zone comprises a series of fractures that branch and join, and are distributed over widths up to 40 feet and separated by massive granodiorite. Individual fractures range in width from a few inches to about 5 feet. The rock within the fractures is sheeted and in places is sheared a little or contains a little gouge. At the surface the most persistent fractures trend about north 75 degrees east and other fractures diverge from the north side of these and trend about northeast and curve until they trend about north 75 degrees east. The dip of individual fractures in the zone ranges between 70 degrees south and 70 degrees north. As much as 3 feet of granodiorite next the fractures is altered in many places to a fine-grained, dark green, chloritic rock; some granodiorite near the fractures is cut by a network of magnetite and hematite seams that range in width from a fraction of an inch to 3 inches; elsewhere the granodiorite near the fractures has been altered to a red rock that contains much finely divided hematite.

Some of the fractures enclose veins of quartz and carbonate, and in some places these veins contain native silver, pitchblende, and a great variety of other metallic minerals. The veins range in width from thin seams to over 2 feet and in many places only one vein occurs in a fractured zone, but in some places several veins occur throughout a 5-foot width of fractured rock. In many places the veins consist of quartz, carbonate, and dark green, altered rock that occur in separate bands, and the bands are parallel to the vein walls and many of them are less than ½ inch wide. Much of the quartz is glassy or white and is finely banded parallel to the walls, due to microscopic inclusions of foreign material; comb structure, vugs, and druses are common. Carbonates are red, pink, or grey, fine- to coarse-grained, and in part fill crystallined cavities in the quartz or form veinlets that cut the quartz; siderite, ankerite, dolomite, rhodochrosite, and calcite are the common varieties.

The quartz-carbonate veins are offset about 1 foot by a fault that crosses the second and third levels 200 feet and 460 feet east of the shaft, respectively. The fault dips about 15 degrees easterly and is a zone of sheeted rock that ranges in width from 1 to 4 feet and in some places contains a seam of stiff gouge 1 to 3 inches thick.

Ore shoots were readily recognized in the veins by the occurrence of native silver and other metallic minerals, including a little pitchblende; metallic minerals are rare where the veins do not contain ore. Carbonates and quartz probably occurred in about equal proportions in the ore shoots, and bornite, chalcopyrite, and native silver were probably the most plentiful metallic minerals. On the adit level there are four stopes with an aggregate drift length of 315 feet; on the second level there are two stopes with an aggregate drift length of 270 feet, and on the third level there are three stopes with an aggregate drift length of 165 feet. All these stopes were opened to mine shoots of silver ore, but pitchblende was encountered

in parts of most of the shoots. Four ore shoots occurred in the adit; they ranged from 30 to 74 feet long and the average width ranged from 1¼ to 5 feet; the average silver content ranged from 72 to 261 ounces a ton. Pitchblende was much less widely distributed than the silver ore that it accompanied. Maps supplied by Bear Exploration and Radium, Limited, indicating the distribution of the pitchblende show that it was mined from all levels and from nine shoots, that the length of all shoots was greater than their depth, and that their longest dimension was nearly horizontal. The same maps show the lengths ranged from 25 to 75 feet and the ratios of depth to length ranged from 1:3 to 1:8. The width of the pitchblende shoots ranged up to about 6 inches and may have averaged 1½ inches. Ore shoots of silver and pitchblende occurred[1] where the fractures are widest; the greatest concentrations of silver on the adit level occurred immediately above horizons where the fractures narrow abruptly and where they dip at comparatively low angles or change sharply in strike or dip. Most silver and pitchblende occurred in the veins with carbonates, quartz, and other metallic minerals, but some silver and pitchblende occurred in granodiorite near the veins. Most silver was present as dendrites, irregular masses, disseminated grains, and leaves of native silver. Pitchblende occurred as seams up to ¼ inch wide and as dendrites, spherules, and ring-like structures. Other minerals reported[2] to have occurred in small amounts in these veins, and mainly within and near the ore shoots, include hematite, magnetite, pyrite, arsenopyrite, bornite, chalcopyrite, chalcocite, tetrahedrite, algodonite, chalcostibite, famatinite, cobaltite, safflorite-löllingite, glaucodot, niccolite, gersdorffite, rammelsbergite, breithauptite, sphalerite, galena, native bismuth, bismuthinite, pearcite, stromeyerite, argentite, hessite, malachite, azurite, erythrite (cobalt bloom), and oxidation products of manganiferous carbonate and pitchblende. Carbonates and most of the metallic minerals, including pitchblende and native silver, are said[3] to have been deposited after most of the quartz was deposited in the veins; pitchblende was one of the earliest metallic minerals deposited with the carbonates and most native silver was the last metallic mineral deposited.

*No. 2 Zone* outcrops or is covered by a very little drift for about 1,300 feet and strikes about north 80 degrees east and dips 65 to 80 degrees south. About 380 feet of the zone is stripped and trenched, and the width of this part of the zone ranges from 3 inches to 3 feet and averages about 1 foot. The zone is slightly fractured granodiorite, which in places grades into massive wall-rock that is also granodiorite; some of the fractured rock is schistose and contains chlorite. In some places the fractured rock contains interlacing or parallel veinlets of white, crustified quartz, pink or buff carbonate, and a very little chalcopyrite, and where the zone is stripped this vein material is continuous for about 380 feet, and has an average aggregate width of about 6 inches. No silver or pitchblende was seen in No. 2 zone.

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[1] Furnival, G. M.: A Silver-Pitchblende Deposit at Contact Lake, Great Bear Lake Area, Canada; Ec. Geol., vol. XXXIV, No. 7, November 1939, p. 764.

[2] Furnival, G. M.: A Silver-Pitchblende Deposit at Contact Lake, Great Bear Lake Area, Canada; Ec. Geol., vol. XXXIV, No. 7, November 1939, pp. 739–776.
Kidd, D. F.: Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, p. 39 (1936).

[3] Furnival, G. M.: A Silver-Pitchblende Deposit at Contact Lake, Great Bear Lake Area, Canada; Ec. Geol., vol. XXXIV, No. 7, November 1939, p. 768.

*No. 3 Zone* lies in a drift-filled draw and is in part a strong shear zone. It is traced by three pits for a length of 350 feet and strikes about north 55 degrees east and dips nearly vertical. The western pit is about 800 feet east-northeast from the shaft on No. 1 zone. The drift on the second level on No. 1 zone intersects No. 3 zone 890 feet from the shaft, and drifts on this zone total 220 feet. The zone ranges in width from 1 foot to more than 6 feet, consists of sheared granodiorite, and in places contains 1 to 3 inches of stiff gouge. Parts of the zone consist of reddened or chloritized fragments of granodiorite cemented by white to glassy, banded, drusy quartz with some coarse-grained, rusty weathering carbonate and a very little chalcopyrite. No native silver or pitchblende was seen in the zone, but it is reported to contain a little silver in the drift.

*Mining, Milling, and Other Operating Data.* Total direct operating cost at the Contact Lake mine from July 1, 1938, to June 30, 1939, was $15.73 a ton of ore milled; direct milling cost was $5.32 a ton milled. Freight from Waterways, Alberta, to the east shore of Great Bear Lake cost $110 a ton. It was hauled from the lake by tractor 1 mile to the west end of Contact Lake and thence 3 miles by barge to the mine. An average of about thirty men were employed at the property during the last 12 months of operation. Fuel oil was brought to the mine in steel drums and cost about 50 cents a gallon at the mine. Lumber was sawn at the mine and cost about $60 a thousand feet board measure. Logs cut were mostly white spruce and the minimum diameter was 10 inches.

Ore was mined by shrinkage stopes and hoisted in mine cars. In most places ore widths were less than stope widths. Drifts do not require timber supports. Permanent frost probably extends below the second level. Fractured and altered granodiorite near the quartz and carbonate veins contained silver and pitchblende in places, and this granodiorite as well as the vein material was sampled and assayed.

Ore, after suitable crushing and grinding in the mill, was passed over two Wilfley tables and a silver-pitchblende concentrate recovered. From July 1, 1938, to June 30, 1939, 6,658 tons of ore were milled and 99 tons of concentrate produced. The average content of ore entering the mill was: silver, 50·79 ounces a ton; pitchblende, about 2 pounds a ton. About 58 per cent of the silver and 50 per cent of the pitchblende in the ore were recovered in the concentrate.

## Thompson Group (16)

The Thompson group consisted of eighteen claims, and most of them have reverted to the Crown (1940). A mineral deposit on the property has been described by Kidd[1].

"These claims were staked by Wight and McKee in 1932. The discovery is on an east-facing slope to the west of, and overlooking, a small lake lying between the east end of Bow Lake and the south side of Contact Lake. A little surface stripping had been done in August, 1932. The rock in the vicinity, where seen, is massive, medium-grained granite. It is cut by a basic dyke that strikes approximately east-west, and whose width is estimated as 75 feet. The dyke rock is dark brownish grey, rather fine

[1] Kidd, D. F.: Great Bear Lake Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, p. 26 (out of print).

grained and crystalline with very fine-grained edges against the granite. Near the centre of the dyke and about parallel with the walls is a zone of fracturing with quartz stringers. The zone can be traced 50 feet and is up to 1 foot wide. The quartz carries considerable pyrite, chalcopyrite, and bornite, smaller amounts of brown carbonate, and pink calcite, and a little erythrite (cobalt bloom). The quartz shows combs, and vugs which may contain hematite. In a small fracture that crosses this vein about at right angles, and that can be traced a few feet, is a seam up to 1 inch wide showing bright yellow stains thought to be uranium minerals. An assay[1] of a selected sample of this material gave:

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|---|---|
| Gold (oz. Troy per ton 2,000 lbs.) | 0·20 |
| Silver (oz. Troy per ton 2,000 lbs.) | 3·92 |
| Uranium oxide (as $U_3O_8$) | 14·15 per cent |

"The chief present interest in this occurrence is that it apparently shows that this pitchblende mineralization took place considerably later than the emplacement of this granite. The amount of mineralization seen was small."

### How Group[2] (17)

Silver occurs on the north shore of Camsell River about 9 miles from its mouth and one-quarter mile west of the first large rapid. The deposit was staked by J. Borthwick in 1932 and has been described by Kidd[3]. A summary of his report follows.

The deposit occurs in a fine-grained, grey, volcanic rock that contains feldspar phenocrysts in places, and a little disseminated pyrite. Silver has been found in one of several fracture zones. This zone is stripped for 110 feet, is 6 inches to 6 feet wide, strikes north 75 degrees east, and dips 80 to 85 degrees north. It was explored by a shaft 60 feet deep. A network of veinlets occurs in the zone and the veinlets range up to 8 inches wide. The vein filling is mostly manganiferous dolomite, and this is accompanied by a little quartz, pyrite, chalcopyrite, sphalerite, galena, native bismuth, silver-bearing bismuthinite, and native silver. Native silver occurs in tiny leaves in cracks in chloritized rock near the veins. In one place in the zone flakes of silver averaging one-sixteenth inch across were sparsely scattered over an area 3 feet wide and 10 feet long, and in that place the fractures did not contain carbonate.

### Otter Group (White Eagle Silver Mines, Limited) (18)

The Otter group of four claims is on the north bank of Camsell River, 9 miles from the mouth and three-quarters mile west of the first large rapid. Native silver was found there in the summer of 1932 by W. J. Workman and E. B. McLellan. The deposit was explored by White Eagle Silver Mines, Limited, and so far as known no work has been done on the property since 1934. The following account is a summary of reports by Kidd[4].

[1] Laboratories of Mines Branch, Dept. of Mines, Ottawa.
[2] Reverted to the Crown.
[3] Kidd, D. F.: Great Bear Lake Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, p. 30 (out of print).
Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, pp. 33-34 (1936).
[4] Kidd, D. F.: Great Bear Lake Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, p. 29 (out of print).
Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, pp. 30-32 (1936).

Rocks near the deposit are mostly andesitic tuffs and agglomerates, and a fine-grained altered diabase that accompanies them may be intrusive into them but of nearly the same age. Granitic intrusive rocks occur about 1¼ miles east, and also 2 miles south. The silver occurs in a fracture zone that cuts the diabase and strikes north 40 to 45 degrees west and dips 70 to 75 degrees northeast. An adit, starting at the river bank, crosscuts 40 feet to intersect the zone, which it then follows northwest for 300 feet. One hundred and seventy-five feet from the portal a crosscut extends northeast from the drift for 110 feet. A winze, 100 feet deep, was sunk from this crosscut and another crosscut extends southwest from the bottom of the winze and intersects the fracture zone. Some drifting was done on this level. The fracture zone ranges from 1 inch to 3 or 4 feet wide and has been traced 250 feet on the surface. Parts of the zone consist of two or more closely spaced, parallel fractures along which a little movement may have taken place. The rock near these fractures is shattered. Veins now occupy the main parallel fractures and swarms of veinlets occupy the adjacent shattered rock. In the western part of the drift on the adit level there are in places three such veins up to 15 inches wide, which with the intervening breccia occupy the full width of the drift. Banding and crustification are common in the veins and the vein filling is mostly quartz and coarse, pink, manganese-bearing dolomite; these minerals are accompanied by a little pyrite, arsenopyrite, chalcopyrite, sphalerite, galena, native bismuth, bismuthinite, safflorite-rammelsbergite, hematite, argentite, and native silver. Most of the native silver accompanies fine-grained, banded quartz, some occurs as fine wires evenly distributed in quartz, and much occurs in fragments of chloritic country rock included in this quartz. Some native silver is associated with niccolite. Silver occurs in one shoot in the fracture zone. It is abundant in one trench and also on the adit level 60 feet below the trench, where the shoot is much longer and wider than at the surface. The shoot was not found in the drift from the bottom of the winze and its dimensions and silver content are not known. The silver in the adit level occurred about 240 feet from the portal, where the fracture zone is bent and where numerous fragments of rock are embedded in quartz. The zone is wider at this place than at the surface.

## Elite Group (19)

The Elite group of four claims is on the south bank of Camsell River, 9 miles from its mouth, and opposite the Otter group. Native silver was found late in 1932 on Elite 2 claim and was explored by trenches in 1933. The deposit has been described by Kidd[1] and his description is summarized below.

The rock at the silver deposits is pink to grey, feldspar-quartz porphyry that may be a quartz latite. Granite outcrops about one mile east and is probably younger than the porphyry. A 6-foot diabase dyke cuts the porphyry and is younger than the granite. Five fractures cut the porphyry and trend east to east-southeast. They occur within a belt about 300 feet wide. The longest fracture is exposed for 550 feet; the others can be traced from 20 to 200 feet. The diabase dyke is younger than the

[1] Kidd, D. F.: Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, pp. 34, 35 (1936).

fractures and crosses all of them; it cut and displaced the longest fracture, but the dyke is not fractured. The fractures are filled by veins, ½ inch to 12 inches wide, which do not penetrate the dyke. The veins consist of quartz, buff-coloured carbonate, chalcopyrite, safflorite-rammelsbergite, gersdorffite (?), galena, native silver, argentite, covellite, and an unidentified bismuth-lead-copper mineral. Chlorite was formed in the wall-rock. Native silver occurs in three of the veins and may occur in a fourth. It is present in quartz as patches of abundant wires, and these masses have lengths up to 12 feet and widths from a fraction of an inch to a rare maximum of several inches. All the silver is near the diabase dyke. Although the dyke was introduced after the fractures had formed it was not necessarily introduced after the vein filling, but the absence of mineral occurrences within it suggests that it was.

## W L O and W K Claims[1] (20)

Pitchblende deposits on these claims have been described by Kidd[2] and his report is summarized below.

The W L O group of fourteen claims and the W K group of ten claims were staked at the head of Stairs Bay at the southeast end of Hottah Lake. The country rock is mainly biotite granite. Three bands of altered gabbro occur in the granite, trend about northeast, and range up to several hundred feet wide. Quartz-vein stockworks, up to 400 feet wide, cut the granite and gabbro and are cut by diabase dykes. Younger quartz veinlets cut the diabase dykes and most known pitchblende is accompanied by hematite and occurs in these veinlets where they cut diabase or older gabbro. Pitchblende was seen in seven widely separated places. The largest known deposit is on the northwest part of W L O 12 claim where a quartz vein, up to 4 inches wide, strikes east, dips 30 to 50 degrees north, and is exposed for a length of 150 feet. The vein is in gabbro, which is crossed by a network of other quartz veins. A band of pitchblende-bearing material, up to 3 inches wide, accompanies the quartz and is exposed at intervals for a distance of 25 feet. This band contains seams, up to ½-inch wide, of pitchblende-hematite mixture. A sample, probably from this deposit, sent to the Mines Branch at Ottawa, contained 13·70 per cent $U_3O_8$.[3].

## Tatee and Bee Claims[1] (21)

The Tatee (No. 32024) and Bee No. 3 (No. 32031) claims have been described by Kidd[4], and the following is a summary of his account.

The claims are on the north side of the east arm of Beaverlodge Lake. D. Arden and E. H. Hargreaves staked claims there in January 1934 and at various times later. Some work was done on the claims by Hottah Lake Mines, Limited, a company organized for that purpose.

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[1] Reverted to the Crown.
[2] Kidd, D. F.: Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, pp. 29, 30 (1936).
[3] Communication from the Ore Dressing Division, Department of Mines, Mines Branch, Ottawa.
[4] Kidd, D. F.: Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, pp. 26–29 (1936).

Two and one-half miles northeast of the narrows in the lake an intrusive sheet of gabbro cuts sediments and porphyries and probably dips gently south. Sediments, porphyries, granite, and gabbro are cut by quartz veins that range up to several hundred feet wide, strike northeast, and are nearly vertical in most places. The quartz veins are cut by diabase dykes. Later veinlets containing quartz and pitchblende occur in these veins and cut the dykes.

The Tatee claim was about 1½ miles northeast of the narrows of the lake and on a large quartz "vein" that crosses the narrows and trends north 50 degrees east. The "vein" has been traced 10 miles. At the claim it ranges from 175 to 250 feet wide and consists of a network of quartz veinlets in finely banded, fine-grained, quartzose sediments. The proportion of vein quartz to sedimentary rock is not known, but in places the sediments in the "vein" form lenses several feet wide. Bedding planes and ripple-marks are recognizable in some of the lenses, but in others recrystallization and silicification have obliterated the original structures. The "vein" is cut by many fractures, some of which are faults. Pitchblende was found in two pits in the "vein." In No. 1 pit it occurred as three lenses several feet long, in a twisted and intensely sheared chloritic schist lens 8 feet long. No. 2 pit is 50 feet south of No. 1 pit. The pitchblende occurred as short, wide lenses of a few cubic feet each. The lenses occurred along joints in chloritic schist. The principal minerals in the deposit are intimately mixed hematite and colloform pitchblende in a quartz gangue. They are accompanied by a little pyrite, chalcopyrite, galena, marcasite, and an unidentified bismuth-lead-silver mineral. One and one-half tons of selected ore from the pits was shipped to Ottawa and contained 40·5 per cent $U_3O_8$.[1].

"On the Bee No. 3 claim (32031) pitchblende was found in 1934. The locality is 1⅛ miles northeast of the Tatee claim and ½ mile from the east arm of Beaverlodge lake. It is 700 feet southeast of the quartz vein that outcrops at the crest of the ridge north of the east arm of Beaverlodge lake. The pitchblende lies in a quartz vein, 300 feet wide. Eight hundred feet southwest the vein narrows to 40 feet and disappears under drift. At a point the same distance northeast it is faulted, and its extension was not found. To the northwest beyond a shallow depression a gently dipping sheet of gabbro occurs and to the southeast, gabbro, sediments, and quartz porphyry. The vein holds lenses of altered sediments and quartz porphyry. East-west right-hand faults displace it with throws up to 30 feet. Some movement on the faults must have taken place before the final filling of the vein, because a dyke of fine-grained porphyritic diabase that lies along one fault cuts the vein and is cut by later comb-quartz veinlets carrying specular hematite.

"The pitchblende occurs near the middle of the vein 100 feet northeast of the dyke. Limy argillite and quartz porphyry occur here in the vein as a lens up to 40 feet wide and 150 feet long. The porphyry intrudes the argillite and both are cut by a network of quartz veinlets. The porphyry is altered to a waxy, pale yellow-green aggregate, partly serpentine, in which are numerous glassy quartz grains. The pitchblende occurs

[1] Average of five assay results supplied by the Ore Dressing Division, Mines Branch, Department of Mines, Ottawa.

at several places in a distance of 100 feet, appearing as seams a fraction of an inch wide, and is associated with comb quartz similar to that cutting the dyke. The greatest amount at any one place is a lens 5 feet long by 3 inches wide, estimated to contain 10 per cent pitchblende. The lens is partly along the contact of sediments and porphyry and partly along a shear plane that branches from the contact. It is thus localized apparently because the inclusion of country rock has been more intensely fractured than the quartz of the vein.

"The mineralogy is similar to that at the Tatee deposit except for the presence of small amounts of native bismuth and the apparent absence of galena and the unidentified mineral. At one place there are distinct strains of cobalt and nickel bloom.

"Though excellent in quality the pitchblende so far visible is quite insufficient in amount to be of much value. The large inclusion of country rock, with which the pitchblende is associated, does not extend to the southwest, but may continue beneath the drift to the northeast. Nothing was found to indicate whether other lenses of pitchblende might be expected at depth."

## FORT NORMAN AREA

### Imperial Oil, Limited (22)

*References*:

Hume, G. S.: Geology of the Norman Oil Fields and a Reconnaissance of a Part of Liard River; Geol. Surv., Canada, Sum. Rept. 1922, pt. B, pp. 47-64.

Oil and Gas in Western Canada (Second edition); Geol. Surv., Canada, Ec. Geol. series No. 5, 1933, pp. 290-305.

Oil is produced and refined by Imperial Oil, Limited, on the east bank of Mackenzie River about 50 miles northwest of Fort Norman and about 100 miles south of the Arctic Circle. All oil comes from two wells. The first well to produce oil at this locality was drilled in 1920. It struck oil at a depth of 783 feet and produced at the rate of 100 barrels a day. By 1923 the well had been deepened to 1,025 feet, but the flow remained the same. The second successful well was drilled in 1924-25, 150 feet from the first well. Oil was obtained at 936 and 1,063 feet and amounted to about 110 barrels a day. Oil is obtained from both wells by artificial means. Three unsuccessful wells were drilled by Imperial Oil, Limited, during 1921-22; two of these were within 4 miles of the productive well and one was about 40 miles southeast on the east bank of Mackenzie River. Another unsuccessful well was drilled to a depth of 1,830 feet by the same company in 1939. Production of fuel oil and gasoline was commenced at a small refinery in 1932, and the products were used principally in connection with mining operations in Great Bear Lake area. A new refinery was erected during the summer of 1939 and is expected, during the summer of 1940, to commence producing fuel oil, diesel oil, and aviation and motor gasoline; it is reported to be capable of processing 840 barrels of oil a day. New oil tanks were erected at the same time, and the total tank capacity is 12,500 barrels. The refinery operates from about June 10 to September 10 and oil produced during the winter is stored. Steady production started in the Fort Norman area

in 1932, and in that year production was 910 barrels of petroleum valued at $9,251. In 1939 production was 17,013 barrels valued at $51,039. From 1932 to 1939, inclusive, the area has produced 6,100,000 cubic feet of natural gas valued at $1,355 and 71,708 barrels of petroleum valued at $329,210. The Federal Government formerly received a royalty on oil produced in the Fort Norman area. This payment was waived for a 5-year period commencing January 1, 1939. This action was reflected in reduced oil prices to the mineral industry in Northwest Territories.

Oil in the producing wells comes from the Upper Devonian, Fort Creek formation of mostly black shale. The formation is about 1,500 feet thick. Sandstones and shales outcrop near the wells, overlie the Fort Creek shales, and are also of Upper Devonian age. The wells are on the southwest flank of an anticline that forms the Norman Mountains, which lie northeast of the wells. The beds dip gently southwest near the wells and pass beneath Mackenzie River to form a syncline west of the river. The Fort Creek shales on the flanks of this syncline outcrop about 1½ and 23 miles northeast and southwest of the wells, respectively. The oil has apparently accumulated in fractures in the shale.

## INDIN LAKE AREA

### Dingo Group (23)

The Dingo group of twenty-four claims is about 23 miles north of the west tip of Indin Lake and about 2 miles east of Emile River. A trail 2½ miles long connects the claims with a lake on Emile River on which aeroplanes can land. The claims are on a plateau about 350 feet above Emile River. Drift and muskeg cover probably 85 per cent of bedrock near the principal known veins and seriously retard prospecting. The property was visited on August 15, 1939.

The claims were staked by J. D. Mason in July 1939, following the discovery of gold-bearing quartz veins, and four men were employed on the property from early July until late September 1939. About ninety small pits and trenches were dug, most of which are on Dingo 2, 3, 4, 12, and 15 claims.

The rock near the principal known quartz veins is mostly fractured and sheared greenstone of the Yellowknife group; much of it is fine-grained, but some of it has a medium-grained, dioritic texture. The dip and strike of the greenstone are not known. Granite outcrops about ½ mile east of the principal veins and cuts the greenstone. A few dyke-like bodies of feldspar porphyry occur in the greenstone near the veins, trend about northwest, and may average 20 feet wide.

Many narrow quartz veins occur on the claims, mostly in shear zones, and some of them contain gold. Most of the shear zones are in greenstone, but some[1] may be partly within feldspar porphyry. Most of the shear zones and veins strike about north 40 degrees west and dip 70 to 85 degrees northeast. Those on which most work has been done lie within a rectangle that measures about 4,200 feet from northwest to southeast and about 2,000 feet from northeast to southwest. One vein has

[1] Mason, J. D.: Personal communication.

been traced for 850 feet and may be longer. Many other veins have been traced shorter distances, but because of heavy overburden none of them has been thoroughly explored. The exposed parts of most veins are between 6 inches and 5 feet wide and may average 2 feet. In most places the quartz has sharp walls against the enclosing greenstone or chloritic schist. In many places metallic minerals constitute a few per cent of a quartz vein, but locally they constitute more than 30 per cent. The following minerals were seen in quartz and are abundant in places; pyrite, pyrrhotite, chalcopyrite, galena, and sphalerite. Smaller quantities of the following minerals also occur in quartz: native copper, gold, pale violet fluorite, and a soft, fibrous, grey, metallic mineral that contains bismuth, sulphur, and possibly other constituents.

Most work has been done on a vein known as the Galena vein on Dingo 4 claim. This vein is traced about 850 feet by nineteen trenches and it strikes north 40 degrees west and dips 80 degrees northeast. At the northwest end of the trenches the vein branches and passes under drift; at the southeast end of the trenches the vein passes under muskeg that borders a lake. The vein lies in a shear zone in greenstone and the width of the shear zone ranges from 2 to 6 feet and averages 4 feet; the zone may branch in places. The width of the quartz vein ranges from 1 to 4½ feet and averages about 2½ feet. The vein branches in places. In the most northerly trench the shear zone is 6 feet wide and encloses 2½ feet of quartz in two veins. The vein is 1 foot wide in the most southerly trench. In many places the walls of the vein are sharp and free, but in some places the vein grades into the enclosing schist through a few inches of schist and quartz stringers. The quartz is milky white and contains pyrite, pyrrhotite, chalcopyrite, galena, sphalerite, gold, and native copper, and many irregular inclusions of chloritic schist. In many places metallic minerals constitute less than 1 per cent of the vein, but in one trench they constitute about 30 per cent. A sample across 2 feet of vein in this trench is reported to have contained: gold, 0·99 ounce a ton; silver, 5·50 ounces a ton. Fourteen samples from 825 feet of vein are reported to have averaged 0·25 ounce of gold a ton over an average width of about 2½ feet.

### Pa Group (24)

The Pa group of thirty-six claims is on the north shore of Indin Lake and about 8 miles east of the west end of the lake. The claims were staked for Territories Exploration Company, Limited, in August 1938. Most work has been done on the Brown veins of gold-bearing quartz; no work was being done on these veins in August 1939. Pa 1 claim lies north of and adjoins Pa 2 claim, and the veins cross the boundary between these claims about 15 feet from the west side of the claims.

The rock near the west side of Pa 1 and Pa 2 claims is soft, fissile, grey, sericite-carbonate-chlorite schist that is an altered volcanic rock of the Yellowknife group. The foliation strikes about north 10 degrees east and the dip ranges from 75 degrees east to vertical. A fault is reported[1] to cut these rocks and to strike north 35 degrees west. It lies beneath a channel in Indin Lake that trends about parallel to the fault

[1] Johnston, A. W.: Personal communication.

and is about 1,200 feet wide. The veins outcrop on the north side of the channel, strike towards the fault, and pass beneath the channel. The exact position of the fault is not known, but it is probably near the north shore of the channel. The relative age of the fault and veins is not known. The nearest granite outcrops about 5 miles northwest of the Brown veins and cuts rocks of the Yellowknife group.

The Brown veins comprise two parallel quartz veins that are separated by about 12 feet of schist, trend about north 10 degrees east, and dip between 75 degrees east and vertical. They are nearly parallel to the foliation of the enclosing schist, but in places may cross the foliation at very small angles. The east vein has been stripped for 145 feet and the width of the exposed part of the vein ranges from 1 foot to 5½ feet and averages 2½ feet. At the south end of the stripped part the vein passes under Indin Lake. At the north end of the stripped section the vein ends on the surface, but the end of the vein plunges north beneath the schist. A lens of quartz about 27 feet long and up to 2½ feet wide outcrops on the strike of the east vein and about 110 feet north of it. No gold or other metallic minerals were seen in the lens. No quartz or shear zone is known to occur north of the lens or between the lens and the east Brown vein. The west vein is stripped for 145 feet, and throughout most of this length its width ranges from 6 inches to 3½ feet and averages 1½ feet. At the south end of the stripped part the vein tapers to a point and may end at the edge of the lake. At the north end of the stripped part the vein passes under drift and probably ends a few feet beyond. The east and west veins are broken into three approximately equal lengths by two faults. These faults are nearly vertical cracks and trend about northwest; the veins on the north side of each fault are offset about 4 feet northwest relative to the veins on the south side. The walls of the veins are sharp and in many places are bordered by about 3 inches of rusty schist and in a few places by rusty schist 2 feet wide. Most of the quartz in the veins is much fractured, is grey, and includes a few seams of schist that are parallel to the walls. Some quartz is white and vuggy and contains an iron-bearing carbonate. The white quartz occurs as veinlets and irregular masses and some is separated from the grey quartz by sharp walls and some appears to grade into the grey quartz. Locally the grey and white quartz occurs in about equal quantities. Metallic minerals constitute less than 1 per cent of the veins and include pyrite, arsenopyrite, chalcopyrite, pyrrhotite (?), and gold. Visible gold occurs in both types of quartz, but is probably most common in the grey quartz. Fifty feet of the east vein is reported[1] to average 35 inches wide and to contain 1·42 ounces of gold a ton. No underground work has been done on the veins.

### Ma Group (25)

The Ma group of thirty-six claims is about 7½ miles east of the west end of Indin Lake and adjoins the Pa group on the south and west. The claims were staked for Territories Exploration Company, Limited, in August 1938. On July 31, 1939, visible gold was discovered in the Johnson quartz vein on the northeast quarter of Ma 5 claim. Rock outcrops are scarce

[1] Johnston, A. W.: Personal communication.

near the vein. The vein was examined on August 3, 1939, and was exposed in three trenches. Volcanic rocks of the Yellowknife group underlie the Ma 5 claim near the Johnson vein. Over wide areas the rock is a soft, grey, fissile schist that weathers buff in places. Near the vein elliptical fragments of fine-grained, light grey rock comprise about 30 per cent of the schist and range up to about 6 inches long. Foliation trends about north 45 degrees east and dips steep northwest to vertical. The rocks may strike about northeast and dip nearly vertical. The nearest granite outcrops about 6 miles northwest of the Johnson vein and cuts Yellowknife rocks. The vein strikes about north 40 degrees east and was exposed for 100 feet by three trenches and an outcrop. The vein is hidden by muskeg northeast of the 100-foot section and probably extends less than 100 feet southwest of the 100-foot section. The dip of the vein is not known, but may be steep northwest. The width of the explored part of the vein may range from 2 to 4 feet. The walls are sharp in places. A few inches to 2 feet of rock next the quartz is a little more sheared than elsewhere and some of the rock next the quartz is rusty, probably due to the oxidation of iron-bearing carbonate. Most of the quartz is grey. A little white, vuggy quartz with iron-bearing carbonate occurs as veinlets that cut the grey quartz. The vein contains a very little pyrite and arsenopyrite(?). Gold was seen in grey quartz in one trench.

## Ann Group (26)

The Ann group of twenty-four claims is on the east shore of Indin Lake about 8 miles north-northeast of the outlet of the lake. The claims were staked for Territories Exploration Company, Limited, following a discovery of spectacular gold ore in the Barker vein on September 11, 1938. The vein was explored by nine trenches and about 1,600 pounds of selected ore, containing about 83 fine ounces of gold, was sent to Yellowknife by aeroplane for treatment. In so far as is known no ore remains in the vein. No work was being done on the vein in August 1939.

The rock near the vein is mostly massive, dark green, andesitic lava (greenstone) of the Yellowknife group; much of it is uniformly fine-grained, but some of it contains a few white phenocrysts or amygdules that range up to ½ inch across. The strike and dip of the lavas are not known. Feldspar-quartz porphyry cuts the lava and outcrops 50 feet east of the vein and in several places about 225 feet northeast of the vein. A granite body about ½ mile in diameter outcrops 2 miles southwest of the vein and another body about 2½ miles in diameter outcrops 5½ miles southeast of the vein. A major fault[1] cuts the lavas about ¼ mile west of the vein and strikes north 10 degrees west.

The Barker vein is on Ann 10 claim and about ¼ mile east of Indin Lake. Most rock near the vein is covered with drift, muskeg, or moss. The vein is 40 feet long at the surface, strikes north 25 degrees west, and dips 60 degrees east. It is about 1 foot wide near the south end and gradually widens towards the north, the northern half of the vein ranging from 3 to 6 feet in width and ending abruptly in soft, grey, flaky schist. In places the rock next the walls of the vein is strongly sheared for about 1 foot. The outcrop of the vein ended to the south against a fissure that strikes

[1] Wilson, J. T.: Personal communication.

north 35 degrees west and dips 70 degrees southwest. The fissure contains a few inches of sheeted rock and gouge and may be a fault. The vein and fissure meet along a line that plunges about 35 degrees southeasterly, and a pipe-like body of ore with abundant coarse gold occurred along this intersection. The pipe-like body was about 1 foot in diameter and was followed down the intersection of the vein and fissure for about 10 feet and ended at the intersection of the fissure and a vertical fracture that strikes north 75 degrees west. All ore shipped from the vein came from this body. The vein is not known to have been located south of the fissure or south of the vertical fracture. The vein material is a mixture of grey and white quartz, black and white, coarse-grained carbonate, fine-grained, white carbonate, and irregular fragments of chloritic wall-rock. Carbonate and quartz are present in about equal proportions, and the carbonate is probably calcite. Metallic minerals may constitute 2 per cent of the vein material; chalcopyrite is most plentiful and there is some galena, sphalerite, pyrite, arsenopyrite, and gold. A little cobalt bloom is reported[1] to have occurred at the surface. Practically all known gold occurred in the pipe-like ore shoot at the south end of the vein, and the gangue in this shoot was mostly carbonate. Most of the gold is reported[2] to have occurred in fine-grained carbonate.

## SNARE RIVER AREA

### Deloro Group (27)

No work has been done on this group since 1938 when it was examined by Lord[3].

"The Deloro group of twelve mineral claims is located on G Lake[4], on Snare River, and is owned by the B. and M. Syndicate of Winnipeg, Manitoba. A crew of six men was employed on surface work when the property was visited in July 1938, but was withdrawn before the end of the summer. Most work has been done on Deloro 1 and Deloro 5 claims in nodular quartz-biotite schist, on the east shore of G Lake about one-half mile east of the main body of granitic rock. The schist belongs to the Yellowknife group and strikes about south 10 degrees east and dips about 65 degrees northeast. On Deloro 1 claim eight pits and trenches have been put down on the east shore of G Lake, over a distance of 275 feet and along a line trending south 10 degrees east. They do not expose a well-defined shear zone or quartz vein, but in a few places the schist contains some lenses and veinlets of glassy and milky quartz with a very little arsenopyrite, pyrite, and green copper stain. Several specimens reported to have come from these pits contained a little free gold. A pink aplite dyke is exposed in some of the northern pits and contains a little arsenopyrite and pyrite. Six trenches have been dug on Deloro 5 claim on the east shore of G Lake about 2,100 feet southeast of the trenches on Deloro 1 claim. In one trench biotite schist is sheared and rusty for a width of 8 feet, and this shear zone trends southeasterly and dips 60 degrees northeast but is not exposed in the other trenches. The sheared rock contains a little quartz with a very little arsenopyrite and white mica."

[1] Johnston, A. W.: Personal communication.
[2] Johnston, A. W.: Personal communication.
[3] Lord, C. S.: Snare River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-5, pp. 15, 16.
[4] Fifteen miles upstream from Slemon Lake.

## Au Group (28)

The Au group of twelve claims lies about 2 miles northeast of where Snare River enters Slemon Lake, and about 80 miles northwest of Yellowknife. Boats with a draught of about 2 feet can navigate from Great Slave Lake to the head of Slemon Lake. The claims were staked by John Lundmark and Waino Lahti on August 24 and 25, 1939, and were prospected by four men for several weeks during the summer. Most work was done on a quartz vein on Au 4 claim, and this vein contains plentiful visible gold. Rocks underlying the claim are black slate and greywacke of the Yellowknife group. Many of the beds are less than 6 inches thick, and near the vein they strike about north 25 degrees west and dip about 85 degrees east. The nearest granitic rocks outcrop about 4 miles north and south of the vein and intrude the slate and greywacke. The vein strikes north 35 degrees west, dips from 55 to 70 degrees east, and is traced 240 feet. At the northwest end it passes under drift and at the southeast end it dies out in a fractured zone from 1 to 5 feet wide, which is visible on the same strike as the vein for 60 feet before it passes under drift. The width of the vein ranges from 4 inches to 4 feet and averages 2 feet. The quartz contains no wall-rock and is bordered in most places by a few inches of fractured rock. Most of the quartz is fine-grained and grey, and in places is ribboned by seams that are parallel to the walls and contain chlorite and pyrite. A little quartz is coarse-grained and white, and some of this quartz occurs as veinlets cutting the fine-grained quartz in which most of the metallic minerals and visible gold occur. Minerals other than quartz constitute less than 1 per cent of the vein and include pyrite, pyrrhotite, chalcopyrite, gold, possible arsenopyrite, and feldspar. A little violet quartz is reported to surround some of the grains of visible gold on the surface.

## Corinne Group (29)

No work has been done on this group since 1938 when it was examined by Lord[1].

"The Corinne group of twenty-one claims was staked on Mosher Lake early in the summer of 1938 and the claims are registered in the names of A. C. Mosher of Haileybury, Ontario, H. Lajeunesse, C. J. Mosher, and H. Grozelle. The claims are underlain by Yellowknife group rocks, which are greywacke, nodular quartz-biotite schist, and greenstone. The principal discovery is on a small island near the centre of the lake about one-half mile east of its outlet. A northwesterly-trending fault probably passes close to this island. Stripping on the northeast shore of the island has exposed a stockwork of quartz in fresh black slate and greywacke. This stockwork trends about south 30 degrees east, is exposed for a length of about 120 feet, and passes under the lake at each end. It contains about 10 per cent quartz. Its exposed apparent width is about 90 feet, but it passes under the lake on the northeast side and may be wider. Its true width may be much less than its apparent width because the quartz stockwork follows the beds, which may be drag-folded in the area that has been stripped. The greywacke and slate are crumpled within the quartz stockwork. The quartz is mottled grey and white and contains a little

[1] Lord, C. S.: Snare River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-5, p. 16.

rusty weathering carbonate, pink feldspar, pyrrhotite, pyrite, chalcopyrite, arsenopyrite, and free gold, and is reported to contain some sphalerite."

## YELLOWKNIFE BAY-BEAULIEU RIVER AREA

### Keno Vein (30)

The following description is by J. F. Henderson, who examined the vein in 1939.

The Keno vein is near the east shore of a large island 7 miles south of the north end of Gordon Lake. A considerable amount of trenching was done on the vein in 1937 by Mining Corporation of Canada, Limited. The vein parallels the bedding planes of the neighbouring greywacke and slate and lies 200 to 250 feet east of the synclinal axis of a fold that plunges 35 to 45 degrees south. The vein strikes north 10 degrees east and dips 70 to 75 degrees west. Its width ranges from 3 to 38 feet and averages 6 to 8 feet over an exposed length of more than 700 feet. The northern part of the vein consists of two parallel veins, the westerly being 1 to 3 feet and the easterly 3 to 38 feet wide. To the south the two join to form one vein. The veins are parallel to the bedding and the 1 foot to 1½ feet of greywacke separating them appears to be the same bed over a length of 400 feet.

The quartz is milky white and irregularly banded. Pale pinkish albite and rusty weathering carbonate occur throughout the quartz. In places chalcopyrite, pyrite, sphalerite, and galena are fairly plentiful, but most of the vein contains little or none of these sulphides. The vein has been trenched and sampled at 20-foot intervals over its entire length. Visible gold has been found in places, but the sampling showed that no part of the vein was of sufficient grade to warrant further work.

### Galloway Gordon Lake Mines, Limited (31)

This property was examined by J. F. Henderson in September 1939 and his description follows.

Galloway Gordon Lake Mines, Limited, was incorporated in March 1938 to develop a group of claims having an area of about 1,500 acres and lying on the east side of Gordon Lake west of Bars Lake. Surface trenching and diamond drilling have been done on the main showings near the southeast end of the bay on Gordon Lake west of Bars Lake.

The property is underlain by greywacke and slate of the Yellowknife group. The beds strike north 15 to 30 degrees east and dip 75 to 90 degrees southeast. The main showing is about half-way between the southeast end of the bay of Gordon Lake and the small lake immediately to the east. Vein quartz has been introduced as a series of discontinuous quartz lenses along the ruptured axis of an anticline that strikes about north 30 degrees east. The amount of vein quartz varies greatly. For short distances, particularly where slaty beds pass around the nose of the fold, lenses and saddle-like masses of vein quartz outcrop over widths of 10 to 12 feet, but elsewhere over long stretches little or no quartz is present. About 250 feet south of the creek draining into the southeast end of the bay a large

amount of vein quartz outcrops over a length of about 60 feet. Two trenches have been cut across it and a shaft sunk to a depth of 35 feet. The northeasterly trench is 10 feet long. Vein quartz occurs in the trench as lenses and stringers. About 80 per cent of the rock in the trench is quartz and the rest is greywacke and slate between the quartz lenses. The quartz is a glassy, blue-grey variety cut by veinlets of white quartz that contain white to pinkish feldspar crystals. Contacts between quartz and country rock are sharp and inclusions of greywacke and slate in the quartz are angular and clearly defined. The quartz contains a few grains of pyrrhotite, pyrite, and chalcopyrite. Most of the sulphides occur in the quartz near the wall-rock or near and in rock inclusions in the quartz. Visible gold is reported to have been found in this trench. About 60 feet to the southwest is a second trench 23 feet long. About 11 feet of this trench is across quartz lenses in greywacke and perhaps 50 per cent is quartz. The remaining 12 feet is across greywacke cut by a few quartz stringers. The quartz and sparse sulphide mineralization is similar to that of the first trench. Many lenses and irregular masses occur in the contorted and broken beds along the axis between the two trenches. Vein quartz as lenses and saddle-like masses occurs here and there along the axis for more than 1,000 feet to the southwest of the creek. In addition to the two trenches described, four other trenches have been made in this distance in places where quartz stringers and lenses are plentiful.

Trenching has also been done on a quartz vein near the east shore of the bay of Gordon Lake to the southeast of the camp buildings. Five trenches have been made across this vein over a length of about 350 feet. The quartz occurs as a series of discontinuous lenses that range in width from a fraction of an inch to 3 feet and are enclosed in slate and greywacke. The quartz lenses are parallel to the bedding, strike north 25 degrees east, and dip 75 to 80 degrees east. The zone containing the quartz ranges in width from 5 feet to 18 feet. The amount of quartz exposed in the trenches varies considerably; in several trenches the quartz lenses make up perhaps 80 per cent of the zone; in others slate and greywacke are more abundant than quartz. A small amount of fine-grained pyrite occurs in the quartz and slate near quartz-slate contacts, but most of the quartz contains no sulphide. Veinlets of light green chlorite cut the slate along and near quartz-slate contacts.

A third vein runs through the more easterly of the two islands in the bay of Gordon Lake. The vein parallels the bedding of the enclosing slate and greywacke, striking north 15 degrees east and dipping 80 degrees southeast. It is 4 to 8 feet wide and is composed of white to greyish quartz sparsely mineralized with arsenopyrite, chalcopyrite, pyrite, and galena. One trench has been cut across the vein.

The two veins on the mainland have been diamond drilled. Judging by the amount of core in the core shed about 1,500 feet of drilling was completed.

### Ardogo Group (32)

The following description is by J. F. Henderson, who visited the property in 1939.

A small but interesting gold deposit occurs on the Ardogo group on the large island 12 miles north of the south end of Gordon Lake. The

deposit was trenched by Mining Corporation of Canada, Limited, in 1939. The vein is in closely folded greywacke and slates about 700 feet south of the large bay. The quartz lies on the axis of a synclinal fold plunging steeply south. Irregular lenses and stringers occur in a band of black slate where it passes around the nose of a fold. A pit about 12 by 12 by 3 feet has been dug in the slate and quartz on the axis. As the quartz is limited to the slaty band where it passes around the nose of the fold the deposit is confined to the small area explored by the pit. The quartz in the pit is sparsely mineralized with pyrite, chalcopyrite, sphalerite, and galena. Visible gold is plentiful in the quartz.

### Try Me Group (33)

The Try Me group of forty-six claims on Mac Lake lies about 50 miles northeast of Yellowknife townsite and about 10 miles northwest of the Camlaren mine. Rock is exposed over wide areas. The claims were staked for Consolidated Mining and Smelting Company of Canada, Limited, by U. J. Arsenault and C. S. McDonald in July and August 1938. About fifteen men were employed on the property from September to December 1938 and H. G. Barker was in charge. Most work was done on a gold-bearing quartz vein on the west shore of Mac Lake on claims Try Me 3 and 4; this work included thirty-four diamond drill holes with an aggregate length of 8,341 feet and thirty rock trenches with a combined length of about 670 feet. A little prospecting was the only work done on the claims in 1939.

The rock near the vein is sedimentary quartz-biotite schist of the Yellowknife group. Most of the beds contain abundant rounded or rectangular knots of metamorphic minerals, which range up to 5 inches long and average about 1½ inches long. The nearest granite is reported[1] to outcrop on the east side of Mac Lake about ½ mile northeast of the vein and probably intrudes the Yellowknife rocks. The sediments lie in an anticlinal fold that probably plunges southeast and whose axial plane strikes about northwest and dips steeply northeast. Beds on the northeast flank of the anticline strike between north 40 degrees west and north 10 degrees east and dip 25 to 55 degrees east. Some beds on the southwest flank of the anticline strike north 60 degrees west, dip 75 degrees northeast, and are overturned. The quartz vein on claims Try Me 3 and 4 is exposed at intervals throughout a length of 2,450 feet; at the north end of the outcrop it strikes north 5 degrees east and passes under Mac Lake; the strike gradually changes towards the south and is about south 30 degrees east near the south end. About 1,700 feet from the north end of the outcrop the vein dips 25 and 35 degrees east, as indicated by diamond drill holes that intersect the vein as far as 650 feet from the outcrop. The northern part of the quartz vein is on the northeast flank of the anticline and is parallel to the enclosing sediments; the vein and axial plane of the anticline converge towards the southeast and may meet at the surface about 1,550 feet from the north end of the vein outcrop. The width of this northern, 1,550-foot section of the vein ranges from 1 to 11 feet and averages about 4 feet. In some places the quartz is bordered by a few inches of gouge and crushed rock, but in most places the contact between the quartz and rock

[1] McDonald, W.: Consolidated Mining and Smelting Company of Canada, Limited, personal communication

is slightly sheared for a few inches or is tight and sinuous. The quartz includes a little biotite schist. The structure of the enclosing rocks southeast of the probable junction of the vein and the axial plane at the surface is not known, but the vein and beds may be nearly parallel in the 650-foot section of vein lying immediately southeast of the intersection. This part of the vein ranges from 6 inches to 10 feet wide and averages about 4½ feet; it includes up to 30 per cent biotite schist and is separated from the wall-rock by as much as 10 feet of schist and quartz stringers. Quartz south of this 650-foot section of the vein occurs as stockworks and irregular masses within the schist and the vein loses its identity and ends within 250 feet. Most quartz in the vein is medium-grained and grey, and in places contains many dark patches of partly assimilated biotite schist and a very little disseminated pyrite and feldspar. In some places a few inches of rock bordering the vein contains a little disseminated pyrite. A few veinlets of coarse-grained, glassy to milky quartz cut the grey quartz, range in width up to 10 inches, and have sharp walls; some coarse-grained pyrite occurs in these veinlets and much of the pyrite occupies drusy cavities in the quartz. Gold is reported[1] to occur in the vein, but none was seen. In so far as is known no ore occurs in the vein, although the quartz is reported to contain more than one ounce of gold a ton in a very few places. Most known gold occurs about 1,400 feet south of the north end of the vein outcrop.

### Territories Exploration Company, Limited[2] (34)

"In a block extending northeast for 15 miles from Clan Lake[3] six groups, totalling 232 claims, were staked in 1937 on behalf of Territories Exploration, Limited. Many gold-bearing quartz veins, six of which show visible gold, were found on these claims. According to the company's geologists, those veins carrying visible gold have only minor amounts of other metallic minerals, whereas those in which no visible gold was seen, but from which gold could be panned, contain considerable arsenopyrite, pyrite, pyrrhotite, chalcopyrite, galena, sphalerite, stibnite, and unidentified soft, grey, metallic minerals. The quartz in both types of veins varies from light bluish grey to dark grey, contains small amounts of ferruginous carbonate, and in general resembles the quartz found in other veins carrying neither visible gold nor gold values. One glassy white quartz vein, 4 inches wide and carrying several gold nuggets from the size of a match-head down, was found in a joint in a diorite sill."

### Pan Group (35)

The Pan group of thirty-four claims is on the south side of Murray Lake and about 48 miles northeast of Yellowknife and 6½ miles west of the Camlaren mine. The property is reached by aeroplane or by a 60-mile winter road from Yellowknife. Relief is about 50 feet and rock is well exposed. The claims were staked for Consolidated Mining and Smelting Company of Canada, Limited, by Gordon Murray in August

[1] McDonald, W.: Consolidated Mining and Smelting Company of Canada, Limited, personal communication.
[2] Jolliffe, A. W.: Quyta Lake and Parts of Fishing Lake and Prosperous Lake Areas, Northwest Territories; Geol. Surv., Canada, Paper 40-14, p. 9.
[3] Thirty-four miles north of Yellowknife townsite.

1937, following the discovery of gold-bearing quartz veins. About ten men were employed on the property under the direction of Gordon Murray during the latter part of 1937 and from about April 1, 1938, to December 15, 1938. About eight men were employed under the direction of J. Kilburn and G. Clayton from about March 15, 1939, to August 15, 1939, when the camp was dismantled and equipment removed from the property. Work done included more than 110 pits or trenches; no diamond drilling or underground work was done.

The claims are underlain by greywacke and slate of the Yellowknife group, and these rocks are not much altered and do not contain knots of metamorphic minerals. The rocks lie in a series of parallel anticlines and synclines whose axial planes strike about northwest and dip steep northeast or vertical. In most places the beds strike about northwest and dip about 85 degrees northeast. A few diabase dykes cut the greywacke and slate, strike between north 15 degrees west and northwest, and range in width up to about 120 feet. The nearest granite outcrops about 2½ miles west of the principal known gold-bearing quartz veins and cuts the greywacke and slate.

Quartz is common in the greywacke and slate and occurs in highly irregular veins, masses, and stringers. Quartz occurs near the axial planes of many of the anticlinal and synclinal folds. Most quartz contains abundant, white-weathered feldspar and some contains a little pyrrhotite, sphalerite, galena, pyrite, chalcopyrite, and gold. Most known gold occurs in quartz on claims Pan 2, 7, and 8, as described below.

Gold-bearing quartz occurs near the centre of Pan 2 claim 4,200 feet southwest of the east end of Murray Lake. Much quartz occurs as highly irregular groups of veinlets ranging in widths from cracks to a few inches, but one quartz body is about 55 feet long, averages about 3 feet wide, and contains about 20 per cent partly assimilated fragments of wall-rock. The quartz probably lies near the folded axial plane of an anticline. The axial plane strikes about northwest into the quartz lode; within the quartz lode its trend is uncertain but may be southwest for about 120 feet and beyond the quartz lode what may be the same axial plane strikes about north 60 degrees west. A little quartz occurs in many places at the surface along the axial plane, but most of it occurs near where the outcrop of the axial plane is believed to bend from northwest to southwest; quartz outcrops as lenses and stringers that extend about 110 feet southeast from this point and lenses and stringers of this section strike about southeast and contain most gold. Quartz also outcrops as lenses and stringers that extend about 80 feet southwest from this point, and many quartz bodies in this section strike about southwest. Most of the quartz is fine-grained and grey and contains white-weathering feldspar and a very little pyrite; a little gold was seen in this quartz. A little quartz is coarse-grained and glassy to milky and contains abundant white-weathering feldspar and some of this quartz occurs as veins within the grey quartz. In most places the walls of the quartz bodies are tight, but along some of the larger quartz lenses they are slightly sheared over widths of a few inches.

Quartz occurs near the middle of the west boundary of Pan 7 claim about 800 feet east of the occurrence described on Pan 2 claim. The slate

and greywacke country rock strikes about north 30 degrees west, dips 80 degrees northeast to vertical, and is folded so that two adjacent anticlinal axes lie about 175 feet apart. Two highly irregular bodies of quartz occur parallel to the bedding, about opposite each other and about 30 feet apart, and contain gold. They may lie close to the axial plane of a syncline. One quartz body is a lens about 50 feet long and at its widest point is about 8 feet wide and includes about 20 per cent wall-rock. Near each end it splits into many quartz stringers and merges into the country rock. One channel sample across 3 feet of quartz is reported to have contained about 10 ounces of gold a ton. The other quartz body at one place consists of two veins each 1½ feet wide, separated by 5½ feet of rock, and each of two channel samples at this point, each 3 feet long, are reported to have contained about ½ ounce of gold a ton. Only a few quartz stringers outcrop on the strike of these veins 35 feet northwest and southeast. Most of the quartz in these bodies is fine-grained and grey; it contains a very little pyrite and pyrrhotite and some visible gold. A little coarse-grained, glassy to milky quartz with abundant feldspar and brown mica cuts the grey quartz.

A third deposit of gold-bearing quartz occurs near the northwest corner of Pan 8 claim, about 1,200 feet southeast of the deposit described on Pan 2 claim. The slate and greywacke country rock trends about northwest and dips nearly vertical, and many beds are less than 4 inches thick. The axial plane of a syncline is southwest of the vein and trends northwest. The axial plane of an anticline northeast of the vein and about 200 feet from the axial plane of the syncline strikes about northwest in most places, but north of the vein the plane may have been warped and may strike about west-southwest for about 50 feet parallel to the adjacent beds. The quartz occurs about midway between the axial planes as three veins, designated, from west to east, A, B, and C. Vein A is exposed for 35 feet, trends east, and averages about 1 foot wide. The vein is nearly vertical and has sharp, sinuous, and unsheared walls. It passes under drift at the west end and may end to the east against a zone of sheared rock that is 7 feet wide and trends north and separates vein A from the west end of vein B. Vein B strikes about east for 50 feet from this shear zone, then strikes about northeast for 35 feet and enters a trench that was filled with water when examined. The vein dips about 80 degrees north and the walls are sinuous and sharp and in places are slightly sheared so that the quartz parts from the wall-rock. The northwest end of the outcrop of vein C is about 27 feet northeast of the east end of vein B. Vein C strikes about southeast and averages about 1 foot wide for a length of 37 feet, but veinlets branch from the main vein at many places throughout this length. Southeast of this 37-foot section the vein branches and ends. The northwest end of the 37-foot section passes under drift. Most quartz in veins A, B, and C is fine-grained and grey and contains a little white-weathered feldspar and a very little pyrite. No gold was seen in the quartz, but gold is reported to occur in many places in veins A and B and to be plentiful in some places. Vein C is cut in one place by a veinlet of coarse-grained, glassy quartz that is 3 inches wide and contains plentiful white-weathered feldspar. In many places the wall-rock is cut by a multitude of quartz veinlets, but in so far as is known these do not contain appreciable quantities of gold.

## Sentinel Mines, Limited (36)

No work has been done by this company on its Gordon Lake property since 1938, when it was examined by Henderson.[1]

"Sentinel Mines hold a group of claims north of the large bay on the west side of Gordon Lake. A large amount of trenching and surface work have been done on the property, and visible gold has been found in two localities.

"The original showing is located about 600 feet inland from the north shore of the bay. A large body of quartz occurs in the sediments[2] in a drift-filled, northeasterly trending valley. The greywacke and slate beds to the northwest and southeast of the valley strike north 75 to 80 degrees east and dip 80 to 85 degrees northwest. The dimensions of the quartz body as outlined by trenching are about 140 by 80 feet, but much of the quartz contains a large proportion of slate. The slate beds within the quartz strike at right angles to the strike of the sediments on either side of the valley. This suggests that the valley marks a drag-fold or contortion in a slaty band in the sediments. The quartz is a glassy, grey type sparsely mineralized with pyrite, pyrrhotite, and arsenopyrite; a few white weathering feldspar crystals occur in the quartz.

"Visible gold has been found in quartz in sediments one-half mile northwest of the deposit described above. The quartz outcrops as a series of lenses following the strike of the sediments, which strike southeast and dip 85 degrees southwest. One lens has been crossed by trenches at close intervals over a length of 275 feet, and in the trenches ranges in width from 9 feet at the northwest end to a few inches at the southeast end. Another quartz lens, measuring 17 to 35 feet, outcrops 10 feet northeast of the main body. The most common metallic minerals in the quartz are pyrite, arsenopyrite, and pyrrhotite, but on the whole sulphides are scarce. Visible gold accompanied by galena and sphalerite has been found in two trenches.

"Visible gold has also been found about one-quarter mile south of the showing described above. The gold occurs in a narrow quartz vein that lies in sediments, and varies from a few inches to 2½ feet in width. The sulphides associated with the gold are similar to those in the other occurrences that have already been described".

## Camlaren Mines, Limited (37)

*Reference:* Henderson, J. F.: Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-1.

*General Statement.* Camlaren Mines, Limited, was organized in July 1937 to develop part of the claims on Gordon Lake held jointly by Mining Corporation of Canada and the A.X. Syndicate. The property is on the east side of the lake near the south end, and consists of forty-eight claims. It is accessible from Yellowknife by aeroplane or by a 65-mile winter road. Some ore was indicated by diamond drilling prior to July 1937. The property was explored continuously, under the direction of A. K. Muir, from the summer of 1937 to December 1938 when all work was stopped.

[1] Henderson, J. F.: Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-1, pp. 12, 13.
[2] Yellowknife group.

Diesel power was installed and most work was done on the discovery or "Hump" vein. This vein outcrops near the south end of a small island 7 miles from the south end of the lake and ½ mile from the east shore. A two-compartment vertical shaft (No. 1 shaft) near this vein is 380 feet deep. Drifts and crosscuts on the 200- and 350-foot levels total 2,241 feet. This work indicated 13,177 tons of ore.[1] Some samples from the vein contained much more gold than others and if these abnormal samples are included, the calculated gold content of the ore is 0·86 ounce a ton; if the abnormal samples be reduced to correspond more nearly with adjacent samples, the calculated gold content of the ore is 0·62 ounce a ton. No. 2 shaft was sunk to explore the "31" vein, which outcrops on the northeast shore of a large island one mile southwest of the "Hump" vein. The shaft is 220 feet deep and crosscuts and drifts from the shaft total 309 feet. "H" vein is on a small island about 3,000 feet west of the "Hump" vein and was explored by diamond drill holes. Diamond drilling done on the property by Camlaren Mines, Limited, totals 14,994 feet. The company spent $411,874 on the property from July 1937 to December 1939. Some machinery has been removed from the property.

*Geology.* The claims are underlain by remarkably fresh greywacke and slate of the Yellowknife group. The beds strike about north 35 degrees east and are tightly folded, so that they dip at steep to vertical angles and are overturned in places. The distance between the axes of the folds ranges from 50 feet to several hundred feet. Quartz occurs in many places along the axes, and elsewhere. The nearest granite outcrops about 9 miles southeast of the property.

*Veins and Ore-bodies.* These were described by Henderson[2] in 1939 and quotations to follow are from his report.

"Hump" Vein.

" The rocks in the vicinity of the ' Hump ' vein are thinly bedded slates and greywackes striking north 30 to 35 degrees east and dipping easterly at angles of 75 to 80 degrees. The sediments lie in a tightly compressed, overturned, anticlinal fold inclined to the east and plunging northeasterly at an angle of about 50 to 55 degrees. The outcrop of the vein, from which its name is derived, forms an islet about 10 feet in diameter lying a few feet east of the southern tip of the north-south trending island in Gordon Lake[3]..... The islet consists of vein quartz belonging to an outcrop that extends beneath the waters of the lake and measures about 18 feet by 20 feet. This mass is the shape of a saddle and, as indicated by banding in the quartz and other features, it lies immediately over the axis in the anticlinal fold. It continues as a saddle reef along the axis of the fold, but as the fold plunges northeasterly at an angle of 50 to 55 degrees the saddle reef disappears underground in that direction.

" Less than 1 foot east of the islet constituting the 'hump', the Hump vein is visible on the lake bottom. This vein is 3 to 4 feet wide, strikes parallel to the enclosing sediments, and like them dips at high angles (80 to 85 degrees) to the east. The saddle reef is connected with and is a branch from the northeasterly striking, steeply inclined vein.

[1] Camlaren Mines, Limited; Directors' Report and Statement of Accounts to 31st December, 1939.
[2] Henderson, J. F.: Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-1, pp. 10, 11.
[3] No. 1 shaft is on this island.

"A shaft has been sunk to a depth of 380 feet and levels established at 200 and 350 feet. The underground workings show that the saddle-like branch of the vein continues to the 350-foot level without any signs of ending, and that to this depth it maintains about the same dimensions as at the surface, i.e., it is a sheet 25 to 30 feet wide and 12 to 13 feet thick.

"By September 1938 more than 450 feet of drifts had been completed along the steeply inclined, main part of the vein on the 200-foot level, and more than 500 feet on the 350-foot level. The width of the vein as exposed in the drifts varies from less than 1 foot to 3 feet; the dip is vertical to very steep northwest. Ore shoots within the vein apparently plunge, like the quartz saddle and the anticlinal fold, at about 50 to 55 degrees northeast.

"The saddle or 'hump' branch of the vein is composed of rather coarsely crystalline white quartz, whereas the quartz of the vein proper has a somewhat bluish grey colour. Slip surfaces within and along the walls of the vein and of the saddle-like branch are coated with black graphite. Brown weathering carbonate is plentiful as veinlets cutting the quartz. Pyrite and chalcopyrite are the most abundant sulphides, although galena and sphalerite are common. The sulphides are rather coarsely crystalline; cubes of pyrite and galena occur up to one-quarter inch in size. The sulphides are sparsely distributed throughout the quartz and probably constitute less than 1 per cent of the whole. Visible gold is present as a fine powder in the quartz, usually in close association with the sulphides. Sphalerite and, to a lesser degree, galena are almost invariably associated with quartz that is high in gold, but the presence of sphalerite and galena does not necessarily imply the presence of gold."

The Company reports the following ore opened by drifts on the "Hump" vein prior to July 5, 1938. On the 200-foot level, 322 feet of drift exposes three ore shoots with a total drift-length of 152 feet and an average width ranging from 1·25 to 3·09 feet. On the 350-foot level 352 feet of drift exposes four ore shoots with a total drift-length of 270 feet and an average width ranging from 1·11 to 7·02 feet. The calculated gold content of the seven drift-lengths of ore ranges from 0·30 ounce to 1·13 ounces a ton if all assay results are included; or, if occasional high assays are reduced, from 0·30 to 0·82 ounce a ton.

"31" Vein.

"The sediments in which it occurs are greywackes and slates, with a general strike of north 35 degrees east and vertical or very steep dip. The steeply dipping beds on either side of the vein zone face in opposite directions. The vein quartz has come in along the crest of the fold where the beds are ruptured and sheared as a series of irregular, discontinuous, quartz lenses nearly parallel to the axial plane of the fold. The vein matter is similar to that of the 'Hump' vein, but sulphides are not so plentiful and are much more erratic in distribution. At the surface, one of the larger quartz lenses contained a pocket from which spectacular specimens of visible gold were obtained. Several shallow diamond drill holes intersected bodies of quartz of variable widths. Some of the drill intersections returned high, but erratic, assays in gold."

No ore was found in this vein.

"H" Vein.

"The vein is in a massive bed of greywacke 20 feet thick, striking north 30 degrees to 35 degrees east, dipping vertically, and having the top of the bed facing east. The vein follows the bed about one foot from the top and has a similar strike and dip. It is exposed over a length of 110 feet, and extends into the lake at both ends. The width of the vein ranges from 5 to 30 inches, with an average width of 15 inches. The company reports that surface sampling of the vein indicates a gold content of 2·09 ounces a ton, or if occasional high assays are excluded, 1·22 ounces a ton. The quartz and sulphide of the 'H' vein are similar to those of the 'Hump' vein. In many places the vein has a banded appearance, due to numerous elongated inclusions of graphitic material, which are probably, in part, incompletely replaced country rock. Pyrite is the most abundant sulphide, but sphalerite and galena are also present. Much carbonate occurs as veinlets cutting the quartz. Visible gold is present as a fine powder in the quartz."

No ore-bodies were found in this vein.

## E.P. Group (38)

The following description is by J. F. Henderson, who visited the property in 1939.

The E.P. group of claims includes the point on the east shore of Gordon Lake 4 miles north of the south end of the lake. A. N. Greathouse and G. D. De Steffany of Yellowknife were trenching veins on the group in September 1939. Two synclinal and two anticlinal folds in greywacke and slate pass through the point and zones of quartz lenses and stringers occur along the axes of the three eastern folds.

The original showing is near the shore at the north end of the eastern anticlinal axis. Quartz has been introduced along the crest of the fold as lenses, stringers, and irregular masses. A trench has been cut across a large quartz lens 2 to 3 feet wide and 15 feet long. The bluish grey quartz is sparsely mineralized with pyrite. Visible gold is reported to have been found in this trench.

A second zone of greywacke and slate injected by quartz lies about 600 feet northwest along the adjoining synclinal axis. Two trenches 160 feet apart have been dug across the axis. The northeasterly trench is 9 feet long and about 10 feet deep. Quartz stringers and lenses up to 1 foot in width in greywacke and slate make up perhaps 50 per cent of the rock exposed in the trench. The quartz contains small amounts of pyrite and chalcopyrite and some visible gold. The trench 160 feet to the southwest is 9 feet long and about 6 feet deep. Quartz stringers and lenses make up perhaps 30 per cent of the rock exposed in the trench. The quartz is very sparsely mineralized with pyrite.

The third zone of greywacke and slate injected by quartz lies along an anticlinal axis 250 feet to the west. One trench 10 feet long has been cut across the zone. Lenses and stringers of quartz make up 60 to 70 per cent of the rock exposed in the trench. The quartz is sparsely mineralized with pyrite. The quartz zone can be traced for more than 300 feet along the axis of the fold.

## Mon Group[1] (39)

"The Mon group of thirty-five claims was staked by G. Moberly and L. Nelson in September 1937 on behalf of Consolidated Mining and Smelting Company of Canada, Limited. These claims lie around and to the northwest of Discovery Lake, about 30 miles north of Yellowknife. Gold has been found in half a dozen or more quartz veins on this property. The main showing is in a steeply plunging drag-fold at the contact of altered basic sills and flows with sediments[2] (chert, tuff, greywacke, and cordierite hornfels). The contact strikes north 30 degrees west, with sediments on the northeast and basic igneous rocks on the southwest. The beds and contact dip moderately to steeply to the southwest and are probably overturned. An S-shaped quartz lens about 20 feet wide and 50 feet long lies in the drag-fold. Quartz veins up to 3 feet wide extend along and near the contact for at least 40 feet southeast, and at least 250 feet northwest, from the lens. The quartz in the lens and veins is glassy and in places contains much hornblende or chlorite or both minerals arranged in vertically elongated foils or pencils up to several inches long, which are parallel to a similar structure in the adjacent basic igneous rocks. Metallic minerals make up less than 5 per cent of the vein matter and include pyrrhotite, arsenopyrite, pyrite, chalcopyrite, galena, sphalerite, a little native copper, and, in places, considerable visible gold. During the summer of 1938 a vertical prospect shaft located 50 feet southeast of the lens was put down and 160 feet of lateral work was done at a depth of about 60 feet. This limited underground investigation encountered only a few quartz stringers carrying low gold values."

## Lil and Lilex Groups[3] (40)

The Lil and Lilex groups of eighteen claims are about 29 miles north of Yellowknife, on the south side of the Mon group. They were explored on the surface by Oro Plata Mining Corporation, Limited, in 1938. Gold occurs in several places and some is in shear zones in altered gabbroic sills of the Yellowknife group. Native silver occurs in a 6-inch quartz vein in gabbro.

## S.D.C. Group (41)

The S.D.C. group of forty-three claims is owned by Dome Mines, Limited. The main deposit (1938) is on S.D.C. 2 claim and about 800 feet east of the north end of the S-shaped lake lying 3 miles north of the northeast end of Pensive Lake. The property was staked in July 1938 and some diamond drilling and trenching were done that summer. In 1939 about twenty men were employed on the property from early March to early July. The company reports[4] as follows:

"Had this property been in a district where average costs could have been expected, further development work would have been warranted."

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[1] Jolliffe, A. W.: Quyta Lake and Parts of Fishing Lake and Prosperous Lake areas, Northwest Territories; Geol. Surv., Canada, Paper 40-14, p. 8.
[2] Yellowknife group.
[3] Data supplied by A. W. Jolliffe.
[4] Dome Mines, Limited: Report to Shareholders for the Financial Year ending December 31st, 1939, p. 20.

The property has been examined by Henderson, who describes the main deposits as follows:

The deposit consists of bodies of quartz that lie in highly contorted greywackes and slates striking northwest and dipping northeast at angles of 75 to 80 degrees. Where the quartz outcrops the strata lie in an S-shaped drag-fold, such that proceeding northwestward the strike of the beds curves from northwesterly around through westerly to southerly and again back through westerly to northwesterly. The drag-fold plunges southeast at an angle approaching 90 degrees and is traversed by a fault striking northwest along the middle limb of the drag-fold. The fault is well defined in the sediments, but cannot be traced into the quartz. The main mass of quartz lies along and southwest of the fault in the southwest (anticlinal) part of the drag-fold, but at the northwest and southeast ends of the quartz body the vein material crosses over to the northeast side of the fault to form two hook-shaped masses of quartz extending along the strike of the strata in the northeast (synclinal) part of the drag-fold. This whole irregular body of quartz outcrops over a length of about 200 feet and has a maximum width of about 40 feet. Much quartz also occurs as lenses and stringers in the disturbed, drag-folded zone along the strike of the main mass of quartz. To the northwest two quartz veins branching from the main mass of quartz lie along faulted zones, which are assumed to be forks of and the continuation of the main fault. The central part of the main body is quartz, but at either end and along the margin the quartz contains much country rock.

The quartz is massive and bluish grey; it is cut in places by a few veinlets of glassy white quartz from a fraction of an inch to several inches in width. Occasional grey to white feldspar crystals up to one-eighth inch in size occur throughout the quartz, particularly near the margins. Sulphides are erratically distributed throughout the quartz, but the greater part is well, and in places heavily, mineralized with arsenopyrite, pyrrhotite, galena, pyrite, chalcopyrite, and sphalerite. The surface outcropping of quartz is remarkably free from the rusty capping that would normally be expected from the oxidation of such heavily mineralized quartz as is exposed in the trenches. This may be due to the rather high proportion of arsenopyrite, galena, and sphalerite, which leave little iron stain on oxidation. Visible gold is reported to occur, but is not common. Channel samples from the trenches are reported to return good assays in gold.

About 1,000 feet southeast of the main showing, within an area of about 80 by 100 feet, gold-bearing vein quartz occurs as irregular stringers and lenses within the crumpled and broken axial part of a fold in greywacke and slate. The amount of vein quartz material within this area is variable, and makes up only a relatively small proportion of the whole. Arsenopyrite is very abundant in both country rock and vein quartz where trenching has been done. Some pyrrhotite and chalcopyrite were also observed.

About 150 feet north of the main showing a quartz vein that varies in width from less than 1 foot to 2 feet contains visible gold and can be traced about 100 feet. The vein lies in sediments along a northwest trending fault, of small apparent displacement. The vein in places contains much galena, sphalerite, pyrrhotite, pyrite, chalcopyrite, and arsenopyrite.

Visible gold has also been found in quartz veins in the sediments about one-third mile west of the northwest end of the "S"-shaped lake mentioned above. There the quartz occurs as lenses and stringers, some of which are as much as 3 feet wide, injected parallel to the bedding of the sediments, which strike north 35 degrees west and dip 80 degrees northeast. The quartz stringers and lenses occur within a zone 20 feet wide that can be traced more than 60 feet and continues much farther than this as a narrower, less well-defined zone of small quartz stringers. Pyrrhotite, arsenopyrite, galena, chalcopyrite, sphalerite, and pyrite are plentiful in some of the quartz lenses.

### Harry A. Ingraham Trust (42)

*Reference:* Bureau of Mines, Canada, Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 769, 1939.

Harry A. Ingraham Trust, comprising Harry A. Ingraham and associates, owns seventy claims on the north side of Pensive Lake about 38 miles northeast of Yellowknife townsite. The property includes W, Tix, Q, Vic, Co, Rare, and Ness groups, and is reached from Yellowknife by aeroplane. A 50-mile winter tractor road from Yellowknife to the property of Thompson-Lundmark Gold Mines, Limited, ends about 10 miles south-southwest of the Rare group. The property was visited in September 1939, and Harry Ingraham was in charge. The claims were recorded during the latter part of 1938. From October 1 to December 15, 1938, about seven men were employed on surface work on the W, Tix, Q, Vic, and Co groups, and most work was done on the Vic 5 claim. From August to December 1939 four men were employed on the Rare group, and most work was done on a vein on the Rare 15 claim.

The property is underlain by faulted and complexly folded, but only slightly altered, greywacke and slate of the Yellowknife group. Irregular bodies of quartz with feldspar occur in many places, and some of them occur in bands of soft, weak slate that have been squeezed between beds of relatively hard, strong greywacke. The nearest known granite outcrops 5 miles east of Vic 5 claim and cuts the greywacke and slate.

Near the northeast corner of Vic 5 claim, twelve trenches with an aggregate length of about 450 feet explore a band of thin-bedded black slate for a length of about 340 feet. The slate band ranges from 45 to 65 feet wide near the trenches, strikes about north 85 degrees west, and dips 65 degrees north, but is overturned. The rocks north and south of the slate are mostly buff weathering greywacke and arkose that in a very few places are slightly altered and contain a few small, rounded knots, which are probably cordierite. The slate at the trenches appears to lie on the south limb of an anticline that is overturned towards the south, for the slate beds face south near the trenches and near the eastern trench the strike changes from about east through north to northwest; the beds are about vertical where they strike north. Beyond the western trench the slate band occupies a drift-filled depression about 50 feet wide and about 325 feet west of this trench the slate outcrops and is 22 feet wide and farther west passes under drift. Quartz occurs in four trenches and in the slate outcrop 325 feet west of the western trench. It is coarse-grained, grey to white, contains plentiful chalky white feldspar, and occurs as irregular

lenses and stockworks. Some of the adjacent slate is crumpled. Most of the quartz occurs near the middle of the slate band and within an area 100 feet long and 30 feet wide, and the largest body in this area is about 30 feet long, ranges in width from 2 to 8 feet, and contains about 30 per cent slate and some visible gold. About 825 pounds of ore from this area was shipped to the Bureau of Mines, Ottawa, and contained 4·67 ounces of gold a ton, 1·22 ounces of silver a ton, and a very little arsenopyrite, pyrite, marcasite, pyrrhotite, and chalcopyrite. Much gold in this ore was in very small grains and fine grinding was necessary to free it from quartz or sulphide minerals and permit its extraction by cyanide.

Near the southwest corner of the Rare 15 claim a pit 27 feet long, 3 feet wide, and 13 feet deep is sunk on the east end of a narrow quartz vein in a band of black slate and slaty greywacke that strikes about north 75 degrees east, dips 80 degrees north, and ranges in width from 15 to 35 feet in an exposed length of 500 feet. Many beds in the slate band are between 1 inch and 6 inches thick and the band is bordered by greywacke beds that range up to 11 feet thick. The slate lies on the south limb of an anticline that trends north 75 degrees east and is overturned towards the south; the slate band at the pit is about 100 feet south of the crest of the anticline. A vein of fine-grained, sugary grey quartz lies along the bedding of the slate and outcrops for 120 feet, passes under drift at the west end, and tapers to a rusty crack at the east end. It is 1 foot wide at the west end of the outcrop, and the total length at the surface is not much more than 120 feet. The walls of the vein are sharp, free, and straight in most places. In some places the vein branches and in others it is cut by veinlets of coarse-grained, white quartz with feldspar. About 20 feet of vein at the east end ranges in width from 1½ inches to a thin film of quartz and contains abundant visible gold, and a little pyrite and pyrrhotite, and may contain chalcopyrite, galena, and native copper. Much of the gold occurs as films on transverse cracks in the quartz, and some gold films extend across the quartz veinlet and as far as ⅜ inch into the slate. Quartz mined from the pit was carried by men and canoe, and by dog team, ¾ mile to a mill on Pensive Lake. The mill is said to have a daily capacity of about 2 tons and gold is recovered by amalgamation. The quantity of ore milled in 1939 is not known. It is reported that about 20 ounces gold was recovered from an unknown quantity of ore milled between August 12 and September 12, 1939; the amount of gold recovered from September 12 to the end of 1939 is not known.

## Kal Group (43)

The Kal group of twelve claims is 2 miles north of Pensive Lake and was staked by Miller and Williamson in the summer of 1938. It is described by Henderson.[1]

[1] Henderson, J. F.: Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39–1, p. 13.

"The gold occurs in vein quartz lying along a faulted drag-fold in overturned slates and greywackes[1] that strike north 80 degrees west and dip 75 to 80 degrees northeast. The faulted zone along which most of the quartz is found is largely drift covered, but scattered outcrops of quartz occur over a length of 350 feet, and at one point quartz outcrops over a width of 30 feet. The quartz is a glassy, bluish grey variety and contains a few small feldspar crystals. Sulphides are not plentiful, but in one small trench arsenopyrite is fairly abundant close to the wall-rock and in and around fragments of country rock, and galena is irregularly distributed through the quartz as cubes up to one-eighth inch in size."

## XL Group (44)

The XL group of thirty claims is on the northwest shore of Turnback Lake on Beaulieu River about 58 miles east-northeast of Yellowknife. The claims are reached from Yellowknife by aeroplane. Bedrock is well exposed and the relief may be 100 feet. The property was visited in September 1939.

The claims were staked late in 1937 by Garfield Smith and Lars Johnston for Aerial Exploration Syndicate. They were optioned in June 1938 by Westfield Mining Company and about twelve men were employed by this company on these and adjacent claims during the summer of 1938, and several men remained on the property until March 1939. Most work was done on a deposit of copper, lead, and zinc that lies partly on claim XL1 and partly on claim XL2, and the deposit was explored by trenches and pits totalling about 500 cubic yards and by diamond drill holes aggregating about 2,450 feet. Some exploration was done with a magnetometer. No commercial ore-bodies were found. Work was directed by A. S. Dadson and J. R. B. Jones.

Rocks near the deposit are highly altered sediments of the Yellowknife group and lie at the eastern edge of a body of pink to grey biotite granite that is about 18 miles wide. The sediments occur in troughs in the granite and are cut by the granite and by related pegmatite. Much of the sedimentary rock has been altered to quartz biotite gneiss, but the bedding is well preserved. Some of the rock has been altered to coarse-grained gneiss that contains black to green amphibole, biotite, garnet, and quartz; the amphibole laths range up to about 2 inches and many of the garnet crystals are 1 inch in diameter. Some of the adjacent quartz biotite gneiss contains a little amphibole and garnet. A few beds of white and light green, crystalline limestone with garnet, vesuvianite, and wollastonite (?) accompany the amphibole gneiss. The gneisses strike north 30 degrees east and dip about 65 degrees east. Beds of amphibole gneiss contain disseminated and massive sulphides of copper, lead, and zinc in many places along a zone that trends north 30 degrees east. At the surface this zone is 1,900 feet long and ranges up to 130 feet wide. Only minor amounts of sulphide minerals occur within adjacent beds of quartz-biotite gneiss. The mineralized zone is part of a body of gneiss that probably occupies a shallow trough in granite and pegmatite. Granite outcrops continuously near the west side of the zone and in places is in contact with the mineralized rock and in places is separated from it by as much as 100 feet of quartz-biotite gneiss. At the south end the mineralized gneiss and associated rock narrows to a point and ends in granite. Rock outcrops are

[1] Yellowknife group.

scarce immediately east of the southern 1,000 feet of the zone, but it is probably bounded by pegmatite and granite throughout most of this length. Througout the northern 900 feet the zone is bordered on its east side by quartz-biotite gneiss that is cut by much pegmatite, but nearly solid granite and pegmatite outcrop about 800 feet east of the mineralized area. Gneisses outcrop for more than 600 feet beyond the northern extension of the mineralized zone, but are not known to contain notable amounts of metallic minerals and are cut by much granite and pegmatite.

The mineralized bodies of gneiss are rudely tabular in form. At the surface they are covered by rusty gossan and in places the adjacent drift is stained by iron oxide. In parts of the zone there is one band of mineralized gneiss and in other parts there are four or more mineralized bands distributed throughout a width of 130 feet. The proportion of sulphide minerals to gneiss varies greatly within short distances within each body, and in so far as is known none of the beds is mineralized throughout the length of the zone. The mineral bodies consist of amphibole, biotite, garnet, quartz, chalcopyrite, sphalerite, pyrrhotite, galena, pyrite, arsenopyrite, molybdenite, and native copper. Probably chalcopyrite, sphalerite, and pyrrhotite are the most plentiful metallic minerals. In places pegmatite and granite cut the mineralized beds of amphibole gneiss and a little garnet, chalcopyrite, sphalerite, and galena occur in some of pegmatite and granite where it passes through the mineralized gneiss, but not elsewhere. The metallic minerals probably replaced the gneiss after the granite and pegmatite had solidified. Samples taken by Westfield Mining Company from a few trenches and diamond drill holes indicate four principal mineral deposits within the mineralized zone, and details are tabulated below. Because of the irregular nature of these replacement mineral deposits these data might be greatly modified by more sampling. Diamond drilling is reported[1] to show that in some places the gneiss of the mineralized zone ends in granite less than 200 feet below the outcrops and that probably all rock 400 feet below the outcrop of the zone is granite. No granite near the mineralized zone is known to contain appreciable quantities of copper, lead, and zinc minerals and the zone may end down the dip where the gneiss ends in granite.

*Mineral Deposits on XL1 and XL2 Claims, Turnback Lake*

| Distance from south end of zone | Length of deposit | Average width of deposit | Silver | Copper | Lead | Zinc |
|---|---|---|---|---|---|---|
| Feet | Feet | Feet | Ounces | Per cent | Per cent | Per cent |
| 400–500 | 100 | 12·6 | 3·9 | 2·1 | 1·4 | 6·1 |
| 625–950 | 325 | 4·8 | 3·3 | 2·5 | 2·0 | 8·4 |
| 1,080–1,450 | 370 | 5·1 | 1·68 | 0·26 | 1·33 | 5·38 |
| 1,670–1,820 | 150 | 28·6 | —— | 1·83 | —— | —— |

[1] Dadson, A. S.: Private report to Westfield Mining Company, 1938.

### Ruth Group[1] (45)

"The Ruth claims were staked by D. F. Kidd at the southeast end of Victory Lake in July 1937. The claims include a point of land extending into Victory Lake that is underlain by sediments and a narrow belt of volcanic rocks. A heavily mineralized shear zone occurs along the northeast contact of the lavas with the sediments. The sediments are fine-grained, knotted, quartz-mica schist. The volcanic rocks are green weathering andesites and light grey to buff weathering, fine-grained, banded rhyolites, which in places contain small phenocrysts of quartz and feldspar. Some of the rhyolite may be intrusive. Aplitic dykes, probably related to the small granite body to the southeast, occur near the southeastern end of the claims. A fine-grained, light weathering, banded rock, which is probably a rhyolite flow, has been altered to a sericite schist along a contact with sediments, and the schist is heavily impregnated in places with pyrite, chalcopyrite, and pyrrhotite. A number of veins or lenses of bluish quartz, heavily mineralized in places with galena, pyrite, chalcopyrite, and some arsenopyrite and sphalerite, lie in the shear zone. No work had been done on the claims at the time of the writer's visit in July 1937, and because of the covering of heavy iron gossan the dimensions of the mineralized zones and the proportion of vein material to schist could not be determined. Considerable trenching and stripping have since been done on the property, and assays of channel samples are reported to have shown gold to be present."

The sedimentary and volcanic rocks belong to the Yellowknife group.

### Irma Group[2] (46)

"The Irma claims were staked in July 1937 by D. F. Kidd. They lie one-half mile south of Victory Lake, to the southwest of the Ruth claims, along the northeast contact of the belt of volcanic rocks. Sulphides and vein quartz occur in shear zones along the contact of rhyolite flows with the sediments."

The volcanic rocks and sediments belong to the Yellowknife group.

### Bobjo Group[2] (47)

"The Bobjo claims, staked by Blaisdale and McLeod in July 1937, adjoin the Irma claims on the northwest and include the northwest and western contact of the volcanic belt with the sediments. Shear zones along the contact contain much pyrite and chalcopyrite, accompanied by quartz veins and lenses containing galena, sphalerite, chalcopyrite, and pyrite."

The rocks referred to belong to the Yellowknife group.

### Thompson-Lundmark Gold Mines, Limited (48)

(*See* Figure 6)

Thompson-Lundmark Gold Mines, Limited, owns and is actively exploring the Kim and Waco groups of thirty-eight claims on Thompson Lake, about 30 miles east-northeast of Yellowknife. The property is

[1] Henderson, J. F.: Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-1, pp. 13, 14.
[2] Henderson, J. F.: Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-1, p. 14.

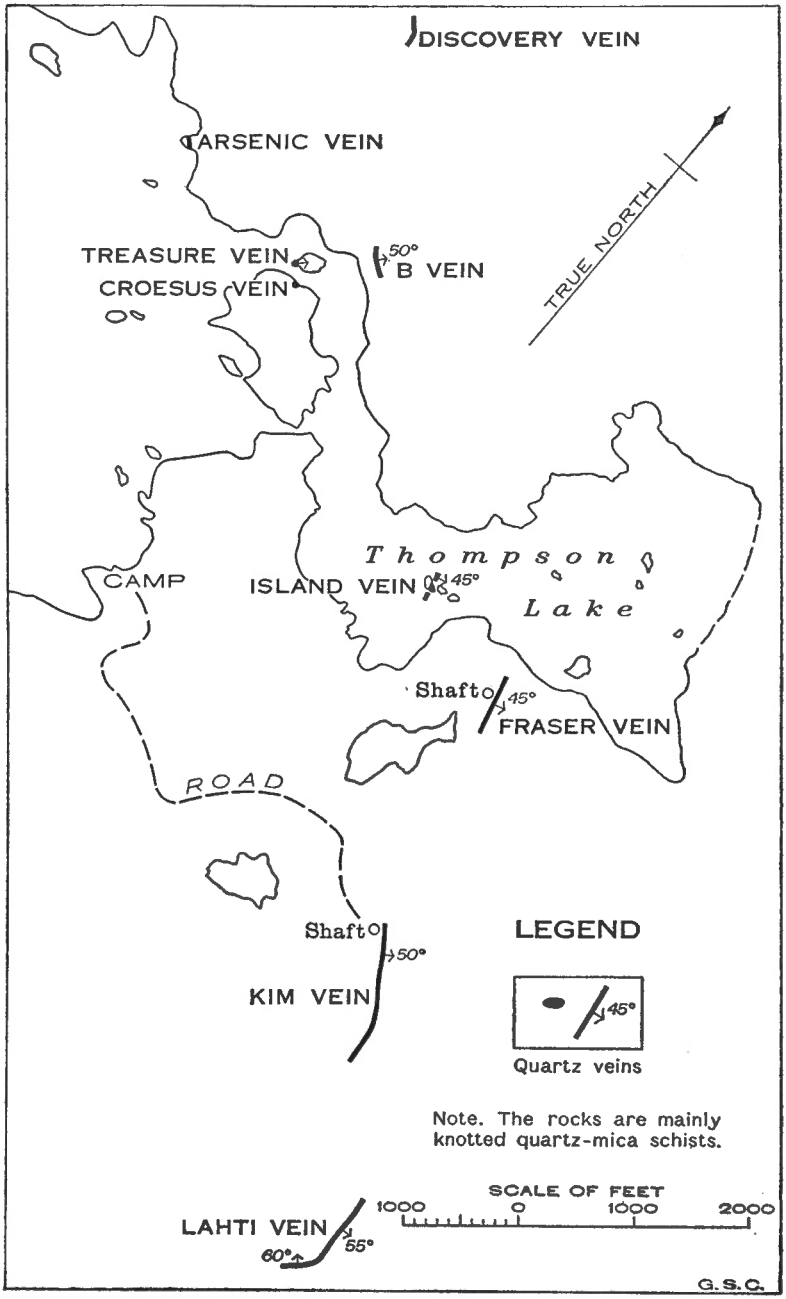


Figure 6. Part of Kim and Waco groups, Thompson-Lundmark Gold Mines, Limited, Yellowknife Bay-Beaulieu River area. From survey by Thompson-Lundmark Gold Mines, Limited.

reached from Yellowknife by aeroplane in summer or winter and by tractor over a 55-mile road in winter. A. K. Muir is superintendent. The property was visited in August 1939.

*History.* Roy Lundmark and Fred Thompson discovered gold near Thompson Lake on July 22, 1938, and staked the Kim and Waco groups of claims. The claims were acquired by Thompson-Lundmark Gold Mines, Limited, which was incorporated in August 1938. The Treasure and Kim veins were trenched and explored by diamond drilling. An incline shaft was started on the Kim vein on February 8, 1939. The Fraser vein was discovered during the summer of 1939 and in August of that year underground work on the Kim vein was stopped and an incline shaft started on the Fraser vein.

*Ore Reserves.*[1] Ore, or material which is nearly ore, occurs in the Kim and Fraser veins.

The material that contains most gold in the Kim vein is stated to be below ore grade, if worked on a small scale under present conditions. It is estimated that, after sorting, 27,230 tons of this material will be available for milling and that it will contain 0·50 ounce a ton ("uncut")[2] or 0·40 ounce a ton ("cut").

It is stated that, assuming some dilution, the indicated ore available for milling in the Fraser vein is 18,600 tons containing 1·24 ounces of gold a ton ("uncut") or 0·83 ounce a ton ("cut").[3]

*Development.* A temporary camp of frame buildings and tents is located on the east side of Thompson Lake; a mining plant and office are on the Kim vein, 3,600 feet east-southeast of the camp, and camp and plant are connected by a tractor road. The mining plant includes assay office, shop, and hoist and power-house. A steam hoist is operated from a 20-horsepower steam boiler using wood fuel. A 125-horsepower Caterpillar diesel engine connected to a Gardner-Denver compressor and an Ingersoll-Rand gasoline-powered portable compressor supply 595 cubic feet of free air a minute. Work stopped on the Kim vein in August 1939 and the mining plant was moved to the Fraser vein.

Work has been done on Treasure, Croesus, B, Kim, Lahti, Fraser, and Island veins (*See* Figure 6), which outcrop on Waco claims Nos. 7 and 13 and Kim claims Nos. 4, 5, 9, and 10. The Treasure and Croesus veins are on islands and about 3,000 feet north of the camp. They are explored by a pit on Treasure vein 12 feet deep, and by twenty-two diamond drill holes with a total length of about 2,500 feet. The B vein is 700 feet northeast of the Treasure vein and is stripped only. The Kim vein outcrops about 4,100 feet east-southeast of the camp. The surface is explored by fifty-one trenches, and sixteen diamond drill holes, totalling 3,339 feet, intersect the vein down to a vertical depth of 370 feet. A two-compartment shaft, 325 feet deep, is about 40 feet southwest of the vein and inclined 50 degrees northeast, nearly parallel to the dip of the vein. Stations in the shaft are 150 and 300 feet from the collar and short

[1] First Annual Report of Thompson-Lundmark Gold Mines, Limited, March 28, 1940.

[2] The term "uncut" indicates that unusually high assays were not reduced before being used to calculate the gold content of the material. The term "cut" indicates, in this case, that all assays greater than 2·0 ounces of gold a ton were reduced to 2·0 before being used to calculate the gold content of the material.

[3] Assays greater than 2·5 ounces a ton were reduced ("cut") to 2·5 before being used to calculate the average gold content of the ore.

crosscuts from them connect with drifts on the vein, which total 1,202 feet. The Lahti vein outcrops about 3,000 feet south-southeast of the Kim shaft and is exposed by stripping and about twenty trenches. The Fraser vein outcrops about 2,400 feet north-northwest of the Kim shaft. The surface is explored by eighteen trenches and about twelve diamond drill holes, totalling 1,557 feet. The deepest drill holes intersect the vein 300 feet from the outcrop. It is reported (March 1940) that a shaft, inclined about 45 degrees east, nearly parallel to the dip of the vein, is 322 feet deep and that crosscuts from the shaft connect with drifts on the vein 150 and 300 feet from the outcrop; these drifts total 712 feet. The Island vein outcrops on a small island about 1,200 feet northwest of the Fraser vein and is stripped.

*Geology.* Most of the rocks near Lahti, Kim, Fraser, Island, Croesus, Treasure, and B veins are knotted, quartz-mica schists of the Yellowknife group, and in many places they strike between north and northwest and dip about 50 degrees northeast. Granitic rocks outcrop about 3 miles southwest of the veins and intrude the schist. Pegmatite dykes occur near the veins and some of them probably cut the veins because a lens of similar pegmatite cuts the Kim vein. Rocks near Kim, Fraser, Island, B, Treasure, and Croesus veins occupy the northeast flank of an anticline.[1] The axial plane of this anticline trends about northwest and probably dips northeast; it lies about 750 feet southwest of the Kim shaft and about 650 feet southwest of the Treasure vein. The anticline plunges southeast. The axis of the adjacent syncline lies about 4,500 feet northeast of the axis of the anticline.

*Veins and Ore Deposits.* Most of the known gold-bearing quartz veins are parallel to the bedding of the quartz-biotite schists in which they occur, and in most places the walls are sharp and not sheared. Most of the veins strike between north 5 degrees west and north 50 degrees west and dip about 50 degrees east. The Kim is the longest known vein and it is explored for 1,750 feet. The Lahti, Kim, Fraser, and Island veins occur within an area about 1 mile long and 600 feet wide and oriented north 25 degrees west. The Lahti, Fraser, and B veins are single lenses of quartz without much included rock, and one end of the Fraser and both ends of the B vein gradually taper to a point, the veins before they end becoming thin seams of quartz along bedding planes. The Kim vein comprises several parallel quartz veins distributed throughout a zone of slightly sheared and fractured rock. Rock in the vicinity of all the veins contains knots in many places, but most of the rock on the walls of the Treasure and Fraser veins and on the walls of and within the Kim vein does not contain knots. Most of the veins are quite regular in strike and dip. Most of the quartz of the veins is white to grey and glassy. Some of it is ribboned parallel to the walls by seams of other minerals and some of it cleaves along these seams. In some places transverse veins of younger white quartz cut across ribboned, grey and white quartz. A pegmatite lens cuts the Kim vein in one place and other pegmatite dykes may cut it in other places. The most plentiful gangue minerals are quartz and tourmaline, but carbonate, feldspar, and black and white mica also occur. Metallic minerals constitute

[1] Fraser, N. H. C.: Geologist, Thompson-Lundmark Gold Mines, Limited, Personal communication.

about 2 per cent of the Island vein, but are much less plentiful in all other veins examined; pyrite, arsenopyrite, pyrrhotite, chalcopyrite, galena, sphalerite, and gold were seen. Faults displace the Kim vein 2 feet in some places, and no greater displacements were observed on any vein. All quartz in the gold-bearing veins is not ore and the ends of the ore-bodies are found by sampling and assaying. Bodies of quartz that contain most gold in the Kim, Fraser, Lahti, and B veins occur near the northwest end of the outcrops of these veins. In the Kim, Fraser, and B veins the amount of gold in a ton of quartz is greatest near the widest part of the veins. An ore shoot in the Kim vein is 450 feet long at the surface and is the longest found on the property.

A more detailed description of individual veins follows.

*The Treasure Vein* outcrops as a mass of quartz about 60 feet long and 30 feet wide on the southwest tip of an island known locally as Treasure Island. Country rock is well-bedded, quartz-biotite schist with knots in many places, and strikes about north 55 degrees west and dips about 55 degrees northeast. The northeast wall of the quartz is tight and approximately parallels the strike of the enclosing rock, but many small veinlets from the main mass enter the country rock. The southwest, northwest, and southeast margins of the quartz lie under the lake. The vein is explored down the dip by diamond drill holes, and these intersect a zone of quartz lenses and stringers apparently distributed at random through parts of the country rock that do not contain knots. In one place this zone dips about 20 degrees northeast, is traced for 200 feet down the dip, and ranges from 10 to 60 feet wide. The quartz is white to grey and glassy and contains many inclusions of wall-rock and a very little pyrite, arsenopyrite, chalcopyrite, pyrrhotite, galena, carbonate, and probably feldspar. Most of the arsenopyrite is in or near included fragments of wall-rock, some of which are altered to chloritic schist. The quartz contained some spectacular pockets of coarse gold at the surface, but is reported to contain only a little gold in most places where sampled with a diamond drill.

*The Croesus Vein* outcrops as a mass of quartz at the lakeshore 110 feet south 50 degrees east from the Treasure vein. The exposed mass trends east 10 degrees south, but the dip is not known; the quartz is 17 feet wide at the shore and ends abruptly 27 feet from the shore. It occurs in knotted quartz biotite schist that strikes about north 45 degrees west and dips about 50 degrees northeast. Diamond drill holes between the Croesus and Treasure veins show that the veins are not connected. The quartz is white to grey and glassy and contains feldspar and white mica and is reported to contain very little gold.

*The B Vein* strikes north 50 degrees west, dips 50 degrees northeast, and is parallel to the bedding of the adjacent sediments. It is exposed for 260 feet and passes under drift at each end. Its greatest width is 5 feet and for 130 feet it averages 15 inches wide. The walls are not sheared and at each end the vein narrows to a quartz seam on a bedding plane. The quartz is white to dark grey and contains a little feldspar, tourmaline, white mica, and visible gold.

*The Island Vein* strikes north 10 degrees west, dips from 20 to 45 degrees east, and probably nearly parallels the bedding of the adjacent sediments. The vein is exposed for the width of the island on which it occurs, which is 105 feet. Its width ranges from 4 inches to 2 feet and averages 9 inches. Wall-rock separates readily from the vein quartz in some places, but is not sheared. In places about 1 inch of rock next to the quartz is altered and is composed mostly of tourmaline and white mica. The quartz is white and well fractured, and is ribboned by seams that parallel the walls and contain metallic minerals, biotite, tourmaline, and a little greenish, altered rock. Tourmaline and visible gold are abundant and pyrite, galena, pyrrhotite, sphalerite, and possibly arsenopyrite and chalcopyrite, constitute about 2 per cent of the vein. The vein contains about 1·5 ounces of gold a ton at the surface.

*The Fraser Vein* strikes about north 20 degrees west, dips 47 degrees east, and parallels the bedding of the adjacent sediments. The vein is exposed on the surface for 540 feet where its width ranges from 6 inches to 4½ feet and averages 2½ feet. In the most northerly trench the vein is 6 inches wide and north of this trench it is narrower and probably ends as a thin quartz seam on a bedding plane. To the south the vein ends in a zone of fractured rock about 5 feet wide. The walls are sharp. The wall-rock is quartz-mica schist and slate or argillite and resembles the rock a few feet beyond the walls except that it does not contain knots. The quartz is medium-grained, grey, and glassy, and in places cleaves in slabs parallel to the walls. It contains a little tourmaline and a very little galena and pyrite. Some gold occurs in coarse grains, and on the surface some of these are surrounded by violet quartz. An ore shoot in the vein is 310 feet long at the surface and 288 and 340 feet long on the 150- and 300-foot levels, respectively; its plunge is not known. It averages 2·33 feet wide. The average gold content is 1·63 ounces a ton "uncut" or 1·06 ounces a ton "cut".

*The Kim Vein* is a zone of several, closely spaced, parallel quartz veins separated by layers of country rock. The zone strikes between north 5 degrees west and north 35 degrees west, dips about 50 degrees east, and is parallel to the bedding of the enclosing rocks. It is exposed by trenches for 1,250 feet and is intersected by diamond drill holes for 500 feet north of the trenches. On the surface the zone ranges from 4 to 13 feet wide, averages 6½ feet, and contains about 25 per cent quartz. The country rock is mostly knotted, quartz-biotite schist and many of the beds are several feet thick and massive. The rock within the zone contains a little pyrite and is quartz-biotite schist and some thin-bedded phyllite and in most places does not contain knots; in many places it cleaves into slabs that are parallel to the zone and about an inch thick and many of them have smooth green surfaces. In some places about 2 inches of rock adjoining quartz is altered and contains tourmaline and white mica. In many places there are three quartz veins in the zone, but in some places there are more or less than this number and the veins probably branch and join in some places and end in other places. Individual veins range up to 6 feet wide, but in most places are less than 1 foot wide and the average combined width of all quartz veins in the zone is about 1½ feet at the surface and probably about the same underground. In many places the

veins are fairly regular in strike and dip and nearly parallel to the fractured zone in which they occur, but locally they form abrupt folds with amplitudes up to about 10 feet. In most places the contact between the quartz and enclosing rock is sharp and tight, but in some places the quartz grades into the rock through a few inches of banded quartz and rock. Quartz is white to grey and glassy and is ribboned by seams that are parallel to the walls and contain tourmaline, which is the most plentiful gangue mineral excepting quartz. Quartz contains fragments of country rock in places and these are altered and contain tourmaline and pyrite. In some places the ribboned veins contain transverse, vein-like bodies of white quartz and the bands of tourmaline do not pass through these quartz bodies. One lens of quartz-mica pegmatite cuts a banded, gold-bearing vein of quartz and tourmaline and penetrates both walls for a few inches. In a few places the quartz veins are offset about 2 feet by faults. In addition to tourmaline, the quartz contains a very little pyrite, galena, sphalerite, chalcopyrite, visible gold, and biotite. The richest and largest ore shoot is 450 feet long on the surface and 304 and 244 feet long on the 150- and 300-foot levels, respectively, and plunges about 40 degrees north. The average width of the shoot is 4·75 feet. About 65 per cent of the shoot is country rock, which does not contain appreciable amounts of gold. The average gold content of the shoot is 0·35 ounce a ton, "uncut", or 0·28 ounce a ton, "cut".

*The Lahti Vein* is traced for 1,000 feet. Near the south end it strikes north 50 degrees east and dips between 50 and 65 degrees northwest; about 250 feet from the south end the strike of the vein swings to north 5 degrees west and the dip changes to 55 degrees east and the vein maintains this attitude to the most northerly exposure. The vein passes under drift at the northern end and at the southern end abuts against a zone of slightly sheared rock that is there 10 feet wide, trends north 15 degrees west, and contains lenses of quartz. The width of the Lahti vein ranges from 6 inches to 6 feet and averages about 1½ feet. The country rock is knotted quartz-biotite schist and strikes from north 40 degrees west to north 5 degrees west and dips 50 to 65 degrees northeast. The southern 250 feet of the vein cuts across these beds and the wall-rock is not sheared parallel to the vein; the remaining exposed length of the vein is parallel to the bedding of the wall-rock and lies in a zone of fractured rock that ranges up to 6 feet wide. The quartz contains a little pyrite, galena, sphalerite, visible gold, biotite, chlorite, sericite, and a green, fibrous mineral, and in places some of these minerals are concentrated in bands that parallel the vein walls.

*Operating Data.* No unusual difficulties have been encountered in underground work on the Kim vein. No timber is required in drifts and crosscuts. Only a little water enters the drifts. The 150-foot level is in the zone of permanent frost.

Back, face, and muck samples are taken in all drifts on the Kim vein. Back samples are from channels cut at intervals of 2½ feet. After each round is blasted three channel samples are cut from each quartz vein in the face and the material from each channel is assayed separately. A

chip sample is also taken from the whole exposed surface of each vein. One channel sample is cut from each band of rock between quartz veins. Thus, fourteen samples are cut and assayed in a face in which three veins are fully exposed.

A contract for 1,500 feet of diamond drilling was completed for $2.60 a foot.

Freight from Yellowknife to the property costs $34 a ton by aeroplane or $22.50 a ton by tractor, but all freight by tractor must be hauled during the winter.

About forty-five men were employed in August 1939 and wages totalled about $8,000 a month.

Gasoline and diesel engines are used for power. Diesel oil brought to the property from Yellowknife by tractor costs 35 cents a gallon and when brought by aeroplane costs 40 cents a gallon; gasoline by tractor and by aeroplane costs 53½ cents and 58 cents a gallon, respectively. The cost of generating power by diesel engines at the property is not known, but might be about $210 a horse-power each year at the present oil cost if a plant of about 1,000 horse-power were installed. Sites at which hydro-electric power might be generated are reported on Cameron and Beaulieu Rivers, 8 and 18 miles, respectively, from the property. A possible source of future electric power is at Prosperous Lake, 26 miles west of the property, where Consolidated Mining and Smelting Company of Canada, Limited, propose to erect a 4,700-horsepower plant.

### Walsh Lake Group[1] [2] (49)

"The Walsh Lake group comprises six claims on the east side of Walsh lake 2 to 3 miles from its south end. Walsh lake lies about 1 mile north of a point on Yellowknife river 2 miles above its mouth. At a point about 500 feet from the shore of the lake a mineralized zone 10 feet wide and 20 feet long occurs in quartzose schist.[3] The zone strikes northeast and dips vertically, about parallel to the strike and dip of the schist. The zone ends rather abruptly to the northeast and is covered to the southwest. An open-cut, with a maximum depth of 8 feet, extends across the width of the mineralized zone. On the southwest side of the open-cut and one foot from the southeast wall of the zone is a body of sphalerite mixed with small amounts of galena and quartz. The body is 4 feet long, vertically, is 1 foot wide in the middle, narrows slightly toward the top, and narrows to 3 inches wide at the bottom of the open-cut. Elsewhere in the open-cut and on the surface of the outcrop of the zone many masses and veinlets of quartz occur in the schist, the latter forming most of the material. Most of the quartz is barren-looking, but some of it contains arsenopyrite which occurs as scattered crystals and as masses up to 3 inches across. The quartz also contains small amounts of sphalerite and galena. Most of the schist does not contain visible sulphides, but some of it contains scattered or closely spaced crystals of arsenopyrite and small amounts of galena and sphalerite. A chip sample judged to represent approximately the average composition of the mineralized zone in the open-cut contained 0·10 ounce of gold and 3·12 ounces of silver to the ton of 2,000 pounds.[4] A

[1] Reverted to the Crown.
[2] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, p. 73 (out of print).
[3] Yellowknife group.
[4] Assay by A. Sadler, Mines Branch, Department of Mines, Canada.

picked sample of nearly solid galena, apparently from this deposit, was found by the owners of the property to contain $1.80 in gold a ton and 17·2 ounces of silver a ton."

## Homer Group (50)

The Homer group is on Homer Lake, 10 miles north of the head of Yellowknife Bay, and was described by Jolliffe[1] in 1938.

"This group comprises twelve claims, staked in September 1933 by H. T. Dixon on behalf of Yellowknife Gold Mines, Limited.

"At locality 3, Prosperous Lake map-area, a quartz-porphyry dyke[2] about 100 feet wide trends northeast for at least 800 feet through massive, green-weathering rocks,[3] in places showing pillows. Throughout much of this distance the dyke is covered by drift. Where exposed the weathered surface is light coloured except for numerous rusty stains. Fresh surfaces show quartz crystals up to one-quarter inch across in a felsitic groundmass, which also contains some disseminated light coloured metallic minerals including pyrite and possibly arsenopyrite and galena. Chips taken at intervals across this body and over a total length of 400 feet were assayed with the following results: gold, 0·02 ounce to the ton; silver, 0·12 ounce to the ton.

"Five small lead-zinc replacement deposits, named in this report deposits 1 to 5, occur on either side of the quartz-porphyry dyke.

"Deposit 1 lies in and near a north-south fault at the northeast end of the porphyry dyke close to its southeast margin. Drag along the fault indicates that the rocks on the east side have moved relatively northwards. Masses of banded sulphides, up to 2 feet wide, and consisting of galena, sphalerite, pyrite, chalcopyrite, and arsenopyrite, occur along the fault for about 10 feet, and these minerals also are disseminated through the adjacent porphyry. A chip sample taken across a 2-foot width assayed: gold, 0·01 ounce to the ton; silver, 2·14 ounces to the ton.

"Deposit 2 lies 150 feet west of deposit 1, in the southwest end of an exposure of rusty-weathering chlorite schist forming an inclusion or fault block up to 15 feet wide and extending 70 feet northeasterly within the porphyry dyke and close to its northwest margin. A trench across the deposit shows the following section, starting at the northwest end:

| Feet | |
|---|---|
| 0–6½ | Porphyry containing crystals up to ⅛ inch across, in places scattered along bands trending northeasterly and dipping vertically, and in places forming irregular aggregates up to 4 inches across. Possibly one-quarter of this width is pyrite. |
| 6½–8 | Massive, fine-grained galena, some of which contains small amounts of pyrite and sphalerite in vertical bands trending northeasterly. |
| 8–12 | Chlorite schist, trending northeast and dipping vertically and containing a few scattered stringers of pyrite less than an inch across, paralleling the schist. |

[1] Jolliffe, A. W.: Yellowknife Bay–Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38–21, pp. 32–34.
[2] About ¼ mile west of the south end of Homer Lake.
[3] Yellowknife group.

| Feet | |
|---|---|
| 12–15 | Fine- to medium-grained sphalerite and galena, with lesser amounts of pyrite all banded parallel to the adjacent schist; one band of fairly pure sphalerite is about a foot wide. A spectroscopic examination of a chip sample taken across this section showed the presence of tin, zinc, iron, manganese, lead, calcium, indium, silver, cadmium, aluminium, silicon, and magnesium.[1] |
| 15–20 | Chlorite schist containing a few stringers of pyrite less than an inch across, paralleling the schist. |
| 20 | Drift. |

Gossans a few feet across occur at intervals throughout the schist area in the porphyry northeast of the trench. Southwest of the trench is drift.

"Deposit 3 lies 100 feet southeast of deposit 2, and a similar distance southwest of deposit 1. The country rock is dark green and fine-grained, and is probably an altered, early basic intrusive. The southeast border of the porphyry dyke lies under drift a few feet northwest of deposit 3. A trench shows banded galena, sphalerite, pyrite, and arsenopyrite replacing chlorite schist, which strikes north 30 degrees east and dips steeply southeast. These sulphides occur in a lens up to a foot wide and 10 feet long. From a point 10 feet west of the south end of this lens a rusty gossan up to 2 feet wide extends 20 feet southwest. This is not trenched, but appears to indicate vein matter similar to that exposed in the lens.

"Deposit 4 lies 200 feet southwest of deposit 3 and a few feet southeast of the quartz-porphyry dyke. A trench shows banded galena, sphalerite, pyrite, and arsenopyrite with a very little, fine-grained, white to buff carbonate in a lens up to 6 feet wide, elongated north 30 degrees east within and parallel to a schistose zone in a massive, fine-grained, green rock. A gossan of rusty, white, and yellow secondary iron, lead, and zinc minerals extends less than 10 feet both northeast and southwest of the trench, and probably marks the limits of the sulphides. A channel sample across 6½ feet in this trench is reported by the owners to have assayed 0·03 ounce gold and 10·8 ounces silver to the ton.

"Deposit 5 lies 450 feet southeast of deposit 4. Three trenches in a distance of 120 feet along the sheared western contact of an early basic dyke with pillow lavas show erratically distributed lenses of massive banded arsenopyrite and pyrite, with a little chalcopyrite, galena, and pyrrhotite. These are up to a foot wide and 4 feet long. The elongation of the lenses and the banding of the metallic minerals trend north 20 degrees west and dip vertically, parallel to the trend of the enclosing schist. The schist contains a little disseminated pyrite and arsenopyrite. A few milky quartz lenses up to a foot across in the southern trench contain chlorite and ferruginous carbonate, but no metallic minerals.

"Elsewhere on the group lead-zinc replacement deposits accompanied by some quartz are reported to carry higher values in precious metals than the five zones described above."[2]

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[1] Spectroscopic examination by H. V. Ellsworth, mineralogist, Geological Survey.
[2] Personal communication from C. J. Baker.

## Arseno Group[1] (51)

"This group of ten claims was staked in May 1936 by A. Swanson and others. West of the north end of Likely Lake on this group the granite is sheared and mashed throughout an area about 400 feet in diameter near its contact with volcanics.[2] Here and there within this sheared area are rusty patches a few feet across. Fresh surfaces of the sheared rock show much sericite, the most altered specimens consisting of quartz crystals up to one-quarter inch across in a sericitic groundmass. In places the altered rocks are cut by indefinitely bounded quartz veinlets up to one-quarter inch across carrying purple fluorite. In these as well as along joint planes and disseminated through the rock are small amounts of arsenopyrite, pyrite, pyrrhotite, chalcopyrite, galena, and sphalerite. Samples taken over about 30 square feet of the weathered surface of one of the better mineralized parts of the sheared granite showed on assay: gold, 0·0075 ounce to the ton; silver, 0·125 ounce to the ton."

## Nib Group[3] (52)

"This group comprises eighteen claims, staked in April 1936 by R. A. Ingrey, N. Barlow, and A. G. Nielson.

"The deposit described below lies a few hundred feet inland from the southeast corner of Upper Walsh Lake. A trench 25 feet long and 6 feet deep crosses quartz-mica schist and slate,[2] trending north-south with a vertical dip. In the trench walls is visible a glassy, light to dark grey quartz vein 3½ feet wide, parallel to the schistosity. The quartz and the country rock to the west contain few or no metallic minerals. Immediately to the east of the vein arsenopyrite occurs in dark glassy quartz stringers and lenses up to a few inches across, and in intervening bands of slate across a total width of 4 feet. The arsenopyrite is fine to coarse-grained, with some crystals up to one-half inch across. A chip sample taken across this 4-foot width assayed: gold, 0·10 ounce to the ton; silver, 0·13 ounce to the ton; tin, 0·06 per cent. The rocks immediately north and south of the trench are largely drift covered, but two smaller trenches are located 40 feet northeast and 250 feet south respectively. That to the northeast shows closely spaced, dark, glassy quartz stringers carrying abundant arsenopyrite across a total width of about 2 feet. In the southern trench a glassy quartz vein up to a foot wide carries very little arsenopyrite and a few, dull green crystals of andesine up to one-half inch across near the vein borders."

## Fox Claim (53)

The Fox claim is 1¾ miles northwest of the head of Yellowknife Bay and was described by Joliffe[4] in 1938.

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[1] Jolliffe, A. W.: Yellowknife Bay–Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, p. 18.
[2] Yellowknife group.
[3] Jolliffe, A. W.: Yellowknife Bay–Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, p. 36.
[4] Jolliffe, A. W.: Yellowknife Bay–Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, p. 29.

20337—7½

"This claim was staked by Michiel Saingrie in January 1936. Surface trenching and some diamond drilling were done on the deposit described below during the winter of 1936-1937 by Ventures, Limited, who held the claim under option at that time.

"A zone up to 100 feet wide, rich in ferruginous carbonate, extends northeasterly from the shore of a small lake for nearly 1,000 feet. This weathers brown, is moderately sheared and contains no identifiable original structures, but a few hundred feet distant on either side pillowed lavas and cherty and tuffaceous beds occur in the generally massive, green to brown-weathering country rock.[1] Irregularly within the carbonate zone up to half the rock over 10-foot widths is composed of quartz veinlets, commonly less than an inch wide, and an intimate, fine-grained mixture of quartz and ferruginous carbonate. These contain fine-grained, disseminated pyrite and arsenopyrite. Chips taken every few inches across a total width of 60 feet near the lake showed on assay: gold, 0·11 ounce to the ton; silver, 0·05 ounce to the ton."

### A.E.S. Group (54)

The A.E.S. group of twenty-four claims is on the west side of the north end of Yellowknife Bay and was staked in February 1936 for the Aerial Exploration Syndicate, Limited. A gold-bearing vein that occurs in rocks of the Yellowknife group 1¼ miles west of the head of the bay was described by Joliffe,[2] in 1938.

"This vein lies about 1,000 feet east of the West Bay fault. The country rock is pillowed lavas and bands of thinly bedded, cherty sediments up to 10 feet wide striking north 30 degrees east and dipping steeply to the east. South of the southernmost pit on the vein is a drift-covered area. In this pit a rusty schistose zone averaging 6 feet in width is exposed. The schist is highly contorted and encloses quartz lenses. These are up to 8 inches wide and several feet long, and are composed of milky quartz containing tiny curving seams of chlorite that roughly parallel the sides of the lenses. Metallic minerals in the quartz include chalcopyrite, pyrite, and, possibly, tetrahedrite, arsenopyrite, and sphalerite. From the north wall of the pit a milky quartz vein extends in a direction north 30 degrees east for 40 feet, bounded on either side by a foot or two of green schist. Throughout this length the vein varies in width from 8 to 18 inches and contains few metallic minerals. Forty feet north of the pit it is intersected by a fault which meets the vein at a very acute angle. This fault trends north 25 degrees east and along it the northeasterly extension of the vein is displaced 30 feet to the south, nearly back to the southernmost pit. From this point the vein can be traced continuously for 135 feet in a direction north 40 degrees east. In this distance the schistose zone enclosing the vein narrows from 5 to 3 feet and is composed of very fine-grained green schist, except for bands about 6 inches in width on either side of the vein which are rusty and contain considerable disseminated fine pyrite and arsenopyrite. Both schist and vein dip steeply east to vertical. Throughout the length of 135 feet the quartz is

[1] Yellowknife group.
[2] Joliffe, A. W.: Yellowknife Bay–Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, pp. 16, 17.

commonly less than 1 foot wide, but in places is 20 inches. It is milky to grey in colour and contains chalcopyrite, pyrite, tetrahedrite (?), gold, and electrum. These metallic minerals are for the most part in or near thin chloritic seams lying within the quartz and paralleling the vein walls. Electrum (pale red to white silver—gold) and red gold occur together in most specimens examined. It is reported[1] that a picked specimen from this section containing electrum showed on assay 65·55 ounces gold and 58 ounces silver a ton. Along the assumed northeasterly extension of the vein, bedrock is covered by drift for a distance of several hundred feet. Within the first 50 feet of this drift area, three test pits show quartz in widths up to 9, 7, and 2 inches, respectively."

### Gold Group[2] (55)

"The Gold group comprises four claims on the northwest side of Yellowknife river near its mouth. At a point about 1,000 feet from the river is an irregular-shaped area about 50 feet long and 20 feet wide in which are many quartz stringers and veins the largest of which is 3 feet thick at its widest part and pinches out in a length of 15 feet. The stringers and veins occur in schist[3] and most of them are elongated about parallel to the cleavage of the schist, but some cut across it in various directions. A considerable amount of rusty weathering carbonate forms patches and stringers in the quartz. Small amounts of arsenopyrite and copper stain also occur in the quartz. The schist is generally not visibly mineralized, but in some places contains scattered crystals of arsenopyrite. A chip sample of the quartz veins and schist containing a somewhat greater than average proportion of arsenopyrite was assayed with the following results: gold 0·20 ounce a ton of 2,000 pounds and a trace of silver.[4]"

### Murphy-Bell Group[5] [6] (56)

"The Murphy-Bell group comprises eight claims on the south side of a small bay at the east side of the south end of Walsh Lake. Sulphide deposits outcrop on the west shore of the south end of the bay, on a small island at the south end of the bay, and on a hill 1,000 feet northeast of the south end of the bay. The deposits occur in sedimentary schist,[3] the cleavage of which strikes northeasterly and dips about vertically.

"The deposit on the west shore of the south end of the bay outcrops as a limonite-stained area about 60 feet wide and about 150 feet long and is elongated about parallel to the strike of the schist. A cross-trench, averaging about a foot deep, has been dug across the 60-foot width. The southern 20 feet of the trench is in almost solid pyrrhotite. The pyrrhotite in some places contains a few quartz stringers and a few shreds and bands of schist up to an inch wide. Schist with small amounts of pyrrhotite,

[1] Personal communication from C. Riley.
[2] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 72, 73 (out of print).
[3] Yellowknife group.
[4] Assay by A. Sadler, Mines Branch, Department of Mines, Canada.
[5] Reverted to the Crown.
[6] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 73, 74 (out of print).

pyrite, and quartz is exposed in the remaining 40 feet of the trench. The pyrite occurs as scattered crystals, lenses, and stringers over a width of 2 feet. The pyrrhotite forms small stringers and lenses in the remainder of the schist. Most of the pyrrhotite stringers parallel the cleavage of the schist, but a few cut it. The quartz forms small lenses and stringers in association with the pyrrhotite and the pyrite. A chip sample across the 20 feet of nearly solid pyrrhotite and across the 2 feet of pyrite in schist contained no gold and a trace of silver.[1]

"The deposit on the island outcrops as limonite with some iron sulphide, in schist, over a length of about 50 feet. It is on the strike of the deposit just described and is about 150 feet from it.

"The deposit on the hill northeast of the south end of the bay outcrops as a limonite-stained area about 50 feet wide and about 250 feet long and is elongated about parallel to the strike of the schist. In three cross-trenches the schist is seen to contain disseminated pyrrhotite, generally in less amount than in the deposit on the west shore of the south end of the bay."

### Star Group[2] [3] (57)

"The Star group comprises one claim on the south shore of the west arm of a bay at the south end of Lake Prosperous and one claim on the north shore of the same arm. Lake Prosperous is an expansion of Yellowknife River, 7 miles above its mouth. At a point 100 feet from the south shore of the arm and a few hundred feet from the west end of the arm are three irregular-shaped outcrops of vein quartz in sedimentary schist,[4] which strikes east and dips steeply south. The quartz outcrops are in line with one another and occur over a total length of about 150 feet. The quartz outcrops are separated from one another on the surface by glacial drift, but probably form a continuous vein. The largest of the outcrops is 50 feet long and 20 feet wide. Its north side is in contact with schist and the contact dips at an angle of 85 degrees to the south. The schist for a distance of 2 to 3 inches from the contact contains scattered crystals and stringers of arsenopyrite. The quartz is glassy and generally barren-looking, but in a few places contains sparsely disseminated grains of arsenopyrite and a very small amount of galena. A chip sample of the quartz and mineralized schist contained no gold and a trace of silver.[1] No sulphides were seen in the other two outcrops.

"The owners of the property report that another quartz vein occurs near the south shore of the arm of the bay. It is reported to be 2 feet wide and to have been traced for 900 feet along its strike and to contain in one part a band of galena 2 inches wide. A picked sample of the galena assayed $1.20 in gold a ton and 23·2 ounces of silver a ton. The owners of the property also report that an irregular body of quartz, 20 feet in average width and traced for 500 feet from the strike, occurs on the north side of the arm of the bay. The quartz is said to contain pyrite and galena at several places."

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[1] Assay by A. Sadler, Mines Branch, Department of Mines, Canada.
[2] Reverted to the Crown.
[3] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the Nor th West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, p. 74 (out of print).
[4] Yellowknife group.

## Ptarmigan Mines, Limited (58)

*Reference:* Jolliffe, A. W.: Yellowknife Bay-Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, pp. 35-36.

The Jack and Lily groups, comprising twenty-four mineral claims, are located about 4 miles east of the head of Yellowknife Bay. A gold-bearing quartz vein on these claims is being developed by Ptarmigan Mines, Limited, which is controlled by Consolidated Mining and Smelting Company of Canada, Limited. The ground near the vein is nearly flat and much of the bedrock is covered with drift. H. M. Powell is superintendent. The property is reached by road from Yellowknife Bay and was visited about the middle of August 1939.

*History.* The Jack group of six claims was staked in April 1936 by J. A. Morie and the Lily group of eighteen claims was staked in July 1936 by J. Stevens and W. G. Matthews. Some trenching and diamond drilling were done on the groups during the summer of 1938 by Consolidated Mining and Smelting Company, and Ptarmigan Mines, Limited, was incorporated in October 1938. A three-compartment vertical shaft was started near the northeast corner of Jack 6 claim in October 1938. No statement of ore reserves is available from the operators.

*Development.* A camp and mining plant are located near the northwest corner of Jack 5 claim.

Camp buildings are of frame construction and well insulated and include two bunk-houses (each 20 feet by 50 feet with accommodation for eighteen men), cook-house and dining-room, warehouse, and combined office and staff quarters.

The mine plant includes hoist-house, blacksmith shop, power-house, and dry. There is no assay office, and samples are assayed at the Con mine. Machinery includes a gasoline-powered hoist and two Ingersoll-Rand compressors with a combined output of about 500 cubic feet of free air a minute.

Almost all exploratory work has been done on No. 1 vein, which is exposed by twenty-two trenches. Twenty-five diamond-drill holes, totalling 7,768 feet, have been drilled on the property and most of them were located to explore No. 1 vein at about 100-foot intervals near the 150- and 300-foot levels. A three-compartment vertical shaft near the northeast corner of Jack 6 claim provides access to all underground openings. It is about 40 feet northeast of No. 1 vein and 336 feet deep, with stations 150 and 300 feet below the surface. Drifts extend about northwest and southeast from the shaft and total (August 1, 1939) about 720 and 510 feet on the 150- and 300-foot levels, respectively. About 50 per cent of the drifts are northwest of the shaft. No crosscuts are more than 20 feet long. During the winter of 1939-40 the company planned to install a new hoist and additional power and to deepen the shaft to 600 feet and explore No. 1 vein on the 450- and 600-foot levels.

*Geology.* The rock near No. 1 vein belongs to the Yellowknife group and is mostly quartz-mica schist, but includes some slaty beds. A very few rounded knots of metamorphic minerals occur in places and range up to ½ inch in diameter. The beds at the vein strike about north

10 degrees west and dip 45 to 80 degrees east. A fault may displace these sediments and lies about ¼ mile east of the shaft and strikes north 10 degrees west. The nearest granite outcrops 3 miles northeast of the shaft and cuts the sediments. The axes of some folds in the sediments near the property strike northwesterly and No. 1 vein is about parallel to these axes.

*Veins and Ore-bodies.* No. 1 vein is the only vein on the property known to contain ore shoots. Other veins are reported to occur on the property, but were not examined. No. 1 vein strikes north 65 degrees west, dips about vertical, and is exposed on the surface for 1,300 feet. Both ends are hidden by drift. The vein outcrops on claims Jack 5, Jack 6, and Lily 2. It is a continuous body of quartz, but includes some wall-rock. The observed width at the surface ranges from 1 foot to 25 feet and the maximum width is probably 45 feet, but the average width is about 12 feet. Near the northwest end of the outcrop the vein averages about 4 feet wide and near the southeast end about 8 feet. The dimensions of the vein on the 150- and 300-foot levels are about the same as on the surface. In most parts of the drifts the south wall of the vein is near the south side of the drifts and the north wall is not exposed; at intervals of 50 feet crosscuts north from the drifts intersect the north wall of the vein. In many places the south wall of the vein is sharp and tight but sinuous; in some places it is nearly straight and is slightly sheared. In many places the north wall of the vein is highly irregular and many tongues of quartz from the vein enter the wall-rock; in places the vein is separated from the wall-rock by a stockwork 10 feet wide made up of schist and quartz veinlets. The wall-rock was not noticeably altered by the vein-forming solutions and does not contain appreciable quantities of gold, but in a few places rock next to quartz contains a little disseminated pyrite. A fault outcrops about 620 feet northwest of the shaft and strikes about north and dips about vertical; the vein on the west side of the fault is displaced 13 feet north relative to the vein on the east side. In the west drift on the 300-foot level a nearly flat seam about 1 foot wide contains gouge and seams of crystalline calcite and pyrite and may offset the vein about 1 foot. Some of the quartz is light or dark grey and mottled and the texture ranges from coarse-grained and glassy to fine-grained and sugary. Some milky white quartz forms veinlets up to 3 inches wide with indefinite boundaries in the grey. In parts of No. 1 vein all the quartz is milky white and of uniform texture and in other places milky white quartz occurs near the north wall. In some places grey quartz is ribboned by seams that are parallel to the walls and ½ inch to 3 inches apart. The seams contain chloritic and micaceous minerals and some are sheared a little and have smooth faces. Most of the ribboned, grey quartz occurs near the south wall of the vein. Minerals other than quartz constitute less than 1 per cent of the vein in most places; pyrite, sphalerite, and galena are the most plentiful metallic minerals; other minerals are arsenopyrite, chalcopyrite, pyrrhotite, tourmaline, feldspar, and gold. Much of the pyrite and sphalerite occur in the quartz as irregular patches of each mineral; most of the pyrite in these patches is very fine-grained, occupies drusy cavities in the quartz, and is moulded on clear quartz crystals. Where the quartz contains appreciable quantities

of gold it also contains other metallic minerals, and particularly pyrite, sphalerite, and galena. Gold commonly occurs in ribboned, grey quartz and much of the visible gold occurs as thin flakes on or near the seams in the ribbon quartz. Most massive white quartz is reported[1] to contain very little gold.

Ore shoots occur in the quartz at the surface and on the 150- and 300-foot levels, but the dimensions of these ore shoots are not available for publication. Much of the known ore occurs near the south wall of the vein, but not all of the quartz near the south wall is ore. Probably many of the ore shoots are narrower than the vein in which they occur. The boundaries of the ore shoots are determined by sampling and assaying, but have not been located in all places because in most places part of the vein is in the north wall of the drift and has not been sampled. Only occasional samples of quartz contained more than 2½ ounces of gold a ton. Much of the ore is reported[1] to occur where grey, ribboned quartz with galena and other metallic minerals occurs along nearly straight, slightly sheared sections of the south wall. The plunge of the ore shoots is not known, but may be steep southeast and about parallel to the trace of the sedimentary beds on the vein.

*Operating Data.* Underground work presents no unusual problems. Ore and rock is trammed to pockets at the shaft and hoisted in a bucket. Drifts do not require timber supports. About 20 gallons of water is pumped from the mine each minute. The vein is sampled after each round and three samples taken: one sample is chipped from all quartz exposed in the face of the drift; the second sample is taken from the muck; and the third from the loaded mine cars. The back of the drift is not sampled and no channel samples are taken at the mine. The gold content of the vein, as determined from muck and car samples, agrees fairly well, but averages about 20 per cent less than the gold content determined from face samples; this difference is probably due to the barren rock contained in the muck and car samples. Most diamond drill holes that passed through or near ore shoots contained quartz of ore grade.

Freight for the mine is discharged from barges at a dock on Yellowknife Bay where a warehouse and two 3,500-gallon oil storage tanks are located. Freight is hauled from the dock to the mine by tractor over an all-weather road 5½ miles long. Freight from waterways, Alberta, to the dock costs $37.50 a ton. Fuel oil is hauled to the mine in steel drums or in a tank sleigh and costs 27 cents a gallon at the mine.

About fifty men are employed at the property and wages total about $7,000 each month.

### Giant Yellowknife Gold Mines, Limited (59)

*Reference:* Jolliffe, A. W.: Yellowknife Bay-Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, pp. 29-32.

Giant Yellowknife Gold Mines, Limited, owns the Giant group of twenty-one claims on the west side of Yellowknife Bay, about 1½ miles north of Yellowknife. Gold deposits on the claims are being explored under the direction of D. A. G. Smith. The property was visited early in September 1939.

[1] Powell, H. M.: Superintendent, Ptarmigan Mines, Limited, personal communication.

*History and Production.* The claims were staked by C. J. Baker and H. M. Muir for Burwash Yellowknife Mines, Limited, in July 1935. Some work was done on the claims by several companies, including Consolidated Mining and Smelting Company of Canada, Limited, and Anglo-Huronian, Limited, during parts of 1936, 1937, and 1938. Exploration was carried on continuously from April 1 to October 1, 1939, by Giant Yellowknife Gold Mines, Limited, and from six to fourteen men were employed. During this period 74 tons of ore from the Brock veins were shipped to Trail, B.C., for treatment. This ore contained 647 fine ounces of gold and 45 ounces of silver and the net return to the company was $18,600. The company planned to continue exploration throughout the winter of 1939-40.

*Development.* A temporary camp is located on Yellowknife Bay and includes manager's residence, office, cook-house and dining-room, two bunk-houses, and staff house.

Most work in 1939 was done about one mile north of the camp on the Brock veins and on the Ole shear zone. Between April 1 and September 1 the veins and shear zone were explored by eighteen diamond drill holes, totalling about 5,400 feet, and more drilling was done later in the year. Most drill holes that intersected the Brock veins did so at a vertical depth of about 60 feet below the level of the shaft collar. Most of the holes that intersected the Ole shear zone did so at vertical depths between 275 and 700 feet below the level of the outcrop. During the same period the Brock veins were explored underground. A prospect shaft about 126 feet long was sunk on the vein at an incline of about 33 degrees west. At a vertical depth of 55 feet below the collar a drift was driven 192 feet north to explore the vein and drifting stopped in August 1939.

The following table[1] summarizes work done on the Giant group from July 1935 to September 1, 1939.

| Vein or shear zone | Stripping | Trenches | | Shafts and pits | Drifts and crosscuts | Diamond drill holes | |
|---|---|---|---|---|---|---|---|
| | | Number | Total length | | | Number | Total length |
| | Feet | | Feet | Feet | Feet | | Feet |
| South Giant | ..... | 7 | 140 | 19 | ..... | 2 | 371 |
| Big Giant | ..... | 5 | 400 | 12 | ..... | 4 | 892 |
| Ole | ..... | 13 | 600 | 70 | 20 | 10 | 4,956 |
| Brock | 260 | ..... | 450 | 126 | 192 | 29 | 3,373 |
| North Giant | 200 | 7 | 210 | ..... | ..... | ..... | ..... |
| Totals | 460 | 32 | 1,800 | 227 | 212 | 45 | 9,592 |

*Geology.* The rocks near the Brock and Ole deposits include pillowed and massive, andesitic lavas (greenstone) and tuffaceous sediments, and all these are cut by basic dykes. Quartz-feldspar porphyry outcrops in many places and may be an intrusive rock or a lava. The lavas and sediments are altered and belong to the Yellowknife group. Folds in these rocks strike about north 30 degrees east. A granite batholith outcrops

[1] Data supplied by C. L. Hershman.

about 500 feet west of the Brock deposit and cuts Yellowknife rocks. The granite lies west of the West Bay fault, which lies about 300 feet west of the Brock zone. The fault trends north and is nearly vertical. Rocks on the east side of the fault are displaced about 5 miles north relative to those on the west side.

*Veins, Shear Zones, and Ore-bodies.* The Brock veins are faulted segments of one or more quartz veins and are exposed by stripping and drifting in many places over a length of about 360 feet along a strike of about north-northeast. Diamond drilling, since September 1, 1939, is reported to have extended the length of the zone in which the veins are known to occur. At the surface the veins occur within faulted segments of one or more shear zones that outcrop in a belt 265 feet long and striking north 25 degrees east. The inclined prospect shaft is near the north end of this zone and veins occur in many places throughout the 192-foot drift that extends about north 20 degrees east from the bottom of the shaft. In many places the country rock is green or grey, feldspar-quartz porphyry, but elsewhere it is a fine-grained, andesitic rock or a chloritic schist and in places these rocks cannot be distinguished readily.

On the surface the shear zones and enclosed veins are broken into segments by numerous faults that trend about northwest. The offset along these faults ranges from a few inches to more than 12 feet.

Near the south end the shear zones outcrop forming a "V", the open end of which faces about north 25 degrees east. The west zone is 130 feet long, trends about north 20 degrees east, and dips at low angles to the west. The east zone is 80 feet long, trends about north 40 degrees east, and dips at moderate or steep angles to the east. To the south, the shear zones curve towards each other and are obscured by drift for about 20 feet near the point of the "V". Each zone ends to the north against a steep fault that trends north 25 degrees west and whose direction of movement is not known. A shear zone, broken by other transverse faults, lies east of this fault. This zone extends 160 feet from the fault with an average strike of north 25 degrees east before it narrows to a crack and passes under drift. The rock in the shear zones forming the "V" is chlorite schist that in places has sharp walls against bordering feldspar-quartz porphyry. The schist ranges from a few feet to 8 feet wide, and may be a sheared bed of andesitic lava that bends around the point of the "V" and occurs as an anticline that plunges south-southwest. The shear zone east of the fault ranges in width from a few inches to more than 10 feet and may dip 45 degrees west; it may be a displaced part of the shear zone that forms the northwest limb of the "V". A quartz vein occurs in most places throughout the southern 100 feet of the shear zone that forms the northwest limb of the "V"; its width ranges up to 18 inches and averages about 5 inches. Quartz occurs as several lenses in the shear zone forming the southeast limb of the "V". The largest lens is 15 feet long and up to 2½ feet wide. The quartz is white and is ribboned with chloritic seams that are parallel to the vein wall and commonly less than 1 inch apart. Pyrite, chalcopyrite, and gold occur in the veins and are commonly in or near the chloritic seams. In most places metallic minerals constitute less than 2 per cent of the quartz. Some schist next the quartz is partly silicified and contains disseminated pyrite and may contain a little gold. The walls of the veins are commonly sharp and free.

The quartz exposed in the shaft and drift is broken in many places by faults and the rock next the quartz is not much sheared. A nearly continuous quartz vein is exposed on the north side of the shaft for 92 feet from the collar and averages about 1 foot wide. A quartz vein that averages about 1 foot wide is exposed for about 100 feet in the drift. The veins contain a little coarse, white calcite and fine-grained, pink carbonate, but are otherwise similar to those on the surface.

Much of the quartz in the Brock veins contains gold and some of it contains abundant visible gold. The 74 tons of hand-sorted ore shipped to Trail in 1939 came from the shaft, the drift, and from the outcrops of the western vein, and contained 8·7 ounces of gold a ton. Four sections of quartz vein in the western shear zone are reported to have an aggregate length of 137 feet, to average 0·44 feet wide, and to contain 5·65 ounces of gold a ton. The average gold content of quartz in the shaft and drift is not known, but may be about the same as that of the surface quartz.

The south end of the Ole shear zone is about 600 feet northeast of the outcrops of the Brock veins. The zone is 750 feet east of, and parallel to, the West Bay fault, and has been described[1] as follows:

"A strongly sheared zone, largely drift covered, extends north for at least 800 feet along the eastern base of a ridge composed largely of quartz-feldspar porphyry. Drift and muskeg extend north, south, and east from the ridge, and most of the fifteen trenches along the 800-foot length expose only the western edge of the zone. The porphyry hanging-wall dips 60 to 70 degrees west, and is commonly underlain by a foot or two of rusty, powdery gouge. In some places minor shears extend several hundred feet into the porphyry in a direction south 30 degrees west. The total width of the zone is revealed at only one place, 450 feet south of the northernmost trench. There intense shearing is about 40 feet wide and is bounded on the east by a few feet of moderately sheared greenstone. East of this for several hundred feet is muskeg. Throughout the exposed parts of the zone most of the schist strikes north and dips 60 to 70 degrees west, parallel with the hanging-wall, but in places it trends up to 30 degrees east of north. It is very fine-grained, soft, green-grey to brown-grey, and in part weathers rusty. Milky quartz lenses and veins in the zone are up to 3 feet wide and commonly parallel the trend of the schist. In places these contain arsenopyrite, pyrite, electrum, and acicular crystals of a blue-grey, metallic mineral (probably jamesonite or stibnite). Quartz also occurs in replacement bodies consisting of interbanded thin layers of milky and cherty quartz, carbonate, and chlorite. These contain disseminated, fine-grained pyrite and arsenopyrite. The banding parallels adjacent schist, into which the replacement bodies grade by decrease in quartz."

Gold is reported to occur in some of the quartz lenses and in adjacent parts of the Ole shear zone that are partly replaced by quartz and carbonate. Data supplied by the company indicate an ore shoot at the surface that is 155 feet long, averages 15·5 feet wide, and contains 0·47 ounce of gold a ton. Diamond drill holes that intersected the zone between depths of 275 and 700 feet in 1939 did not locate an ore-body.

[1] Jolliffe, A. W.: Yellowknife Bay–Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, p. 31.

## Aye Group (60)

The Aye group is on the west side of Yellowknife Bay near Yellowknife and was described by Jolliffe[1] in 1938.

"This group of thirty-seven claims was staked in September 1935 by V. Stevens, D. McLaren, and E. B. McLellan, on behalf of A. X. Syndicate, Limited, following their discovery of the first visible gold west of Yellowknife Bay. The claims are now being developed by Kamlac Gold Mines, Limited. Gold has been found within several veins on this property, but description here will be limited to a rather unusual occurrence in aplite.

"About a mile northwest of the outlet of Baker Creek a sheared aplite dyke on the Aye group carries gold. The country rock is pillowed lava[2] cut by several narrow, pink, aplite dykes and a diabase dyke 25 feet wide. One hundred feet west of the gold-bearing aplite the lava is in contact with granite. The gold-bearing aplite dyke strikes north 13 degrees east and has a steep dip. It varies in width from less than an inch to 30 inches and is exposed for a total length of 250 feet. The northern part of the exposed length of the dyke is relatively unsheared and consists of fine to coarse-grained, salmon-pink feldspar and dark glassy quartz. Towards the south this is strongly sheared, the shearing being confined largely to the dyke itself. The resulting rock is very fine-grained and is banded pink and grey. The centres of some of the wider pink bands consist of relatively unsheared aplite. Within and between the bands are lenses of grey, sugary quartz up to one-quarter inch wide. Small amounts of fine-grained arsenopyrite, pyrite, chalcopyrite, molybdenite, and gold occur in the quartz lenticles and to a lesser extent in the altered aplite."

## Duck Lake Group[3] [4] (61)

"The Duck Lake group comprises ten claims on the north side of Duck lake. This lake empties by a short stream into Yellowknife bay 7 miles south of the mouth of Yellowknife river. A mineralized zone outcrops on the north shore of the lake near its west end. The mineralization consists of iron sulphides disseminated through slightly schistose pillow lava[2] over a width of about 100 feet. Another mineralized zone occurs on the north shore of the lake 1 mile northeast of the deposit just described. Iron sulphide is disseminated through lava and forms tiny stringers cutting lava. A chip sample across a width of 30 feet contained no gold and a trace of silver.[5]"

## Rich Group (62)

The Rich group is on the east shore of Yellowknife Bay southeast of Yellowknife townsite and was described by Jolliffe[6] in 1938.

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[1] Jolliffe, A. W.: Yellowknife Bay-Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, pp. 18, 19.
[2] Yellowknife group.
[3] Reverted to the Crown.
[4] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 74-75 (out of print).
[5] Assay by A. Sadler, Mines Branch, Dept. of Mines, Canada.
[6] Jolliffe, A. W.: Yellowknife Bay–Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, pp. 36-38.

"This group comprises twenty-four claims, staked in September 1934 for Yellowknife Gold Mines, Limited, by C. J. Baker and H. Muir. A subsidiary company, Burwash Yellowknife Mines, Limited, was formed to take over the claims. During the summer of 1935 an open-cut 25 feet long and 30 feet deep was put down on the widest part of the discovery vein near the northeast corner of the Rich 4 claim (locality 14, Yellowknife Bay map-area). All the quartz from the open-cut with a little wall-rock, aggregating in all 16 tons, was shipped to Trail, B.C., for treatment and yielded 13·6 ounces gold to the ton.[1] A 2-compartment vertical shaft was started in September 1935, and this had been carried to a depth of 125 feet by the end of that year. Early in 1936 a crosscut was driven 70 feet west from the shaft at the 125-foot level and several quartz lenses were intersected and drifted on, but no values comparable to those in the open-cut were found. During the summer of 1936 more than 2,000 feet of diamond drilling and 300 feet of trenching were done on the discovery and adjacent veins. Development work on these was discontinued in September and has not since been renewed, but prospecting of the rest of the group is being carried on.

"The discovery vein has been briefly described previously.[2] The country rock is greywacke and slate of the middle and upper sediments of the Yellowknife group. The bedding varies in strike from north 60 degrees east to south 60 degrees east; the dip is vertical to steeply south, but tops of beds face north. A shear zone containing quartz lenses strikes about 15 degrees east of north, dips 75 degrees west, and marks a fault along which the rocks on the west side have moved relatively upward and slightly south. This shear zone is exposed for 230 feet to where it disappears under muskeg and drift to the north and south, respectively. It is only slightly wider than the quartz lenses that it contains. Where no quartz is present the shear zone is marked by a few inches of chlorite schist. Rather dark quartz, in widths up to 10 inches, occurs at intervals along the exposed length of the zone. The open-cut and shaft are located at the greatest width of quartz, about 45 feet from the south end of the outcrop. Here for 25 feet along the zone widths up to 27 inches of quartz occur and are offset in several places by cross faults. The maximum horizontal displacement observed along any of these is 3 feet. The vein is largely grey quartz with considerable brown-weathering pink dolomite, some calcite, and minor amounts of pink to buff feldspar. The metallic minerals in order of their apparent relative abundance are arsenopyrite, pyrite, gold, marcasite, chalcopyrite, galena, and pyrrhotite. The gold occurs chiefly in quartz, but some is in carbonate, and a very little in the chloritic schist marking the foot-wall of the vein.

"On the 125-foot level the shear zone contains up to 2 inches of dark, glassy quartz on the north wall of the crosscut, and less than an inch of chlorite schist on the south wall. The zone was drifted on for 53 feet south of the crosscut. In this distance quartz nowhere exceeded 30 inches in width, and in places was absent. One face sample across 5½ feet, including a 10-inch width of quartz, is reported to have assayed 0·35 ounce gold a ton.[1]"

[1] Personal communication from L. T. Burwash.
[2] Yellowknife River Area; Geol. Surv., Canada, Paper 36-5, pp. 4, 5 (1936).

## Con and Rycon Mines (63)

(*See* Figure 7)

*Reference:* Joliffe, A. W.: Yellowknife Bay-Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, pp. 19-28.

The Con and Rycon gold mines are on the west side of Yellowknife Bay and 2 miles south of Yellowknife. The Con mine is on the Con group of fourteen claims owned by Consolidated Mining and Smelting Company of Canada, Limited. The Rycon mine is 2,200 feet east of the Con mine and on the adjoining P. and G. group of four claims owned by Rycon Mines, Limited. Consolidated Mining and Smelting Company of Canada, Limited, controls Rycon Mines, Limited, and operates the Con and Rycon mines. The mines are operated from one mining and milling plant and camp and H. C. Giegerich is mine manager. The mines were visited about the end of September 1939.

*History, Production, and Ore Reserves.* The Con group of claims was staked for Consolidated Mining and Smelting Company in September and October 1935. By the end of 1936 the property was explored by trenches and pits, by diamond drill holes totalling about 4,500 feet, and by a 50-foot inclined prospect shaft on C10 shear zone, nad plans were made for the erection of a 100-ton mill. A three-compartment vertical shaft was started near the prospect shaft in the summer of 1937 and mill construction was started in September 1937. First gold was produced September 5, 1938. About 6,794 fine ounces of gold were recovered in 1938 and approximately 33,750 fine ounces in 1939. At the end of 1939 ore reserves were reported to be 53,720 tons, containing 0·86 ounce of gold a ton.

The P. and G. group of claims was staked by G. Latham and T. Payne in August 1936, and initial development work was done by Ryan Gold Mines, Limited. In August 1937 Consolidated Mining and Smelting Company obtained a controlling interest in the property and later formed Rycon Mines, Limited, to explore the property. A three-compartment vertical shaft was started near R51 shear zone in December 1938. A little ore from the Rycon mine has been treated in the Con mill.

*Development.* Camp buildings are at the shore of Yellowknife Bay. Office and mining and milling plants are at the Con mine, 3,600 feet west of the camp. All buildings are of frame construction, and heated by steam from a 125-horsepower boiler at the lake shore. Walls are covered with asbestos siding over tar paper and shiplap and are lined with Insulboard.

Camp buildings include three bunk-houses, each accommodating fifty men, one combined cook-house and dining-room seating 200 men, one apartment building accommodating four families, a 5-bed hospital, and a manager's residence. All are supplied with running water and electric light. A cold-storage building, maintained by P. Burns Company, is in the camp area.

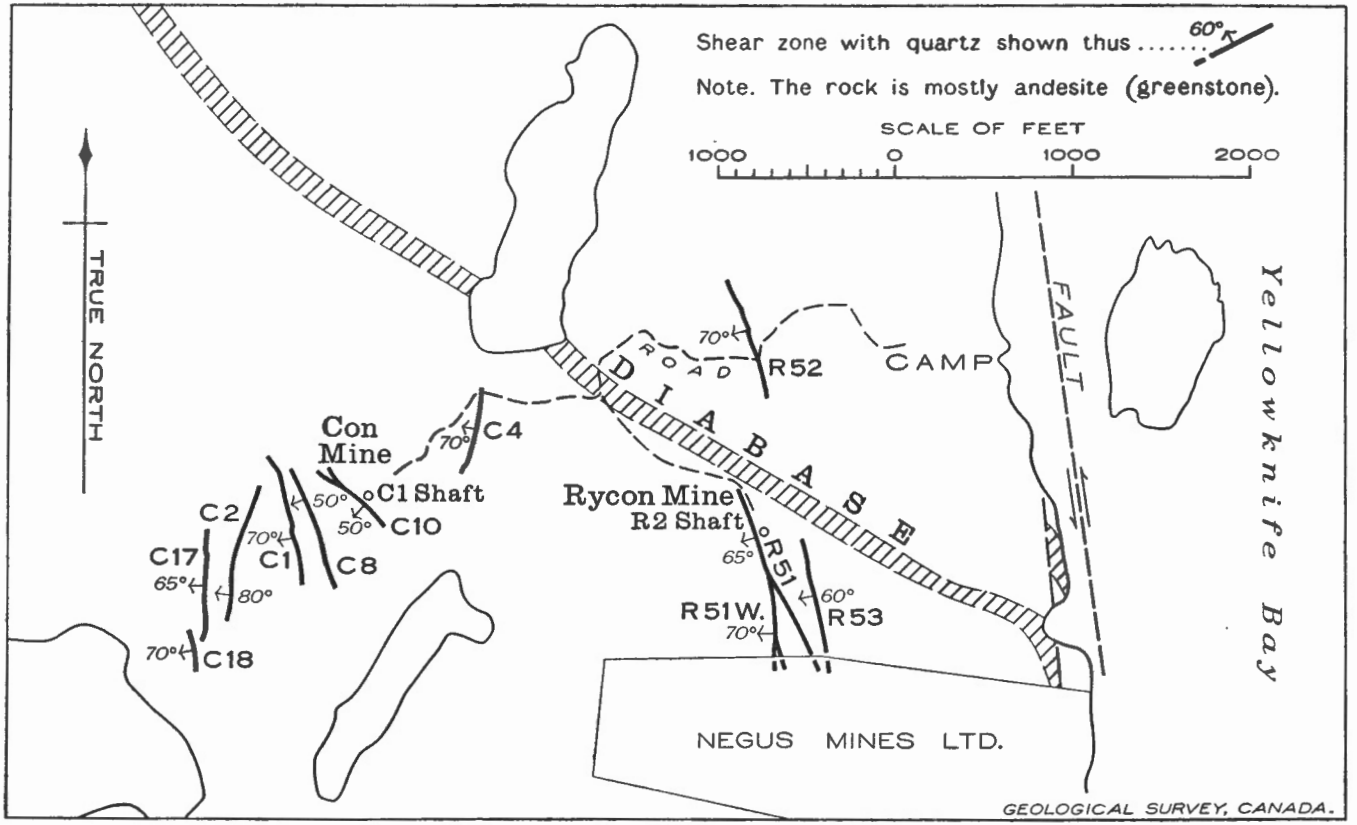


Figure 7. Con and Rycon mines, Yellowknife Bay, Great Slave Lake. From survey by Consolidated Mining and Smelting Company of Canada, Limited.

Mining and milling plants include mill, power-house, hoist-house, assay office, refinery, blacksmith shop, machine shop, carpenter shop, office and wireless station, and other structures. Power is supplied by six Ruston diesel engines. Three engines with a total output of 468 horse-power drive two-stage Ingersoll-Rand air compressors with an aggregate output of 1,900 cubic feet of free air a minute. Three engines with a total output of 880 horse-power drive Westinghouse generators that provide 550-volt alternating current and have an aggregate output of 624 kilowatts. C1 shaft is equipped with an Ingersoll-Rand two-drum electric hoist.

Shear zones (*See* Figure 7) C1, C2, C4, C8, C10, C17, and C18 are on the Con group and shear zones R51, R51W, R52, and R53 are on the P. and G. group. The shear zones and accompanying veins on both groups have been explored by trenches and pits and most of them have been explored by diamond drill holes. Zone C10 is near C1 shaft; zones C8, C1, C2, C17, and C18 outcrop about southwest from the shaft and about 325, 475, 925, 1,100, and 1,225 feet from it, respectively. Zone C4 outcrops about 800 feet northeast from C1 shaft. R51 zone, of which R51W zone is a branch, is near R2 shaft, which is 2,200 feet east of C1 shaft. R53 zone is about 200 feet east of R51 zone. R52 vein outcrops about 1,200 feet north of R2 shaft. The main entrance to the Con and Rycon mines is by C1 shaft, which is a three-compartment shaft 500 feet deep with stations at intervals of 125 feet. Drifts and crosscuts at the Con mine total more than 7,500 feet and this work is on the 125-, 250-, and 500-foot levels. Most of the drifts are on C4 and C10 zones. Drifts and crosscuts at the Rycon mine total more than 4,000 feet. R51 zone is opened on the 500-foot level by a 1,950-foot crosscut from C1 shaft. R51 and R51W zones are opened by crosscuts and drifts on the 125- and 250-foot levels from R2 shaft, which has three compartments and is 250 feet deep.

*Geology.* Most rocks near the Con and Rycon mines are pillowed or massive, andesitic lavas (greenstones) of the Yellowknife group. The flows strike northeasterly and dip moderately to steeply southeast and in most places are not sheared but are broken by closely spaced irregular joints. Altered gabbro and diabase dykes cut some of the lavas, but are probably about the same age as the lavas; the dykes strike north-northwest and north-northeast and some of them dip west. Borders of these dykes are difficult to find and to follow. A body of granite about $\frac{1}{8}$ mile in diameter outcrops about $\frac{1}{4}$ mile west of C1 shaft. The edge of a granite batholith lies about one mile west of the shaft. The granite intrudes the lavas and associated dykes. Unaltered diabase occurs as dykes trending northwest and ranging in width up to 175 feet, and is the youngest consolidated rock near the mines. The West Bay fault lies in Yellowknife Bay about 4,000 feet east of C1 shaft; it trends a little west of north and probably dips nearly vertical. Rocks on the east side of the fault are displaced about 3 miles north relative to those on the west side. Many other faults and shear zones of much smaller displacement occur near the mines.

*Shear Zones and Ore Deposits.* Ore deposits at the Con and Rycon mines occur in shear zones that cross the strike of massive and pillowed, andesitic lavas. The zones on which most work has been done trend between north 15 degrees east and north 40 degrees west and dip between 50 degrees and 70 degrees west; widths range from less than 1 foot to over 36 feet and average about 4½ feet. Some of the zones are more than 1,200 feet long. The rock in the zones is soft, flaky, dark green, chlorite-carbonate schist that weathers buff to rusty brown. In many places the walls of the zones are sharp, but in some places the schist grades into massive andesite through several feet of partly sheared andesite. Some shears branch or join other shears, and some follow borders of altered gabbro and diabase dykes.

Parts of some of the shear zones have been replaced by quartz and ferruginous carbonate and are bodies of gold ore. Many of these bodies are banded parallel to the walls. Some bands are grey or white, medium-grained, nearly pure quartz; others are buff, carbonate-chlorite schist with pyrite; still others are very fine-grained, dull grey mixtures of quartz and carbonate with disseminated pyrite and may be partly silicified schist. Many bands grade into adjacent bands and are between ¼ inch and 1 foot wide. In many ore-bodies at the Con mine nearly pure quartz occurs in several parallel bands and probably constitutes less than 50 per cent of the ore-body; the quartz bands are separated by bands of carbonate schist and fine-grained mixtures of quartz and carbonate. In some ore-bodies in the Rycon mine all nearly pure quartz occurs in one vein, which in places has sharp walls against carbonated schist and in other places grades through a mixture of quartz and carbonate to carbonated schist. Some quartz in the ore-bodies in the Rycon mine is medium-grained and grey like that in the Con mine, but some is coarse-grained, glassy, and mottled or banded and ranges in colour from black to white. A little coarse-grained, vuggy, milky quartz with nests of coarse-grained carbonate occurs as sharp-walled veinlets in medium-grained, grey or white quartz at the Con mine. Most ore-bodies in both mines contain conspicuous lenses or bands of relatively pure quartz, but not all of such quartz is ore. The shear zones cross pillowed and massive andesite and preliminary work by mine geologists suggests that ore shoots are most numerous where shear zones cross massive andesite. An ore shoot in C4 shear zone is cut by a dyke of unaltered and unsheared diabase, which is the youngest consolidated rock in the area. Steep-dipping, transverse faults are reported to offset shear zones and quartz in a few places; most of the offsets are less than 4 feet. Ore occurs at the surface and on the 125-, 250-, and 500-foot levels; there are no drifts on the 375-foot level. Ore-bodies range up to 287 feet long and their average width ranges up to 17 feet; many of them contain more than one ounce of gold a ton. Most ore has been mined from C4 and C10 zones between the 250-foot level and the surface.

A great variety of very fine-grained, sparsely disseminated, metallic minerals occur in the ore-bodies at the Con and Rycon mines, but in most places constitute less than 1 per cent of the ore. Pyrite and arsenopyrite are most common; other reported[1] metallic minerals are: hematite, spha-

[1] Ridland, G. C.: Mineralogy of the Negus and Con Mines, Yellowknife, N.W.T.; Princeton, 1939, unpublished Ph.D. thesis.

lerite, chalcopyrite, gudmundite, boulangerite, jordanite, guitermantite, jamesonite, galena, pyrrhotite, altaite, stibnite, tennantite, chalcostibite, marcasite, leucopyrite, nagyagite, chalcosite, and covellite. Visible gold occurs in many places, and most of it is in quartz; it is rare in fine-grained mixtures of quartz and carbonate and only negligible amounts occur in schist. Gold occurs in all types of quartz and in some places is very finely divided. Most of it is reported[1] to occur in quartz rather than in metallic minerals in the quartz.

A more detailed description of individual shear zones follows.

*C17 Shear Zone* strikes north, dips about 65 degrees west, and is traced on the surface for 650 feet. The zone ranges in width from a few inches to about 1 foot, and in the northern half contains a dark, glassy quartz vein that ranges up to 9 inches wide and contains gold.

*C10 Shear Zone* strikes about north 40 degrees west, dips 50 degrees southwest, and is traced on the surface for about 250 feet. The zone is explored by drifts on the 125- and 250-foot levels and its width ranges from 1 foot to 8 feet and averages 3 feet; the walls are sharp. An ore shoot in the zone is made up of bands of milky and dark quartz, fine-grained mixture of quartz and carbonate, medium-grained carbonate, and carbonate-chlorite schist; many bands are less than 2 inches thick, but in places bands of nearly pure quartz are 18 inches thick. The ore shoot was about 250 feet long at the surface, 187 feet long on the 150-foot level, and did not extend to the 250-foot level. Its width ranged from 3 inches to 7½ feet and averaged about 15 inches. It plunged about 90 degrees and has been mined to the surface.

*C4 Shear Zone* strikes about north 15 degrees east, dips about 70 degrees west, and is traced 550 feet on the surface and enters low ground at each end. On the 250-foot level the zone is followed by a drift for 1,200 feet and the zone extends for an unknown distance beyond each end of the drift. The width of the zone where exposed on the 250-foot level and at the surface ranges from 1 foot to over 36 feet and may average 8 feet; in many places the walls of the zone are sharp, but in some places schist grades through several feet of partly sheared rock into unsheared andesite. Some work has been done on this zone on the 500-foot level, but dimensions there are not known.

Parts of the shear zone are ore and comprise mottled, fine-grained, grey and white quartz, fine-grained mixture of quartz and carbonate with pyrite, and green to buff, carbonate schist with pyrite; all these materials occur as bands and lenses parallel to the walls of the zone and grade into each other. Most of this material contains less than 50 per cent quartz and grades along the strike into chlorite schist; in some places it grades across the strike into chlorite schist and in other places it extends to both walls of the shear zone. Visible gold is abundant in the northern trench on C4 zone. On the 250-foot level 1,200 feet of drift exposed 648 feet of ore in six shoots that averaged about 5½ feet wide and contained about 1·3 ounces of gold a ton. One shoot is 287 feet long; its width ranges from 1 foot to 13 feet, and averages 3·8 feet; part of it is mined to the surface. Another ore shoot is 100 feet long, averages 17 feet wide, and contains 1·00 ounce of

[1] Ridland, G. C.: Op. cit.

gold a ton. C4 shear zone was being explored on the 500-foot level when the property was visited (September 1939) and some ore was found on that level, but its dimensions are not known.

A dyke of diabase, the youngest consolidated rock in the region, cuts through an ore-bearing section of C4 shear zone on the 250-foot level about 1,400 feet north-northeast of C1 shaft. The dyke is 125 feet wide at that point, strikes north 57 degrees west, and dips about 70 degrees northeast. At the south wall of the dyke the shear zone is more than 36 feet wide and at the north wall of the dyke it is about 7 feet wide, and at both places chilled diabase is in contact with the shear zone and the shear zone does not pass through or enter the dyke. A dyke about 2 inches wide of similar diabase cuts the shear zone about 10 feet north of the main dyke, of which it may be a branch. The shear zone north of the dyke does not lie on the projected strike of the shear south of the dyke, but about 80 feet east of it. The ore shoot south of the dyke is 100 feet long and is widest near, but not at, the dyke; the ore shoot north of the dyke is 54 feet long and may be widest at the dyke. Chilled edges of the dyke are in contact with quartz of the northern ore shoot and similar quartz in the same ore shoot contains gold a few feet from the dyke. A steep-dipping joint passes through the dyke on the projection of the strike of the shear zone south of the dyke, and the dyke is reddened and contains some green epidote over a width of 6 inches to 1 foot along this joint. Bands of dense, red material and epidote occur in the mineralized shear zone near the dyke.

*R51 Shear Zone* strikes north 25 degrees west and dips 65 degrees west. On the surface it is traced 1,200 feet, of which the southern 160 feet lie on Negus property; the zone passes under muskeg at both ends. On the 125- and 250-foot levels it is reported to be followed about 900 feet and 1,060 feet, respectively. On the 500-foot level it has been traced more than 570 feet. At the surface the shear zone ranges from 4 feet to 14 feet wide and averages about 7 feet; on the 500-foot level it ranges from 2 feet to 6 feet wide and may average 3 feet. In many places the walls of the zone are sharp, but in some places the sheared rock grades through several feet of partly sheared rock to unsheared andesite. Lenses of nearly pure, mottled black, grey, and white quartz occur in parts of the shear zone and many of these contain gold and some are of ore grade. The largest quartz lens is reported to be 180 feet long and to range up to nearly 5 feet wide. Exposed quartz in 750 feet of shear zone at the surface averages 1½ feet wide. Some quartz is banded parallel to the walls by seams of carbonate or pyrite or by bands of quartz of various colours and textures. In some places the quartz lenses have sharp walls and in places at the surface are bordered by 1 inch to 12 inches of soft, red, earthy material; in other places they grade along and across the strike to carbonate and chlorite schist and the gradational material includes nearly pure quartz and fine-grained mixtures of quartz, carbonate, and pyrite that probably represent partly silicified, carbonated schist. Some quartz in the shear zone at the surface is reported to contain considerable gold, but no ore-bodies were found between the surface and the 250-foot level. On the 500-foot level, 570 feet of drift disclosed three ore shoots with an aggregate length of 150 feet and an average width of about 2 feet.

*R51W Shear Zone* strikes north 7 degrees west and joins the west side of R51 shear zone 200 feet south of R2 shaft. The dip at the surface ranges from 60 degrees to 80 degrees west. The zone is covered with drift in some places, but may be traced on the surface for 450 feet on Rycon property and an additional 70 feet on Negus property. The shear zone was not seen underground, although about 150 feet of drift on the 250-foot level may follow it. The width of the shear zone at the surface ranges from 2 inches to 5 feet and averages about 1 foot. The zone contains mottled and streaked, white to black quartz that averages about 9 inches wide at the surface and has plentiful visible gold near the south end.

*R52 Shear Zone* strikes about north 20 degrees west and dips between 60 and 75 degrees west; it is partly covered with drift, but has been traced on the surface for about 700 feet. The width of the shear zone ranges from 1½ to 4 feet. In some places the zone contains banded, white to grey quartz that ranges up to 2 feet wide, and some of the quartz grades into the schist. Some of the quartz contains gold. The zone was explored by diamond drill holes, but not by drifts.

*R53 Shear Zone* strikes north 12 degrees west and dips about 60 degrees west. It is traced on the surface for 670 feet on Rycon property and an additional 140 feet on Negus property. The shear zone ranges from 1 foot to 2½ feet wide and in some places contains a quartz vein up to 9 inches wide; some of the quartz contains plentiful visible gold.

*Mining, Milling, and other Operating Data.* According to the Company's annual report for 1938, the operating cost at the Con mine for that year was $13.43 a ton of ore milled. It was also stated that a large part of this cost was for development, as very little ore was developed when mining operations started. About $1,100,000 was spent at the property before gold was produced.

Freight from Waterways, Alberta, by boat costs $37.50 a ton.

About one hundred and sixty men are employed at the Con and Rycon mines and wages, excluding those of the staff, total about $20,000 a month. Recreation hall, curling rink, and bowling alley are provided for the employees. A resident doctor is employed. Probably 30 per cent of the employees leave and are replaced each year.

The cost of developing power by diesel engines is 2½ cents a killowatt-hour. Diesel fuel costs 22 cents a gallon delivered at the mine; it is brought from Turner Valley and from Fort Norman and reaches the mines in tank barges. Storage tanks at the mine hold 350,000 gallons, which is about a year's supply. The company plans to replace diesel power by electric power. In the Annual Report for 1939 it is stated that a contract has been let for the erection of a 4,700-horsepower hydro-electric plant near Prosperous Lake. The proposed site is 17 miles north of the mine. A considerable reduction in power cost is expected.

The average of summer and winter heating cost for camp and mine buildings is reported to approximate one dollar a ton of ore milled. About 2,500 cords of wood fuel is used for heating during 6 winter months.

There are no unusual mining problems at Con and Rycon mines. Ore is mined in shrinkage stopes, and some ore-bodies are narrower than the minimum stope width. Material and men entering and leaving the mines

are handled in two compartments in C1 shaft. R2 shaft is the only entry to underground openings on the 125- and 250-foot levels of Rycon mine and was idle in September 1939. Material and men enter and leave the 500-foot level of Rycon mine by a 1,950-foot crosscut from C1 shaft. All tramming is done by hand in cars with a capacity of 16 cubic feet and ore and waste are hoisted to the surface in these cars. Drifts and crosscuts do not require timber supports. About 50 gallons of water a minute are pumped from the Con mine by centrifugal electric pumps. Samples for assay are chipped from all exposed vein material in each drift face and in stopes; no channel samples are cut in the mines. Assaying indicates that some samples contain a much higher percentage of gold than the average of adjacent samples; in most cases the assay figures for these abnormal samples are not modified ("cut") before being used to calculate the gold content of ore-bodies. Gold content of ore determined from samples taken underground agrees very well with mill results.

About 53,000 tons of ore were milled between August 1938 and the end of 1939, and the average gold content of this ore was 0·82 ounce a ton. In August 1939 about 110 tons of ore were milled each day and the average gold content of this ore was 1·00 ounce of gold a ton. After suitable crushing and grinding about 27 per cent of the recoverable gold is caught in jigs and in a blanket table and is amalgamated. The ore that passes over these machines is treated by ordinary methods of cyanidation. Milling operations recover about 92 per cent of the gold in the ore and most of the remainder is reported[1] to be so finely divided that it cannot be freed from enclosing gangue and metallic minerals without excessively fine grinding.

## Negus Mines, Limited (64)

(*See* Figure 8)

*Reference:* Jolliffe, A. W.: Yellowknife Bay-Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21, 1938, pp. 19-28.

Negus Mines, Limited, owns the Negus group of six claims on the west side of Yellowknife Bay. The claims are 2 miles south of Yellowknife and adjoin the Con and Rycon properties. A mining and milling plant and camp are on Negus 3 and Negus 4 claims and all exploration, development work, and mining has been done on these claims. J. G. McNiven is acting superintendent. The property was visited at the end of July 1939.

*History, Production, and Ore Reserves.* The Negus group of claims was staked by O. Hagen and others in January 1936 and later. The surface was prospected during the summer of 1937, and diamond drilling was done during the winter of 1937-38. An inclined prospect shaft (No. 1 shaft) was started on No. 1 vein in March 1938 and followed the vein to the 100-foot level. This shaft was the only underground opening when the mining and milling plant was ordered in the spring of 1938. The main vertical shaft (No. 2 shaft) was started 600 feet northwest of No. 1 shaft in September 1938. Milling started February 5, 1939, and at that time no work, except diamond drilling, had been done below the 100-foot level.

[1] Walton, F.: Mill Superintendent, personal communication.

The first gold brick was poured February 21, 1939. From February 5 to December 31, 1939, 18,996 tons of ore were milled and 15,995 ounces of gold recovered. The company reports that ore reserves at January 1, 1940, amounted to 12,900 tons and contained 11,428 ounces of gold; this ore lies below the 100-foot level.

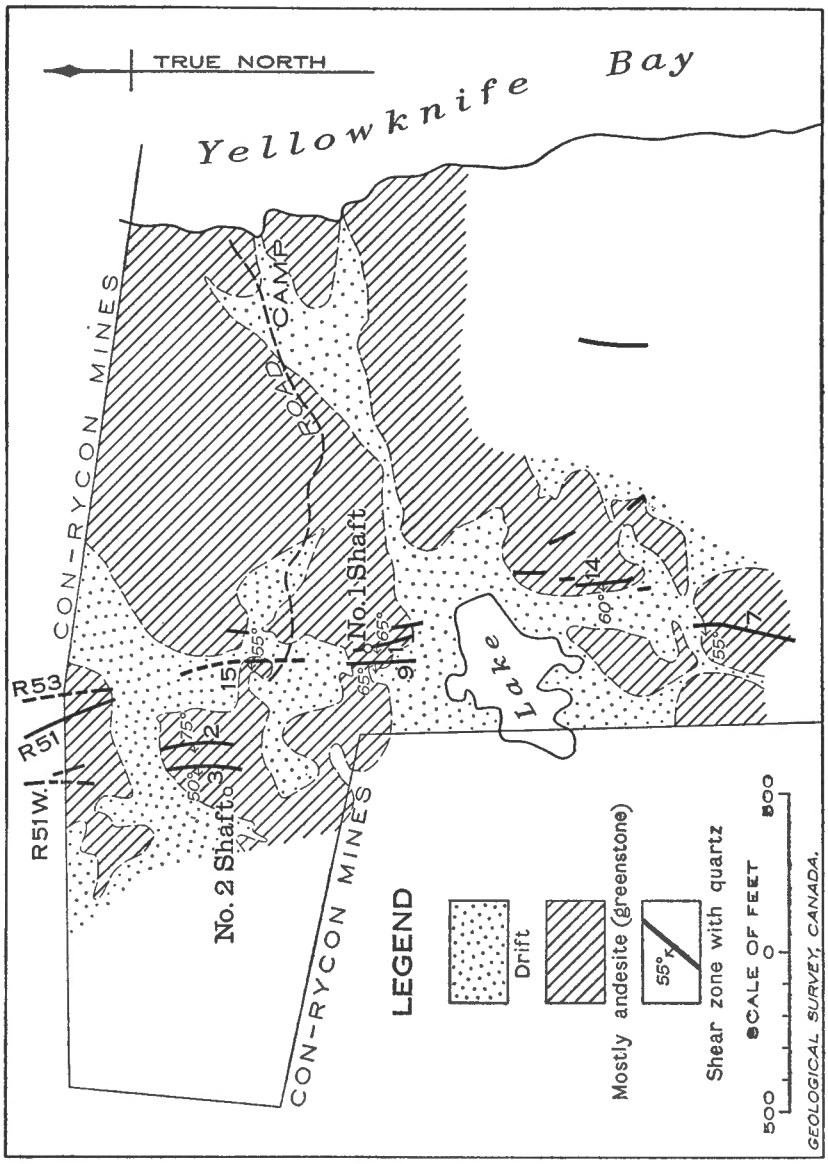


Figure 8. Negus mine, Yellowknife Bay, Great Slave Lake. From survey by Negus Mines, Limited.

*Development.* The camp buildings and mine office are at the lake-shore and the mining and milling plants are 1,800 feet west of the camp and 100 feet above the lake. All buildings are of frame construction, and steam heated from a central plant. Walls and roofs of office and bunk-house have rubberoid sheathing laid over tar paper and shiplap and are lined with Ten-Test. Spruce, cut on Slave River, is used for most building purposes, but a little Douglas fir from British Columbia is used as heavy timbers.

Mining and milling plants include a 60-ton mill and crusher-house, power-house, hoist-house, assay office, refinery, blacksmith shop, dry, and other structures. Power is supplied by three Ruston diesel engines with a total output of 472 horse-power. One engine drives a General Electric generator providing 550 volts, 60-cycle, 3-phase alternating current. Two engines drive Belliss and Morcom compressors with a combined output of 1,500 cubic feet of free air a minute. No. 1 shaft is used for ventilation only and No. 2 shaft is equipped with a two-drum compressed-air hoist.

Veins that outcrop have been explored by about sixty pits and trenches and thirty diamond drill holes totalling about 6,300 feet; drill holes intersect the veins 100, 200, and 300 feet below the surface.

A three-compartment vertical shaft (No. 2 shaft) with stations 100, 200, and 300 feet below the surface gives access to underground openings on veins 1, 2, 3, 9, and 15, and these are the only veins that have been explored underground. The veins (*See* Figure 8) strike about north and dip west and all of them outcrop east of the shaft. Drifts and crosscuts total 4,400 feet. The following remarks describe underground openings at December 31, 1939. The shaft intersects No. 3 vein at the 100-foot level and a crosscut east from this point intersects No. 2 and No. 15 veins at 120 and 330 feet, respectively. Drifts north and south from the shaft, on the 100-foot level total 550 feet; drifts north and south of the crosscut where it crosses No. 2 vein total 220 feet. A drift north from the end of the crosscut, and designed to explore No. 15 vein, is 290 feet long. A drift south from the end of the crosscut is 575 feet long, and connects with the bottom of No. 1 shaft 470 feet from the crosscut; this drift explores No. 1 vein near No. 1 shaft. A 40-foot crosscut west from the bottom of No. 1 shaft gives access to 180 feet of drift on No. 9 vein. On the 200-foot level a crosscut east from No. 2 shaft ends at No. 15 vein 270 feet from the shaft. Drifts extend north and south from the end of the crosscut; the north drift is 170 feet long and the south drift is 490 feet long and at the south end explores No. 1 vein. On the 300-foot level a crosscut east from the shaft ends at No. 15 vein 190 feet from the shaft. Drifts extend north and south from the end of the crosscut; the north drift is 140 feet long and the south drift is 675 feet long and near the south end explores No. 9 vein. A crosscut from the south drift provides access to 105 feet of drift on No. 1 vein, which lies 45 feet east of No. 9 vein.

Underground diamond drilling totals 750 feet.

In September 1939 development was being done on the 200- and 300-foot levels only.

*Geology.* The exposed rocks on the Negus claims are mostly andesitic lavas (greenstones) of the Yellowknife group. The lavas are dense to medium-grained, dark green rocks that weather black to rusty brown

and some of them contain pillows. Boundaries between individual flows are difficult to find, but near the adjacent Con and Rycon mines the lavas strike northeasterly and dip moderately to steeply southeast; they probably have the same strike and dip on the Negus claims. In most places the lavas are not sheared, but are broken by closely spaced, irregular joints. The pillows are not much distorted. The lavas are cut by a few altered gabbro or diabase dykes that may be about the same age as the lavas. Some of these dykes are about 15 feet wide, but all dyke boundaries are difficult to find. The lavas and dykes are cut by a few aplitic dykes that range from a few inches to a foot wide and are probably related to the granite batholith that outcrops about 1 mile west of No. 2 shaft and there cuts the lavas. West Bay fault lies in Yellowknife Bay about 2,000 feet east of No. 2 shaft; it trends a little west of north, is probably nearly vertical, and rocks on its east side are displaced about 3 miles[1] north relative to those on the west side.

*Veins and Ore Deposits.* The gold-bearing veins at Negus mine are tabular and lenticular quartz bodies within shear zones in altered andesite, gabbro, and diabase. Many of the shear zones trend a few degrees west of north and dip about 55 degrees west. Those on which most surface work has been done occur near the west edge of the Negus claims and within a belt with a north to south length of 2,300 feet and a width of 600 feet. The zones range up to 27 feet wide, average about 5 feet wide, and some have been traced for 440 feet and are probably longer. The rock in them is a grey, green, or buff, flaky, chlorite-carbonate schist, and in many places the borders of the shear zones are sharp or the schist grades through only a few inches of partly sheared andesite to unsheared andesite. In one place an aplite dyke is crossed by a shear zone and on the east side of the shear zone is displaced 7 feet north. Bodies of quartz within shear zones occur in lengths up to 400 feet and widths up to 12 feet, but some quartz in the shears occurs as disconnected lenses a few feet or less long or as stringers less than one inch wide and parallel to the shear walls. Quartz is mostly light and dark grey and mottled, but some is milky white and some is nearly black and glassy and in many places the light and dark varieties of quartz intergrade; in some places white quartz, with vuggy cavities and coarse, rusty weathering carbonate occurs as veins that cut dark grey quartz. Not all quartz is of ore grade and in many places the limits of ore grade quartz cannot be seen and are determined by sampling and assaying. Five ore shoots on the 100-foot level have a total length of 557 feet and an average width of 1·65 feet; two ore shoots on the 200-foot level have a total length of 289 feet and an average width of 5 feet; four ore shoots on the 300-foot level have an aggregate length of 320 feet and an average width of 2 feet. Practically all gold occurs within the quartz veins. In many places quartz of ore grade is light and dark grey and mottled and the walls against the enclosing schist are sharp and free and in places are marked by a little gouge. The quartz is sliced by fractures parallel to the walls and contains metallic minerals up to about 1 per cent, and some of these minerals occur in streaks parallel to the walls. Most quartz of ore grade contains very little rock, and in most places where

[1] Jolliffe, A. W.: Personal communication.

such bodies of relatively pure quartz grade to bodies of quartz and schist the gold content falls below ore grade. In many places soft, grey, metallic minerals occur in quartz with a high gold content. Visible gold occurs in both white and grey quartz, but all quartz in which gold can be seen is not of ore grade.[1] In some places quartz containing as much as 20 ounces of gold a ton contains no visible gold, and in other places quartz of ore grade with no visible gold grades into quartz that contains visible gold but which is not of ore grade.

Pyrite is the most plentiful metallic mineral; there is some sphalerite, chalcopyrite, arsenopyrite, and gold; jordanite, pyrrhotite, stibnite, tennantite, nagyagite, sylvanite, jamesonite, covellite, and chalcocite are reported in small amounts. A few faults offset the shear zones and accompanying vein quartz; the greatest offset seen underground is 3½ feet and the greatest offset seen on the surface is about 35 feet.

A description of individual veins follows.

*No. 1 Vein* outcrops at No. 1 shaft and the vein and associated shear zone have been traced for at least 170 feet on the surface and strike a little west of north and dip 65 degrees west. The shear zone ranges from 5 to 10 feet wide and the quartz vein ranges up to 3 feet wide. Vein and shear zone are opened for more than 100 feet on the 100-foot level and to the north enter a zone of fractured and carbonated rock that extends 420 feet north to the south end of No. 15 vein on that level. The vein is exposed for about 105 feet on the 200- and 300-foot levels. An ore shoot occurs in this vein on all levels and averages 80 feet long and about 1½ feet wide.

*No. 2 Vein* outcrops 150 feet east of the No. 2 shaft, and vein and shear have been traced for 230 feet on the surface, where they strike about north and dip 70 degrees west. On the 100-foot level they have been followed for 140 feet, but the vein is not continuous. The shear zone ranges from 1½ to 3½ feet wide and the vein up to 15 inches wide. In many places there is only a few inches of fractured rock between the vein walls and the unsheared andesite. An ore shoot in this vein is 95 feet long on the 100-foot level, where it averages 0·58 feet wide.

*No. 3 Vein* outcrops 80 feet east of No. 2 shaft. Vein and shear zone have been traced 220 feet on the surface and strike about north and dip 50 degrees west. On the 100-foot level they have been followed for 440 feet, but the vein is not continuous. The shear zone is about 30 inches wide and the vein ranges up to 30 inches wide. Part of this vein is of ore grade and on the 100-foot level is 146 feet long and averages 1·26 feet wide.

*No. 7 Vein* outcrops 1,050 feet south of No. 1 shaft. The shear zone has been explored for 300 feet, strikes a little east of north, and dips about 55 degrees west. The width of the sheared rock ranges from 4 to 12 feet and the quartz is from a few inches to 4 feet wide, but may not be continuous. Some of the quartz is reported to contain considerable gold.

[1] Ward, John: Mine engineer, Negus Mines, Ltd., personal communication.

*No. 9 Vein* outcrops 50 feet west of No. 1 shaft and is about 100 feet long at the surface. It lies in a shear zone that has been traced 200 feet on the surface, strikes north, and dips 65 degrees west. The shear zone is from 3 to 8 feet wide and the vein up to 3 feet wide. Vein and shear zone are opened for 180 feet on the 100-foot level and 260 feet on the 300-foot level, and on both levels the shear zone probably continues farther north to join a zone of fractured and carbonated rock that extends to the south end of No. 15 vein. An ore shoot on the 100-foot level is 150 feet long and averages 1·51 feet wide; on the 300-foot level there are two ore shoots in the vein and each is 65 feet long and averages about 2½ feet wide.

*No. 14 Vein* and shear zone outcrop about 700 feet south of No. 1 shaft and have been traced 180 feet on the surface and strike north and dip about 60 degrees west. The shear zone is from 3 to 7 feet wide and the vein ranges from 6 inches of solid quartz to 5½ feet of quartz and schist. At the south end the shear zone ends against a vertical seam that may be a fault. The probable continuation south of the seam lies 35 feet west. The vein is reported to contain plentiful gold in places.

*No. 15 Vein* and shear zone outcrop for 60 feet, 410 feet east of No. 2 shaft. They strike north 20 degrees west and dip 55 degrees west. The shear zone ranges from 12 to 27 feet wide and the vein from a few inches to about 12 feet wide. Vein and shear zone are opened for 300, 340, and 420 feet on the 100-, 200-, and 300-foot levels, respectively. An ore shoot occurs in the vein on all levels and averages 140 feet long and 4½ feet wide; on the 200-foot level it is 197 feet long and averages 6·85 feet wide, and this is the longest and widest known drift-length of ore in the mine.

*R51, R51W, and R53 Veins* are described in the account of the Con and Rycon mines.

*Mining, Milling, and other Operating Data.* The operating cost at Negus mine is $17.15 a ton milled, distributed as follows: development and exploration, $3.38 a ton; mining, $6.11 a ton; milling, $4.64 a ton; other costs $3.02 a ton. These costs do not include head office, depreciation, pre-production, or taxation charges. Total expense at the property before production started was $579,171.67; camp buildings, mining plant, mill, and equipment cost $255,057.84 and development cost $217,012.98. Freight from Waterways, Alberta, by boat, costs $37.50 a ton. About ninety men are employed at the mine and wages total about $16,500 each month. Fuel oil costs 24 cents a gallon at the mine and comes from Fort Norman in tank barges; storage tanks at the mine hold about 140,000 gallons or about a year's supply.

Most of the ore is mined in ordinary shrinkage stopes. In many places the veins are so narrow that some wall-rock, which contains no gold, must be broken with the veins and the miners are paid a bonus to minimize this dilution by maintaining the narrowest practicable stope. The ore shoot in No. 2 vein averaged 0·58 foot wide and was removed by a method known as "resuing", which avoids dilution of vein material by barren rock. The vein was first exposed on one side by blasting away the rock and the exposed part of the vein was then blasted onto canvas and removed from the stope. In almost all ore-bodies the ore breaks readily

from the wall-rock. Ore is trammed and hoisted to the surface in cars of 1-ton capacity. Drifts and crosscuts do not require timber supports. Water that enters the mine is not sufficient to hamper operations.

The gold content of the ore, as determined by sampling in the mine, and by milling, checks satisfactorily. Samples are taken from development faces after each round, and from the muck. Four channels are cut across the vein on each face and the material from these is assayed as one sample. If the gold content of a sample is more than 3·5 ounces a ton the assay value is averaged with 3·5 and the resultant figure is used as the gold content of the part of the vein from which the sample came. The gold content of the parts of ore shoots sampled by diamond drilling from the surface, checks in most places very well with the gold content as determined by underground sampling.

Some gold is recovered by gravity, but most is recovered by cyanidation. About 69 tons of ore are hoisted daily, from which about 10 tons of waste are removed by hand. The remaining 59 tons of ore is suitably ground and first treated by a jig, hydraulic trap, and on blanket tables. The products from these machines contains about 20 per cent of the recoverable gold and this is amalgamated and sent to a refinery. The ore that passes over these machines is treated by ordinary cyanidation methods and a gold-bearing precipitate sent to the refinery. The average gold and silver content of ore entering the mill to July 31, 1939, was $31.64 a ton. Bullion recovered contains about 25 per cent silver. Milling operations recover about 92 per cent of the gold and silver in the ore and most of the remainder is[1] reported to be so finely divided that it cannot be freed from enclosing gangue and metallic minerals without excessively fine grinding.

### Baltic Group[2] (65)

"The Baltic claims, staked for D. F. Kidd in August 1937, are located at the northwest end of Hearne Lake. A quartz-feldspar porphyry dyke striking north cuts the sediments[3] on the west shore of the lake one-half mile from the north end. It ranges from 75 to 250 feet in width and extends north from the shore of Hearne Lake for at least a mile. The dyke is extremely irregular in outline; it contains many sharply defined inclusions of the sediments and sends many branches into the surrounding sediments. The porphyry weathers white to light grey and is composed of light grey feldspar and smoky quartz crystals up to one-eighth inch in size in a fine-grained, light grey groundmass. In places the phenocrysts are so closely packed that the rock has a granitic appearance. The porphyry is cut, and apparently to some extent replaced, by an intricate stockwork of blue quartz veins from 4 feet to a fraction of an inch in width; they make up perhaps 5 to 7 per cent of the dyke. Most of the quartz is a glassy, smoky blue variety with no metallic minerals, but in places it contains coarse crystals of arsenopyrite. Small amounts of galena, sphalerite, and molybdenite are also reported to be present. No work had been done on the property when visited in the early part of August 1937. Assays of grab samples of quartz containing arsenopyrite are reported to have shown gold to be present."

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[1] McNiven, J. G.: Acting Superintendent, personal communication.
[2] Henderson, J. F.: Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39–1, p. 14.
[3] Yellowknife group.

## June Group (66)

The June group of thirty-six claims is about 47 miles east of Yellowknife and about 2½ miles southwest of the end of an arm of Desperation Lake that extends 14 miles southwest from the main lake. The property is reached from Yellowknife by aeroplane. The claims were staked for Consolidated Mining and Smelting Company of Canada, Limited, by Clifford Brock and Gordon McLeod late in June and early in July 1939. About seven men were employed on surface work on the claims during August and September 1939, under the direction of G. E. Clayton. Coarse gold was found in quartz-vein stockworks in Discovery zone and in No. 1 zone. The property was visited on August 24, 1939.

The claims are underlain by quartz-mica schist and slate of the Yellowknife group. The nearest granite outcrops 8 miles north and cuts the Yellowknife rocks.

At Discovery zone the quartz-mica schist and slate beds strike about north 50 degrees west and dip about vertical; the foliation of the schist strikes north 30 degrees west and dips 75 degrees northeast. Rock is stripped over an area 125 feet long and 60 feet wide and parallel to the foliation of the schist. Rock within this area is not notably more sheared or altered than elsewhere in the vicinity. Quartz occurs as stringers and lenses and may constitute 5 per cent of this area. Most of the quartz is in stringers that range up to about 3 inches wide and lie parallel to the foliation of the schist. The largest body of quartz is 25 feet long and about 1 foot wide. Most of the quartz is fine-grained and grey. A little quartz is coarse-grained and white or glassy and contains up to 10 per cent pink and white feldspar. Some of the coarse-grained quartz occurs in veinlets that cut the fine-grained quartz. The quartz contains a very little pyrite and arsenopyrite. Coarse gold was seen in the fine-grained quartz, but none was seen or is known to occur in the coarse-grained quartz. Violet quartz is reported[1] to have surrounded some of the gold grains on the weathered surface.

No work has been done southeast or northwest of the stripped area described above. A lake lies 100 feet southeast of the stripped area and only a little rock outcrops between this area and the lake. Sheared rock with a little quartz outcrops at several places along and near a line that extends north 25 degrees west for 1,200 feet from the stripped area. The sheared rock lies within comparatively unsheared quartz-mica schist and slate, strikes north 25 degrees west, and in places is more than 50 feet wide. Beds near the line of sheared rock strike about north 25 degrees west and may dip nearly vertical, but in many places from 100 to 200 feet on either side of the line the beds strike about northeast and dip steep northwest or vertical. Because of intervening areas of overburden it is not known whether the outcrops of sheared rock represent one or more shear zones or whether any of them are related to the quartz occurrence in the stripped area. Quartz in the sheared rock outside of the stripped area is reported to contain a little gold.

No. 1 zone is about ½ mile southwest of Discovery zone and on the northwest side of a small lake. A trench in muskeg exposes an area of rock

[1] Clayton, G. E.: Personal communication.

37 feet long and 15 feet wide and 40 per cent of this is quartz. The strike and dip of the enclosing quartz-mica schist is not known and this rock is not more sheared than rock elsewhere in the vicinity. The quartz occurs as irregular stringers and masses and most of it is fine-grained and grey. A few veinlets of coarse-grained, white quartz with feldspar cut the fine-grained quartz. Coarse gold was the only metallic mineral seen in quartz. Muskeg extends from the lake to a point about 75 feet northwest of the trench. At that point a quartz-vein stockwork in slightly sheared greywacke trends about north 25 degrees west and extends for an unknown distance in that direction and was not stripped or trenched. This stockwork may be a continuation of the quartz in the trench, but was reported[1] to contain almost no gold.

### July Group (67)

The July group of eighteen claims is 50 miles east of Yellowknife and about 1 mile south of the end of an arm of Desperation Lake that extends 14 miles southwest from the main lake. The property is reached by aeroplane from Yellowknife. The claims were staked by R. J. Stevens and S. Hooker in July 1939. About five men were employed on the property from about August 1 to September 15, 1939, and most work was done on a quartz stockwork near the boundary between claims July 1 and July 2. The property was visited on August 23, 1939.

The rocks near the lode are greywacke and slate of the Yellowknife group. They are not much altered and do not contain knots of metamorphic minerals. The beds are straight and strike about north 60 degrees west and dip about 80 degrees northeast. In many places closely spaced joints, most numerous in the slate beds, trend about north 25 degrees west and dip nearly vertical.

The lode is exposed for 400 feet along a line parallel to the strike of the enclosing rocks (north 60 degrees west), and passes under overburden at each end. It is explored by five rock trenches, each of which crosses the strike of the rocks and is about 30 feet long. The lode is made up of irregular lenses and interlacing stringers of quartz in greywacke and slate that is crumpled in places. Most of the quartz lenses and stringers strike about parallel to the joints (north 25 degrees west). The lode may contain 25 per cent quartz for a length of 400 feet and a width of 30 feet, but it has no definite walls and rock with quartz grades irregularly into rock without quartz. A little quartz is coarse-grained and milky or glassy. Most of the quartz is fine-grained and light or dark grey and contains feldspar, many inclusions of chloritized wall-rock, and a very little pyrite, arsenopyrite, and probably chalcopyrite. A little pyrite and arsenopyrite occurs in the included fragments of rock and in rock bordering quartz bodies. The quartz is reported to contain a little gold.

### P. L. D. Group (68)

The P. L. D. group of twenty-three claims is about 49 miles east of Yellowknife and about 2½ miles south of the end of an arm of Desperation Lake that extends 14 miles southwest from the main lake. The property is

[1] Clayton, G. E.: Personal communication.

reached by aeroplane from Yellowknife. The claims were staked late in July 1939 by Peter Davidson and Peter Lauder, and are owned by Thomas Payne, W. F. Payne, I. R. Payne, and O. Banks. Four men were immediately employed to prospect the claims and remained on the property until the end of August, when work stopped. The property attracted widespread attention at the time of its discovery and specimens of quartz, reported to come from these claims, contained plentiful coarse gold. Most work was done on three zones of quartz veinlets and these are known, from north to south, as No. 1, Discovery, and No. 2 zones. The claims were visited on August 22, 1939.

The property is underlain by greywacke, slate, and quartz-mica schist of the Yellowknife group. Some of these rocks contain small, rounded knots, ranging up to ¾ inch long, of metamorphic minerals. In places the beds strike north 25 degrees west and dip 80 degrees northeast. The nearest granite bodies outcrop 9 miles north of, and 9 miles southeast of, the claims and intrude the Yellowknife rocks.

Near No. 1 zone the greywacke and slate strikes north 20 degrees west and dips steeply east. Quartz of No. 1 zone occurs as irregular stringers within an area about 200 feet long and 90 feet wide and parallel to the sediments. Quartz may constitute 5 per cent of this area and the enclosing rock is not notably altered, or sheared. This zone of rock and quartz stringers grades in all directions to rock without quartz stringers. The zone is explored by one trench, which is near the centre of the area, is 25 feet long, and is transverse to the bedding. Quartz constitutes about 15 per cent of the rock in the trench, and most quartz occurs as stringers that range up to 2 inches wide. The quartz is fine-grained and grey and contains a very little pyrite, pyrrhotite, chalcopyrite, arsenopyrite, chlorite, and feldspar. No gold was seen in No. 1 zone, although coarse gold was seen in specimens reported to have come from the trench in the zone.

Trenches on Discovery zone are about 750 feet south-southwest of No. 1 zone. Beds near Discovery zone strike north 30 degrees west and dip 85 degrees northeast. Rock within the zone is jointed parallel to the walls of the zone, and this sheeted zone may be continuous for 1,100 feet. It trends parallel to the beds and is about 15 feet wide in places, but the walls are not sharp. The rock within the zone may be mostly slate and slaty greywacke, whereas the rock on either side of the zone may be mostly greywacke. A little quartz outcrops in several places throughout the exposed part of the zone and occurs as clusters of veinlets and irregular bodies. Two trenches 36 feet apart crosscut the zone where it contains the highest proportion of quartz. In one trench, 20 feet long, quartz veins that range in width from ½ inch to 1½ feet occupy one-quarter of the sheeted zone, which is there about 20 feet wide. The other trench is 15 feet long and the rock in the eastern 6 feet of the trench is about one-third quartz. The quartz at the trenches is fine-grained and grey to white and contains a very little pyrite. Coarse gold was seen in a 6-inch band of ribboned quartz in one trench, and appreciable amounts of gold are not known to occur elsewhere within the zone.

No. 2 zone is about 1,700 feet southwest of Discovery zone and is a zone of slightly fractured rock cut by a stockwork of quartz stringers.

The enclosing quartz-mica schist and slate strikes north 25 degrees west and dips 80 degrees northeast; the rock within the fractured zone may be a little more slaty than the rock on either side. The zone is parallel to the enclosing sediments, is exposed for 135 feet, and passes under muskeg at each end. The exposed part of the zone ranges from 25 to 45 feet wide and in most places the fractured rock grades into unfractured rock. The zone is explored by five crosscut trenches, and these average about 10 feet long and contain about 20 per cent quartz. Quartz occurs as veinlets and irregular masses and much of it is fine-grained and dark grey to white. Some coarse-grained, milky white quartz with feldspar occurs as veinlets that cut the fine-grained quartz. In some places numerous vertical joints cross the zone, and in those places the rock and quartz breaks into many blocks that measure a few inches on a side. Quartz contains wall-rock, chlorite, and a very little pyrite and arsenopyrite. Some rock near quartz contains a little pyrite and arsenopyrite. No gold was seen in the zone, but a sample cut across 3 feet of quartz and rock in one trench is reported[1] to have contained about one-third ounce of gold a ton.

### Ena Group (69)

The Ena group of twenty-six claims is at the north end of Buckham Lake and 56 miles east of Yellowknife. Gordon Murray staked the claims late in July 1939 for Consolidated Mining and Smelting Company and discovered a quartz-feldspar porphyry dyke with some quartz and metallic minerals on the largest island, 2 miles south of the north end of the lake. A camp was erected on the island in August and about eight men were employed trenching and stripping the dyke until the end of September when work stopped. A Warsop gasoline drill was used. Gordon Murray was in charge. The property was visited August 26, 1939.

The island on which the discovery was made is about 1 mile long and is underlain by knotted quartz-mica schist and greywacke of the Yellowknife group. On the west side of the island these rocks strike about north 20 degrees east and dip about 70 degrees west. A granitic stock about 2½ miles in diameter intrudes similar rocks, and the west side of the stock outcrops about 2 miles northeast of the island. The dyke may be related to this stock. It cuts the rocks on the island, has been traced for 1,450 feet, and enters the lake at each end; its width ranges from 3 to 33 feet and may average 15 feet. At the north end it strikes north 25 degrees east and dips about 70 degrees west. The dyke probably nearly parallels the enclosing rocks in some places, but elsewhere the width and strike of the dyke are irregular and it probably cuts across the enclosing rocks at small angles. The contact between the dyke and enclosing rocks is sharp and the wall-rocks are not noticeably altered by the dyke. The dyke is a fine-grained, light grey, sugary rock that weathers grey to rusty brown and contains a few quartz and feldspar phenocrysts that range up to $\frac{1}{16}$ inch in diameter, and also grains of arsenopyrite and pyrrhotite. The matrix is mostly fine-grained quartz, but contains a little sericite. In many places along and near the west wall the dyke is sheared and altered to a quartz-sericite schist. Some coarse-grained, white to glassy, and

[1] Payne, Tom: Personal communication.

fine-grained, sugary, grey quartz occurs as lenses in the dyke; most of this quartz is in the west half of the dyke and much of it is in fractures that trend about north 50 degrees west, dip about 40 degrees northeast, and curve at their northwest end to become nearly parallel to the west wall of the dyke. The largest single quartz lens seen was 12 feet long and 1½ feet wide. The quartz lenses may constitute 10 per cent of the dyke and in some places they contain pockets of arsenopyrite, pyrite, galena, sphalerite, and rusty weathering carbonate. Some free gold is reported to have been seen in rusty dyke rock where it enters the lake at the north end. A sample of the dyke rock with grains of arsenopyrite and pyrrhotite, but without vein quartz, contained[1] 0·005 ounce of gold a ton. A sample taken from a quartz lens in the dyke and containing arsenopyrite, pyrite, and galena totalling 10 per cent, contained[2] 0·13 ounce of gold a ton.

### Niccolite Veins Near François River (70)

In so far as is known no work has been done on this deposit for several years. It was described by Henderson[3] in 1939.

"The deposit occurs in augite diorite east of François River, about 1½ miles south of Caribou Lake. The augite diorite of the basic intrusive body is cut by granite, and the niccolite veins cut both diorite and granite dykes. The niccolite occurs in two veins lying within a few hundred feet of each other. They strike about east, dip from 70 to 80 degrees south, and have a maximum width of 15 inches. The larger vein has been trenched at intervals for 230 feet along its strike; the smaller parallel vein is exposed in only one trench. The veins are formed chiefly of massive niccolite with some smaltite and chloanthite, in a carbonate gangue. The surfaces of the nickel and cobalt arsenides are coated with green and pink nickel and cobalt bloom."

## GREAT SLAVE LAKE AREA

### Iron Deposits Near Utsingi Point[4] (71)

". . . . . oolitic iron deposits occur in the sedimentary volcanic series which overlies the granite and pre-granite rocks. None of the iron deposits is of economic value.

"Oolitic hematite beds are best exposed at several localities along 5 miles of shoreline on the east side of a narrows 5 miles north of Utsingi Point. The hematite beds occur in red and black shales that are associated with volcanics. The sediments strike north and dip from 5 degrees to 15 degrees to the east. Some of the hematite beds are only a foot or less thick, but several exposures, all probably parts of a single bed, show thicknesses of 10 to 30 feet of oolitic hematite associated with hematite-rich shales and jasper. The iron content is no doubt quite low. Oolitic iron deposits up to 20 feet thick occur at several other localities on the lake."

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[1] Assayed by Bureau of Mines, Department of Mines and Resources, Ottawa.
[2] Assayed by Bureau of Mines, Department of Mines and Resources, Ottawa.
[3] Henderson, J. F.: Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-1, p. 15.
[4] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 84-85 (out of print).

## Gold-Quartz Veins on Wilson Island[1] (72)

"Wilson island, Great Slave lake, is 23 miles long in an easterly direction and averages about 2 miles wide. Its west end is 46 miles north 20 degrees east from Resolution. Forty-six claims have been staked on the west end of the island and along the south shore of the main body of the island for a distance of 11 miles from the west end.

"The rocks[2] on which the claims have been staked are chiefly white, grey, and pink quartzites with smaller amounts of arkose, sedimentary schist, and brown-weathering, limy quartzite. The quartzites are cut by a few basic dykes. The limy quartzite occurs chiefly along the north side of the island, the arkose outcrops at a few localities on the south shore, and the schist is interbedded with the arkose and limy quartzite. Schistose conglomerate interbedded with arkose is exposed in Blind bay, a deep bay on the south side of Wilson island, and on a few small islands just south of Wilson island and near its west end. The sediments are irregularly folded in some places, but most commonly strike east and dip from 60 to 80 degrees to the south or are vertical. The tops of the beds face north. The sediments are probably pre-granite in age, for they are correlated on lithological grounds with sediments, on Iles du Large, which are intruded by granite.

"One of the claims, called the Big Moose, is ¾ mile from the west end of Wilson island and was staked by R. H. Wilson in September 1916. Another claim, called the Big Bear, adjoins the Big Moose on the east and was staked by C. P. McTavish in September 1916. Both claims were subsequently taken over by Aurous Gold Mining Company and were still in good standing in June 1931. A well-constructed cabin has been built in Safety cove, 2 miles from the west end of the island, and a cabin has been partly completed on the Big Moose claim. Old workings on the Big Moose claim consist of two shafts, about 100 feet from the south shore, and a few open-cuts.

"The material on the dumps at the shafts is quartzite. The quartzite is fractured and the cracks are stained with red iron oxide. Southwest of the shafts and close to the shore of the island a vein is exposed in a series of open-cuts along the strike of the vein for a distance of 250 feet. The vein varies from 1 to 6 inches wide, strikes easterly, and in one open-cut dips 65 degrees to the north. The vein is of milky quartz mixed with a small amount of specularite and, in one open-cut, with a very small amount of pyrite. A chip sample of the vein material taken at various localities along the strike contained 0·04 ounce of gold a ton of 2,000 pounds and a trace of silver.[3] East of the shafts is a test pit showing a quartz vein 3 feet wide with one wall not exposed. The quartz is milky, is much fractured, and the cracks are stained with red iron oxide. A chip sample across the 3 feet contained no gold and a trace of silver.[3] West of the shafts a few small quartz veins carry small amounts of specularite. A few quartz veins and lenses up to 3 feet wide occur north of the shafts. Some of these veins and lenses carry a small amount of red feldspar. Many

[1] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 75, 76 (out of print).
[2] Wilson Island group.
[3] Assay by A. Sadler, Mines Branch, Department of Mines, Canada.

quartz stringers and lenses occur in a zone about 30 feet wide and 200 feet long close to the south shore of the island and near the east boundary of the Big Moose claim and probably extending into the Big Bear claim."

## Slave Lake Gold Mines, Limited (73)

*References*:

Jolliffe, A. W.: Geology and Gold Deposits of Outpost Islands, Great Slave Lake, Northwest Territories; Geol. Surv., Canada, unpublished manuscript.

Hawley, J. E.: The Association of Gold, Tungsten and Tin at Outpost Islands, Great Slave Lake; University of Toronto Studies, Geol. Ser. No. 42, 1939, pp. 53-67.

*General Statement.* Slave Lake Gold Mines, Limited, owns the Fox group of eighteen claims on Outpost Islands, which are the most westerly islands in the east arm of Great Slave Lake. The Fox claims are about 40 miles slightly east of north from Resolution and about 55 miles south-southeast from Yellowknife. The property is a gold-tungsten prospect. The following description is based mainly on data collected by A. W. Jolliffe in 1936; the property has not been visited by an officer of the Geological Survey since 1936.

The claims were staked in July 1935 for Athabaska Syndicate by W. D. Brady, M. J. Shunsby, and H. D. Tudor, and were later acquired by Slave Lake Gold Mines, Limited. The claims were explored by N. A. Timmins Corporation, which held the property under option from November 1935 to March 1938. Although tungsten was known to occur, the object of this exploration was to locate gold ore. Early in 1936 a two-compartment vertical shaft was started on Fox 13 claim on what is known as the West zone. This zone is on an island that is 800 feet long. By March 1938 the shaft was 450 feet deep and drifts and crosscuts reported to total about 1,390 feet had been opened 50, 125, 200, 325, and 425 feet below the surface. The property has been idle since early in 1938, but is reported to have been examined in the autumn of 1939; the object of this examination was to locate tungsten ore.

Ore reserves are reported to be 17,308 tons, with an average content of 0·5 ounce of gold a ton. The tonnage and average content of the tungsten-bearing bodies is not known.

*Geology.* The islands are underlain by metamorphosed sedimentary rocks of early Precambrian age that belong to the Wilson Island phase of the Point Lake-Wilson Island group. They are mostly quartz-mica schist and gneiss, quartzite, and conglomerate. Crossbedding is common and knots of andalusite and staurolite occur in places. Near the mineralized shear zones the beds strike about north 70 degrees east and dip about 80 degrees southeast. They are cut by a few narrow basic dykes and by many small bodies of quartz containing mica and andalusite.

*Shear Zones and Ore Deposits.* Sheared and silicified zones with disseminated metallic minerals occur in quartz-mica schist and gneiss and lie parallel to the bedding, or nearly so. Some of these zones contain bodies of gold- and tungsten-bearing rock. Some work has been done on eight zones that outcrop on a group of four islands that form a part of

the group known as Outpost Islands. The zones outcrop within an area that trends about north 70 degrees east and is 7,300 feet long and 750 feet wide. This area covers parts of the four islands and the intervening channels. Most of the zones strike between north 65 degrees east and north 85 degrees east and dip between 75 and 85 degrees south. They are exposed at the surface for lengths up to 1,550 feet and range up to about 20 feet wide. In places the beds within the shear zones are thinner than those bordering the zones or are crossbedded. The rock in the zones is slightly sheared along closely spaced fractures parallel to the walls or is brecciated, but none of it is strongly sheared. The sheared and fractured rock of the zones grades into the wall-rock. A few bodies of quartz with mica and andalusite occur in the shear zones. Some of the sheared and fractured rock is cut by quartz veinlets and is cemented and partly replaced by quartz, chalcopyrite, and pyrite, with which are associated a little ferberite, magnetite, specular hematite, ilmenite, marcasite, bornite, chalcocite, covellite, molybdenite, chlorite, white mica, gold, and possibly other minerals. In most places the mineralized material is readily recognized as an altered sediment. Gold occurs within the shear zones: (1) as leaves on nearly flat joints in quartzite or in introduced quartz and sulphides; (2) in quartz veinlets; (3) in quartz bodies with mica and andalusite; (4) in seams of gouge; and (5) disseminated in impure quartzite without apparent introduced quartz. The tungsten occurs in ferberite, which has been found in four of the eight shear zones and may occur in others. Ferberite is a dark brown to black mineral. Most of it occurs as plates up to one-eighth inch across in quartz surrounding fragments of quartzite.

Most of the underground openings are reported to be on or near the West zone, but they were not examined. The West zone outcrops 30 feet southwest of the shaft and from that point its outcrop extends 260 feet south 65 degrees west to the southwest end of the island. The zone extends beneath overburden to the shaft and probably dips between 80 and 85 degrees south. A zone that may be a continuation of West zone outcrops 100 feet east of the shaft and from there extends 250 feet north 75 degrees east to the east end of the island. The width of the zone west of the shaft ranges up to about 7 feet and may average 2 feet. The width of the shear zone east of the shaft is not known because the zone is not well exposed. Parts of the zone at and west of the shaft contain considerable gold. A half-ton sample of ore from the 50-foot level on the West zone was assayed by the Bureau of Mines at Ottawa and contained[1]: gold, 3·15 ounces a ton; silver, 0·29 ounce a ton; copper, 1·67 per cent; tungsten trioxide, 1·20 per cent; and tin, 0·20 per cent. Another sample, weighing 825 pounds, probably from the West zone, contained[2]: gold, 0·616 ounce a ton; silver, 0·075 ounce a ton; copper, 0·60 per cent; tungsten trioxide, 0·25 per cent; and tin, trace. Most tungsten found to date is reported to occur on the 425-foot level in a body of mineralized rock reported to be 189 feet long, to average 12·8 inches wide, and to contain 1·40 per cent tungsten trioxide a ton.

[1] Gold-copper Ore from the Slave Lake Gold Mines, Limited, Great Slave Lake, N.W.T.; Bureau of Mines, Canada, Investigations in Ore Dressing and Metallurgy, January to June, 1937, pp. 75.

[2] Experimental Tests on a Sample of Gold Ore from the Slave Lake Mine on Outpost Island, Great Slave Lake, Northwest Territories; Bureau of Mines, Canada, Report of the Ore Dressing and Metallurgical Laboratories, October 24, 1938.

## Other Gold Occurrences[1]

"In the east arm of Great Slave lake, many of the islands and certain stretches of the main shore are occupied by two groups of sedimentary strata all younger than the granites. The older group consists of sandstone, shale, limestone, etc., with interbedded acid and basic volcanic flows. It is cut by irregular bodies and sills of rocks of a variable composition, generally approaching that of a syenite. The younger group is chiefly of conglomerate and sandstone. Both groups are cut by dykes and sills of diabase. In these rocks mineralization has been noted here and there.

"On the north side of a small island 4½ miles slightly south of west of "P rock H 22"[2] sandstone of the older group is cut by a vein that strikes east, dips about vertical, and is exposed along its strike for a length of 100 feet. The vein has a maximum thickness of 4 feet and pinches out at its west end. The vein material is chiefly quartz containing considerable quantities of specularite and pyrite. Buff carbonate is also present in the vein. A chip sample of the vein material was found to contain no gold and a trace of silver.[3] On the east end of an island 6 miles north 35 degrees east of Taltheilei narrows brecciated sandstone and quartzite are injected by many quartz-carbonate stringers containing disseminated chalcopyrite. At one locality in the mineralized area quartz and carbonate with disseminated chalcopyrite and a few masses of quartzite occur over a width of 15 feet. A sample of the 15-foot zone was assayed and found to contain 0·71 per cent of copper, no gold, and a trace of silver.[3] On the west shore of Pethei peninsula at a point 2 miles northeasterly of Taltheilei narrows greatly contorted sandstone is cut by a vein of carbonate and quartz varying in widths between 10 and 50 feet. Generally no sulphides are visible, but in one place there is a small amount of disseminated chalcopyrite. This exposure may possibly be a continuation of the vein material on the island to the northeast of the narrows. On the southwest of "P rock B 9" a considerable amount of copper stain and many quartz stringers occur in quartzite over an area about 100 feet across. Small amounts of chalcopyrite were noted in the rocks of the older group at nine other localities. Barite veins, the largest of which is about 3 feet wide, were noted at about half a dozen localities in the same group.

"Carbonate veinlets with disseminated chalcopyrite cut syenite at a point 1¾ miles east of "P rock C 16" and at the southwest end of Et-Then island. In conglomerate and sandstone which are the youngest sediments of the district, small amounts of chalcopyrite were observed in quartz stringers at four localities. On the east side of an island 4 miles northeasterly of Taltheilei narrows a few quartz-carbonate stringers about ½ inch wide occur in joint cracks in diabase. The stringers contain a few scattered grains of bornite and pyrite.

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[1] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 76–78 (out of print).

[2] A reference point marked by a numbered metal plate in rock outcrop; *See* Eastern Sheet Great Slave lake, Topographical Survey of Canada, Dept. of Interior.

[3] Assay by A. Sadler, Mines Branch, Dept. of Mines, Canada.

"In addition to these occurrences Lausen[1] reports copper mineralization at five different places in the east arm of the lake. A brief summary of his account of these occurrences follows. Near Pekanatui point quartz veinlets in schist contain calcite, barite, specularite, pyrite, and chalcopyrite. North of the entrance to Murky channel veinlets of bornite and chalcocite occur in syenite. About 3 miles up Murky channel malachite was found as thin films traversing fractures in chlorite schist. At one place along the north shore of Stalk lake[2] a thin film of malachite occurs along fractures in dark brown argillites. In an embayment on the south shore of Tochatwi bay and north of the east end of Portage inlet a thin film of chalcopyrite crystals in a gangue of barite occurs on the face of a large talus block of diabase.

"Some earlier records of mineralization from the Precambrian rocks of Great Slave lake are as follows. At one locality on the north shore of the bay west of the narrows between Christie and McLeod bays thin plates of chalcopyrite occur in joint cracks in greenstone which gave rise to green copper stain and cobalt bloom.[3] On the northwest side of McLeod bay, small, interrupted gash veins and stringers of calcspar occur in gneiss and granite and some of them contain nuggets of chalcopyrite.[4] An assay of quartz, stained and, in parts, coated with hydrated peroxide of iron, from a large vein on the west side of East bay, showed neither gold nor silver.[5] An assay of schist with quartz, more or less thickly coated with hydrated peroxide of iron, carrying some coarsely crystalline galena from between Resolution and Rae, about 40 miles from Resolution, showed no gold and 16·012 ounces of silver to the ton of 2,000 pounds. The galena amounted to 41·2 per cent by weight of the whole.[6]

"Some occurrences in pre-granite rock areas follow. Small amounts of galena, pyrite, and chalcopyrite occur in quartz stringers and enclosing rocks on an island ½ mile north of Wilson island and 12 miles from its east end. Small amounts of disseminated chalcopyrite associated with fluorite and carbonate occur in quartz stringers near the first portage on Thubun river which enters Great Slave lake at a point 8 miles east of the mouth of Taltson river. Pyrite is fairly plentiful in quartz veins on some small islands south of the east part of Wilson island and on the north shore of Blind bay. On the south shore of Great Slave lake at a point 17 miles east of the mouth of Taltson river many quartz stringers occur in schist across a width of 4 feet and both the quartz stringers and the schist, over this width, contain disseminated pyrite and a small amount of chalcopyrite.

"A small vein cuts granites on the north end of a small island 1½ miles southeast of "P rock M.E. 22" on the northeast side of the north arm of Great Slave lake. The vein strikes slightly west of north, dips vertically, is exposed for about 120 feet along its strike, and varies from 1 inch to 1 foot wide. The vein material is chiefly of quartz and sphalerite in about equal amounts. A few specks of chalcopyrite are disseminated through the quartz and at one locality in the vein there is a small amount of galena".

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[1] Lausen, Carl: Can. Min. and Met. Bull. 1929, pp. 391–392.
[2] More commonly known as Stark lake.
[3] Bell, R.: Geol. Surv., Canada, Ann. Rept., vol. XII, pt. A, p. 108 (1902).
[4] Bell, R.: Op. cit., pt. A, p. 108.
[5] Geol. Surv., Canada, Ann. Rept., vol. XII, pt. R, p. 42 (1902).
[6] Geol. Surv., Canada, Ann. Rept., vol. XI, pt. R, p. 32 (1901).

## Iron Deposits on Iron Islands[1] (74)

"Specularite iron deposits occur in pre-granite rocks . . . None of the iron deposits is of economic value.

"The specularite deposits, as far as known, occur chiefly on a small group of low islands, known as Iron islands and situated 35 miles north 15 degrees east from Resolution. The islands extend in a north direction over a total distance of 4,000 feet. Six claims were staked on the islands in July, 1928, on behalf of the Atlas Exploration Company.

"The islands consist chiefly of quartzite which generally strikes slightly north of east and dips 30 degrees southeasterly. Within the quartzite are beds of specularite composed chiefly of quartz and micaceous specularite and generally containing a few disseminated flakes of chlorite. The cleavages of the specularite and chlorite are about parallel to the bedding of the quartzite.

"On the south island and about 300 feet from its north end is a bed of specularite. It is about 35 feet thick, strikes and dips parallel to the quartzite, and outcrops along its strike almost continuously from one side of the island to the other over a length of about 1,200 feet. A chip sample across the bed was analysed with the following results[2]:

| | Per cent |
|---|---|
| Insoluble | 88·9 |
| Insoluble $Fe_2O_3$ | 20·43 |
| Soluble $Fe_2O_3$ | 9·23 |
| Total $Fe_2O_3$ | 29·66 |

"Across the northwest corner of the south island is another specularite bed about 35 feet thick dipping about 30 degrees south. It appears to have about the same composition as the bed just described. The specularite bed grades north into quartzite containing a small percentage of specularite.

"At the west end of the middle island is a specularite bed about 30 feet thick and dipping about 30 degrees south. Some layers in the bed contain considerably more specularite than others, but the average composition appears to be about the same as that of the first described specularite bed. One of these is 1 foot thick and the other is 20 feet thick.

"On the southeast shore of the middle island is a bed of specularite with an exposed thickness of about 2 feet and probably containing a somewhat higher percentage of specularite than the bed first described. At the east end of the same island is another outcrop of specularite which is probably a continuation of the bed on the southeast shore of the island.

"The west and north parts of the north island, which is roughly circular and about 800 feet across, are composed very largely of quartzite containing specularite. The percentage of specularite varies considerably at different localities, but on the average is considerably lower than that of the first-described locality. The bedding of the quartzite on this island strikes and dips irregularly.

"Specularite-rich beds and lenses up to 2 feet wide occur in quartzite on a small island ¾ mile east of the south end of Iron islands and in argillaceous quartzites 2 miles southwest and 3 miles northeast of Basile bay."

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[1] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 84, 85 (out of print).

[2] Analysis by A. Sadler, Mines Branch, Dept. of Mines, Canada.

## Lead and Zinc Deposits Near Pine Point (75)

So far as known no work has been done on these deposits in recent years. They were described by Stockwell and Kidd[1] in 1931 as follows:

"As far as known lead and zinc deposits occur only in the Presqu'ile dolomites of Middle Devonian age. The most important deposits are on property of the Northern Lead Zinc, Limited, 10 miles south-southwest of Pine point. A deposit of less importance occurs 7 miles southwest of Pine point. Small deposits of lead and zinc have been found at intervals over an area about 15 miles from east to west and 10 miles from north to south in the vicinity of Pine point.[2]

"Some prospecting for lead and zinc has been carried on in Presqu'ile dolomites on the northwest shore of the western part of the lake, but it is reported that only unimportant amounts of these minerals were found. The Presqu'ile dolomite is about 375 feet thick at Nintsi (Windy) point[3] and is at least 255 feet thick on the property of the Northern Lead Zinc, Limited.[4]

"The Northern Lead Zinc, Limited, property may be reached over a wagon road about 13 miles long, from Dawson landing on the shore of the lake about 3 miles east of Pine point and about 20 miles southwest of Resolution. The deposits were visited by R. Bell in 1899[5], by Cameron in 1916[6], and were described in 1929[7], 1930[8], and 1931[9] by J. Mackintosh Bell.

"The deposits outcrop, at an elevation of about 200 feet above the lake, on a nearly flat upland largely covered by glacial drift and swamp. In the immediate vicinity of the deposits the drift in many places is only a few feet thick, but in places is as much as 40 feet thick. Dolomite outcrops on the sides of sink-holes and on low, flat areas at the level of the drift or rising only slightly above it. The low, flat areas of dolomite are irregular in outline, but are generally elongated in a direction slightly north of east. The depth of the ground water table is generally about 75 feet, but in some places it is only 10 feet below the surface. Sink-holes are numerous and have been formed subsequent to the deposition of the drift.

"The dolomite is generally massive but in a few places is bedded. The beds are flat or dip at angles of 5 to 10 degrees. The structure is difficult to determine, but in places the dolomite is probably gently domed. Thin-bedded, dolomitic limestone, in places associated with argillaceous lenses, has been found in shafts and drill holes and apparently occurs in narrow layers which are more conspicuous towards the bottom and top, where it is fossiliferous.[10]

"The massive dolomite is coarse to fine grained. The coarse dolomite is usually grey, but some is brown; the grey dolomite in some places is mottled with white. The fine-grained dolomite is generally brown, but a

[1] Stockwell, C. H., and Kidd, D. F.: Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 78-81 (out of print).
[2] Bell, J. Mackintosh: Econ. Geol., vol. XXVI, p. 617 (1931).
[3] Cameron, A. E.: Geol. Surv., Canada, Sum. Rept. 1921, pt. B, p. 13.
[4] Bell, J. Mackintosh: Econ. Geol., vol. XXVI, p. 615 (1931).
[5] Bell, R.: Geol. Surv., Canada, Ann. Rept., vol. XII, pt. A, pp. 104, 108, and 109 (1901).
[6] Cameron, A. E.: Geol. Surv., Canada, Sum. Rept. 1921, pt. B, pp. 35, 36.
[7] Bell, J. Mackintosh: Can. Min. and Met. Bull. 1929, pp. 1141-1157.
[8] Bell, J. Mackintosh: Geol. Surv., Canada, Econ. Geol. Ser. No. 8, pp. 219, 224 (1930).
[9] Bell, J. Mackintosh: Econ. Geol., vol. XXVI, pp. 611-624 (1931).
[10] Bell, J. Mackintosh: Econ. Geol., vol. XXVI, p. 615 (1931).

greyish type is also present. Pores and cavities occur in both the coarse and the fine-grained dolomite. The pores are small spaces between the faces of crystals which make up the rock. The cavities are larger openings from a fraction of an inch to a foot or more across and have irregular, curved, or angular outlines. The cavities are lined with very coarse, white dolomite forming curved rhombohedral crystals from ¼ to ½ inch across. Similar coarse, white dolomite also forms veinlets cutting the grey and brown dolomite. In some places the coarse, white dolomite is associated with sulphides; the dolomite is in part earlier and in part later than some of the sulphides and it is probable that both were deposited from the same solution. In many places, however, no sulphides are associated with the coarse, white dolomite. The grey and brown dolomites formed earlier than the white dolomite and may or may not be related in origin to the solutions that deposited the white dolomite and the sulphides.

"Sulphide deposits are known to occur chiefly at four localities: A, B, C, and D.[1]

" Locality A is in the southeast part of the Melville claim. Sulphides are exposed on the walls of a sink-hole, in test pits, and in a shaft 21 feet deep. The exposures indicate mineralization over a roughly circular area 280 feet by 220 feet. The sink-hole, which is on the south side of the area, is a crescent-shaped depression 280 feet in diameter. The concave side of the sink-hole faces north.

" Locality B is about 1,000 feet south of locality A. It is in the eastern part of Paragon 1 claim and extends across some fractional claims into the western part of Paragon 3 claim. Many churn drill holes, generally at intervals of 50 feet, have shown lead and zinc mineralization in a western area and in an eastern area. The two areas almost touch one another and further exploration may show that they are connected. From the results of the drilling it may safely be inferred that lead and zinc mineralization occurs in the western area almost continuously over an area 600 feet long in an easterly direction and 100 to 300 feet wide, and, in the eastern area, over an area 400 feet long in a northerly direction and 300 feet wide at the south end and 50 feet wide at the north end. Sulphides also occur in a shaft 35 feet deep, in many test pits, and on a few surface outcrops. Only a few small sink-holes occur on the mineralized areas.

" Locality C is about 900 feet easterly of the east end of locality B. It is on and near the boundary between Paragon 3 and Paragon 4 claims. Sulphides are exposed on the walls of a large sink-hole, in a shaft 76 feet deep, in a few open-cuts, and on natural exposures, all of which indicate a mineralized area roughly circular in shape and measuring 300 feet by 270 feet. The large sink-hole, which is on the north side of the area, is a crescent-shaped depression 300 feet in diameter. The concave side of the sink-hole faces south. Many smaller sink-holes occur in the mineralized area and are scattered over a distance of 200 feet south of it.

" Locality D is about 2,600 feet slightly north of east of locality C. It is in the southeast part of Gwynn claim. Sulphides occur on the walls of a large sink-hole which forms an almost complete circle about 260 feet in diameter, and in test pits and a shaft 51 feet deep within the limits of

[1] In writing the following description of these localities, a detailed map made by the Northern Lead Zinc, Limited, was freely used.

the sink-hole. Many drill holes, generally about 50 feet apart, have been put down within and around the sink-hole. From the results of the drilling it may safely be inferred that lead and zinc mineralization occurs almost continuously over a roughly circular area about 400 feet in diameter. Another large sink-hole, roughly circular and about 120 feet in diameter, lies about 200 feet slightly west of north of the sink-hole just mentioned. Lead and zinc minerals occur in loose fragments in the sink-hole and in a shaft 15½ feet deep in the centre of the sink-hole. Drill holes at intervals of 50 feet on the west, north, and east sides of the sink-hole, and at irregular intervals between the two sink-holes, showed no lead and zinc mineralization or any small quantities of it.

"The eastern boundary of lead and zinc mineralization of the eastern area at locality B is fairly well defined by drill holes which showed no important values in lead and zinc. In general, however, not enough drilling has been done to show the boundaries of the large mineralized areas at either B or D localities, although several scattered holes outside of the areas show little or no values in lead and zinc. The drilling has nowhere eliminated the possible existence of mineralized masses less than 50 feet across. The deepest churn drill hole is 255 feet and the average depth of all of them is about 100 feet. Lead and zinc values were absent or negligible in the bottom of most of the holes, indicating that the horizontal dimensions of the deposits are greater than the vertical dimensions. Some of the deposits, at least, are located on the probable dome already mentioned.

"The sulphides in the deposits are sphalerite, galena, and pyrite. These are in part altered to limonite, smithsonite, and probably cerussite and are associated with grey, brown, and white dolomite, calcite, and small amounts of quartz and sericite.[1] As seen in natural exposures, in open-cuts, and in shafts, the sulphides, white dolomite, calcite, and alteration products occur as fillings of cracks and cavities in grey and brown dolomites and the sulphides occur as complete or partial replacements of the grey and brown dolomites. The replacement deposits form irregular masses and occur along and across beds. In the drill holes[2] beds of low mineralization may separate successive beds of ore and ore is not limited to surface croppings. Assay values of lead, zinc, and silver have been published in the three articles by J. Mackintosh Bell. The silver values are negligible.

"In the veinlets and open cavities there is some irregularity in the order of deposition of the sulphides, but pyrite is generally followed by galena and sphalerite. As shown in the drill holes pyrite is generally most abundant on the top, except where removed by erosion. Beneath the pyrite, galena and sphalerite are generally mixed in various proportions, but near the bottom sphalerite usually predominates over galena. On natural exposures, the sulphides are locally fresh but are generally partly or almost completely oxidized. In depth[3] highly oxidized beds are found below those that show no obvious oxidation and the deposits are oxidized in places down to a depth of 100 feet. The large sink-holes are formed chiefly as a result of decomposition of pyrite."

[1] The presence of quartz and sericite have been reported by J. Mackintosh Bell: Econ. Geol., vol. XXVI, pp. 619, 623 (1931).
[2] Bell, J. Mackintosh: Econ. Geol., vol. XXVI, p. 618 (1931).
[3] Bell, J. Mackintosh: Op. cit., p. 618.

# APPENDIX

## PUBLICATIONS

The following selected list of maps and reports issued by the Department of Mines and Resources includes those most likely to prove useful to prospectors and others interested in the mineral industry of that part of Northwest Territories described in this report. Other reports, some of which include maps, are listed in the Bibliography or are referred to in the reports listed below.

### *General Reports*[1]

Canada's Western Northland, its History, Resources, Population, and Administration; Dept. Mines and Resources, Lands, Parks and Forests Branch (1937).

Regulations for the Disposal of Quartz Mining Claims on Dominion Lands in the Northwest Territories; Dominion Lands Administration, Department of the Interior (1932).

### *Geological Reports and Maps*[2]

(*See* Figure 2)

HENDERSON, J. F.:

Nonacho Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 37-2 (1937). Report and map.

Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-1 (1939). Report and map.

Nonacho Lake, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 256A (1939). Map with marginal notes.

Taltson Lake, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 525A (1939). Map with marginal notes.

Gordon Lake, Northwest Territories; Geol. Surv., Canada, Paper 40-9 (1940). Map only.

Gordon Lake South, Northwest Territories; Geol. Surv., Canada, Paper 40-7 (1940). Map only.

JOLLIFFE, F.:

Yellowknife River Area, Northwest Territories; Geol. Surv., Canada, Paper 36-5 (1936). Report and map.

JOLLIFFE, A. W.:

Yellowknife Bay-Prosperous Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 38-21 (1938). Report and maps.

Quyta Lake and Parts of Fishing Lake and Prosperous Lake Areas, Northwest Territories; Geol. Surv., Canada, Paper 39-6 (1939). Maps only.

KIDD, D F.:

Great Bear Lake-Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1931, pt. C (1932). This report is out of print, but all mineral properties described in it are described in the present report.

Great Bear Lake Area, Northwest Territories; Geol. Surv. Canada, Sum. Rept. 1932, pt. C (1933). This report and accompanying geological map are out of print, but all mineral properties described in it are described in the present report.

Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187 (1936). Contains maps.

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[1] Requests for these reports should be addressed to the Director, Lands, Parks and Forests Branch, Department of Mines and Resources, Ottawa, or to the District Agent, Department of Mines and Resources, Fort Smith, Northwest Territories.

[2] Requests for geological maps and reports should be addressed to the Chief, Bureau of Geology and Topography, Department of Mines and Resources, Ottawa.

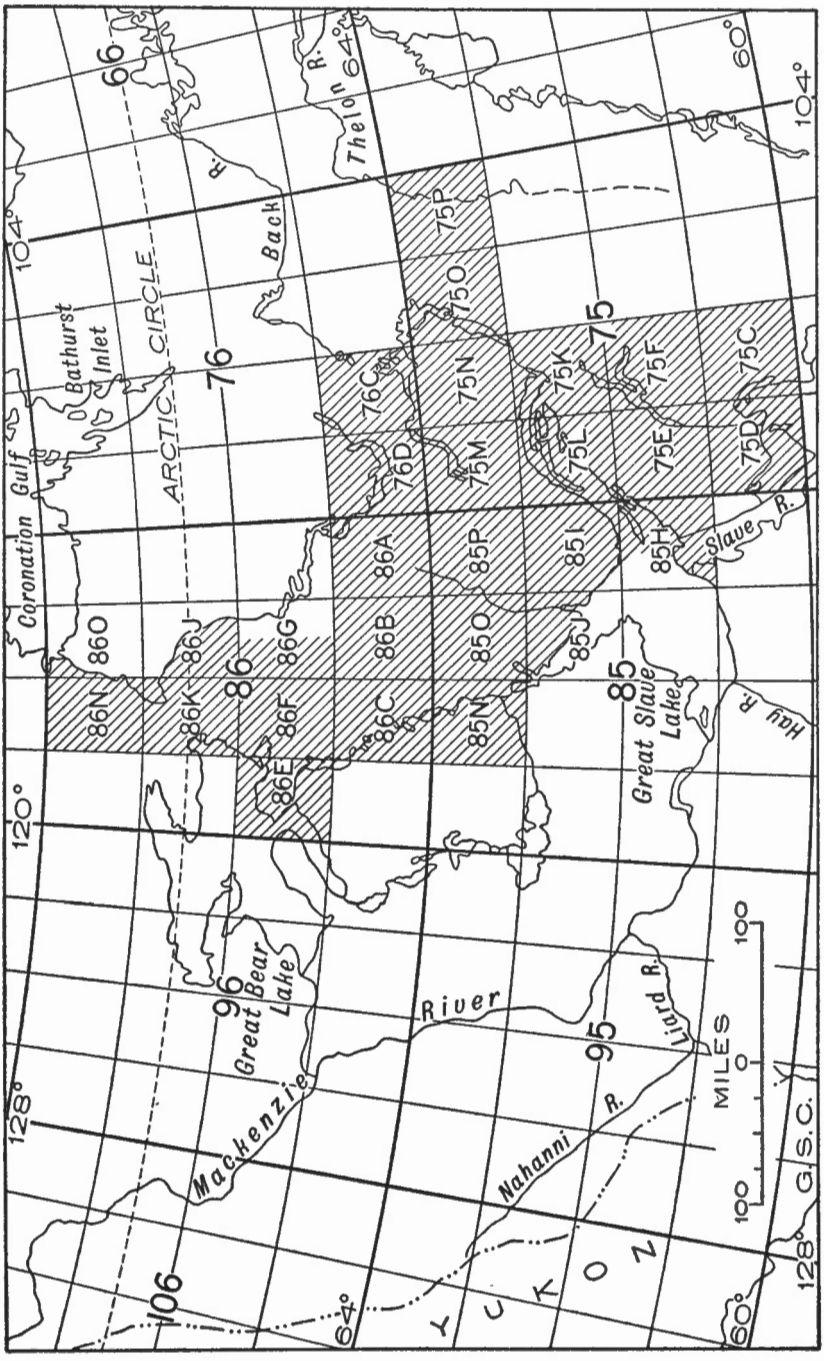


Figure 9. Areas for which aerial photographs and topographical maps are available.

LORD, C. S.:
Snare River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-5 (1939). Report and map.

STOCKWELL, C. H.:
Great Slave Lake-Coppermine River Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C (1933). This report is out of print, but all mineral properties described in it are described in the present report.
Eastern Portion of Great Slave Lake, District of Mackenzie, Northwest Territories; Maps 377A and 378A (1936). Maps with marginal notes.

STOCKWELL, C. H., and KIDD, D. F.:
Metalliferous Mineral Possibilities of the Mainland Part of the North West Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C (1932). This report is out of print, but all mineral properties described in it are described in the present report.

WILSON, J. T.:
Fort Smith Area, Northwest Territories; Geol. Surv., Canada, Paper 39-11 (1939). Map only.

## *Topographic Maps*

(*See* Figure 9)

*[1]Northwest Territories, Sheet No. 2, 35 miles to 1 inch; Top. Surv., Canada, Dept. of the Interior (1933).

*Northwest Territories and Yukon, 80 miles to 1 inch; Hydrographic and Map Service, Surveys and Eng. Branch (1939).

*Dismal Lakes-Coppermine (86 N and 86O), 4 miles to 1 inch; Top. Surv., Canada, Dept. of the Interior (1932).

*Hunter Bay-Coppermine River (86 K and 86 J), 4 miles to 1 inch; Top. Surv., Canada, Dept. of the Interior (1932).

**[2]Leith (86E), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Camsell River (86 F), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Redrock Lake (86 G, West half), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Hardisty Lake (86 C), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Indin Lake (86 B), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Fort Enterprise (86 A), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Lac de Gras (76 D), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Aylmer Lake (76 C), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Marian River (85 N), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Wecho River (85 O), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Carp Lake (85 P), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Mackay Lake (75 M), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

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[1] Requests for this map should be addressed to the Surveyor General and Chief, Hydrographic Service, Surveys and Engineering Branch, Department of Mines and Resources, Ottawa.

[2] Requests for this map should be addressed to the Chief, Bureau of Geology and Topography, Mines and Geology Branch, Department of Mines and Resources, Ottawa.

**Walmsley Lake (75 N), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Artillery Lake (75 O), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Hanbury River (75 P), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

*Yellowknife Bay (85 J and 85 I), 4 miles to 1 inch; Hydrographic Service, Surveys and Eng. Branch (1939).

**Yellowknife Bay ($85J_8$), 1 mile to 1 inch; Map 500A, Top. Surv., Bur. of Geology and Topography (1939).

**Prosperous Lake ($85J_9$), 1 mile to 1 inch; Map 499A, Top. Surv., Bur. of Geology and Topography (1939).

*Fort Reliance (75 L and 75 K), 4 miles to 1 inch; Hydrographic Service, Surveys and Eng. Branch (1938).

**Resolution (85 H), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

**Taltson Lake Sheet (75 E), 4 miles to 1 inch; Map 466A, Top. Surv., Bur. of Geology and Topography (1938).

**Nonacho Lake (75 F), 4 miles to 1 inch; Map 526A, Geol. Surv., Bur. of Geology and Topography (1939). Geology and topography.

**Fort Smith Sheet (75 D), 4 miles to 1 inch; Map 467A, Top. Surv., Bur. of Geology and Topography (1938).

**Hill Island Lake (75 C), 2 miles to 1 inch; Top. Surv., Bur. of Geology and Topography. Preliminary copies subject to revision.

## AERIAL PHOTOGRAPHS[1]

(*See* Figure 9)

Aerial photographs taken by the Royal Canadian Air Force are available for areas covered by all but the first two topographic maps listed above. Photographs are available for some other parts of the district, mostly as strips along the main waterways. All are oblique photographs except those covering small areas at Yellowknife Bay and Gordon Lake.

[1] Requests for aerial photographs should be addressed to the Chief, Bureau of Geology and Topography, Mines and Geology Branch, Department of Mines and Resources, Ottawa.